Белгородский
государственный
национальный
исследовательский
университет

WE MAKE THE FUTURE
(МЫ ДЕЛАЕМ БУДУЩЕЕ)

Сборник научных статей
Выпуск XIII

2025

Министерство науки и высшего образования Российской Федерации
Федеральное государственное автономное образовательное
учреждение высшего образования
«Белгородский государственный национальный
исследовательский университет»

WE MAKE THE FUTURE
(МЫ ДЕЛАЕМ БУДУЩЕЕ)

Сборник научных статей

Выпуск XIII

Белгород 2025

УДК 378.147
ББК 74.480.278
W 37

Рекомендовано к изданию редакционно-издательским советом института межкультурной коммуникации и международных отношений НИУ «БелГУ» (протокол № 8 от 28.05.2025)

Редакционная коллегия:

ответственный редактор:

Л.В. Цурикова, кандидат педагогических наук,
доцент кафедры иностранных языков
и профессиональной коммуникации НИУ «БелГУ»

члены редколлегии:

*Ю.С. Блажевич, Е.Н. Таранова, И.В. Сопова, К.А. Страхова,
С.Е. Григоренко, Н.Л. Гусакова, Е.В. Калюжная, Н.И.Купина, Е.А. Марьясова,
Н.С. Мирошниченко, Т.В. Петрунова, В.В. Платошина, И.В. Сагалаева*

Рецензенты:

И.В. Борисовская, кандидат филологических наук, доцент,
доцент кафедры немецкого и французского языков факультета иностранных языков
педагогического института НИУ «БелГУ»;
А.Ф. Дорофеев, доктор экономических наук, доцент,
профессор кафедры профессионального обучения
и социально-педагогических дисциплин ФГБОУ ВО Белгородский ГАУ

W 37 We make the future (Мы делаем будущее): сборник научных статей / отв. ред. Л.В. Цурикова. – Вып. XIII. – Белгород: ЦПП ИД «БелГУ» НИУ «БелГУ», 2025. – 299 с. – URL : http://dspace.bsuedu.ru/handle/123456789/65255 – Текст: электронный.

ISBN 978-5-9571-3872-3

Сборник статей охватывает широкий спектр актуальных проблем современной науки, отражает результаты теоретических и научно-практических исследований.

За содержание и достоверность статей, а также соблюдение закона об интеллектуальной собственности ответственность несут авторы. Мнение редакции может не совпадать с мнением авторов статей.

Минимальные системные требования
Yandex (20.12.1) или Google Chrome (87.0.4280.141) и т. п.
скорость подключения – не менее 5 Мб/с, Adobe Reader и т. п.

УДК 378.147
ББК 74.480.278

ISBN 978-5-9571-3872-3

© НИУ «БелГУ», 2025

CONTENS

SECTION 1. NATURAL SCIENCES

Dronova Kristina Dmitrievna, Mariasova Elena Anatolyevna
A modern approach to the design of pedestrian spaces using the example of the Belgorod region.....8
Sorokina Elena Vladimirovna, Strakhova Ksenia Aleksandrovna
Organic matter in soil formation.....11
Vereitin Nikita Aleksandrovich, Sagalaeva Irina Vladimirovna
Rare mineral elements in rocks of the Russian Federation.....14
Schapowalow Sergej Dmitrijewitsch, Taranowa Elena Nikolayewna
Geoökologisches Mosaik von Altai.....18
Vaseeva Anastasia Andreevna, Mariasova Elena Anatolyevna
The effects of colours, shapes and boundaries of landscapes on preception, emotion and mentalizing processes promoting health and well-being.....23
Babich Julia Sergeevna, Mariasova Elena Anatolyevna
Ideas for creating green spaces on the roof and walls of buildings: advantages and care.....26
Karpenko Kirill Sergeevich, Sagalaeva Irina Vladimirovna
The mineral resource of uranium in Russia.....29
Ugnich Darya Mikhailovna, Strakhova Ksenia Aleksandrovna
Climate as a factor of soil formation.....33
Blokhina Daria Olegowna, Sopowa Irina Walentinowna
Statistische Analyse des Zustands der Umwelt in der Region Belgorod.....36

SECTION 2. LEGAL SCIENCES

Kazanina Evgeniya Viktorovna, Tsurikova Larisa Vladimirovna
Problems of legal regulation of placement of minors deprived of parental care in family forms of education.....41
Shcherbakova Elizaveta Romanovna, Tsurikova Larisa Vladimirovna
Contents of a civil law contract.....45
Mozhegova Antonina Anatolyevna, Tsurikova Larisa Vladimirovna
The impact of the digital technologies introduction in the mechanism of state administration on reducing the level of corruption in the Russian Federation and foreign countries.....48
Shvydkova Valeria Vitalievna, Petrunova Tatyana Vladimirovna
Piracy as an international crime.....52
Adadimova Victoria Alexandrovna, Tsurikova Larisa Vladimirovna
Legal regulation of competition in the Russian Federation and foreign countries.....55
Ibragimov Renat Ibragimovich, Tsurikova Larisa Vladimirovna
The problem of the concept of entrepreneurial activity.....58
Korobchinskaya Kristina Nikolaevna, Tsurikova Larisa Vladimirovna
The role of legal terminology in law enforcement practice.....62
Polshikova Viktoria Victorovna, Praslova Veronika Maksimovna, Gusakova Natalya Leonidovna
The problem of optional elements of a crime in criminal law.....66

Kononova Alisa Sergeevna, Platoshina Victoria Vladimirovna
Maternal deprivation theory as a theory of the development of criminality.....69
Shcherbak Sofya Dmitrievna, Cherkashin Vladislav Dmitrievich, Tsurikova Larisa Vladimirovna
Tax control as the main element of the tax administration system.....72
Kravtsova Anastasiya Anatolyevna, Platoshina Victoria Vladimirovna
Prevention of recidivism among students.....75
Aleynikova Valeriya Andreevna, Gusakova Natalya Leonidovna
Current problems of prevention of illicit drug trafficking.....78
Kozin Ewgenij Andrejewitsch, Taranowa Elena Nikolayewna
Wirtschaftliche Grundlagen des Verfassungssystems Russlands.....81
Gaydidey Olesya Evgenievna, Grigorenko Svetlana Evgenievna
National sovereignty, self-determination of the nation and the citizen in a state governed by the rule of law.....85
Kirichenko Oleg Artemovich, Grigorenko Svetlana Evgenievna
The role of Russia in the progressive development of international law.....89
Shepelev Maxim Ruslanovich, Miroshnichenko Natalia Sergeevna
Comparison of the functioning of penitentiary systems in Russia, the UK and the USA.....93

SECTION 3. SOCIAL AND HUMANITARIAN SCIENCES, ECONOMICS

Golovaneva Ekaterina Konstantinovna, Grigorenko Svetlana Evgenievna
Indicators of energy consumption of athletes specializing in cyclic sports.....97
Ivanova Ksenia Olegovna, Sagalaeva Irina Vladimirovna
Information wars: history and modernity.....103
Bykovtsova Polina Alexandrovna, Sagalaeva Irina Vladimirovna
Background music a factor influencing the memorization of an advertising message.....106
Goncharova Anastasia Andreevna, Pakhomova Daria Konstantinovna, Mariasova Elena Anatolyevna
Economic and statistical assessment of the production of the main types of tobacco products in Russia.....110
Ivanisova Kseniya Eduardovna, Mariasova Elena Anatolyevna
Digitalization of the economy: how technologies are changing financial operations and consumer habits.....115
Shevelyova Daria Vitalievna, Mariasova Elena Anatolyevna
Analytical capabilities of statistical methodology for assessing threats to economic security.....119
Matvienko Valeria Gennadievna, Mariasova Elena Anatolyevna
The economic security of a person in modern conditions of the Russian Federation development.....123
Sukhomlinova Darya Yurievna, Zubko Antonina Dmitrievna, Mariasova Elena Anatolyevna
Development of ladder deposits of banks.....127
Astakhova Daria Ivanovna, Kabanenko Yulia Vladimirovna, Mariasova Elena Anatolyevna
Role, necessity and importance of statistical observation in scientific research.....130

Shkrudneva Marina Vitalievna, Belousov Stanislav Viktorovich, Mariasova Elena Anatolyevna
Corruption as a threat to the economic security of the country 133
Stepanov Alexander, Kutnyakov Alexander Andreevich, Mariasova Elena Anatolyevna
Demographic trends and economic security of the state: challenges and opportunities 137
Kuznetsov Danil Alekseevich, Mariasova Elena Anatolyevna
Improvement of loyalty programs of commercial banks 140
Linnik Ksenija Jewgenjewna, Sopowa Irina Walentinowna
Bild des Journalisten in modernen Videospielen 143
Antsiferova Anastasia Igorevna, Petrunova Tatyana Vladimirovna
The specifics of the representation of environmental issues in modern media 148
Dotsenko Irina Pavlovna, Petrunova Tatyana Vladimirovna
Theoretical foundations of the influence of the media on the formation of public opinion 151
Durnev Ilya Viktorovich, Petrunova Tatyana Vladimirovna
The evolution of the Russian media system in the era of new media 155

SECTION 4. COMPUTER SCIENCES

Gulyaev Vitaly Igorevish, Grigorenko Svetlana Evgenievna
Trends and development of frontend 160
Efremova Elizaveta Viktorovna, Grigorenko Svetlana Evgenievna
Development of a virtual local network for a restaurant 163
Ismailova Kamilla Sandjarovna, Grigorenko Svetlana Evgenievna
Software implementation of three-dimensional scenes 166
Andrushchenko Daria Aleksandrovna, Maslova Angelina Viktorovna, Gusakova Natalya Leonidovna
Methods of protecting databases from SQL injection 169
Ivanov Daniil Vitalyevich, Martynov Ilya Romanovich, Gusakova Natalya Leonidovna
The principle of construction and operation of a ternary adder 172
Chebotarev Vyacheslav Alekseevich, Kalyuzhnaya Elena Vyacheslavovna
Information and analytical support for managing the reliability of technical systems 177
Kashirsky Konstantin Igorevich, Kosinov Alexey Vitalievich, Gusakova Natalya Leonidovna
Overview of metaprogramming tools in the python programming language 180
Zhuravlev Pavel Pavlovich, Leonov Egor Yevgenyevich, Gusakova Natalya Leonidovna
C++ in the modern world: relevance, advantages, and comparative analysis with new programming languages 183
Dotsenko Polina Evgenievna, Grigorenko Svetlana Evgenievna
Encryption of voice data: methods and algorithms 186
Dotsenko Evelina Evgenievna, Grigorenko Svetlana Evgenievna
Protection of speech data in the digital age 191

Mochalkin Ivan Andreevich, Grigorenko Svetlana Evgenievna
Formalized evaluation of streaming music services..... 196

SECTION 5. CHEMICAL AND BIOLOGICAL SCIENCES

Romanzowa Alina Alexandrowna, Taranowa Elena Nikolayewna
Die Verwendung von Nifedipin als rektale Zubereitung..... 202
Romanzowa Alina Alexandrowna, Taranowa Elena Nikolayewna
Poloxamere als Hilfsstoffe in der Pharmaindustrie..... 205
Morkel Angelina Ruslanovna, Andrievskaya Arina Vladimirovna, Mariasova Elena Anatolyevna
Biotechnological production of α-amylase by micromycetes of the aspergillus genus..... 208
Gordienko Alina Nikolaevna, Garkavaya Anastasia Andreevna, Mariasova Elena Anatolyevna
Laboratory diagnosis of infectious diseases..... 212
Saltevskaya Anastasiya Evgenievna, Malinovsky Nikita Sergeevich, Mariasova Elena Anatolyevna
Microbiological processing of organic waste..... 216
Burakova Anastasia Alexandrovna, Efimova Alisa Olegovna, Mariasova Elena Anatolyevna
Modern methods of bioremediation of oil-contaminated soils..... 218
Kireev Sergey Alexandrovich, Prilutsky Leonid Yurievich, Mariasova Elena Anatolyevna
Isolation of soil actinomycetes and their study morphological and physiological properties..... 222
Potapowa Olga Petrowna, Taranowa Elena Nikolayewna
Genetische Marker. Mikrosatelliten-loci..... 225
Sechkarewa Ekaterina Nikolajewna, Taranowa Elena Nikolayewna
Mikrobiologische Ölzerstörung: moderne Errungenschaften und Perspektiven der Bioremediation..... 229
Bachurina Sofya Maksimovna, Buglova Maria Viktorovna, Mariasova Elena Anatolyevna
Bioremediation of soils contaminated with heavy metal compounds by microorganisms..... 233
Firsova Irina Andreevna, Kuzemkina Vladislava Alekseevna, Gusakova Natalya Leonidovna
Isolation of nitrogen-fixing microorganisms from mosses growing on trees..... 236
Zhidkikh Tatiana Denisovna, Gusakova Natalya Leonidovna
Evaluation of the antagonistic activity of bacillus subtillis isolated from the intestines of poultry against certain microorganisms..... 239
Grigoryewa Olesya Walentinowna, Taranowa Elena Nikolayewna
Die Anwendung von Nanotechnologien bei der Entwicklung von Arzneiformen: aktuelle Trends und Perspektiven..... 242
Schemelinina Ksenia Alexandrowna, Taranowa Elena Nikolayewna
Die Rolle von Phytopräparaten bei Nieren- und Harnsystemerkrankungen..... 247

Popova Anastasia Borisovna, Semenova Sophia Valerievna,
Gusakova Natalya Leonidovna
Examination of hematological parameters of coturnix japonica 251
Tregubowa Marina Wladimirowna, Taranowa Elena Nikolayewna
Polysaccharide als eine wertvolle Klasse natürlicher Verbindungen in der Medizin 254
Podaneva Alina Evgenyevna, Koupina Natalya Ivanovna
Colorants naturels dans l'industrie alimentaire:
particularités de la composition, de la stabilité et de l'application 257
Zybina Ekaterina Wladimirowna, Sopowa Irina Walentinowna
Assortiment und Qualitätsbewertung von Butter im Merkaufsnetz „Magnit“ 261
Stoyanova Natalya Georgievna, Platoshina Victoria Vladimirovna
Biochemical study of grape juice obtained from red grape berries grown
in the central black earth region..... 264
Zawatskiy Daniil Wadimovich, Sopowa Irina Walentinowna
Kinetik der Veresterungsreaktion von Indol-5-yl Carbonsäure..... 267
Podaneva Alina Evgenyevna, Koupina Natalya Ivanovna
Acides aminés non protéinogènes: régulateurs imperceptibles
des processus physiologiques..... 271
Semenova Daria Sergeevna, Koupina Natalya Ivanovna
Les produits pétroliers comme sources de pollution des sols 275
Potapowa Olga Petrowna, Taranowa Elena Nikolayewna
Biologische und ökologische Aspekte der Landschnecken-Populationen
von hondruia tridens 279
Voloshina Irina Evgenievna, Miroshnichenko Natalia Sergeevna
Titrimetric methods for quantitative determination of table salt..... 284
Speter Eduard Ewgenyewich, Taranowa Elena Nikolayewna
Der Einfluss moderner Insektizide auf die Populationsdynamik
und Physiologie der Insekten 288

SECTION 6. PHILOLOGY

Krivosheev Gleb Sergeevich, Gusakova Natalya Leonidovna
From blessings to justice: linguocultural representations
of God in English and Russian phraseologisms and paremias 294

SECTION 1
NATURAL SCIENCES

UDK 712.3

A MODERN APPROACH TO THE DESIGN OF PEDESTRIAN SPACES USING THE EXAMPLE OF THE BELGOROD REGION

Dronova Kristina Dmitrievna,
Student of the Institute of Earth Sciences,
Belgorod State National Research University, Belgorod, Russia,
E-mail: dronova.krystina@yandex.ru
Mariasova Elena Anatolyevna,
Ph.D. in Philosophy,
Associate Professor of the Department of Foreign Languages and Professional Communication,
Belgorod State National Research University, Belgorod, Russia,
E-mail: mariasova@bsuedu.ru

Abstract: *This article focuses on the factors influencing the design of tracks. Various elements that support people's interest in pedestrian zones are described. Examples of successful implementation of projects in the Belgorod region are also considered.*

Keywords: *pedestrian spaces, folk trails, design of pedestrian zones, trends in design, urban landscape.*

Walkways in public spaces play an important role in ensuring safety and comfort for pedestrians. They serve not only for movement, but also to create comfortable conditions for recreation and an active lifestyle. Track design requires consideration of various factors such as safety, accessibility, aesthetics, and functionality.

Throughout the entire pedestrian zone, there should be elements that will hold a person's attention, but at the same time not look impressive. These can be interactive displays, installations, sculptures, and other small architectural forms.

When designing sidewalks and pedestrian zones, zoning should be performed, correctly locating places for recreation. Benches, observation decks, gazebos along the route create a sense of community, encourage people to stay longer in the area, allow them to relax and admire the surrounding environment. To maintain order, it is necessary to install bins, especially near recreation areas and points of sale. Planting trees or shrubs along the paths provides an opportunity to enjoy nature while walking, creates a soothing environment, and protects from the sun in summer [Rozhkov, 2019].

The design of the pedestrian zone has an information and entertainment component. The installation of information boards is currently trending, which acquaint passersby with interesting facts about the location and events. The task of architects is to ensure the proper integration of these elements into the urban landscape. They should harmoniously fit into the existing architecture and infrastructure. Playgrounds, a stage for musicians to perform, fairs, and sports facilities enliven the public space [Burdeyny, 2017].

For example, in the Belgorod region, the bike path was recently extended by 1.4 km from the Picnic Park to the aquopark to make walks and trips more interesting and diverse (Figure 1).



Figure 1. The location of the bike path in the area of Razumenskaya St., Belgorod

Modern design of pedestrian zones involves not only the quantitative increase and technical improvement of the existing network of sidewalks and passageways in courtyards, but also the creation of a full-fledged infrastructure that meets the needs of pedestrians.

This infrastructure includes landscaping, landscaping, street lighting installations, as well as the creation of various attractive points along the routes. An important component is to increase the attractiveness of the territories as a whole. Pedestrian paths should provide residents with convenient access to all important facilities: social, commercial, cultural and recreational facilities.

Thanks to the federal program "Comfortable Urban Environment", additional "centers of attraction" appear in small towns – significant infrastructure facilities with attractive specific or leisure characteristics (embankments, parks, squares, public spaces). It is very important to link all socially significant places and “points of attraction” of the city with the help of pedestrian space.

Despite the apparent uniformity, pedestrian space is a collection of different zones, each of which is characterized by specific features of use and functional purpose:

- The transit zone is designed to ensure fast and comfortable movement of pedestrians.
- The mixed zone combines the possibilities for both rapid passage and short-term rest. For this purpose, benches, catering areas and places for relaxation are provided along the routes.
- The social zone is designed for active communication and interaction of people, therefore its spatial organization presupposes the presence of recreation areas, children's and sports areas.

The requirements for the design of pedestrian zones will vary depending on their functional purpose. This concerns the choice of the type of road and sidewalk

coverings, the materials used, the design and filling of the space (outdoor furniture, small architectural forms, additional landscape elements, navigation system) [Nesterova, 2016].

The "folk trails" program is also gaining popularity. It often happens that the proposed paths are inconveniently located for people, so they "cut" the path with trails. The essence of the program is to build a new road network along already well-trodden routes. The program aims to increase the comfort level of citizens and accelerate access to socially significant facilities. The improvement of sidewalks will make the movement of residents more convenient, including in adverse weather conditions. For example, in the summer of 2021, this event was proposed in Belgorod, and in the fall of the same year, new tracks appeared in the region. In the Energomash park in Belgorod, even during its landscaping, 5 "folk trails" were made, they also appeared in Victory Park (Figure 2). This year, it is also planned to make paths in Lenin Park.



Figure 2. "National Trail" in Victory Park, Belgorod (2022)

In conclusion, the creation of high-quality pedestrian spaces is a multifaceted process that requires careful attention to the needs of residents and current trends in urban planning. From thoughtful zoning to the use of interactive elements and landscaping, each aspect plays a role in shaping a comfortable and attractive urban environment.

The "Comfortable Urban Environment" program and initiatives like "folk trails" demonstrate the desire to create pedestrian zones that best meet the needs of citizens. The integration of such projects into existing infrastructure not only improves mobility and accessibility but also improves the quality of life by creating "points of attraction" and stimulating social interaction.

Ultimately, the successful design of pedestrian zones contributes to the formation of a healthy, active and socially connected urban environment where every resident feels comfortable and safe.

References

1. Burdeiny, M.A. (2017). Planirovka dorozhek i ploshhadok. Dekorativny`e priemy` i texnicheskie resheniya [The layout of paths and playgrounds. Decorative techniques and technical solutions]. – M.: Fiton. – 136 p. (in Russian)

2. Nesterova, A.V. (2003). Gazony`, czvetniki i dorozhki [Lawns, flower beds and paths]. – M.: VECHE. – 158 p. (in Russian)

3. Rozhkov, M.O. Kalinina, P.M. Blagoustrojstvo peshexodnoj zony`: sozdanie interesny`x marshrutov na primere real`nogo kejsa [Landscaping of a pedestrian zone: creating interesting routes using the example of a real case]. – [online]. Available at: https://gov.cap.ru/home/21/park/way.htm. (Accessed: 02.03.2025). (in Russian)

UDK 631.48

ORGANIC MATTER IN SOIL FORMATION

Sorokina Elena Vladimirovna,
Student of the Institute of Earth Sciences,
Belgorod State National Research University, Belgorod, Russia,
E-mail: 1644401@bsuedu.ru
Strakhova Ksenia Aleksandrovna,
Ph.D. in Philosophy,
Associate Professor of the Department of Foreign Languages and Professional Communication,
Belgorod State National Research University, Belgorod, Russia,
E-mail: strakhova@bsuedu.ru

Abstract: *The article deals with organic matter which is a complex compound derived from plant and animal biomass. Authors define the factors influencing the formation of organic matter in soil horizons. This article also discusses the benefits of organic fiber including the fact that the presence of organic matter contributes to the improvement of the physical properties of soil, such as its structure and air regime.*

Keywords: *organic matter, soil organic matter, biomass, vegetation, nutrient.*

The organic matter is a complex compound derived from plant and animal biomass. In the forest-steppe zone, its content can reach significantly high values due to the presence of a rich vegetation cover and the active actions of microorganisms. The presence of organic matter contributes to the improvement of the physical properties of soil, such as its structure and air regime.

Soil organic matter is a highly integrated biogeochemical system in which plant and animal components interact with soil organisms and inorganic compounds. This complicated complex plays a fundamental role in the formation of soil fertility by regulating the cycles of organic substances and biogeochemical processes that determine the productivity of soil ecosystems.

The structure of soil organic matter includes two interactive parts – inanimate and living:

1. The inanimate component includes a variety of polymer compounds formed as a result of the transformation of plant and animal residues under the influence of microorganisms. These complex organic molecules, such as humic and fulvic acids, cellulose, lignin, and others, have a high degree of polymerization and stability.

2. The living part is represented by soil microorganisms, which play a fundamental role in the breakdown of organic matter and its transformation into humic substances. This complex consortium of bacteria, fungi, protists, and other organisms ensures high rates of biodegradation and supports the cycling of organic matter in the soil [Kukharuk et al., 2011].

The factors influencing the formation of organic matter in soil horizons are very diverse. The key ones are:

– climatic conditions;
– vegetation cover;
– properties of soil;
– anthropogenic load on soils.

The **climatic conditions** of a particular region, which determine the intensity of biogeochemical reactions in the soil by influencing temperature, humidity and radiation regimes, play one of the determining roles in the processes of accumulation and transformation of organic matter in various horizons of the sphere. Optimal temperature values, the amount of precipitation during the growing season, their precipitation regime and the soil moisture regime significantly affect the activity and abundance of decomposer microorganisms, the rate of hydrolysis and destruction of plant and animal residues and their conversion into humic acids, fulvic acids and humates.

The **vegetation cover** of a particular territory, characterized by the species richness of woody, shrubby and herbaceous plants, as well as microorganisms of the phytosphere, ensures the annual intake of a wide variety of organic compounds of plant origin into the soil due to the fall, death of roots and underground organs of plants. The richness and diversity of floral complexes ensures the accumulation of a wide range of organic compounds in the soil, varying in degree of stability and resistance to mineralization.

The **properties of the soil** itself – its granulometric, mineralogical and chemical composition, structural and aggregate state, water-physical and gas-exchange characteristics – largely determine the tendency of this soil to accumulate, transform and stabilize organic compounds coming from the upper horizons. In particular, this is reflected in the ability of soils to accumulate and maintain a certain level of humus, which ensures fertility. Soils with high humus content have the highest capacity in relation to humification processes.

Anthropogenic load on soils, determined by the nature and intensity of agricultural activities, industrial production, transportation and recreational loads, can both stimulate the accumulation of organic matter in the soil, and, conversely, initiate its dehumification and degradation under the influence of pollution and the negative consequences of violations of natural processes [Lukin, 2016].

The decomposition of organic matter in the soil is a globally important biogeochemical process that determines the structure and agronomic potential of this component of the landscape. This process ensures the existence of a whole range of soil microorganisms that implement a complex system of interrelated mechanisms for the destruction of organic matter.

Physical mechanisms include both abiotic and biotic effects, as well as surface colonization and mechanical destruction of organic particles.

Chemical decomposition is caused by the influence of dissolved salts and the enzymatic activity of edifiers.

The main mechanism is represented by the microbiological destruction of macromolecules using a wide range of exoenzymes and endoenzymes.

Incomplete decomposition products, such as humic compounds, form a stable organic component of the soil.

Only a comprehensive study of these processes makes it possible to optimize organic management in order to increase yields [Malyshev, 2017]. The decomposition of organic matter in the soil is one of the key biotransformation processes that determine its structure and fertility over the years.

Complex transformations of plant and animal remains continuously occur under the influence of large-scale microbial communities, including bacteria, fungi, actinomycetes and protists.

The rate of organic matter accumulation in the soil is determined by a complex interaction of biotic, abiotic and anthropogenic factors, namely the physico-chemical and biological properties of the soil itself, the climatic features of the region, the intensity of activity of edifying microorganisms and other soil inhabitants. Thus, microbes decompose organic matter to a stable humic phase.

The effect of organic matter on fertility is due to the improvement of soil structure, increased water and air permeability, which has a beneficial effect on the growth of root systems and the processes of mineral nutrition of plants. In addition, organic matter serves as a substrate for soil microorganisms that ensure the cyclic transformation of nutrients and the balance of nutrients.

Many aspects of anthropogenic human activity often disrupt the delicate natural process of organic matter accumulation in the soil. Therefore, it is extremely important to develop and implement rational gentle farming techniques that contribute to the accumulation and preservation of organic matter in the soil substrate [Goleusov, Lisetsky, 2009].

The organic matter in the soil is of great importance. Plant remains and roots, humus and microorganisms play an important role in maintaining the balance of the soil ecosystem. Organic matter contributes to the formation of humus in soils, an essential component that improves soil structure, promotes fertility and water retention. It is the main source of plant nutrients such as nitrogen, phosphorus, potassium, sulfur and other elements.

Due to the actions of organic matter, the soil in forest-steppe zones is less susceptible to erosion and more resistant to the effects of adverse factors. Also, organic matter, by virtue of its properties, helps to retain moisture and, thanks to its action, the soil becomes more fertile.

References

1. Goleusov, P.V., Liseckij, F.N. (2009). Vosproizvodstvo pochv v antropogenno narushennyh landshaftah lesostepi [Regeneration of soils in anthropogenically disturbed landscapes of forest-steppe zone]. – M.: GEOS. – 210 p. (in Russian)

2. Kukharuk, N. S., Chendev, Yu. G., Petin A. N. (2011). Mikromorfologicheskie osobennosti organicheskogo veshchestva pri agrogennoj transformacii pochv lesostepnoj zony [Micromorphological features of organic matter after agrogenic transformation of the soils in forest-steppe zone] // *Belgorod State University Scientific Bulletin. Natural sciences*. – № 15 (110). – Issue 16. – Pp. 168-179. – Belgorod: Belgorod National Research University Press. – [online]. Available

at: https://bsuedu.ru/upload/iblock/a6c/w15_100_%20vip_16.pdf. (Accessed: 18.02.2025). (in Russian)

3. Lukin, S.V. (2016). Biologizaciya zemledeliya v Belgorodskoj oblasti: itogi i perspektivy [Biologization of agriculture in the Belgorod region: results and prospects] // *Dostizheniya nauki i tekhniki APK [Achievements of science and technology of the Agroindustrial complex]*. – V. 30. – № 7. – Pp. 20-23. – [online]. Available at: https://cyberleninka.ru/article/n/biologizatsiya-zemledeliya-v-belgorodskoy-oblasti-itogi-i-perspektivy/viewer. (Accessed: 18.02.2025). (in Russian)

4. Malyshev, A.V. (2017). Processy estestvennogo vosproizvodstva agrogenno narushennyh pochv na territorii Belgorodskoj oblasti v zalezhnom rezhime [The processes of natural reproduction of agrogenically disturbed soils in the Belgorod region in the fallow regime] // *Molodoy uchenyi [Young scientist]*. – № 9 (143). – Pp. 201-204. – [online]. Available at: https://moluch.ru/archive/143/40202/. (Accessed: 18.02.2025). (in Russian)

UDK 553.041

RARE MINERAL ELEMENTS IN ROCKS OF THE RUSSIAN FEDERATION

Vereitin Nikita Aleksandrovich,
Student of the Institute of Earth Sciences,
Belgorod State National Research University, Belgorod, Russia,
E-mail: 1688061@bsuedu.ru
Sagalaeva Irina Vladimirovna,
Ph.D. in Pedagogy,
Associate Professor of the Department of Foreign Languages and Professional Communication,
Belgorod State National Research University, Belgorod, Russia,
E-mail: sagalaeva@bsuedu.ru

Abstract: *This article covers the topic of rare metals and elements that are found in the bowels of Russia. The author indicates the important location of extraction, processing and use of these components. The article is based on statistics, hard facts and data that have been obtained at the current level of knowledge and help to study this issue as much as possible. The author pays attention to the study of the issue of extraction and processing of these elements, as well as their allocation by quantity, quality and content. The article highlights the importance of finding new deposits of various ores, replenishing their reserves and carrying out work within the framework of lean production.*

Keywords: *rare metals, deposits, rare earth elements, chemical and metallurgical enterprises, alloyed alloys.*

Russia is a leader in reserves of various types of minerals, both common and valuable, as well as ore and rare. All scarce ores are mined, produced, and sold in accordance with state laws, regulations, and regulations. This industry is actively and intensively developing through the improvement of plants, mines, methods, production and field surveys. Of course, it is possible to increase production capacity even more, but this requires changes. They include the transformation of the already established provision for the commissioning of world-class critical facilities in our territory and the ability to meet the needs of the market and the challenges of the time [Krukov et al., 2012: 5-7].

Particular interest for production are chemical elements that add up a group of rare earth elements and metals. But their concentrations are relatively low compared to

the main components of the Earth's crust. It takes much more effort to find these particles, and even more so deposits. It is possible to isolate them from already mined ores, but this raises the question of retrofitting and creating expensive chemical and metallurgical enterprises where the useful component will be allocated as much as possible. Their concentrations in the total mass reach a fraction of a thousandth compared to the richest element, oxygen, which is 47% in the crust (Figure 1).

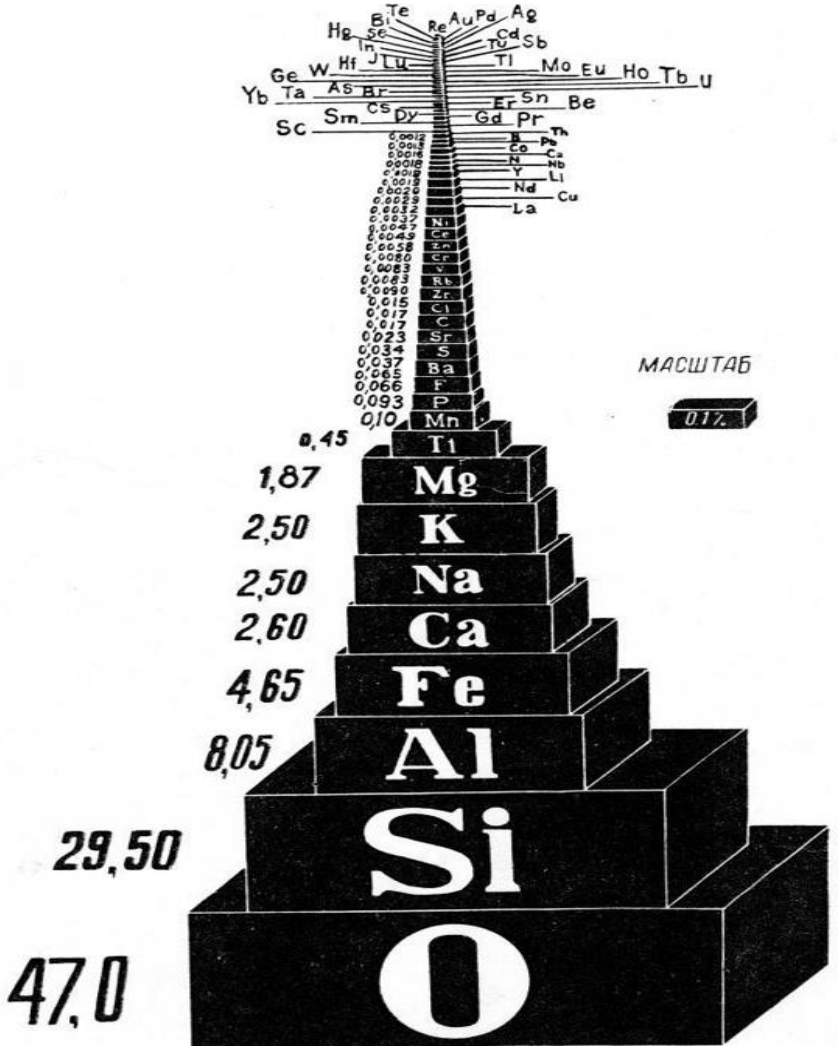


Figure 1. Concentrations of elements in the Earth's crust

There are more than 50 rare elements and they are divided into: refractory, radioactive, light, noble and inert. The light is the most common. They are widely used, are quite easy to extract and have an adequate cost. Heavy ones, on the contrary, are expensive, not so accessible, and difficulties arise in their development. The advantage of the latter is their high resistance to temperatures and pressure, which allows them to be attributed to specific uses [Melentyev, 2011: 107].

Considering the deposits of rare elements and rare earth metals, it should be said that they are not very large. Molybdenum reserves are represented by 36 objects, of which only 18 are relevant. Moreover, the quality of the ores of the undistributed fund is comparable to the quality at the facilities under development. Our country is a leader in the amount of lithium, but there are currently no forecasted resources. There is an

urgent issue of searching for new objects or creating techniques for the extraction of this element, but so far the problem has not been solved.

The main reason for the ore shortage is the special geographical location and geological structure of the main deposits. Their low quality and high need for enrichment, lack of knowledge on maximum extraction, and incomplete infrastructure for the use of deposits. In addition to modern problems, difficulties are also caused by the collapse of the USSR, which left many deposits on the territory of Ukraine, Georgia and Kazakhstan, constant pressure on Russia from unfriendly states and internal disagreements.

The development of the mining complex is connected, oddly enough, with the creation of new and expansion of existing enterprises, processing and reuse of domestic ores such as manganese, titanium, graphite, fluorite. The annual demand for manganese ore in the country is about 1.5 million tons, and this corresponds to the production level of 30-40 thousand tons. Despite this, some of the raw materials are still imported from abroad, as they are cheaper. The lower cost is caused by a higher level of knowledge and production in other countries, which is why raw materials are cheaper in them.

There are about 28 million tons of REM in the country, but the required amounts are 5.2 million tons. There are several types of them: primary, that is, natural, and secondary – technological. They are divided by the content of light and heavy rare earth metals. The reserves are represented by 16 deposits [Kalashnikov et al., 2016: 1543].

The elements in question have special chemical and physical characteristics, which is why they are used in existing innovative technologies, or vice versa, they build production facilities for available raw materials. We consider alloys that are included in strong permanent magnets as the main component and are used in a wide range of high-tech products to be an example of this. The areas of use have a wide range, ranging from technological devices, defense products and automobiles, to microchips and medical devices.

The issue of alloys was raised, and everyone understands that without small impurities, the properties will already be lost. Rare earth metals improve the quality of nickel, aluminum, and steel. It is proved that if low-alloyed steels are used, in which 0.03-0.07% niobium and about 0.01-0.1% vanadium are used, the weight of the structure of cars, bridges, weapons, exploration equipment can decrease by 30-45%, and the service life and operation can increase 2-3 times or more. For a more precise understanding, (Table 1) shows where rare earths are ultimately used [Krukov et al., 2012: 13].

Rare elements have a strategic role in economic development. Currently, the demand for rare earths is in the order of 200 thousand tons, but further growth and an increase in demand are predicted, based on the trend since 2008, where production has increased by 20 thousand tons every 3 years. With such production changes, it is important to remember that it takes 15 years to open a new field, and only after that time will it begin to cover the needs of the market. New developments also require large financial investments, no less than $1 billion, and they can only be provided by the state and its constant support. For example, the shortage of uranium raw materials currently stands at about 80%. It is closed only by reducing inventory and reusing this component. Secondary sources can be considered waste from nuclear fuel, tailings dumps, reserves of reserve and highly mineralized raw materials [Melentyev, 2011: 111].

Table 1

The final using of rare components

Light rare earth elements (more widespread)	End-use product	Heavy rare earth elements (less widespread)	End-use product
Lanthanum	Hybrid engines, alloys	Terbium	Luminescence of substances, permanent magnets
Cerium	Autocatalysts, oil refining	Dysprosium	Hybrid engines and magnets
Praseodymium	Magnets and magnetic installations	Ytterbium	Lasers and metal alloys
Neodymium	Electronics, most of all hard drives, headphones. Hybrid engines	Yttrium	Fluorescent lamps, red color for screens, ceramics
Samaria	Also magnets and their components	Holmium	Colored glasses, lasers
Europium	Red color for TV screens, computers	Thulium	X-ray machines and their components

The areas of use of various rare elements are constantly changing and expanding. Previously, many metals were not in demand and their reserves were not even studied, but they began to be used due to the needs of energy, industry, machinery, and transport.

Based on the complex production chain when using rare earths and their extraction sites, processing plants are being built next to the deposits. Despite the current positive trends in their use, it is constantly necessary to find and replenish reserves. New enrichment and production facilities will allow the development of the state's economy. Stable links with various regions will be created, and there will be a transition from mining and processing to high-tech creation and further export. Of course, the government needs strong support and steps to strengthen production, and only in this case can the goals outlined in this article be achieved.

References

1. Bolshaya rossiyskaya enciklopediya 2004-2017 [Great Russian Encyclopedia 2004-2017]. – [online]. Available at: https://old.bigenc.ru/section/geology. (Accessed: 15.04.2025). (in Russian)

2. Kablov, E. N. et al. (2013). Redkie metally i redkozemelnie elementy – materialy sovremennikh I budushikh visokikh texnologii [Rare Metals and rare earth elements – materials of modern and future high technologies] // *Aviacionnie materialy i texnologii.* – № 2. – Pp. 3-10. (in Russian)

3. Krukov, V. A. et al. (2012). Strategicheskoe znachenie redkozemelnix metallov v mire i Rossii [The strategic importance of rare earth metals in the world and in Russia] // *Vserossiyskiy ekonomicheskiy zhurnal*. – № 11(461). – M: EKO. – Pp. 5-16. (in Russian)

4. Melentyev, G. B. (2011). Conzeptsia vosstanovlenia i razvitia proizvodstv redkikh metallov v Rossii oboronniy compleks – nauchno-texnichescomy progressu Rossii [The concept of restoration and development of rare metals production in Russia defense complex – scientific and technological progress of Russia] // *Vserossiyskiy ekonomicheskiy zhurnal*. – Pp.104-113. – M.: FGUP VMI. (in Russian)

UDK 504.062:551.58:502.131.1(571.15)

GEOÖKOLOGISCHES MOSAIK VON ALTAI

Schapowalow Sergej Dmitrijewitsch,
Student des Instituts für Erdwissenschaften,
Belgoroder Staatliche Nationale Forschungsuniversität, Belgorod, Russland,
E-mail: sergey.shapowalod@bk.ru
Taranowa Elena Nikolayewna,
Kandidatin der philologischen Wissenschaften,
Professorin des Lehrstuhls für Fremdsprachen
und berufliche Kommunikation,
Belgoroder Staatliche Nationale Forschungsuniversität, Belgorod, Russland,
E-mail: taranova_e@bsuedu.ru

Annotation: *Das Altai-Gebirge ist ein einzigartiges Naturgebiet an der Schnittstelle von vier Nachbarländern – Russland, Kasachstan, die Mongolei und China, dass ein transnationales Naturerbe darstellt. In diesem Artikel wird das Altai-Gebiet als Modellregion für die Untersuchung geoökologischer Prozesse betrachtet. Besonderes Augenmerk wird auf die Rolle des Klimawandels, die Bedrohung der Biodiversität, anthropogene Einflüsse sowie die Möglichkeiten nachhaltiger Entwicklung gelegt. Es werden sowohl geologische als auch ökologische Besonderheiten der Region beschrieben, aktuelle Umweltprobleme gezeigt und die Maßnahmen zum Schutz der Umwelt skizziert.*

Schlagwörter: *Altai, Naturregion, Ökosysteme, geologische Struktur von Altai, ökologische Probleme, Altai-Naturzone, die Biodiversität, Ökologie.*

Der Altai ist eine wirklich einzigartige natürliche Region, die sich am Grenzübergang von vier Nachbarstaaten befindet: der Russischen Föderation, der Republik Kasachstan, der Mongolei und der Volksrepublik China. Dieses Bergmassiv zeichnet sich durch eine außergewöhnliche Vielfalt an natürlichen Bedingungen aus und vereint umfangreiche Ökosysteme, die sich von ewigen Gletschern und Hochebenen bis hin zu Steppenebenen und Taiga erstrecken. Aufgrund dieses natürlichen und ökologischen Reichtums wurde der Altai von der UNESCO zum Weltkulturerbe erklärt, was seine herausragende Bedeutung sowohl hinsichtlich der biologischen als auch der kulturellen Vielfalt unterstreicht.

Die Region Altai erfüllt nicht nur innerhalb ihres Territoriums, sondern auch auf dem gesamten eurasischen Kontinent wichtige klimabestimmende Funktionen. Es hat einen wesentlichen Einfluss auf die Klimaprozesse und bildet eine besondere Zirkulation von Luftmassen und Wasserströmen. Darüber hinaus ist der Altai ein Schlüsselgebiet für die Erhaltung einer großen Anzahl seltener, gefährdeter und endemischer Arten lebender Organismen.

Aber neben den natürlichen Eigenschaften hat es auch eine enorme historische und kulturelle Bedeutung. In diesem Gebiet lebten seit langem alte Völker, die ein reiches archäologisches Erbe hinterließen. Der Altai war ein wichtiger Teil der Großen Handelswege, einschließlich der Abzweige der Seidenstraße, was den Austausch von Kulturen und wirtschaftlichen Beziehungen förderte [Schwetsow, 2018].

In den letzten Jahrzehnten hat die Region jedoch ernsthafte ökologische und klimatische Herausforderungen erlebt. Der Klimawandel, die zunehmende

anthropogene Belastung und das beschleunigte Wachstum der Wirtschaftstätigkeit haben sowohl Wissenschaftler als auch Umweltorganisationen alarmiert. Aus diesem Grund wird der Altai zunehmend als Referenzgelände für wissenschaftliche Studien zur Untersuchung der Auswirkungen der Erderwärmung und der Möglichkeit, ein nachhaltiges Entwicklungsmodell aufzubauen, angesehen [Titowa, 2016].

In dieser Studie werden die wichtigsten geoökologischen Merkmale der Region Altai, die Faktoren, die zur Verschlechterung ihrer natürlichen Umwelt beitragen, im Detail analysiert und mögliche Wege zur Erhaltung des ökologischen Gleichgewichts und zur nachhaltigen Nutzung der Natur der Region entwickelt.

Die geologische Struktur des Altai ist äußerst komplex und vielfältig, was auf seine alten geologischen Ursprünge und mehrere tektonische Prozesse zurückzuführen ist, die im Laufe von Millionen Jahren stattfanden. Im Relief der Region gibt es einen Wechsel von mit Schneekappen bedeckten Hochgebirgsketten, Gletschermassiven, tiefen Intergebirgstälern, mächtigen Flusssystemen und malerischen Seen. Eine solche geomorphologische Vielfalt bildet günstige Bedingungen für die Existenz verschiedener Biogeozenosen und Landschaften, die sich nicht nur im Aussehen, sondern auch in funktionellen Eigenschaften unterscheiden [Sekerin, Dergilewa, Jegorow, 2023].

Zu den bemerkenswertesten natürlichen Formationen gehören große Gletscherfelder, einschließlich des Großen Taldurin – Gletschers (Bolschoy Taldurinskyi Lednik), sowie die riesigen Gletscher, die das Beluga-Bergmassiv umgeben, den höchsten Gipfel Sibiriens. Diese Gletscher schmücken nicht nur die Landschaft, sondern spielen auch eine Schlüsselrolle bei der Versorgung der Region mit frischem Wasser, da sie die Ursprünge der Flüsse sind, die sowohl den Altai als auch die entlegeneren Gebiete Westsibiriens ernähren.

Wichtige hydrologische Objekte der Region sind zahlreiche Flüsse wie Katun, Chuya und Biya, die sich von Schmelzwasser aus Gletschern ernähren. Diese Flüsse versorgen nicht nur die lokale Bevölkerung und die Landwirtschaft mit Wasser, sondern spielen auch eine wichtige Rolle bei der Aufrechterhaltung des Gleichgewichts von Ökosystemen und dem Funktionieren des größten Flusssystems Westsibiriens, des Ob Flusses. Eine wichtige Rolle bei der Bildung der Wasserressourcen des Altai spielen auch Seen, unter denen der Telezkoye Osero (Telez-See) hervorgehoben wird. Es ist das größte Süßwasserbecken der Region, das sich durch eine beträchtliche Tiefe, Reinheit des Wassers und ein einzigartiges Mikroklima auszeichnet. Es dient als Klimapuffer und beeinflusst die Luftfeuchtigkeit und die Temperaturregime des umgebenden Gebiets

Ein integraler Bestandteil der Natur des Altai sind seine Wald- und Steppengebiete. Diese Ökosysteme bilden eine komplexe, mehrstufige biologische Struktur, die die Stabilität natürlicher Prozesse gewährleistet. Die Laubwälder, dunkelgrüne Waldmassive und Lärchenhaine wechseln sich ab und bilden eine mosaikartige Naturlandschaft. Besonders wertvoll sind Nadelwälder mit einer Dominanz von Arten wie sibirischer Zeder, Tanne und Fichte. Diese Pflanzen spielen nicht nur eine klimaregulierende Rolle, sondern sorgen auch für die Stabilität der Bodendecke, tragen zur Feuchtigkeitsretention bei, verhindern Erosion und Entwicklung von Erdrutschprozessen [Paramonow, Klyuchnikow, Chukanow, 2008].

Aufgrund der geografischen Isolation, des komplexen Reliefs und der Vielfalt der klimatischen Bedingungen wurde der Altai zu einem echten Zentrum der Artenvielfalt. Auf seinem Territorium leben viele Arten, die vom Aussterben bedroht sind. Ein bekannter Vertreter der Fauna ist der Schneeleopard (Panthera uncia) – ein Raubtier, das ein Symbol der Region ist. Dieses seltene Tier steht kurz vor dem Aussterben. Im russischen Teil des Altai gibt es nach den Schätzungen von Wissenschaftlern weniger als 50 Individuen dieses Tieres. Der Schneeleopard spielt eine wichtige Rolle bei der Aufrechterhaltung der Ökosystemstabilität, indem er die Anzahl der Huftiere reguliert und das biologische Gleichgewicht aufrechterhält.

Eine andere bedeutende Art ist der Altai-Bergschaffe (Ovis ammon ammon), der eine hohe Anpassungsfähigkeit an die extremen Bedingungen des Hochgebirges aufweist. Seine Anzahl wird jedoch aufgrund von Wilderei, Straßenbau und anderen Formen wirtschaftlicher Aktivitäten reduziert, die natürliche Lebensräume zerstören. Die Erhaltung dieser einzigartigen Arten erfordert einen koordinierten internationalen Schutz und die Umsetzung von Naturschutzmaßnahmen vor Ort [Kulikow, Medwedew, 2012].

Die Gletscher und der Permafrost des Altai sind von wissenschaftlichem Interesse als natürliche "Archive", die Informationen über das Klima vergangener Epochen speichern. Die Untersuchungen von Eiskernen, die aus großer Tiefe extrahiert werden, ermöglichen es, ein Bild des Klimawandels über Zehntausende von Jahren nachzubilden. Diese Daten sind notwendig, um globale Klimaprozesse zu verstehen und zuverlässige Klimaprognosen für die Zukunft zu erstellen.

Eines der wichtigsten ökologischen Probleme der Region ist die schnelle Reduzierung der Gletscherfläche. Sie sind in den letzten 50 Jahren um etwa 30% zurückgegangen. Dies droht mit schwerwiegenden Folgen, einschließlich einer Beeinträchtigung des Wasserhaushalts, einer Abnahme des Flussniveaus und einer verminderten Wasserverfügbarkeit in Trockenperioden. Die daraus resultierenden Auswirkungen können die Landwirtschaft, die Wasserversorgung der Bevölkerung sowie die Industrie und das Ökosystem insgesamt betreffen. Darüber hinaus trägt die Verringerung der Gletscher zu einem erhöhten Hochwasserrisiko bei und beeinträchtigt das saisonale Regime der Flüsse, was sich negativ auf die Flora und Fauna der Region auswirkt [Nosenko, Nikitin, Chromowa, 2014].

Die Erhöhung der durchschnittlichen jährlichen Temperatur führt zu einer vertikalen Wanderung der Klimazonen, wodurch viele Hochgebirgsarten von Pflanzen und Tieren ihre gewohnten Lebensräume verlieren; zur Störung der Nahrungsketten, zur Veränderung der Zusammensetzung von Gemeinschaften und zum möglichen Verschwinden einzigartiger Ökosysteme, die sich im Laufe der Jahrtausende gebildet haben.

Um diesen negativen Prozessen entgegenzuwirken, werden in der Region internationale Programme zum Schutz der Natur und zur Wiederherstellung biologischer Ressourcen durchgeführt. Zu den bedeutendsten gehören die Initiativen der Internationalen Union für Naturschutz (IUCN) und der Globalen Ökologischen Stiftung (GÖS), die Aufklärungsarbeit leisten, die Schutzgebiete schaffen, degradierte Gebiete wiederherstellen und die Umweltkompetenz der Bevölkerung erhöhen.

Die Schaffung und Erweiterung eines Netzes von besonders geschützten Naturgebieten bleibt eines der wichtigsten Instrumente des Naturschutzes. Ein Beispiel

dafür ist das Naturschutzgebiet "Goldene Berge des Altai", das nicht nur natürliche Landschaften bewahrt, sondern auch zur Erhaltung des kulturellen Erbes indigener Völker beiträgt. Solche Zonen wie das Ukok-Plateau erfüllen die Funktionen von Biosphärenreservaten, wissenschaftlichen Labors und Standards für nachhaltige Umweltnutzung.

Trotz vieler Umweltbedrohungen erfüllt die Altai-Region die wichtigsten Klimaregelungsfunktionen in ganz Eurasien und beeinflusst die Luftströmung, den Feuchtigkeitszyklus und die Temperaturregime in weiten Gebieten Sibiriens und Zentralasiens. Darüber hinaus dient dieses Gebiet als natürlicher Zufluchtsort für viele seltene Arten von Flora und Fauna, um ihre genetische Vielfalt zu erhalten und die Nachhaltigkeit von Ökosystemen gegen Veränderungen in der Umwelt zu fördern.

Aber neben seiner natürlichen Bedeutung hat der Altai tiefe kulturelle, historische und ethnographische Wurzeln. Seit Jahrtausenden sind seine Länder der Wohnort verschiedener ethnischer Gruppen und Zivilisationen. Hier befanden sich die alten Wohnorte der Turkstämme, es gaben auch wichtige Handelswege, einschließlich der Abzweige der Seidenstraße [Fachruttinow et al., 2018].

In den letzten Jahrzehnten steht die Region jedoch vor ernsten Umwelt- und Klimaproblemen. Der Klimawandel, die zunehmende Wirtschaftstätigkeit, die Zunahme des Touristenstroms, die unkontrollierte Abholzung, die Wilderei und die industrielle Entwicklung von Naturgebieten – all dies macht einen starken vom Menschen verursachten Druck auf das Ökosystem des Altai aus.

Als Ergebnis dieser Situation wird die Region zunehmend als ein Schlüsselgelände für die Untersuchung der Auswirkungen der Erderwärmung und die Entwicklung neuer Strategien für eine nachhaltige Entwicklung angesehen. Deshalb wird im Rahmen dieser Studie ein ganzer Komplex von geoökologischen Besonderheiten des Altai-Territoriums untersucht, einschließlich spezifischer Bedrohungen seiner natürlichen Systeme, Formen und Ausmaßen der menschlichen Einwirkung sowie möglicher Wege zur Erhaltung und Wiederherstellung des ökologischen Gleichgewichts.

Die Altai-Naturzone zeichnet sich durch eine außerordentliche geologische Komplexität aus, die durch lange tektonische Prozesse entsteht. Über viele Millionen Jahre haben hier zahlreiche geodynamische Ereignisse stattgefunden: Bergbildung, vulkanische Aktivität, Vereisung und Erosion. Das hat ein einzigartiges Relief mit sich abwechselnden Hochgebirgsketten, riesigen Gletscherfeldern, tief eingebetteten Intergebirgstälern, einem dichten Netz von Flüssen und zahlreichen Seen geschaffen. Diese komplexe Struktur trägt zur Bildung einer Vielzahl von Naturlandschaften bei, die Elemente der Taiga-, Steppen-, Berg- und Alpennatur kombinieren.

Fazit: Trotz aller bestehenden Bedrohungen – sowohl natürlicher als auch vom Menschen verursachter Natur – bleibt Altai eine Region mit einem hohen Potenzial für nachhaltige Entwicklung. Sein einzigartiger natürlicher Reichtum, tiefe kulturelle Traditionen, internationale Unterstützung und hohes wissenschaftliches Interesse schaffen günstige Bedingungen für die Bildung eines Modells, in dem Wirtschaftswachstum mit der Erhaltung der Umwelt kombiniert wird. Die nachhaltige Nutzung der natürlichen Ressourcen, die ökologische Aufklärung der Bevölkerung, die Einführung neuer Ansätze für wirtschaftliche Aktivitäten und die Einbeziehung der

Einheimischen in die Naturschutzprozesse können die langfristige ökologische Stabilität der Region gewährleisten.

Literaturliste

1. Fachruttinow, R. G., Fachruttinow, R. R. (2018). Altay i tsentralnaya Aziya: kolybel' tyurkov [Altai und Zentralasien: Wiege der Turkvölker] // *Tyurkologicheskie issledowaniya [Turkologische Studien]*. – № 3. – S. 5–18. URL: https://cyberleninka.ru/article/n/altay-i-tsentralnaya-aziya-kolybel-tyurkov. (Zugriff: 22.04.2025). (in Russisch)

2. Kuschlekow, A. O., Medwedew, D. G. (2012). Otsenka chislennosti i lokalizatsii altayskogo gornogo barana (ovis ammon ammon, l. 1758) na territorii Rossii [Die Schätzung der Anzahl und Lokalisierung des Altaischen Bergschafs (Ovis ammon ammon, L. 1758) in der Russischen Föderation] // *Westnik Altaiskogo gosudarstwennogo argarnogo universiteta [Mitteilungsblatt der Altai-Staatlichen Agraruniversität]*. – № 8 (94). – S. 76–81. URL: https://cyberleninka.ru/article/n/otsenka-chislennosti-i-lokalizatsii-altayskogo-gornogo-barana-ovis-ammon-ammon-l-1758-na-territorii-rossiyskoy-federatsii. (Zugriff: 22.04.2025). (in Russisch)

3. Nosenko, G. A., Nikitin, S. A., Chromowa, T. E. (2014). Izmeneniye ploshchadi i ob'yema lednikov Gornogo Altaya (Rossia) s serediny 20 veka po dannym kosmicheskikh syomok [Die Veränderung der Fläche und des Volumens der Gletscher des Altaigebirges (Russland) seit Mitte des 20. Jahrhunderts anhand von Satellitendaten] // *Led i sneg [Eis und Schnee]*. – № 2 (126). – S. 5-15. (in Russisch)

4. Paramonow, E. G., Kljutschnikow, M. W., Tschukanow, W. I. (2008). Razvitiye lesohozyaystvennogo kompleksa Altaya [Die Entwicklung des forstwirtschaftlichen Komplexes des Altai] // *Ekonomika i upravlenie* [*Wirtschaft und Verwaltung*]. – № 1. – S. 53–55. URL: https://cyberleninka.ru/article/n/razvitie-lesohozyaystvennogo-kompleksa-altaya. (Zugriff: 22.04.2025). (in Russisch)

5. Schwetzow, S. P. (2018). Altai – zapadnaya Sibir' v 19 – nachale 20 vekov: naselenie, hozyaystvo, kultura [Altai – Westsibirien im 19. – Anfang des 20. Jahrhunderts: Bevölkerung, Wirtschaft, Kultur]. – Gorno-Altaisk: Issledowatelskiy institut altaistiki imeni S.S. Surayakowa. – S. 118. (in Russisch)

6. Sekerina, D. D., Dergilewa, E. A., Jegorow, A. S. (2023). Zakonomernnosti lokalizatsii struktur kaledonskogo i gertsinskogo orogeneza rudnogo Altaya [Die Gesetzmäßigkeiten der Lokalisierung der Strukturen des Kaledonischen und Hercynischen Orogenese im Erzgebirge Altai] // *Regionalnaya geologia i metalogenia [Regionale Geologie und Metallogenie]*. – № 93. – S. 52–62. (in Russisch)

7. Titowa, I. W. (2016). *Vliyanie tendentsyi progreshiruyushchego potepleniya klimata na sostoyaniye lednikov (na primere lednikov Gornogo Altaya)* [Die Wirkung der Tendenz der fortschreitenden Klimaerwärmung auf den Zustand der Gletscher (am Beispiel der Gletscher im Altaigebirge)] // *Uchenye zapiski Altaiskogo filiala Rossiyskoy Akademii narodnogo chozyastwa pri presidente Rossiskoy Federacii* [*Wissenschaftliche Mitteilungen der Altai-Filiale der Russischen Akademie für Volkswirtschaft und Staatsdienst beim Präsidenten der Russischen Föderation]*. – № 12–13. – S. 138-144. URL: https://cyberleninka.ru/article/n/vliyanie-tendentsii-progressiruyuschego-potepleniya-klimata-na-sostoyanie-lednikov-na-primere-lednikov-gornogo-altaya. (Zugriff: 22.04.2025). (in Russisch)

UDK 159.937.51

THE EFFECTS OF COLOURS, SHAPES AND BOUNDARIES OF LANDSCAPES ON PRECEPTION, EMOTION AND MENTALIZING PROCESSES PROMOTING HEALTH AND WELL-BEING

Vaseeva Anastasia Andreevna,
Student of the Institute of Earth Sciences,
Belgorod State National Research University, Belgorod, Russia,
E-mail: 1388152@bsu.edu.ru
Mariasova Elena Anatolyevna,
Ph. D. in Philosophy,
Associate Professor of the Department of Foreign Languages and Professional Communication,
Belgorod State National Research University, Belgorod, Russia,
E-mail: mariasova@bsuedu.ru

Abstract: *This article applies new thinking within the framework of psychoanalytic theory to demonstrate how certain therapeutic landscapes promote health and well-being. Over the past two decades, health geographers have expanded the concept of therapeutic landscapes to analyze the relationship between place and health in relation to different locations. The captivating interplay between color and the perception of landscape spaces has been a subject of profound study and exploration. From the psychology of colors to the practical implementation of vibrant palettes, this article delves into the intricate dynamics that shape our experience of outdoor environments.*

Keywords: *effects of colours, shapes and boundaries of landscapes, emotion and mentalizing processes, promoting health and well-bein, landscape.*

Since the appearance of the concept of '***therapeutic landscapes'***, pioneered within health geographies, there has emerged a growing body of evidence to support the observation that landscapes can benefit health and wellbeing. The initial idea of a therapeutic landscape as a physical place with healing associations to which people would travel for treatment or healing – whether physical, psychological or spiritual – has been much expanded over the past 20 years.

The theoretical and methodological approaches taken here to landscape as a feature of practices of visualisation is informed by recent developments in cultural theory and visual culture studies. Briefly, these changes reject the linguistic bias of structuralist and poststructualist approaches, and aim to restore the significance of the object within situated practices of looking and seeing.

The article connects themes current in psychoanalytic theory, in particular the concept of 'mentalising', to a viewer's affective experience of landscape and natural phenomena. It is necessary to explain the idea of mentalising in some detail before examining its application to therapeutic encounters with landscape. The paper presents the mechanism of emotional mirroring explained through the 'social biofeedback model' of reflected affect.

We now move from the question of the relationship between the individual, his or her mental states and capacity to imagine the mental states of others, to the relationship between the individual and the landscape. The concept of mentalising,

connected to the development of emotional awareness, is applied to the individual's engagement with the landscape in order to illuminate how therapeutic and wellbeing benefits might occur.

Applied to the experience of landscape, the theory of mentalising suggests that the individual can encounter landscape as an empathic mirror of feeling states and affects, enabling him or her to gain a broader appreciation of and competence with the emotional and cognitive conditions of subjective and inter-subjective functioning. Projected affect states take place in the context of full awareness of the separation between reality and construction [Lengen, 2015].

With each place we have experienced – where we were born and grew up, where we moved to, where we live now – we have developed a deep but mostly unconscious sense of place and identification with place. Physical, social and cultural place experiences are engraved on our existence. Based on our actions and intentions, and the meanings and symbols of places, we develop an existential consciousness. The way humans perceive landscape has been developed in a process of evolutionary selection over millions of years and is multi-sensory. Humans are surrounded by a huge quantity of stimuli, especially sights, sounds, smells, tastes, and the force of gravity. In order to survive, humans have had to evaluate and rapidly and accurately interpret these stimuli as a reliable means of analysing the environment. In pre-modern European cultures senses such as touch, hearing and smell were predominant.

Making sense of places is an essential task of survival, based on visualising, imagining and mentalising our places. This part of the article aims at combining Relph's 'perceptual space' and 'existential space', again with the focus on the visual experience. In the adaptation process of a complex visual supply, we create meaningful mental representations of objects, places and landscapes.

The 'perceptual and existential' blue space was categorised by the umbrella terms 'water' and 'sky'. Blue space places are linked to refreshment, to movement in nature, to scent. Regardless of personality type, a number of the clients reported that the motion of water sets something in emotion within them – ideas, emotions and feelings, and thus promotes well-being.

The colours and shapes seem to be an important part of the fascination exercised by water and sky. Clients associated green space with recreation, power and width, with movement in landscape, with scent which refreshes. As in blue space, the view of the wide-open space gave them the feeling they could breathe easily, helped relieve the daily stress, helped them to relax and feel free. In the clients' narratives, the forest featured strongly in green space. Colours, the intensity of the green, but also the diversity of colours, was addressed, and in winter the green was emphasized by fir.

In addition to the blue and green spaces, grey and white spaces such as mountains with rock, cliffs, stones and snow filled landscapes, as well as beaches and deserts, were emphasised. These kind of spaces, based on stones in different kind of shapes and material and snow in different states, we define as grey and white 'perceptual and existential' spaces. Abrupt and bizarre shapes of rocks and stones were mentioned as having a particularly fascinating impact.

The most frequently mentioned items are natural boundaries. In each blue, green, grey or white perceptual space mentioned above, the preferred places where the clients

like to rest and from where they prefer to look over the landscape are specifically differentiated and described as boundaries. The clients seek a place to live or spend their holidays by the waterfront or at grassland-forest edges; or during the week they visit places by the waterfront [Chekmarev, 2013].

Contrasting natural processes such as the solar cycle with sunrise and sunset, and connected light aspects such as colour hue, saturation and brightness, all played an important role in the perception of landscape. The participants narrated how the landscapes were coloured blue, green, white or pastel, how they perceived those colours and with which feelings they associate each one.

In the context of health and well-being, clients often narrated their perceptions and experiences within 'blue', 'green', 'grey' and 'white' as well as 'pastel red-coloured' spaces. Green spaces were mentioned more frequently than blue, grey and white spaces. However, many reports also discussed boundaries and edges of differently coloured spaces, such as forest-grassland edges, coastlines, beaches and mountain-grassland edges. Water can be considered incomprehensible; it is a symbol of change for the clients, a metaphor for changes in life [Lengen, 2012].

However, it also represents continuity and is a symbol of identity, forever changing, yet staying the same. Along with trees, the seasonal and solar cycle were also emphasized as symbols of being and transformation in life. In a similar way, the tree symbolizes resistance, power and protection.

The clients' blue space references are linked to refreshment, to motion in nature, to visual perceptions associated with overview and width. The movement of the water in the sea, in lakes, ponds, rivers and streams seems to set something in motion within us – ideas and emotions – and thus promotes well-being. If something moves in us, then we have an 'emotion'. In psychiatric diseases such as depression, manic disorder or schizophrenia the emotional state is dysregulated.

Thus, the psychotherapeutic process established between the author and the clients before the study began made it possible to move deeper into the narrative process on place and landscape than would have been the case with 'healthy' participants unknown to the interviewer. The clients were familiar with the questioning style of the author and had the confidence to talk about autobiographical issues. Of course, this can also be seen as a limitation in terms of being less 'objective'.

References

1. Chekmarev, V. M. (2013). Russko-anglyjskyje sv'yazi v sadovodcheskom iskusstve [Russian-English connections in gardening art]. – M: E-Library. – 513 p. (in Russian)

2. Lengen, C. (2012). Mesto vstrechy: psyhoanalyticheskij podhod k ponimani'u togo, kak terapevticheskie landchagty sposobstvuyet zdorov'u I blagopoluchi'u [Encountering place: A psychoanalytic approach for understanding how therapeutic landscapes benefit health and wellbeing]. – [online]. Available at https://www.sciencedirect.com/science/article/abs/pii/S1353829212001293?via%3Dihub. (Accessed: 10.03.2025). (in Russian)

3. Lengen, C. (2015). Vli'yaniecvetov, form I granic lanshaftovna vospri'yatie, emocii I mentalnye procecci, sposobstvyushie sdorov'y b blagopoluchiu [The effects of colours, shapes and boundaries of landscapes on perception, emotion and mentalising processes promoting health and well-being]. – [online]. Available at https://www.sciencedirect.com/science/article/abs/pii/S1353829215000829?via%3Dihub. (Accessed: 10.03.2025). (in Russian)

UDK 712.3/.7

IDEAS FOR CREATING GREEN SPACES ON THE ROOF AND WALLS OF BUILDINGS: ADVANTAGES AND CARE

Babich Julia Sergeevna,
Student of the Institute of Earth Sciences,
Belgorod State National Research University, Belgorod, Russia,
E-mail: uliababic81@gmail.com
Mariasova Elena Anatolyevna,
Ph.D. in Philosophy,
Associate Professor of the Department of Foreign Languages and Professional Communication,
Belgorod State National Research University, Belgorod, Russia,
E-mail: mariasova@bsuedu.ru

Abstract: *In the context of modern urbanization and environmental problems, the greening of roofs and facades of buildings is becoming increasingly relevant. This article discusses the main ideas of creating green spaces on roofs and walls, their advantages, as well as the features of caring for such projects. The implementation of such initiatives requires an integrated approach that takes into account the structural features of buildings and the bioclimatic characteristics of the area, which allows maximizing the environmental and economic efficiency of projects. Widespread adoption of vertical gardening technologies has the potential to significantly reduce the "heat island" effect in cities, improve air quality, and enhance biodiversity in urbanized areas. Further research into the selection of optimal plant species and the development of innovative irrigation and drainage systems will help expand the scope of vertical gardening and increase its sustainability.*

Keywords: *vertical gardening, sustainable construction, eco-friendly city, energy efficiency, biophilia, drainage system, plant care, urban landscaping, architectural landscape.*

Greening roofs and facades of buildings is an effective solution to improve the environmental situation in cities (Figure 1). Green spaces on buildings contribute to reducing air pollution, increasing energy efficiency and creating a comfortable urban environment. Interest in such technologies is growing in Russia, which is confirmed by a number of scientific studies and implemented projects.



Figure 1. Roof landscaping in Moscow

There are two main types of green roofs – extensive green roofs, which involve the use of unpretentious plants such as mosses and sedums on a thin layer of substrate. They require minimal maintenance and are light in weight, making them suitable for most buildings [Molchanov, 2021]. In addition, intense green roofs, which are full-fledged gardens with trees, shrubs and lawns. Such roofs require a more complex structure, reinforced waterproofing and regular maintenance.

Green walls or vertical gardens can be realized with the help of: climbing plants: the use of vines that rise through special trellises or trellises fixed on the walls of buildings (Figure 2).



Figure 2. Hedera

In addition, modular systems can be used – the use of special panels or containers with a substrate in which various types of plants are planted. Such systems are equipped with automatic irrigation and fertilization. Plants on roofs and facades absorb carbon dioxide and release oxygen, as well as trap dust and harmful impurities, helping to purify the air [Kuznetsova, 2020]. Green spaces on buildings contribute to lowering the air temperature in cities, reducing overheating in the summer. The creation of green spaces on buildings provides a habitat for various species of birds, insects and other animals, contributing to the conservation of biodiversity in cities.

Green roofs improve the thermal insulation of buildings, reducing the cost of heating in winter and air conditioning in summer [Said, 2019]. The vegetation layer protects the roof waterproofing from ultraviolet radiation, temperature fluctuations and mechanical damage, which increases its durability. Green roofs and walls can also serve as places of relaxation and socializing for residents and employees of buildings, improving the quality of the urban environment. Aesthetic improvement – landscaping of buildings helps to improve the appearance of urban development, making it more attractive and harmonious.

A worthy example of such a plan is the sloping roof of the entrance pavilion of the "CSKA" metro station, located in Moscow (Figure 3). There are steps leading up to the roof, where you can climb up and admire the view. The unpretentious plants planted on the roof form a pattern of concentric circles of different colors. ZinCo

systems were used for landscaping. It was planned that on the roof of the station there would be a green park with bike paths, an apple boulevard, an artificial pond and places to relax with benches.



Figure 3. The "CSKA" metro station, located in Moscow

To ensure the durability and effectiveness of green roofs and facades, regular maintenance is necessary, including: watering, depending on the type of plants and climatic conditions, an irrigation system is required. Automatic irrigation systems are often used for intensive green roofs and vertical gardens. And regular application of nutrients contributes to the healthy growth of plants and the maintenance of their decorative effect. Periodic pruning of plants and removal of unwanted vegetation are necessary to maintain an aesthetic appearance and prevent the spread of pests. Cleaning drains and drainage layers prevents stagnation of water and possible leaks [Zintchenko, 2022].

Green roofs help to reduce the temperature in cities due to the effect of a heat shield and evaporation of moisture. They reduce the load on wastewater disposal systems by trapping rainwater.

In addition, such plantings improve the sound insulation of buildings, reducing noise levels in residential and work areas. They help to increase the energy efficiency of buildings, reducing the cost of heating in winter and air conditioning in summer. Facade landscaping, in turn, helps protect the walls from overheating and contamination. Green spaces also have a positive effect on the psycho-emotional state of people, creating a comfortable and aesthetic environment. They increase the biological diversity in the urban environment by providing habitat for birds and insects.

Successful integration of green technologies requires an interdisciplinary approach. To achieve this goal, it is necessary to involve architects, ecologists and engineers. Each of these specialists brings unique knowledge and skills. Government support also plays an important role in the dissemination of green solutions. Incentive measures can significantly accelerate this process. In the future, we can expect green roofs and facades to become the standard of urban infrastructure. This approach will help create more sustainable and environmentally friendly cities.

References

1. Kuznetsova, E.N. (2020). Zeleny`e kry`shi kak e`lement ustojchivogo razvitiya gorodov [Green roofs as an element of sustainable urban development] // *Molodoy Uchenyi.* – № 286. – Pp. 112-115. (in Russian)

2. Malinina, T. A. (2019). Zeleny`e kry`shi gorodskogo landshafta [Green roofs of the urban landscape]. – [online]. Available at: https://moluch.ru/archive/286. (Accessed: 10.03.2025). (in Russian)

3. Molchanov, A.V. (2021). Osobennosti proektirovaniya zeleny`x kry`sh [Features of designing green roofs] // *Universum: Tekhnicheskiye nauki*. – №2(83). – Pp. 57-59. (in Russian)

4. Said, A.N. (2019). Zelyonaya kry`sha – osobennosti konstrukcii i preimushhestva ispol`zovaniya [Green roof – design features and advantages of use]. – [online]. Available at: https://cyberleninka.ru/article/n/zelenaya-krovlya-osobennosti-proektirovaniya-i-preimuschestva-ekspluatatsii/viewer. (Access: 04/03/2025). (in Russian)

5. Zintchenko, N.S. (2022) Preimushhestva zelenoj kry`shi v gorodskom prostranstve [Advantages of a green roof in urban space]. – [online]. Available at: https://cyberleninka.ru/article/n/preimuschestva-zelenoy-krovli-v-gorodskom-prostranstve. (Accessed: 15.03.2025). (in Russian)

UDK 553.04

THE MINERAL RESOURCE OF URANIUM IN RUSSIA

Karpenko Kirill Sergeevich,
Student of the Institute of Earth Sciences,
Belgorod State National Research University, Belgorod, Russia,
Email: 1686630@bsu.edu.ru
Sagalaeva Irina Vladimirovna,
Ph.D. in Pedagogy,
Associate Professor of the Department of Foreign Languages and Professional Communication,
Belgorod State National Research University, Belgorod, Russia,
E-mail: sagalaeva@bsuedu.ru

Abstract: *This article discusses the state and prospects of the development of the mineral resource base of uranium in Russia, one of the key natural resources. The current state is analyzed, positive and negative aspects are highlighted, reserves and the effectiveness of their use are assessed, and factors affecting the state of these reserves are analyzed. As a result, a brief perspective of the uranium industry for the future is given.*

Keywords: *uranium, nuclear energy, deposit, mineral resource base, reserves, production.*

Uranium is one of the most important and strategically important minerals used in nuclear energy. Russia has significant reserves of uranium and is one of the largest producers and exporters of this mineral. Due to the increased demand for uranium in the world and the desire of countries to reduce dependence on traditional energy sources, the analysis of the state and prospects for the development of the uranium mineral resource base in Russia is of current research interest [Bogachev, 2008].

Balance reserves of uranium as of 01.01.2022 amounted to 707.7 thousand tons, they are contained in the bowels of 53 deposits. Only off-balance sheet reserves are accounted for at eight other facilities. The off-balance sheet reserves of uranium in the whole country amounted to 134 thousand tons. However, these figures do not prevent

Russia from occupying the fourth place in the world in terms of uranium resources and the sixth place in terms of its production, being one of the world's largest producers and suppliers of nuclear fuel for the needs of nuclear power plants.

The country also has unique technology for enriching uranium in gas centrifuges. In accordance with the Strategy for the development of the mineral resource base until 2035, approved by Decree of the Government of the Russian Federation dated December 22, 2018 No. 2914-r, uranium belongs to the third group, which includes scarce minerals, but Russia has a fairly extensive and the diverse resource potential of this country in the uranium industry.

Analyzing the current state and structure of the uranium mineral resource base in Russia, it can be noted that as of 2022, reserves have decreased compared to previous years (Figure 1). [https://nedradv.ru/nedradv/ru/resources?obj.=ab05b068239ede80d3dd35cf407239bb].

	As of 01.01.2020		As of 01.01.2021		As of 01.01.2022.
Reserves	$A+B+C_1$	C_3	$A+B+C_1$	C_2	%
quantity, (houshand tons) (changes from proviou-yea	330,1 (-1 %)	388.8 (-0 %)	337.1 (-0.3%)	383.5 (-08%)	3.1 % (-0%)
share of distributed fund, %	65,2	75,1	64.8	72.1 0	63 %

Figure 1. The state of Russia's mineral resource base

Production levels between 2012 and 2021 fluctuated from 2.6 to 3.4 thousand tons annually, with 2,640 tons extracted and 2,635 tons of uranium concentrate produced in 2021 – reflecting a slight decline compared to the previous year. Major mining centers are located in the Trans-Baikal Territory (Streltsovsky Uranium Ore District), the Republic of Buryatia (Vitim district), the Kurgan Region (Trans-Ural region), and the Republic of Sakha (Yakutia), particularly in the Elkon uranium district.

From a structural standpoint, over 54% of Russia's uranium reserves are located in the Elkon group of deposits in Yakutia. These are complex gold-uranium ores, with uranium concentrations ranging between 0.1% and 0.4%, averaging around 0.15%. Although these concentrations are relatively low, the scale of reserves positions them as a strategic reserve for future development, provided that economically viable processing methods – particularly for brannerite ores – are developed.

The Trans-Baikal region holds about 20.7% of reserves, primarily represented by low-grade ores localized in volcanic formations. Within this region, the Argunskoye and Zherlovoye deposits are considered among the few economically feasible for current development, with concentrations of 0.22% and 0.09% respectively. Meanwhile, in Tuva, 14.7% of reserves are found in the Ulug-Tanzek deposit, where uranium exists as an associated component within rare-metal ores. However, no

industrial processing technology currently exists for this type of ore, limiting its practical use.

In Buryatia, which contributes 4.6% to national reserves, uranium is extracted using the in-situ leaching (ISL or SPV in Russian terms) method from sandstone-type deposits like those in the Khiagda field. Though extraction is ongoing, ore concentrations here remain low (around 0.039%).

The Kurgan region contains about 1.8% of the country's reserves, mostly in sandstone deposits such as Dalmatovskoye and Dobrovolnoye. While these fields are being developed, their long-term production potential remains uncertain due to limited reserve volumes and modest ore quality. Similarly, in Kalmykia, two deposits – Stepnoye and Shargadykskoye – hold roughly 3.1% of national reserves, with average uranium concentrations around 0.05%. These remain underexplored and are part of the undistributed subsoil fund (Figure 2) [https://nedradv.ru/nedradv/ru/resources?obj.=ab05b068239ede80d3dd35cf407239bb].

Deposit (Region)	Geological Type	Reserves, tons ($A+B+C_1/C_2$)	Share of Russian Reserves, %	U Content in Ore, %	2021 Production, tons
In Production					
Stroilsovskove (Zabolkalsky Krai)	Molybunoiuni-urasium urannics	15,365/68	3.4	0.15	583
Nayo,Tulakskoe (Zabolkalsky Krai)	Uranium rnanoics Uranianciae	5,550/229	0.15	0,15	499
Argunskove (Buflatstal) (Republic of Buryatia)	Uranium in sandstones	7.135/222	0,15	0.15	409
Dalinatovskoya (Kurgan Region)	Uranium tryanoics Gumantiones	6,901/257	0.2	0.13	382
Kholodnnye (Kurgan Region)	Uranium sandsiones	3.514/855	0,17	640	–
Under Development / Exploration					
Argunskoye (Zabolkalsky Krai)	Uranium ruranium in sandstones	27,356/0 41	0.3	–	540
Zharlovoye (Burylattali) khiogda (Republic	Uranium in sandstones	3,143./342	0.8	–	–
Verkhnee (Republic sriay.) Exant	Bju/e niderometa-atattes	2,30.1/823	60	640	–
Eurung Plateau (Republic of Saha)	Gurboudaunicrie mer-ssomatries	3,8613 reg	–	–	
Drushnoe (Republic of Sakha)	Gold-uranium in productities	11,756/3083	–	–	Eiko
Neproshodlin suslaye (Republic of Sakha)	Neprotomantime (Repubitia)	16,59/294	-	–	US S
Severnoe (Republic of Sakha)	Elkon production (Eikon	123-200		–	Elkon

Figure 2. The main uranium deposits and their reserves

Additionally, smaller uranium-bearing formations are found in the Irkutsk region, Karelia, and Khabarovsk Territory, though their total contributions are minor. Nevertheless, they add to the geological diversity of Russia's uranium portfolio.

Despite the vast size of the mineral base, a common issue across many deposits is low ore grade, which complicates or renders uneconomical the extraction using current technologies. This factor, combined with global demand and the strategic push to reduce dependence on fossil fuels, places increased importance on innovation and exploration in the sector [Sverdlov, 2014].

Looking ahead, the development of currently underutilized or unexplored deposits – such as Vershinnoye, Istochnoye, Kolichikanskoye (in Buryatia), and Severnoye (in Yakutia) – offers a path forward. According to Russia's Mineral Resource Base Development Strategy through 2035, expanding production in these areas, alongside technological advancements, especially in the Elkon group, will be essential. There's also a strong emphasis on improving cost-efficiency in processing stubborn ores and developing combined uranium-gold extraction techniques.

Given that the depletion of actively mined reserves is expected by 2030–2035, the urgency for geological exploration and innovation is increasing. Continued state support, particularly through Rosatom's integrated management of the nuclear fuel cycle, remains vital. This will allow Russia to not only maintain but potentially enhance its role as a key player in the international uranium market (Figure 3). [https://nedradv.ru/nedradv/ru/resources?obj.=ab05b068239ede80d3dd35cf407239bb].

Deposit	Mining Method	Annual Design Capacity (and tun)	Economic Assessment Region
Argunskoye Zheroloye	Underground	1 200 tons in concentrate	Development of PIXl structure
Dobrovolnoye (pilot-industrial section)	ISL	15–13.9 tons in productive solution	Development of DIM
Khiagda	ISL	126;3–374.6 tons in productive sortion	Development of Prestru,

Figure 3. The main projects for the development of uranium deposits

In conclusion, while the uranium resource base in Russia is large and strategically important, its long-term viability depends heavily on overcoming current technological and economic constraints. With the right investment into R&D, exploration, and extraction infrastructure, Russia's uranium sector has significant potential for growth and sustained contribution to the global energy transition.

References

1. Bogachev, V. G. (2008) Osnovy bureniya skvazhin [Fundamentals of well drilling]. – M.: Nedra. – 102 p. (in Russian)

2. Gosudarstvennyi doklad o sostoyanii i ispol'zovanii mineral'no- syr'evyh resursov Rossiiskoi Federacii v 2021 godu [State report on the state and use of mineral resources of the Russian Federation in 2021]. – [online]. Available at:https://nedradv.ru/nedradv/ru/resources?obj.=ab05b068239ede80d3dd35cf407239bb. (Accessed: 12.04.2025). (in Russian)

3. Sverdlov, I. L. (2014) Osnovy bureniya i raboty skvazhin [Fundamentals of drilling and well operation]. – M.: Geos. – 214p. (in Russian)

UDK 631.4

CLIMATE AS A FACTOR OF SOIL FORMATION

Ugnich Darya Mikhailovna,
Student of the Institute of Earth Sciences,
Belgorod State National Research University, Belgorod, Russia,
E-mail: 1665376@bsuedu.ru
Strakhova Ksenia Aleksandrovna,
Ph.D. in Philosophy,
Associate Professor of the Department of Foreign Languages
and Professional Communication,
Belgorod State National Research University, Belgorod, Russia,
E-mail: strakhova@bsuedu.ru

Abstract: *The article considers climate as one of the most important factors influencing the processes of soil formation. Climate changes occurring in our era have a direct impact on the state and properties of soils. Therefore, the study of the relationship between climate and soil formation is a relevant and important area of modern soil science.*

Keywords: *soil, climate, soil formation, components of the environment, humus, temperature conditions, moisture.*

The relevance of this topic is due to the need to understand the influence of climate on the formation and properties of soil. Climate change caused by global warming can lead to alterations in the soil cover and, in turn, affect agricultural production, environmental sustainability and other areas of human activity. Therefore, the study of the interaction of climate and soil has practical significance and can be useful for developing sustainable strategies for the use of soil resources and predicting possible changes in the soil cover in the future.

The review of the influence of climate on soil formation processes has practical significance, as it allows more accurately assessing the state and properties of the soil in a particular region. This, in turn, can be used to develop effective methods of farming, soil protection and prevention of its degradation. In connection with the above, the study of the influence of climate on soil formation is a relevant and important scientific direction that can be useful not only in the field of soil science, but also in practical agriculture and environmental protection.

Soil is a natural object formed as a result of the transformation of the surface layers of land under the combined influence of soil formation factors. The study of soil formation began long before the emergence of modern ecology, when scientists discovered that soil is not just accumulated material on the surface of the earth. It is a unique system that is formed as a result of various factors.

Since 1883, V.V. Dokuchaev was the first to consider soil as an independent natural body formed under the influence of soil formation factors: "a combination of causes (soil, climate, relief, age and vegetation)" [Veski, 1985]. He clarified the factors of soil formation and the definition that soil "is a function (result) of the parent rock (soil), climate and organisms, multiplied by time.

"The concept of "soil formation" means the process of soil formation from the initial material under the influence of various factors, such as climate, vegetation, relief, groundwater, geological structure, etc. As a result of the influence of these factors, various

physical, chemical and biological transformations occur, which lead to the gradual formation of the soil. The essence of the soil formation process lies in the interrelation and interaction of all components of the environment [Val'kov et al., 2013].

Soil formation begins to manifest itself following the weathering processes, or in the case of soil formation on massive crystalline rocks, it can occur in parallel, synchronously, simultaneously with the weathering processes [Gerasimov, 1976].

When the weathered soil is subjected to soil formation processes, the soil-forming substrate acquires qualitatively new properties, the main ones of which are:

1. Specific organic matter (humus) accumulates in the soil.

2. Biophilic elements, including nitrogen, accumulate in the soil (nitrogen does not accumulate in geological deposits, and there is no organic nitrogen in the rocks).

3. A specific organization of the soil mass appears (horizontal structure, soil structure is formed).

Due to these properties, the soil acquires such qualities as water-holding capacity, anisotropy of the soil mass is also formed, that is, various changes in properties vertically and horizontally.

The stage of soil development is characterized by the increase in the thickness of the soil profile and the formation of new horizons that correspond to the ecological situation in a given landscape. The driving force of the process is factors external to the soil, and soil formation continues until the soil reaches equilibrium with these factors. As a result, the equilibrium stage occurs.

In most parts of the earth, soils formed on sedimentary rocks, which cover about 75% of the surface of the continents. According to genetic characteristics, sedimentary rocks are divided into clastic, chemical and organogenic. Clastic deposits were formed as a result of mechanical crushing of various rocks under the influence of thermal weathering and other factors. The influence of relief on soil formation is indirect, mainly through the redistribution of heat and moisture that enter the land surface.

Significant changes in the altitude of the area lead to great shift in temperature conditions and moisture. Air masses, rising into the mountains, cool and cause precipitation, and the air, rolling over the mountains, heats up again and becomes dry. This is associated with the phenomenon of vertical zonality of climate, vegetation and soils in the mountains [Gerasimova, 2018].

The stages of soil formation are one of the main principles within which the process of soil formation occurs. Each stage is a certain sequence of processes and is characterized by specific changes in the soil profile. The main stages of soil formation are:

– the physical fragmentation of rocks;

– the formation of the soil profile;

– the formation of humus.

The first stage is the physical fragmentation of rocks. Within this stage, mechanical and chemical destruction of the rock, as well as its mixing, occurs. As a result of the fragmentations of the rock, primary soil materials are formed, which establish the basis for further soil formation.

The second stage is the formation of the soil profile. At this phase, the process of accumulation and redistribution of soil particles occurs, which leads to the formation of the soil profile. The soil profile consists of different horizons, each of which has its own characteristics in composition, structure and organic matter.

The third stage is the formation of humus. Humus is one of the main components of the soil and is decomposed organic matter [Dokuchaev, 1900].

Climate is one of the main factors determining the formation and diversity of soil cover on earth. Weather conditions such as temperature, precipitation, wind and solar radiation have a significant impact on soil formation processes. Temperature is one of the main climatic factors influencing soil formation. It determines the rate of chemical reactions, biological activity and physical processes occurring in the soil [https://prussia.online/books/entsiklopedicheskiy-slovar].

High temperatures promote rapid decomposition of organic matter, accelerated mineralization of nutrients, and intensive mixing of soil particles. The result is more fertile soil with improved fertility indicators. Low temperatures hinder biological activity in the soil, which leads to slower decomposition of organic matter and accumulation of nutrients. This causes the formation of more acidic and nutrient-poor soils [Dimo, 1985].

Thus, climate is the main factor differentiating the soil cover on earth. Temperature, precipitation, wind and solar radiation determine the formation and diversity of soils with different properties and fertility. Understanding the influence of climate on soil formation processes is crucial for the optimal use and improvement of soil resources in agriculture and other industries.

Each of these stages is important for the formation of soil and is an integral part of the soil formation process itself. In conclusion, it can be said that climate is one of the main factors influencing the processes of soil formation. Under the influence of climate, changes in temperature, humidity, precipitation occur, which in turn affect the biological activity, physicochemical processes and geomorphology of the soil.

References

1. Dimo, V.N. (1985). Klimat pochv i ego sostavlyayushchie na ravninnoj territorii SSSR [Soil climate and its components on the flat territory of the USSR] // *Klimat pochv: sbornik nauchnyh trudov [Soil climate: Collection of scientific papers]*. – AN SSSR. nauch. centr biol. issled. in-t pochvovedeniya i fotosinteza i dr.; Pochv. in-t im. V.V. Dokuchaeva Pushhino [USSR Academy of Sciences. Scientific Center of Biological Research. Institute of Soil Science and Photosynthesis, etc.; Soil Institute named after V.V. Dokuchaev, Pushchino]. – Pp. 62-66. (in Russian)

2. Dokuchaev, V. V. (1900). Pochvovedenie (Lekcii, chit. statisticheskomu personalu Poltavskogo gub. zem-stva) [Soil science (Lectures were read to the statistical staff of the Poltava provincial zemstvo)] // *Khutoryanin*. – № 25. – P. 363-366; – № 26. – P. 383-385; – № 27. – P. 396-399; – № 28. – P. 407-409; – № 29. – P. 423-426; – № 30. – P. 441-445. (in Russian)

3. Enciklopedicheskij slovar' Brokgauza i Efrona: v 86 tomah (1890-1907) [Brockhaus and Efron Encyclopedic Dictionary: in 86 volumes]. – [online]. Available at: https://prussia.online/books/entsiklopedicheskiy-slovar. (Accessed: 18.03.2025). (in Russian)

4. Gerasimov, I. P. (1976). Geneticheskie, geograficheskie i istoricheskie problemy sovremennogo pochvovedeniya [Genetic, geographical and historical problems of modern soil science]. – M.: Nauka [Science]. – 299 p. (in Russian)

5. Gerasimova, M. I. (2018). Geografiya pochv: uchebnik i praktikum dlya akademicheskogo bakalavriata [Soil geography: textbook and practical training for the academic bachelor's degree]. – M.: Yurait, – 315 p. (in Russian)

6. Val'kov, V. F. et al. (2013). Plodorodie pochv: ekologicheskie, social'nye i pochvenno-geneticheskie osobennosti [Soil fertility: environmental, social and soil-genetic features]. – Rostov-on-Don: izdatelstvo Yuzhnogo federalnogo universiteta. – 299 p. (in Russian)

7. Veski, R. E. (1985). O nekotoryh putyah dal'nejshego razvitiya ucheniya o pochvah [On some ways of further development of the theory of soils] // *Soil science*. – № 3. – P. 75-86. (in Russian)

UDK 504.03:311.14

STATISTISCHE ANALYSE DES ZUSTANDS DER UMWELT IN DER REGION BELGOROD

Blokhina Daria Olegowna,
Studentin des Instituts für Wirtschaft und Verwaltung,
Belgoroder Staatliche Nationale Forschungsuniversität, Belgorod, Russland,
E-mail: Darya.blokhi.2.0.6@yandex.ru
Sopowa Irina Walentinowna,
Kandidatin der philologischen Wissenschaften,
Professorin des Lehrstuhls für Fremdsprachen
und berufliche Kommunikation,
Belgoroder Staatliche Nationale Forschungsuniversität,
Belgorod, Russland,
E-mail: sopova@bsuedu.ru

Annotation: *Der Artikel präsentiert eine statistische Analyse des ökologischen Zustands der Region Belgorod. Die Hauptkomponenten der Umwelt werden untersucht: die Luft, die Wasserressourcen und die Bodenbedeckung. Quellen der technogenen Belastung, einschließlich Industrieunternehmen und landwirtschaftlicher Tätigkeit, werden analysiert. Die Angaben der Dynamik ökologischer Indikatoren und der Effizienz der Naturschutzmaßnahmen werden tabellarisch präsentiert.*

Schlagwörter: *das Umweltmonitoring, die Region Belgorod, die Umweltverschmutzung, industrielle Emissionen, die Wasserressourcen, die Bodenerosion, die Naturschutzmaßnahmen, die statistische Analyse der ökologischen Lage, technogene Belastung der Ökosysteme, das Monitoring des Zustands der Umwelt.*

Die Region Belgorod ist eine der dynamisch wachsenden Regionen Russlands, in der Unternehmen der Bergbauindustrie, Metallurgie, Bauindustrie und Agrarindustrie aktiv tätig sind. Unter den Bedingungen einer intensiven industriellen und landwirtschaftlichen Entwicklung der Region wird die Frage des ökologischen Zustands der Umwelt und dessen Einfluss auf die Lebensqualität der Bevölkerung besonders relevant.

Die statistische Analyse der ökologischen Lage in der Region Belgorod stellt eine umfassende Untersuchung verschiedener Umweltkomponenten dar: Luft, Gewässer, Bodenbedeckung und auch Naturressourcen. Besonders wichtig ist das Monitoring des Zustands der Umwelt im Zusammenhang mit der zunehmenden technogenen Belastung der Ökosysteme der Region und der Notwendigkeit, effektive Naturschutzmaßnahmen zu entwickeln.

Beginnen wir mit der Betrachtung der Luftqualität in der Region und der Quellen ihrer Verschmutzung. In der Region Belgorod wird ein moderates Niveau der Luftverschmutzung beobachtet, das als "mittleres Wohlstandsniveau" (Bewertung C) eingestuft wird. Im Jahr 2023 betrug das Gesamtvolumen der Emissionen von Schadstoffen 205 Tausend Tonnen, von denen 164 Tausend Tonnen (80%) auf stationäre Quellen entfallen.

Die intensivste Luftverschmutzung wird in den industriellen Zentren der Region festgestellt (Tabelle 1).

Tabelle 1

Luftverschmutzung in den Städten der Region Belgorod

Stadt	Emissionen pro Kopf der Bevölkerung (kg/Jahr)	Hauptquellen
Gubkin	321,5	Bergbauindustrie
Stary Oskol	188,5	Metallurgie, Zementproduktion
Valuyki	187,4	Industrieunternehmen
Belgorod	72,7	Verkehr, Produktion von Baumaterialien

In den letzten Jahren ist eine positive Dynamik bei der Reduzierung der Emissionen von mobilen Quellen zu beobachten: von 167 Tausend Tonnen im Jahr 2018 auf 42 Tausend Tonnen im Jahr 2022. Gleichzeitig sank der Ausstoß pro Kopf der Bevölkerung von 108 auf 27 Kilogramm pro Jahr.

In der Struktur der Luftverschmutzung dominieren (in % des gesamten Emissionsvolumens):

1. Formaldehyd (39 %)
2. Aerosolpartikel (24 %)
3. Schwefeldioxid (16 %)
4. Stickstoffdioxid (15 %)
5. Kohlenmonoxid (6 %) [Dmitrik, 2017].

Beunruhigend ist die Situation im Bereich des Lebedinsky Bergbaubetrieb, der 59 verschiedene Schadstoffe in die Atmosphäre abgibt. Das Emissionsvolumen des Unternehmens stieg von 22 Tausend Tonnen im Jahr 2005 auf mehr als 54 Tausend Tonnen im Jahr 2020. Zur Verbesserung der ökologischen Lage in der Region wird aktiv die Gasversorgung von Industrieunternehmen und Verkehr vorangetrieben. Es werden erhebliche Mittel für den Umweltschutz in der Region bereitgestellt – mehr als 13 Milliarden Rubel pro Jahr.

Als nächstes bewerten wir den Zustand der Wasserressourcen in der Region. Die Region Belgorod gehört zu den wasserarmen Regionen Russlands, in denen Gewässer etwa 1 % der Fläche ausmachen. Das Flusssystem umfasst mehr als 500 Gewässer mit einer Gesamtstrecke von etwa 5 Tausend Kilometern (Tabelle 2).

Tabelle 2

Wasserverbrauchsindikatoren in der Region [https://fonar.tv/news/2024/01/28/belgorodskuyu-oblast-ocenili-po-ekologicheskomu-blagopoluchiyu]

Wasserverbrauchsindikator	Volumen (mln m³/Jahr)
Gesamtwasserentnahme	429
Oberflächenquellen	144
unterirdischen Quellen	285
Abwasserentsorgung	216,8

In der Region wird aktiv das Abwasserreinigungssystem modernisiert. Im Jahr 2025 ist die Rekonstruktion der Abwasserreinigungsanlagen in den Städten Belgorod, Stary Oskol und Gubkin geplant. Es werden innovative Reinigungsmethoden eingeführt, darunter biologische Technologien unter Verwendung von anaeroben Bakterien. Auf dem Gebiet der Region wurden 22 Schadensherde im Bereich der

unterirdischen Gewässer identifiziert. Die größte Belastung erfahren die Wasserressourcen in den Bereichen der Bergbauindustrie, in denen sich ein Senktrichter mit einer Fläche von 354 km² gebildet hat.

Zur Verbesserung der Situation werden folgende Maßnahmen umgesetzt:

1. Der Bau neuer Abwasserreinigungsanlagen unter Verwendung moderner Technologien;

2. Die Kontrolle der Einhaltung der Anforderungen für den Betrieb unterirdischer Gewässer;

3. Die Einführung von Kreislaufwasserversorgung in den Produktionsstätten.

Nun betrachten wir die Bodenressourcen. Die Region Belgorod verfügt erhebliche Bodenressourcen, wobei landwirtschaftliche Nutzflächen 77,1 % (etwa 2090,8 Tausend Hektar) der Fläche einnehmen. Die Region ist die am stärksten erodierte unter allen Regionen des Zentralen Schwarzbodenbezirks (Tabelle 3).

Tabelle 3

Zustand der Bodenbedeckung

Bodendegradationsart	**Fläche (Tsd. ha)**	**Prozentsatz der Gesamtfläche**
schwach abgewaschen	386,3	48,9%
mittel abgewaschen	247,3	31,3%
stark abgewaschen	101,9	12,9%
sehr stark abgewaschen	24,5	3,1%

Die intensive Nutzung von Landflächen übersteigt häufig ihre Fähigkeit zur Selbstregeneration. Auf dem Gebiet der Region wurden ernsthafte Probleme mit der Bodenverschmutzung festgestellt: Auf 25 % der landwirtschaftlichen Flächen wurden lebensfähige Eier von Parasiten entdeckt, und auf 4,2 % der Fläche wurde eine Überschreitung des zulässigen Nitratgehalts festgestellt.

Besondere Gefahren stellen dar:

1. 180 Tonnen ungeeigneter und verbotener Pestizide in landwirtschaftlichen Lagern;

2. die Bodenverschmutzung mit schweren Metallen in den Bergbaugebieten;

3. radioaktive Bodenverschmutzung in den östlichen und südöstlichen Gebieten der Region auf einer Fläche von 140,221 Hektar (1-5 Ki/km²).

In der Region wird das Projekt „Grüne Hauptstadt“ durchgeführt, das auf die Wiederherstellung degradierten Landes abzielt. Für die Rekultivierung wurden 3,8 Millionen Rubel aus dem Regionalhaushalt bereitgestellt. Besonderes Augenmerk wird auf die Wiederherstellung von Gebieten nach technogenen Auswirkungen in den Bereichen der Aktivitäten des Stoilensky- und Lebedinsky-Bergwerks gelegt. Die Effizienz der Landnutzung in der Region sinkt erheblich: Untersuchungen zeigen, dass eine Erhöhung der erodierten Flächen um 1 % zu einem Rückgang des landwirtschaftlichen Einkommens um 0,3 % führt [Dmitrik, 2017].

Es ist auch wichtig, auf die industrielle und technogene Belastung der Region einzugehen. Die Region Belgorod ist eines der größten Industriezentren Russlands, in dem die Hauptbelastung durch Unternehmen der Bergbau- und Metallurgieindustrie verursacht wird.

Auf dem Gebiet der Region sind große Bergbauunternehmen tätig, die eine erhebliche ökologische Belastung verursachen (Tabelle 4).

Tabelle 4

Bergbauunternehmen der Region Belgorod

Unternehmen	**Anteil an den Emissionen**	**Emissionsvolumen**
Lebedinsky Bergbaubetrieb	21,7%	54 Tausend Tonnen
Stoilensky Bergbaubetrieb	2,3%	2,7 Tausend Tonnen

Von den staubenden Oberflächen der Tailings-Speicher des Lebedinsky Bergbaubetriebs und des Stoilensky Bergbaubetriebs werden jährlich etwa 8,5 Tausend Tonnen Staub emittiert, wobei der Radius ihrer Ausbreitung 15-20 km erreicht.

Das Oskol Elektrometallurgische Kombinat ist der größte Verschmutzer in der Region und verursacht 35,2% aller industriellen Emissionen. Die Gesamtemissionen des Metallurgiekomplexes machen 56,3% des gesamten Emissionsvolumens in der Region aus.

Die Hauptquellen der Verschmutzung sind Zementwerke:

1. "Belgorod Zement" – 6,9% der Emissionen;
2. "Oskolzement" – 9,6% der Emissionen.

In der Region ist eine intensive Entwicklung der Viehzucht zu beobachten, die neue ökologische Probleme verursacht:

1. Die Boden- und Gewässerverschmutzung durch Schweinegülle und Vogelkot;
2. Die Eutrophierung von Gewässern aufgrund des Übermaßes an organischen Stoffen;
3. Unkontrollierte Anwendung von Düngemitteln und Pestiziden [Kovalyova et al., 2021].

Um die technogene Belastung zu verringern, werden in der Region Umweltmaßnahmen umgesetzt, einschließlich der Modernisierung der Abwasserbehandlungsanlagen und der Einführung moderner Technologien zur Emissionsreinigung. So machen die Emissionen 75% der zulässigen Normen aus, dank der Arbeit von 94 Staub- und Gasreinigungsanlagen.

In den letzten Jahren hat die Region Belgorod ihre führende Position im nationalen ökologischen Ranking der Regionen Russlands konstant gehalten. Am Ende des Herbstes 2023 belegte die Region den zweiten Platz, nur hinter der Region Tambow. Im Jahr 2024 trat die Region aufgrund der schwierigen operativen Lage in den Grenzgebieten in die „graue Zone“ des Rankings ein.

In der Region werden eine Reihe von Umweltprogrammen umgesetzt:

1. 45 Gewässer wurden im Jahr 2023 restauriert;
2. Über 400 Tausend neue Bäume wurden im Jahr 2024 auf einer Fläche von 85 Hektar gepflanzt;
3. Abwasserreinigungsanlagen fangen 98% der Schadstoffe auf und neutralisieren 86,4% der Emissionen.

Die größte ökologische Belastung fällt auf die Industriezentren:

1. Stary Oskol – 56% aller industriellen Emissionen;
2. Gubkin – 18% der Emissionen;

3. Belgorod – 7,2% der Emissionen [Kovalyova et al., 2021].

Im Jahre 2025 beginnt die Umsetzung des neuen nationalen Projekts "Ökologisches Wohlstand", das auf die Schaffung von Abfallverarbeitungsinfrastrukturen, die Beseitigung illegaler Mülldeponien, die Reinigung von Gewässern, den Schutz von Wäldern und die Reduzierung von Emissionen in die Atmosphäre abzielt. Besonderes Augenmerk wird auf die Entwicklung der Freiwilligenbewegung gelegt. Mehr als 245 Tausend Freiwillige nehmen an Naturschutzmaßnahmen teil.

Abschließend hat die durchgeführte statistische Analyse des ökologischen Zustands der Region Belgorod sowohl positive Tendenzen als auch bestehende ökologische Probleme aufgezeigt. Trotz der hohen technogenen Belastung durch die entwickelte Bergbauindustrie und Metallproduktion sind in der Region Verbesserungen bei einer Reihe von ökologischen Indikatoren zu beobachten. Die Emissionen von mobilen Quellen wurden erheblich reduziert, die Effizienz der Abwasserbehandlungsanlagen hat sich erhöht, und erfolgreiche Programme zur Wiederherstellung von Gewässern und Waldbeständen werden umgesetzt. Es bleiben jedoch weiterhin Probleme mit Bodenerosion, der Verschmutzung von Grundwasser und den Auswirkungen industrieller Unternehmen auf die Umwelt bestehen.

Literaturliste

1. Belgorodskaya oblast' v shest' raz prevysila srednij pokazatel' po vybrosam v atmosferu [Belgorod Region hat den durchschnittlichen Emissionswert in der Atmosphäre sechsmal überschritten]. – [Elektronische Ressource]. Zugriffsmodus: https://www.go31.ru/news/ekologiya/belgorodskaya-oblast-v-shest-raz-prevysila-sredniy-pokazatel-po-vybrosam-v-atmosferu/. (Datum der Behandlung: 13.02.2025). (in Russisch)

2. Belgorodskuyu oblast' ocenili po ekologicheskomu blagopoluchiyu [Die ökologische Situation der Region Belgorod wurde bewertet] – [Elektronische Ressource]. Zugriffsmodus: https://fonar.tv/news/2024/01/28/belgorodskuyu-oblast-ocenili-po-ekologicheskomu-blagopoluchiyu. (Datum der Behandlung: 13.02.2025). (in Russisch)

3. Danilenko, E.P., Akulowa, A.A., Baryshenskaya, O.N. (2020). Rekul'tivaciya narushennyh zemel' i ustranenie nakoplennogo vreda okruzhayushchej srede goroda Belgorod [Die Rekultivierung von degradiertem Land und Beseitigung von Umweltschäden in der Stadt Belgorod] // *Vektor GeoNauk*. – Belgorod: Federal'noe gosudarstvennoe byudzhetnoe obrazovatel'noe uchrezhdenie vysshego obrazovaniya „Belgorodskij gosudarstvennyj tekhnologicheskij universitet im. V. G. Shuhova“. – Nr. 1. – S. 62-70. (in Russisch)

4. Dmitrik, W.E. (2017). Analiz atmosfernogo vozduha v Belgorodskoj oblasti [Die Analyse der Luftqualität in der Region Belgorod] // *Teoria i praktika sovremennoy naiki [Theorie und Praxis der modernen Wissenschaft].* – Saratow: OOO “Institut upravleniya i social'no-ekonomicheskogo razvitiya”. – Nr. 9 (27). – S. 329-332. (in Russisch)

5. Kowalyowa, E.W., Wasiliew, D.W. (2021). Ekologicheskoe sostoyanie promyshlenno-urbanizirovannyh territorij na primere Belgorodskoj oblasti [Ökologischer Zustand von industrialisierten und urbanisierten Gebieten am Beispiel der Region Belgorod] // *Vektor GeoNauk*. – Belgorod: Federal'noe gosudarstvennoe byudzhetnoe obrazovatel'noe uchrezhdenie vysshego obrazovaniya „Belgorodskij gosudarstvennyj tekhnologicheskij universitet im. V. G. Shuhova“. – Nr. 3. – S. 22-27. (in Russisch)

6. V 2025 godu region priobretyot eshchyo tri malyh zemsnaryada dlya ochistki vodoyomov [Im Jahre 2025 wird die Region drei weitere kleine Bagger zur Reinigung von Gewässern erwerben]. – [Elektronische Ressource]. Zugriffsmodus: https://openbelgorod.ru/news/ecologia/2024-12-01/45-vodnyh-ob-ektov-ochischeno-v-belgorodskoy-oblasti-v-2024-godu-418609. (Datum der Behandlung: 13.02.2025). (in Russisch)

SECTION 2
LEGAL SCIENCES

UDK 347.63

PROBLEMS OF LEGAL REGULATION OF PLACEMENT OF MINORS DEPRIVED OF PARENTAL CARE IN FAMILY FORMS OF EDUCATION

Kazanina Evgeniya Viktorovna,
Master Student of the Low Institute,
Belgorod State National Research University, Belgorod, Russia,
E-mail: eva-2083@ yandex.ru
Tsurikova Larisa Vladimirovna,
Ph.D. in Pedagogy,
Associate Professor of the Department of Foreign Languages and Professional Communication,
Belgorod State National Research University, Belgorod, Russia,
E-mail: tsurikova@bsuedu.ru

Abstract: *The article examines the issues of legal regulation of placement of minors deprived of parental care. Russian legislation concerning various types of family placement of children is analyzed. The problems leading to a decrease in the transfer of minors to foster families are formulated, and possible improvements are proposed for the successful stay of children in such families and the prevention of repeated orphanhood.*

Keywords: *minors, parental care, legal regulation, placement of children, family forms of placement, adoptive parents, guardians, trustees, foster parents, foster cares.*

The problems of legal regulation of placement of children left without parental care in family forms of placement are a topical issue in today's society. Every year, more and more children are left defenseless and in need of care and support, and the issues of their family life arrangement are becoming more complicated. This is due to the lack of unified and clear legislative regulation, the difficulty in determining the optimal types of family placement, the lack of information and education for potential foster parents.

Before the revolution and in the middle of the last century, children were not considered as bearers of rights at all, as was hinted at in the works of leading thinkers of the 20th century. Thus, Maria Montessori noted that: “He is a reproduction of the adult who possesses him as if he were a piece of property… No slave was ever so much the property of his master as the child is of his parent” [Montessori, 1997: 107].

The first attempts to provide assistance to minors left without parental care arose middle of the18th century, when in 1775 Catherine II issued the Decree "Institutions for Governance of Provinces", which divided the adoption agencies according to the class of the minor. According to this decree, orphaned or homeless minors were to be placed into the hands of trustworthy, virtuous and good-natured people for a moderate fee for maintenance and upbringing. Thus, patronage was formed – the first ordered and fixed form of placement of children left without parental care in a family; until that time, there was another form – a custom according to which the community appointed a guardian, and in the absence of property, simply placed the person in a foster family.

Russian legislation provides for the following types of family arrangements for minors who have lost their parents: foster family, guardianship (trusteeship), adoption, and other alternative forms are also possible. The brief characteristics presented in Figure 1 includes a description of the main types of family living arrangements for minors, enshrined in Russian legislation [Semejnyj kodeks Rossijskoj Federacii: Art. 123].

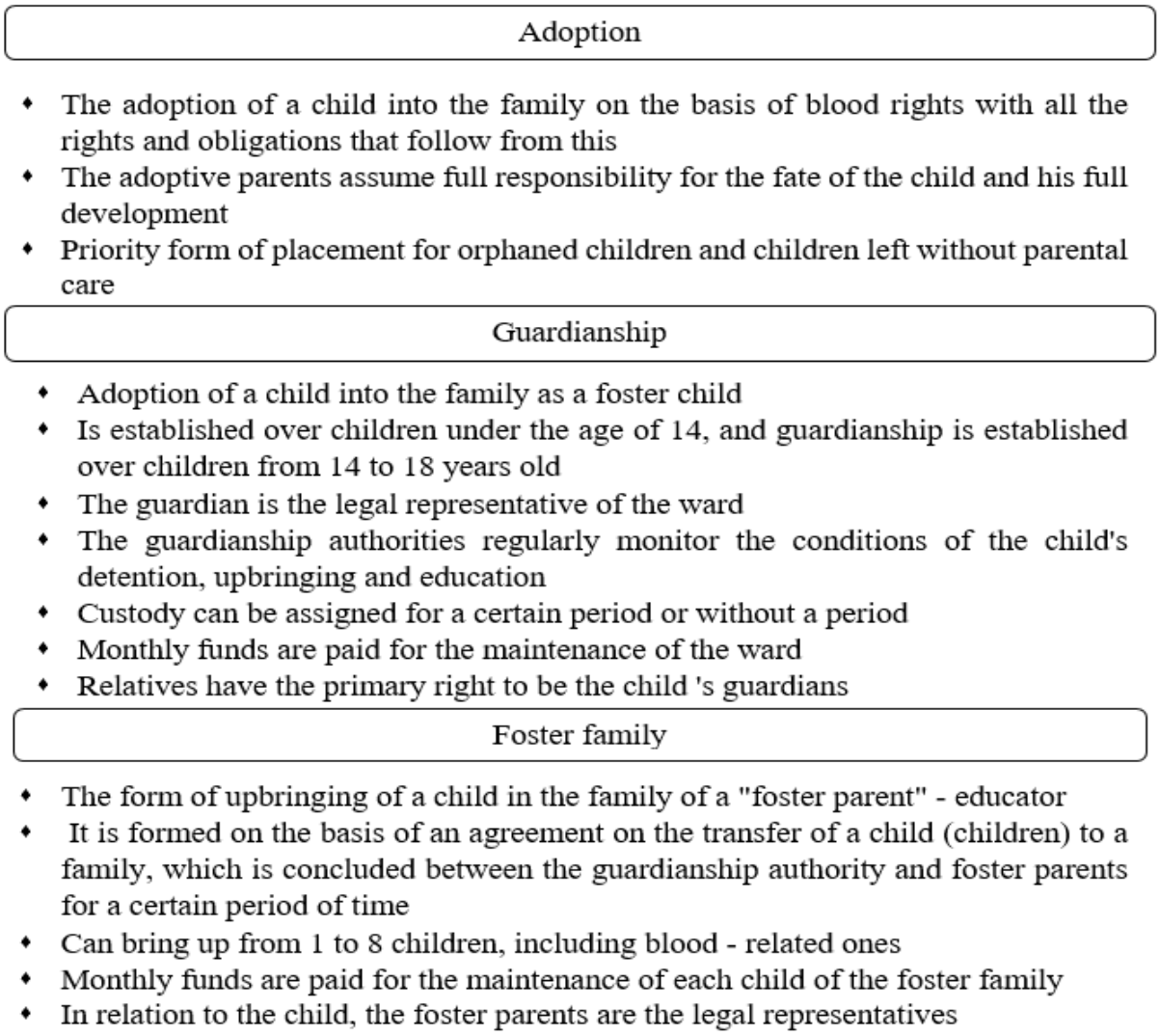


Figure 1. Forms of placement of orphans and children deprived of parental care

According to the Ministry of Education, as of February 1, 2025, there are 32,956 minors in Russia who need a family placement. The decrease in the number of such children is due not only to a decrease in the birth rate in the country (2023 – 1,264.9 thousand people, 2022 – 1,306.2 thousand people), but also to the fact that in recent years there has been a softening of the policy on deprivation of parental rights. Thus, if in 2021 there were 43,680 children whose parents were deprived or limited in rights, then in 2023 this figure decreased to 32,242. If we look at the statistics on the number of children placed in foster families over seven years, we see that it is either decreasing or stable (Table 1) [Svodnye otchety po forme federal'nogo statisticheskogo nablyudeniya № 103-RIK "Svedeniya o vyyavlenii i ustrojstve detej, ostavshihsya bez

popecheniya roditelej", utverzhdennoj prikazom Rosstata ot 17 dekabrya 2021 g. № 928, za 2017, 2018, 2019, 2020, 2021, 2022, 2023 gody].

Table 1

Number of children placed in family care

	2023	2022	2021	2020	2019	2018	2017
Children placed under gratuitous guardianship and trusteeship	19266	20222	20947	19514	21786	22543	24306
Children placed in foster care	10253	11652	11262	10554	12940	13483	15690
Children placed in patronat family	39	60	80	77	97	109	174
Children given up for adoption	2237	2474	2606	2477	3252	3938	4406

Such changes are explained by the complication of the procedure for placing minors in family-based placements. Despite the existing legal norms, specialists and citizens wishing to accept a child into their family regularly face a number of problems. One of them is the complexity of the placement procedure, which requires formalities and long waiting periods, which can also affect the child planned for family placement, leading to a temporary lack of stability and confidence in him.

Since 2008, the legislation in the area of placement of minors in a family has undergone a number of updates and changes. In addition to the Law "On Guardianship and Trusteeship" of April 24, 2008 No. 48-FZ, from 2008 to 2013, the RF Government Resolutions concerning the procedure for adoption of children (No. 275 of March 29, 2000), expanding the scope of resolution of issues on guardianship and trusteeship (423 of March 18, 2009), defining the list of diseases that may become an obstacle to the status of an adoptive parent, guardian or foster parent (No. 117 of February 14, 2013) were adopted and amended.

The main difference of the new regulations is the increase in the list of required documents for adoption and guardianship. Until 2008, it was enough for a citizen to provide a modest package of documents, but now the list has increased significantly. Priority in guardianship and adoption for grandparents has also appeared. According to Government Resolution No. 423 of March 18, 2009, it is necessary to obtain the consent of all family members, including children from 10 years of age.

It is important to note that now adoptive parents must have a certificate from Rospotrebnadzor confirming that the living space meets the required standards, which must be renewed every four years. Obtaining a certificate of no criminal record has also become more difficult. At the same time, the provisions of Article 127 of the Family Code of the Russian Federation raise doubts regarding the applicability of restrictions only to persons entitled to adoption, and do not apply to family members of future parents. The presence of a child in a family with a person convicted of certain crimes may pose a threat to his well-being.

The introduction of mandatory training for foster parents by Order No. 235 of the Ministry of Education and Science of the Russian Federation dated March, 13, 2015

has also created significant difficulties. Initially, such a training course was required even for experienced foster parents, which caused a strong reaction from the majority of public figures and specialists. At the same time, relatives of the child and citizens with positive experience as guardians or adoptive parents were excluded from this program. “These rules are the subject of heated debate, as they create conditions for secondary orphanhood of children due to the insufficient competence of foster parents” [Pukhal’skaya, 2015:146].

Thus, in 2023, the guardianship and trusteeship authorities took significant action, rescinding placement decisions for 2,030 children. These decisions were often prompted by requests from adoptive parents, guardians, trustees, and foster parents who had successfully completed the requisite training programs. Compared to 2021, where the number of such children was only 1,722. This raises important questions about the effectiveness of current training and support systems in preparing foster parents for the complexities of child care, and highlights the need for ongoing evaluation and improvement of these programs to ensure that every child is placed in a safe and nurturing environment.

In order to improve legal regulation in matters of raising children who have lost their parents in a family environment, it is recommended to simplify and speed up the placement process, reduce bureaucratic barriers and provide mandatory detailed training programs for future foster parents and guardians. In order to protect the interests of children adopted into families, it is proposed to expand the list of persons who are prohibited from adoption, guardianship or custody by including family members living with a potential foster parent. It is also necessary to strengthen support for adoptive parents by providing them with professional assistance and consultations in the process of interaction with the child.

References

1. Montessori, M. (1997). Razum rebenka: Glava iz knigi [The Child's Mind: Chapters from the book]. – M.: Izdatel'skij dom Graal'. – 173 p. (in Russian)

2. Pukhal'skaya, L.N. (2015). Problemy ustrojstva detej-sirot, detej, ostavshihsya bez popecheniya roditelej [Problems of placement of orphans, children left without parental care] // *Vestnik magistratury*. – № 12 (51). – Volume 4. – Pp. 73-75. (in Russian)

3. Semejnyj kodeks Rossijskoj Federacii ot 29.12.1995 № 223-FZ (red. ot 31.07.2023) (s izm. i dop., vstup. v silu s 26.10.2023) [Family Code of the Russian Federation of 29.12.1995 No. 223-FZ (as amended on 31.07.2023) (as amended and supplemented, entered into force on 26.10.2023)] // *Sobranie zakonodatel'stva RF*. – 01.01.1996. – No. 1. – Art. 16. (in Russian)

4. Svodnye otchety po forme federal'nogo statisticheskogo nablyudeniya № 103-RIK "Svedeniya o vyyavlenii i ustrojstve detej, ostavshihsya bez popecheniya roditelej", utverzhdennoj prikazom Rosstata ot 17 dekabrya 2021 g. № 928, za 2017, 2018, 2019, 2020, 2021, 2022, 2023 gody [Summary reports on the Federal Statistical Observation form № 103-RIC "Information on the identification and placement of children left without parental care", approved by Rosstat Order № 928 dated December 17, 2021, for 2017, 2018, 2019, 2020, 2021, 2022, 2023 years]. – [online]. Available at: https://docs.edu.gov.ru/document/. (Accessed: 19.01.2025). (in Russian)

UDC 347

CONTENTS OF A CIVIL LAW CONTRACT

Shcherbakova Elizaveta Romanovna,
Master Student of the Law Institute,
Belgorod State National Research University, Belgorod, Russia,
E-mail: elizaveta.shcherbakova98@mail.ru
Tsurikova Larisa Vladimirovna,
Ph.D. in Pedagogy,
Associate Professor of the Department of Foreign Languages and Professional Communication,
Belgorod State National Research University, Belgorod, Russia,
E-mail: tsurikova@bsuedu.ru

Abstract: *This article provides detailed analysis of the conditions forming the content of a civil law contract. Their types and features are described, and the differences between them are revealed. Special attention is paid to the importance of the essential conditions for the contract to be considered as concluded, and their role in legal practice. The theoretical and practical aspects of civil law contracts are also analyzed as an important element of civil law.*

Keywords: *contract, civil law contract, terms of the contract, essential terms of the contract, ordinary terms of the contract, accidental terms of the contract, content of the contract.*

The content of any contract is determined by the terms and conditions that the parties agree upon. These terms and conditions are the agreements of the parties, fixed in the contract, that regulate their relationship. The importance of the terms and conditions is difficult to overestimate, because they form the legal obligations of the parties and ensure a balance of their interests.

Depending on their meaning and nature, legislation distinguishes three main groups of conditions: essential, ordinary and incidental. Each of these groups has its own purpose and plays a certain role in the functioning of civil contracts. Such a distinction allows the parties to approach the process of drafting a contract more consciously, taking into account their rights, obligations and possible risks.

The most important role is played by the essential terms. They represent the conditions that are necessary for concluding a contract. If the essential terms are not agreed upon, the contract is considered not concluded, which entails the impossibility of the emergence of obligations between the parties [Postanovleniye Plenuma Verkhovnogo Suda RF, 2018]. This emphasizes their fundamental importance for the validity of the transaction.

The process of agreeing on essential terms requires special attention, since it is the agreement of such terms that forms the basis of the contract. For each type of contract, the legislation establishes its own lists of such terms. For example, in a contract for the sale and purchase of real estate, the price of the object is an essential term (Article 555 of the Civil Code of the Russian Federation). If the parties do not agree on the price, the contract will be declared invalid. However, for a contract for the sale and purchase of ordinary goods, the price is not considered an essential term (Article 458 of the Civil Code of the Russian Federation), which demonstrates the

flexibility of civil legislation and its focus on practical reality [Grazhdanskiy kodeks Rossiyskoy Federatcii (chast vtoraya), 1994].

Essential terms are key to determining the nature of the contract. For example, the subject of the contract allows for a clear distinction between different types of contracts. Thus, for a sale and purchase agreement, the subject is the transfer of goods to the buyer's ownership, while in a lease agreement, the subject is the temporary transfer of property for use. If the parties erroneously determine the subject of the contract or do not agree on it, the conclusion of the contract becomes impossible. Moreover, an incorrect definition of the subject may lead to the conclusion of a contract of a different type. For example, the parties, wishing to conclude a sale and purchase agreement, may conclude a lease agreement if the terms of the agreement are more consistent with the latter. This emphasizes the importance of a competent approach to drafting an agreement and the need to consult with lawyers [Bogdanov, 2017].

An important aspect is that the essential conditions depend on the type of contract. For a lease contract, an essential condition will be an indication of the specific property being leased (Article 607 of the Civil Code of the Russian Federation), and for an insurance contract, it will be the definition of an insured event (Article 942 of the Civil Code of the Russian Federation). This emphasizes the need for a careful approach to the formation of the terms of the contract, especially in cases where the parties do not have sufficient legal experience. Ignorance of key aspects of the contract can lead to serious legal consequences. Thus, entrepreneurs who do not pay due attention to the essential conditions of the contract risk losing their assets or finding themselves in a disadvantageous position in the event of litigation.

Of particular interest are those conditions that become essential at the request of one of the parties [Beklenishcheva, 2006]. For example, if the buyer insists on coordinating the packaging of the goods, this condition becomes essential. This approach allows for the individual needs of the parties to be taken into account. However, for such a condition to be recognized as essential, it must be clearly stated by one of the parties, and the statement can be made either orally or in writing.

Normal conditions, unlike essential ones, do not require mandatory agreement [Sadikov, 1996]. They are enshrined in legislation and automatically come into force upon conclusion of the contract. However, this does not mean that such conditions are in force against the will of the parties. If the parties do not agree with any normal condition, they can change it or exclude it, if this is permitted by law.

Standard terms play an important role in simplifying the conclusion of a contract. Thanks to their presence, the parties do not have to waste time agreeing on all the details, but can focus on the really important aspects. For example, in paid contracts, the price can be determined based on established market practice and tariffs if the parties have not specified it in the contract [Bogdanov, 2017]. This helps avoid disputes and simplifies the process of contract execution. Such regulation is especially important for business relations, where the speed and simplicity of concluding a contract play a key role.

Incidental conditions are additional and are included in the contract at the discretion of the parties. Their absence does not affect the validity of the contract, but their presence allows for clarification or modification of the usual conditions. An

example is when the parties can agree on conditions concerning delivery times or additional services that are not provided for by law. Such conditions acquire legal force only after they are included in the text of the contract. This makes incidental conditions a universal tool for adapting the contract to the specific needs of the parties.

Of particular interest are also "force majeure" circumstances, which refer to random conditions. These circumstances, or force majeure circumstances, relieve the parties from liability for failure to fulfill obligations. Such circumstances include natural disasters (earthquakes, floods), man-made accidents (explosions, fires), military actions, terrorist attacks and other events that the parties could not foresee or prevent [Postanovleniye Plenuma Verkhovnogo Suda RF, 2018]. Including such conditions in the contract allows you to determine in advance the course of action in such situations and avoid them. In the context of the COVID-19 pandemic, many companies included special conditions related to quarantine restrictions, which allowed them to minimize losses and avoid the breakdown of business relations. "Force majeure" clauses are an example of how a contract can be adapted to unforeseen circumstances while still remaining legally binding.

After conducting a comprehensive analysis of the topic under study, it can be concluded that it is relevant both in theoretical and practical aspects, and many authors still devote their scientific works to it. The aspects considered in the article show that the content of a civil contract is determined both by legislative norms and the will of the parties. The essential terms form the basis of the contract, defining its essence and nature. Regular terms simplify the process of concluding a contract, while random terms allow you to take into account the individual needs of the parties. The flexibility of civil law allows the parties to adapt the contract to their needs, which makes civil law relations more stable and predictable. Careful attention to the formation of the terms of the contract and their coordination is the key to the successful functioning of civil law relations.

References

1. Beklenishcheva, I.V. (2006) Grazhdansko-pravovoy dogovor: uchebnik dlya vuzov [Civil law contract: textbook for universities]. – M.: Statut. – 351 p. (in Russian)

2. Bogdanov, E.V. (2017) Spornyye voprosy zaklyucheniya grazhdansko-pravovogo dogovora [Controversial issues of concluding a civil contract] // *Sovremennoye pravo*. – № 5. – Pp. 34-40. (in Russian)

3. Grazhdanskij kodeks Rossijskoy Federatcii (chast vtoraya) ot 30.11.1994 № 51-FZ (red. ot ред. от 13.12.2024) [The Civil Code of the Russian Federation (Part Two) dated 11/30/1994 № 51-FZ [as amended on 12/13/2024] // *Sobranie zakonodatel'stva RF*. – 29.01.1996. – № 5. − Art. 410. (in Russian)

4. Postanovleniye Plenuma Verkhovnogo Suda RF ot 25.12.2018 № 49 “O nekotorykh voprosakh primeneniya obshchikh polozheniy Grazhdanskogo kodeksa Rossiyskoy Federatsii o zaklyuchenii i tolkovanii dogovora” [Resolution of the Plenum of the Supreme Court of the Russian Federation dated December 25, 2018, № 49] // *Byulleten Verkhovnogo Suda RF*. – 2019. – № 2. (in Russian)

5. Sadikov, O.K. (1996) Grazhdanskoye pravo Rossii: kurs lektsiy. Chast pervaya [Russian Civil Law: a course of lectures. Part One]. – M.: Yuridicheskaya literatura. – 782 p. (in Russian)

UDK 342.9

THE IMPACT OF THE DIGITAL TECHNOLOGIES INTRODUCTION IN THE MECHANISM OF STATE ADMINISTRATION ON REDUCING THE LEVEL OF CORRUPTION IN THE RUSSIAN FEDERATION AND FOREIGN COUNTRIES

Mozhegova Antonina Anatolyevna,
Master Student of the Law Institute,
Belgorod State National Research University, Belgorod, Russia,
E-mail: 1075281@bsuedu.ru
Tsurikova Larisa Vladimirovna,
Ph.D. in Pedagogy,
Associate Professor of the Department of Foreign Languages and Professional Communication,
Belgorod State National Research University, Belgorod, Russia,
E-mail: tsurikova@bsuedu.ru

Abstract: *In this article, the authors study effectiveness of the impact of digital technologies introduction in the mechanism of public administration on the level of corruption in various states. Considers opinions of the political and business sectors representatives of the Russian Federation concerning the effectiveness of the introduction of digital technologies in the mechanism of government. It describes the current condition and development of anti-corruption mechanisms and means of reducing corruption in some foreign countries.*

Keywords: *corruption, public administration, digital technologies, digitalization, anti-corruption policy, international cooperation, corruption perception index.*

Introduction. On the official website of the United Nations, corruption is defined as a crime that is committed not only by representatives of state bodies, but also by private individuals by using their official position and aimed at obtaining personal financial gain.

Corruption has long been a global problem. The processes of globalization, to a fairly large extent, have allowed states to reduce the overall level of corruption. Particular assistance in this was provided by various international treaties and other cooperative acts aimed at creating a system of stable interstate cooperation in the field of combating corruption.

It is generally accepted that the greatest achievement of international cooperation in the field of combating corruption, occurred in the 20th millennium, is the adoption of "UN Convention against Corruption" by the UN General Assembly in 2003. This made possible to set a number of standards for anti-corruption activities, used by many countries of the world.

Recently, scientists and politicians have increasingly paid attention to the possibilities of digital technologies and their supposed positive impact on the development of anti-corruption mechanisms. Such issues are raised not only within the forums (OECD Global Anti-Corruption & Integrity Forum; Forum Against Corruption Time To Act), organized by various non-governmental organizations, but also in the course of discussions between political representatives at the international level.

One of the latest anti-corruption events at the international level was the regular conference of the participants of the UN Convention against Corruption, held in December 2021. It brought together leading experts, public figures, heads of ministries and anti-corruption agencies from more than 150 states parties to the UN Convention against Corruption, world-famous scientists in the field of preventing and combating corruption, as well as anti-corruption education. The agenda had many issues to be solved, including the introduction of digital technologies in the mechanisms for combating corruption processes occurring in the participant countries.

The era of information technology, automation and digital society enables the world to apply, among other things, the latest methods for combating the corruptness of certain social groups of the population.

The use of information technologies in the world community proves their effectiveness for the implementation of anti-corruption practices.

Results and Discussion. In 2019, the World Economic Forum published information indicating that developing countries suffer $1.26 trillion annually in losses due to corruption crimes. At the same time, it is noted that corruption can have a negative impact not only on the economy of a single state as a whole, but also on the life quality, social status and security of its population [https://www.weforum.org/agenda/2019/12/corruption-global-problem-statistics-cost/].

Corruption affects the most important sectors of the economy of any state. For example, it is reliably known that, on average, about 7.5 trillion US dollars are spent annually on medical services around the world. 300 billion of this amount is spent only because of corruption. That is 6 % of the total costs. The world now, more than ever, needs a stable supply of medical services, governments spend huge amounts of money to meet the needs of the population, but rampant corruption increases such amounts by as much as 6 %, that, of course, affects the economy and the quality of medical care [Mackey et al., 2020: 13].

At the present stage, the digitalization of public administration, economy, education, healthcare and other areas of state and public life has become a global trend [Ovchinnikov, 2019: 158]. The impact of digitalization on the fight against corruption, as well as the effectiveness of the digital technologies introduction in the mechanisms for combating corruption crimes, are the subject of consideration both in the regulatory and legal context and in the framework of many scientific discussions [Addo et al., 2020: 57].

Active attention is paid to the following types of anti-corruption measures based on information and communication technologies: anti-corruption training using digital technologies; introduction of digital public services and e-government; crowd sourcing platforms; introduction of BigData and artificial intelligence technologies [https://www.oecd.org/corruption/integrity-forum/academic-papers/ Milani].

These anti-corruption measures have a complementary relationship. Through effective digital governance has also brought transparency and accountability to government agencies and their officials.

Approving statements of various politicians, as well as representatives of the business community about the usefulness of introducing digitalization into the mechanism of public administration, at the present stage in the Russian Federation, are

supported by existence of the Strategy for the Development of the Information Society in the Russian Federation for 2017-2030, approved by the Decree of the President of the Russian Federation of May 9, 2017 № 203. The Strategy will allow the massive integration of digital technologies not only in public administration, but also in the life of society as a whole.

So, in Russia, digital technologies have been effectively introduced into the public procurement system. The digitalization of public procurement not only helped to simplify the application mechanism, but also made it possible to improve significantly the tools for monitoring this economic activity area, which, accordingly, led to a decrease in the corruption level. At the same time, it is noted that such actions led to the possibility for control exercised by regulatory bodies themselves, as well as by citizens of the state as a whole [Litvinova et al., 2021: 129].

Using digital technologies in the process of providing public services to citizens in the field of domestic relations allows to minimize domestic corruption. An example is the transition to electronic sick leave, electronic queues and registration forms for kindergartens and schools, and much more that has already been implemented in Russia.

The analysis of the introduction of digital technologies into the mechanism of public administration in the developed countries, which have been quite successfully reducing the spread of corruption processes for several years now, shows that the anti-corruption policy of Hong Kong and Singapore can be considered one of the most effective anti-corruption policies. These regions reduced the corruption rate in a fairly short period of time in. Other countries were not able to manage it.

Studies regarding the experience of Singapore show this state has quite actively pursued the digitalization policy in reforming the public administration system. First of all, in Singapore they used digitalization to improve the efficiency of monitoring, and also to ensure compliance with current legislation. The availability and openness of information, as well as a simplified monitoring procedure, can increase the level of trust in public organizations [Addo et al., 2021: 56].

The TRADENET system, created in Singapore, made it possible to optimize the processes of international trade and reduce the level of corruption in this area. This has led Singapore to become one of the world's leading port states and also the country with the lowest corruption rate in Asia [https://www.cpib.gov.sg/about-corruption/prevention-and-corruption/singapores-corruption-control-framework].

A few years later, Ghana, which is a developing country, tried to integrate TRADENET into its trade management system. In general, the technology has helped to make some improvements, e.g. to increase the level of customs administration, but the problem of corruption has not changed significantly.

As practice has shown, borrowing the experience of a state in the field of digitalization is not enough to reduce the level of corruption. It is quite common to believe that digitalization has had such an effective impact in Singapore due to the general state policy, which brings the problem of corruption to the fore. The state in question does not allow politics to interfere in anti-corruption investigations, that makes this activity independent. Singapore also provides a fairly large-scale financing of anti-corruption organizations. It was the competent national anti-corruption policy, which fully coincided with the general trend of the state's economic development, that

made it possible to put into practice the ideas of improving the situation by integrating digital technologies into management mechanisms.

Talking about borrowing the successful experience of digitalization of public administration in other countries to implement it on the territory of the Russian Federation, it can be noted that the example of Singapore and Ghana clearly shows that digital technologies must necessarily be accompanied by a competent anti-corruption policy of the state. Digitization itself, in the case of Ghana, has not contributed to the reduction of corruption, as evidenced by numerous studies on this issue.

Such type of anti-corruption activities based on information and communication technologies as transparency portals, the so-called online platforms, usually managed by governments or non-governmental organizations that publish information about the activities of a particular public authority or institution. Examples include the "I Paid A Bribe" portal operating in India, which allows users to report anonymously facts of bribery in government bodies, as well as the "Check My School" system implemented in the Philippines, which allows parents to control school expenses [Setor et al., 2021: 60].

It should also be noted that some researchers call into question the real effectiveness of introducing digitalization into the public administration mechanism to reduce corruption. According to them, a fairly large number of scientists and politicians around the world have high hopes for digital technologies, but at the moment there are not enough objective data that could indicate that the digitalization of public administration actually leads to a decrease in the level of corruption.

In conclusion, we note that corruption remains one of the most important problems of the 21st century. The introduction of digital technologies into the mechanism of public administration is seen as a rather positive means that can reduce the level of corruption. However, the practice of applying digitalization in this area shows that the digital technologies can be effective only if the state policy in the field of combating corruption is built in a competent way. On this basis, it does not seem surprising that in the Russian Federation, despite numerous approving statements of politicians and the business community representatives, no significant and rapid measures are being taken to introduce digital technologies into public administration. Obviously, at the beginning, government agencies plan to build a profitable support in the form of an updated anti-corruption policy, which, together with digitalization, will achieve the desired results.

References

1. Addo, A. et al. (2021). Information Technology and Government Corruption in Developing Countries: Evidence from Ghana Customs. – 56 p.

2. Addo, A. et al. (2020). Digitalization and Government Corruption in Developing Countries: Towards a Framework and Research Agenda. – 57 p.

3. Litvinova, Yu. M., Korotchenko, A. S. (2021). Protivodejstvie korrupcii v usloviyah cifrovizacii: sravnitel'no-pravovoj analiz [Anti-corruption in the context of digitalization: comparative legal analysis] *// Leningradskij yuridicheskij zhurnal [Leningrad Legal Journal*]. – № 1(63). DOI 10.35231/18136230_2021_1_120. – Saint Petersburg. – Pp. 120-132. (in Russian)

4. Mackey, T. K. et al. (2020). An interdisciplinary review of digital technologies to facilitate anti-corruption, transparency and accountability in medicines procurement. Global Health Action. – 13 p.

5. The impact of corruption on procurement performance. An assessment of Italian public work contracts and suppliers. – [online]. Available at: https://www.oecd.org/corruption/integrity-forum/academic-papers/Milani. (Accessed: 18.02.2022).

6. Ovchinnikov, A. I. (2019). Protivodejstvie korrupcii v usloviyah cifrovizacii: vozmozhnosti, perspektivy, riski [Anti-Corruption in the Context of Digitalization: Opportunities, Prospects, Risks] // *Journal of Russian law*. – № 11. DOI: 10.12737/jrl.2019.11.12. – M. – Pp. 158-170. (in Russian)

7. Setor, T.K. et al. (2021). Snizhayut li cifrovye platezhnye tranzakcii uroven' korrupcii? Dannye iz razvivayushchihsya stran. Telematika i informatika [Do digital payment transactions reduce corruption? Evidence from developing countries. Telematics and Informatics]. – M.: LitRes. – 60 p. (in Russian)

8. Singapore's Corruption Control Framework. – [online]. Available at: https://www.cpib.gov.sg/about-corruption/prevention-and-corruption/singapores-corruption-control-framework/. (Accessed: 18.02.2022).

9. World Economic Forum. Corruption costs developing countries $1.26 trillion every year – yet half of EMEA think it's acceptable. – [online]. Available at: https://www.weforum.org/agenda/2019/12/corruption-global-problem-statistics-cost/. (Accessed: 17.02.2025).

UDK 344.431.2

PIRACY AS AN INTERNATIONAL CRIME

Shvydkova Valeria Vitalievna,
Student of the Law Institute,
Belgorod State National Research University, Belgorod, Russia,
E-mail: shvydkova04@bk.ru
Petrunova Tatyana Vladimirovna,
Ph.D. in Psychology,
Associate Professor of the Department of Foreign Languages and Professional Communication,
Belgorod State National Research University, Belgorod, Russia,
E-mail: petrunova@bsuedu.ru

Abstract: *This article describes piracy as an international crime. The author emphasized the analysis of the composition of this crime and the special difficulties of its investigation. It is concluded that despite the successful statistics provided in the research process, states urge to keep control of the situation in the same mode, paying attention to the specifics and the great complexity of the investigation of such crimes.*

Keywords: *piracy, crime, international crime, privateering, raiding.*

Piracy is one of the oldest crimes, it arose from the moment a person went to sea. Throughout the time, there has been a rather contradictory attitude towards piracy on the part of the world community: in ancient times, pirates were the enemies of mankind, then legal piracy called privateering began. Privateers in wartime could attack enemy ships in order to seize property. Piracy has existed since ancient times, and in the 21st century it has become more organized and dangerous. Pirates seize ships and demand a ransom for the crew and cargo. The geography of pirate attacks includes the coastal waters of Asia, Africa and South America.

Over time, legal piracy has become an international problem due to its detrimental impact on the development of maritime trade. In 1856, the Paris Declaration on the Principles of International Law was adopted, which enshrined the

abolition of privateering [Naumov, 2023]. But in the 20th century, piracy began to take on new forms, for example, in the form of raiding. The main goal was to cause losses to the enemy, which distinguished raiders from privateers. Then the criminals expanded the scope of the attack and began to encroach on ships of neutral countries. Therefore, the Neon Agreement was adopted, according to which attacks on merchant ships of neutral countries fell under piracy.

At the beginning of the 21st century, the situation worsened. The most dangerous place was the Gulf of Aden, 92% occurred off the coast of Somalia. The UN Security Council adopted relevant resolutions that provided for additional measures to protect shipping and counter pirate attacks, for example, the protection and escort of ships by armed guards [Naumov, 2023]. Somalia is one of the poorest countries in the world, where pirates hijack ships and demand ransom.

In 2008, Somali pirates seized the Ukrainian cargo ship Faina, and in 2009 the American container ship Mayersk Alabama. The situation has improved significantly at the moment. Rostransnadzor cites the following data: according to the International Maritime Bureau, maritime piracy has reached its lowest level in 30 years. In the first quarter of 2023, 27 incidents were reported, which shows a decrease compared to 2022, in which 37 cases were recorded during the same period [Rostransnadzor, 2023].

Despite the measures taken by the international community, piracy poses a threat to safe navigation, human life and health, as well as the economy of many States. The high danger of this type of crime definitely gives grounds to give it an international character.

The object is considered to be relations in the field of ensuring freedom and safety of maritime navigation, as well as human life and health, property relations.

The subject of piracy is a water or aircraft, whose characteristics and features do not matter; property that is on board the vessel (may belong to both the crew and passengers); persons on board (passengers, crew).

Turning to the objective side, we consider it advisable to turn to A.V. Brilliantov, who characterized it as follows:

1) any unlawful act of violence or any robbery that is committed for personal purposes by the crew or passengers of private ships or aircraft. Actions on the high seas must be directed against another vessel or aircraft, as well as against persons and property on board; against any vessel or aircraft, persons or property in a place outside the jurisdiction of any State;

2) any act of voluntary participation in the use of any vessel or aircraft. At the same time, the subject is aware of the circumstances by virtue of which the tool is pirated;

3) incitement and aiding in the commission of the above actions [Brilliantov, 2023].

The crime scene is the open sea or an area that is not under the jurisdiction of any State. The main feature of the subjective side is personal goals. Most often, these are selfish goals in the form of taking possession of property, but sometimes the goal may be to cause as much damage to a competitor as possible.

The difficulties of investigating piracy. Some difficulties arise with the investigation of the crime in question. A large number of obstacles appear already at the stage of the prosecution of pirates. So E.A. Postoeva mentions that one of the main problems is the lack of prosecution of pirates by states [Postoeva, 2023]. This is often attributed to the fact that such a procedure can be quite expensive. In fact, for a trial

that may take place in a fairly remote region, it is necessary to transport suspects, witnesses, victims, if necessary, interpreters and persons to provide legal assistance, as well as all the evidence collected. Modern pirates use new technologies and are well organized. Combating piracy is difficult, but armed guards on board ships can be an effective means of protection.

The problem of piracy is linked to poverty, unemployment and corruption on shore. In fact, this problem appears to be one of the key ones, since the prosecution and detention of suspects and perpetrators before trial and their further stay in places of deprivation of liberty may incur large costs that States may not go to.

An example is the case of maritime piracy, where Russia took an active part: in 2020, pirates tried to seize the container ship Lucia but were stopped by the Russian navy. The Marines boarded the container ship and unblocked the crew, informing them of safety until the next meeting with the pirates.

Problems also arise with the crime scene, i.e. with the open sea. E.A. Postoeva points out that the right of a detainee to appear before a court immediately may be violated [Postoeva, 2023]. We consider it necessary to agree with this problem, because according to certain aspects of the legislation of countries, a suspect should be released if he was not given a preventive measure in the form of detention within a certain period (Russia) or after detention, the suspect was not taken to a judge no later than a day to explain the reasons for detention, interrogation, etc. (Germany). When pirates are detained by representatives of the above-mentioned countries, there is no guarantee of transporting suspects on time.

The bulk of the difficulties arise when collecting evidence at the crime scene. E.A. Postoeva leads a survey of investigators who were engaged in collecting evidence. Of these, we will highlight the most common:

1) the lack of a cellular signal or its low level, which made it difficult to communicate with team members;

2) loss of evidence due to contamination of the crime scene;

3) weather conditions that caused the loss of physical evidence,

4) physiological characteristics of employees, for example, motion sickness;

5) damage to equipment during the collection process due to humidity and large amounts of water.

Based on the above, it can be concluded that piracy in itself is a rather difficult crime to investigate due to its specific features. Despite the successful statistics provided in the research process, States urge to keep control of the situation in the same mode, paying attention to the specifics and the great complexity of the investigation of such crimes. In general, it is worth saying that at the moment Russia's policy in this aspect is characterized successfully and helps to reduce the risk of the spread of cases of maritime piracy due to the extensive legislative framework and the availability of qualified professional bodies with appropriate competence.

References

1. Brilliantov, A.V. (2023). Mezhdunarodnoe ugolovnoe pravo: uchebnik dlya vuzov [International criminal law: textbook for universities]. – M.: Urait. – 358 p. (in Russian)

2. Konvenciya Organizacii Ob"edinennyh Nacij po morskomu pravu 1982 [United Nations Convention on the Law of the Sea, 1982]. – [online]. Available at: http://www.un.org. (Accessed: 17.02.2025). (in Russian)

3. Naumov, A.V. et al. (2023). Mezhdunarodnoe ugolovnoe pravo: uchebnik dlya vuzov [International criminal law: textbook for universities]. – M.: Urait. – 517 p. (in Russian)

4. Postoeva, E. A. (2023). Processual'nye osobennosti provedeniya rassledovaniya i sudebnogo presledovaniya po delam o morskom piratstve [Procedural features of the investigation and prosecution of cases of maritime piracy] // Problemy rassledovaniya prestupleniy i puti ikh resheniya [Investigation of crimes: problems and ways to solve them]. – № 1(39). – Pp. 191-195. (in Russian)

5. Rostransnadzor: morskoe piratstvo dostiglo samogo nizkogo urovnya za 30 let [Rostransnadzor: maritime piracy has reached its lowest level in 30 years]. – [online]. Available at: https://rostransnadzor.gov.ru/news/1590?ysclid=lo7fog2sy812512958. (Accessed: 10.02.2025). (in Russian)

UDK 34.096

LEGAL REGULATION OF COMPETITION IN THE RUSSIAN FEDERATION AND FOREIGN COUNTRIES

Adadimova Victoria Alexandrovna,
Master Student of the Law Institute,
Belgorod State National Research University, Belgorod, Russia,
E-mail: VictoriaAlexXI@yandex.ru
Tsurikova Larisa Vladimirovna,
Ph.D. in Pedagogy,
Associate Professor of the Department of Foreign Languages and Professional Communication,
Belgorod State National Research University, Belgorod, Russia,
E-mail: tsurikova@bsuedu.ru

Abstract: *The relevance of this study lies in the normative legal regulation of competition in the Russian Federation and abroad. Currently, the antimonopoly policies of a number of states have seen significant development. The legislative regulation and the framework of antimonopoly policies in foreign countries are partially adopted by Russian legislation. Competition in the market environment remains an incompletely studied phenomenon, requiring a more thorough approach to its investigation.*

Keywords: *legal regulation of competition, antimonopoly policy, antimonopoly legislation, competition, market.*

The active development of a market economy in modern states inevitably leads to the emergence of competition. Competition is a defining characteristic of market relations. Referring to the position of M.B. Demin, it should be noted that the fundamental feature of a market economy is competition, which gives rise to competitive relations among economic entities. Historically, the economy of our state has undergone dynamic transformations.

Z.M. Kazachkova provides a precise description of competition, defining it as a lever for managing a market economy. Most industrialized countries implement legislative regulation through the concentration of capital and competition.

It is necessary to examine the concept of the state's antimonopoly policy in greater detail. Scientific research into this phenomenon in the economic sphere leads to a division of opinions into positive and negative perspectives. However, in the case of Russia, it should be noted that antimonopoly policy is being implemented, with

current legislation containing norms regulating monopoly and the protection of competition.

The antimonopoly policy system in our state is partially built on the experience of foreign countries. Policy and the stability of the state structure determine the direction of the economy. Today, market competition is implemented in many states, but its system has not yet reached a perfect level.

It is widely accepted that the life of the modern world revolves around various types of market relations, the key feature of which is rivalry among market participants (entities). The aforementioned fact directly highlights the relevance of their development and improvement, as well as the state's interest in creating conditions for business expansion.

It is important to note that the antimonopoly policies of states often determine the level and direction of market competitiveness as an independent phenomenon [Zavadnikov, Kuznetsov, 2017: 166]. Scientific literature identifies several approaches to justifying the need to study the tools and mechanisms of antimonopoly regulation.

According to the positions of I. Artemiev and A. Sushkevich, the antimonopoly policy of the state is subject to criticism by researchers in the field of economic development. Most scholars who oppose the state's antimonopoly policy support the idea of abolishing this mechanism of economic regulation. Others advocate for minor adjustments to the functioning of the state's antimonopoly policy.

Based on the position of O.A. Gorodov, it is important to emphasize that states differ in the legal regulation of market relations. These differences allow for the classification of states into two groups:

1. The first group includes states that have adopted special legislation at the statutory level. The norms of this legislation explicitly provide for protection against unfair competition and impose sanctions for violations of the established economic regulations.

2. The second group comprises states whose policies for the protection and control of economic relations are based on general legislative norms.

This classification highlights the diversity of approaches to regulating competition and underscores the need for a nuanced understanding of antimonopoly policies in different jurisdictions. The debate over the effectiveness and necessity of such policies remains a significant topic in the discourse on economic regulation.

Additionally, there is active lobbying for the position that the very existence of market relations predetermines the need for certain regulatory mechanisms, including legislative ones. Thus, some legal scholars argue that currently, in the Russian Federation, the bodies authorized to implement state policy in the field of competition protection are not fulfilling their assigned duties. Consequently, scientific works periodically propose the adaptation of various models and solutions in the field of competition protection practiced in foreign markets [Gorodov, 2018: 25-26].

Particular attention deserves the method of legislative enshrinement of antimonopoly regulatory norms in the country. States such as Germany and Switzerland explicitly prohibit violations of competition rules. At the same time, they offer interpretations of these prohibitions that allow legislators to save resources by avoiding the adoption of numerous clarifying by-laws.

In contrast, countries like the United Kingdom, France, the United States, and Italy use the concept of "unfair competition" primarily to describe the hypothesis of legal norms, particularly in the field of criminal law. The choice of legal instruments often depends on geographical factors. For example, the United States has the Sherman Act, a model also adopted by Canada and several other countries bordering the U.S. American tools are aimed at directly combating monopolization [Svyados, 1989: 311-312]. As for European states, they, on the contrary, prefer to establish restrictions around monopolists in order to extract benefits from them.

Notably, the legal regulation of competition in the Russian Federation leans more toward the European model. There are also models similar to those of Germany and Japan, which enforce a direct ban on monopolization while establishing strict rules for the existence of consolidated market participants. Analyzing Russian legislation in the field of economic development, it is essential to focus on Federal Law No. 135-FZ of July 26, 2006, "On Protection of Competition." This law outlines general norms regulating competition and imposes sanctions on economic entities engaging in unfair competition.

Currently, many modern states face an increasing need to develop and adopt a unified regulatory legal act in the field of antimonopoly protection [Talantsev, 2019: 76]. Turning to the history of legislative protection of competition abroad, it is worth noting that the Asia-Pacific region began this process in the 1980s. China adopted a special law enshrining provisions for improving and protecting competition. One of the foundational laws in the development of antimonopoly legislation was the Law Against Unfair Competition, adopted in 1993. In 2008, China enacted a new law that remains in force today.

In Japan, the Sherman Act of the United States served as the basis for its antimonopoly legislation. Japanese law strictly regulates the restriction of certain actions by economic entities in the context of antimonopoly regulation. In Korea, the primary law on antimonopoly regulation and fair trade was adopted in 1980. Subsequently, the state introduced a series of laws that complement the legal regulation of competition, aiming to prevent the creation of monopolized market structures.

Examining the development of antimonopoly legislation in the United States, the Sherman Act stands out as a cornerstone, its provisions forming the basis of global trends in antimonopoly regulation. This law has been adopted as the foundation of antimonopoly legislation in several countries with highly developed industries and economic potential. A key feature of this law is the imposition of criminal liability for violations of fair competition laws.

In Germany, the Law Against Unfair Competition was first adopted in 1896. It was later expanded in 1909 and further revised until 2004, when a new law was enacted, establishing updated prohibitions in line with societal needs [Yacheistova, 2016: 468]. Similarly, France adopted its first act regulating competition issues very early on.

In conclusion, based on the above, it can be inferred that the exchange of experience in economic development among leading countries in this field could lead to the improvement of antimonopoly legislation in Russia and address existing gaps in the current system.

At present, the Russian Federation has implemented antimonopoly regulation, adopting specialized legislation that governs market relations and provides protection

against unfair competition. It is also important to note that the system of antimonopoly legislation has been developed based on the experience of a number of foreign countries.

In this regard, it is necessary to emphasize that the interstate exchange of experience is crucial for the dynamic development of the state and its economic growth. Such collaboration facilitates the adoption of best practices, enhances the effectiveness of regulatory mechanisms, and contributes to the creation of a competitive and stable economic environment.

References

1. Galenitsky, A.E. (2017). Zloupotreblenie dominiruyushchim polozheniem na tovarnom rynke po zakonodatel'stvu Rossii i Francii: sravnitel'no-pravovoj analiz: magister. diss. [Abuse of Dominant Position in the Commodity Market under the Legislation of Russia and France: A Comparative Legal Analysis: Master's diss.]. – M.: Statut. – 165 p. (in Russian)

2. Gorodov, O.A. (2018). Nedobrosovestnaya konkurenciya: teoriya i pravoprimenitel'naya praktika: monografiya [Unfair Competition: Theory and Law Enforcement Practice: A Monograph]. – M.: Statut. – Pp. 25-26. (in Russian)

3. Svyados, Yu.B. (1989). Regulirovanie ogranichitel'noj praktiki i vneshnetorgovyh operacij [Regulation of Restrictive Practices and Foreign Trade Operations] // *Foreign trade and trade policy of the USSR*. – № 7. – St. Petersburg. – Pp. 311-312. (in Russian)

4. Talantsev, V.I. (2019). Antimonopol'noe regulirovanie za rubezhom [Antimonopoly Regulation Abroad]. – Vladivostok: TGEU. – 76 p. (in Russian)

5. Yacheistova, N.I. (2016). Mezhdunarodnaya konkurenciya: zakonodatel'stvo, regulirovanie i sotrudnichestvo [International Competition: Legislation, Regulation, and Cooperation] // *European Journal of Law and Political Sciences*. – Geneva: UN. – Pp. 468. (in Russian)

6. Zavadnikov, V.V., Kuznetsov, Yu.P. (2017). Promyshlennaya politika v Rossii: popytka novogo podhoda [Industrial Policy in Russia: An Attempt at a New Approach]. – № 3. – M.: – 166 p. (in Russian)

UDK 34

THE PROBLEM OF THE CONCEPT OF ENTREPRENEURIAL ACTIVITY

Ibragimov Renat Ibragimovich,
Master Student of the Law Institute,
Belgorod State National Research University, Belgorod, Russia,
E-mail: 1465419@bsuedu.ru
Tsurikova Larisa Vladimirovna,
Ph.D. in Pedagogy,
Associate Professor of the Department of Foreign Languages and Professional Communication,
Belgorod State National Research University, Belgorod, Russia,
E-mail: tsurikova@bsuedu.ru

Abstract: *This study is devoted to the examination and analysis of the current definition of the concept of "entrepreneurial activity," as provided by the Russian legislator in the Civil Code of the Russian Federation, focusing on the obsolescence that the studied definition has undergone over the years and lost its functional relevance in the context of modern economic realities. The presence of terminological ambiguity creates preconditions for the emergence of legal conflicts, which can lead to inconsistent judicial practice due to the resulting difficulty in distinguishing entrepreneurship from other types of economic activity. The outcome of the study is a proposal to develop measures aimed*

at reforming the legislative definition by incorporating into its structure an updated set of criteria that fully correspond to current realities.

***Keywords**: entrepreneurial activity, economic activity, Civil Code of the Russian Federation, entrepreneurship, business, profit, risk.*

The beginning of the post-Soviet period in domestic history can be characterized as a cornerstone stage in Russia's development, which was marked by a whole series of significant transformations and metamorphoses that affected all spheres of societal life.

The change in economic formation not only reshaped the state's approaches to regulating economic processes (the transition to capitalism that occurred during that era) but subsequently triggered a cascade of changes in the sphere of law-making and the substance of legislation. Thus, in 1994, the Russian legislators introduced a civil-law category that was still new for that political structure of society – "entrepreneurial activity," the definition of which, in essence, allowed any willing individual to engage in and be the direct manager of running a personal business.

However, the authors wish to note that after more than three decades, neither the wording contained in the definition of this term nor its conceptual positioning has undergone, in essence, any changes. As a result, the opinion about the inadequacy of this definition's relevance to modern economic and social realities of societal life is gaining traction in academic circles. It is suggested that the reason for this lies in the preservation of the original wording, which characterized "entrepreneurial activity" based on entirely different economic conditions and socio-political factors (Russia of the 1990s).

In the authors' view, the current definition fundamentally fails to account for the novelties characteristic of the 21st century. The present era is unfolding under the aegis of globalization processes and associated innovations in digital technologies, which poorly correlate with the normative definition of the term "entrepreneurial activity." Judicial practice already exhibits case incidents that stem from the absence of updated criteria which would facilitate the enforcer's process of differentiating entrepreneurship from other similar types of economic activity. Among such examples, one may cite court cases concerning repeated real estate lease transactions, where the difficulty in qualifying such activity as entrepreneurial is clearly evident due to the lack of sufficiently clear distinguishing features/criteria in the legislation. The contradictions only underscore the urgency of amending the current version by incorporating more precise criteria.

The main drawback, in our opinion, lies in the weak adaptability of the legislative enshrinement of the analyzed term to new realities. Considering that entrepreneurship undeniably serves as a system-forming element of the economy, its regulation, in our view, must inevitably correlate with the highly dynamic spheres of modern societal life, such as, for instance, IT. Consequently, in our opinion, it becomes evident that definitive approaches formed within past economic and legal realities lose relevance, and the concept itself requires conceptual rethinking due to its inability to regulate and account for the current format of economic and legal relations.

Paradoxically, most legal scholars agree that the normative standard continues to be the definition enshrined in Article 2 of the Civil Code of the Russian Federation. However, we wish to emphasize that its content accumulates features

relevant to the entrepreneurial environment of the mid-1990s. The legislator refers to the following: “1) autonomy of the subject’s volitional expression; 2) presence of economic risks; 3) regular derivation of income; 4) mandatory state registration” [https://www.consultant.ru/document/cons_doc_LAW_5142/].

These criteria have become the subject of debate in the academic community. Most researchers insist on expanding the list of differentiating characteristics reflecting modern forms of economic activity. A pivotal argument in this discussion remains L.V. Shchennikova’s position: “Under this definition falls virtually any economic activity that generates even minimal profit for the subject” [Shchennikova, 2005].

In addition to the aforementioned position of L. V. Shchennikova, the authors wish to draw attention to the significant discourse present in academic circles regarding the methodology of constructing the concept of "entrepreneurial activity". Thus, de jure, the Russian legislator clearly adopts a model that implies the declaration of basic characteristics, on the basis of which, in turn, the definition is formed. In contrast, we emphasize that in a number of foreign jurisdictions, the emphasis shifts to the subjective criterion, where the starting point is the status of a person authorized to engage in economic activity.

Among these, France should be noted: a vivid illustration is Article 1 of the French Commercial Code, which interprets a merchant as a subject conducting transactions within the framework of professional activity. Germany also follows a similar vector: in the German Commercial Code (§§ 1-6 HGB), entrepreneurial activity is differentiated through four categories of economic entities [https://www.gesetze-im-internet.de/englisch_hgb/index.html], which, in our opinion, ensures objective flexibility in the process of law enforcement.

Contemporary academic discussions currently focus on comparing the regulatory conditions for access to entrepreneurship. Russian law, as previously stated, establishes an imperative necessity for acquiring a special legal status, whereas in Spain (Art. 19 of the Spanish Commercial Code), the legislator explicitly prohibits requiring mandatory registration as an entrepreneur to engage in this type of economic activity [https://www.uaipit.com/uploads/legislacion/files/1366620586_Code_of_Commerce.pdf].

Despite the polarity of approaches, we nevertheless note that the majority of domestic researchers, despite the existing issues, de facto support the national model, interpreting the concept through the prism of key characteristics. This trend can be clearly traced in scholarly works where the term "entrepreneurial activity" is revealed either through a combination of features (autonomy, risk, systematic profit) or by detailing one of them.

The authors conducted an analysis of the key features of entrepreneurial activity in scholarly doctrine and revealed that, for instance, researchers I. G. Mamedova and A. K. Sheremeteva, in their work, identify purposeful income generation as a key criterion for entrepreneurship, emphasizing the necessity of its regular, rather than sporadic, nature. According to them: “systematic engagement in activity entails the execution of a transaction or interrelated transactions, taking into account their nature and the essence of the legal relationships formed, as well as actions aimed at fulfilling

obligations arising from such a transaction, necessary to achieve the primary goal of this activity over a corresponding period" [Sheremeteva, Mamedova, 2018].

Professor O. M. Oleynik, in her work, expands the discourse by incorporating property autonomy of the subject and the socio-economic function of entrepreneurship: "the most significant aspects here are the risky nature, as well as the property independence of the subject engaged in this activity, considering, of course, the very goal the creation of jobs, production and sale of goods, and the ultimate result profit generation" [Olejnik, 2015]. It is crucial to emphasize the ongoing transformation of property independence within the context of business digitalization. For instance, the widespread use of rented resources, such as cloud services by freelancers, challenges traditional interpretations of "independence".

M. V. Rarova, in her article, develops the idea of risk, supporting Professor O.M. Oleynik's observation, interpreting it (risk) "as a factor determining and demonstrating the financial resilience of an entrepreneur" [Rarova, 2018]. It should be noted that in her interpretation, risk is associated with the probability of adverse events capable of affecting the outcome of the activity and the economic standing of the subject.

It should be emphasized that the category of "risk", which is an integral component of the definition of entrepreneurial activity, reveals the dual nature of this type of economic activity. On the one hand, risk may provide an incentive for entrepreneurs to innovate, but on the other hand, it inevitably creates conditions that are not fully covered by the current legal framework. In this context, it is very noteworthy, in our opinion, to consider the situation mentioned earlier, for example, blockchain startups. Their activities, as is well known, are not sufficiently regulated by current legislation and, thus, go beyond the existing legal norms.

Based on this, the authors would like to emphasize that in this case, the encounter with new legal torts is merely a matter of time, which will undoubtedly provoke a new "wave" of divergence in judicial practice among domestic law enforcers. It should be noted that this state in the law enforcement field "de facto" partially already exists, since in cases where normative prescriptions are not fully exhaustive in their essence, law enforcement bodies, particularly courts, are vested with competencies to resolve legal disputes between parties to judicial proceedings, guided for this purpose by their own interpretations (yet in the spirit of the law) to fill gaps in the legislative framework.

However, it is pertinent to note that such situations are highly undesirable, as they inevitably lead to a "dichotomy" in the sphere of judicial practice, which only further destabilizes the legal field.

Thus, the results of the research clearly demonstrate the actual necessity to refine the definition declared by the legislator in Article 2 of the Civil Code of the Russian Federation by introducing amendments that would update its content to align with current socio-economic realities.

From the researchers' perspective, the concomitant efforts to develop clearer differentiating criteria will simplify the task for law enforcers in distinguishing entrepreneurial activity from adjacent types of economic activities. This appears possible because the cause of the emerged terminological confusion among legal scholars will be mitigated by the legislator's updated prescription, which would fully correspond to modern narratives.

References

1. Código de Comercio [Spanish Commercial Code]. – [online]. Available at: https://www.uaipit.com/uploads/legislacion/files/1366620586_Code_of_Comerce.pdf. (Accessed: 25.03.2025).

2. Grazhdanskiy kodeks Rossiyskoy Federatsii [Civil Code of the Russian Federation]. – [online]. Available at: https://www.consultant.ru/document/cons_doc_LAW_5142/. (Accessed: 25.03.2025). (in Russian)

3. Handelsgesetzbuch (HGB) [German Commercial Code]. – [online]. Available at: https://www.gesetze-im-internet.de/hgb/. (Accessed: 25.03.2025).

4. Olejnik, O.M. (2015). Ponyatie predprinimatel'skoj deyatel'nosti: teoreticheskie problemy formirovaniya [The concept of entrepreneurial activity: theoretical problems of formation] // *Predprinimatel'skoe pravo*. – № 1. – Pp. 13-25. (in Russian)

5. Rarova, M.V. (2018). 1.16 Sushchnost' i analiz predprinimatel'skikh riskov [The essence and analysis of entrepreneurial risks] // *Problemy razvitiya sovremennogo predprinimatel'stva: Kollektivnaya monografiya [Problems of the development of modern entrepreneurship: Collective monograph]*. – Stavropol: OOO "SEKVOYA". – Pp. 70-75. (in Russian)

6. Sheremet'eva, A.K., Mamedova, I.G. (2018). Problema tolkovaniya termina "predprinimatelskaya deyatelnost'" [The problem of interpreting the term "entrepreneurial activity"] // *Aktual'nye voprosy yuridicheskoj nauki i praktiki*. – Habarovsk: Izd-vo Tihookean. gos. un-ta. – 352 p. (in Russian)

7. Shchennikova, L.V. (2005). Predprinimatel'skaya deyatel'nost' kak grazhdansko-pravovaya kategoriya [Entrepreneurial activity as a civil law category] // *Civilisticheskie zapiski: Mezhvuzovskij sbornik nauchnyh trudov*. – V. 4. – M.: Statut. – Pp. 76-90. (in Russian)

UDK 340

THE ROLE OF LEGAL TERMINOLOGY IN LAW ENFORCEMENT PRACTICE

Korobchinskaya Kristina Nikolaevna,
Master Student of the Law Institute,
Belgorod State National Research University, Belgorod, Russia,
E-mail: kristina003k@gmail.com
Tsurikova Larisa Vladimirovna,
Ph.D. in Pedagogy,
Associate Professor of the Department of Foreign Languages and Professional Communication,
Belgorod State National Research University, Belgorod, Russia,
E-mail: tsurikova@bsuedu.ru

Abstract: *The article is aimed at defining the role of legal terminology in law enforcement practice. The authors analyze the essence and content of legal terminology, identify the properties of legal terms, and classify them based on their degree of generality. Taking into account the context of the Russian legal system, practical issues of using legal terminology are considered to ensure uniformity of law enforcement practice, increase the effectiveness of legal institutions, and respect the principles of justice, legality, and equality in regulating public relations on the part of the state.*

Keywords: *legal technique, legal terminology, legal term, legal category, law enforcement practice, legal concept.*

The complexity of the system of legislation, which includes many norms interconnected with each other, gives rise to ambiguous wording, ambiguous

interpretations, which lead to law enforcement errors. In order for legal norms to be properly applied in practice, it is important to use effective tools to convey their exact content, excluding any double meanings and other problems that can cause difficulties in the process of legal understanding. One of such tools today is legal terminology, the role of which in law enforcement practice is undeniably high.

A.S. Kagermanov in his study points out that legal terminology has a number of important functions. In particular, this tool is used to ensure a high speed of thought operations of the subject of law enforcement, which he carries out in the process of analysing and studying the text of a particular normative-legal act.

E.R. Chernova, considering the role and meaning of legal terminology, makes an indication that it is a set of legal terms that are used by the legislator to define a particular legal institution. The author also states that when considering issues related to legal terminology, first of all, it is necessary to determine the meaning and content of such a legal concept as legal term [Chernova, 2022: 54].

It should be noted that among domestic legal scholars there is no unified approach to the definition of this concept, which is due to the complexity of the legal system and the interdisciplinary nature of legal terminology. Many researchers believe that a legal term is a lexical unit that has a normative meaning and is used in the texts of normative legal acts. Other researchers talk about the functional nature of a legal term, in other words, its role is to ensure uniformity of law enforcement and systematisation of legal norms. Disagreements arising in the definition of the concept of 'legal term' are caused by the peculiarity of the functioning of the legal system: terms can be of general and highly specialised nature. Some legal terms are universal, used in different legal branches, while others have a strictly limited area of application.

The analysis of thematic sources of information allows us to come to the conclusion that many researchers agree on the following properties characteristic of a legal term:

– the form of expression of a legal term – a specific word or combination, which have a special legal character, are used in legal language, and are designed to fulfil a set of clearly defined functions;

– a legal term is a verbal designation that is applicable to a legal concept that has a meaning and content reflecting the idea that was put by the legislator in a specific legal norm designed to regulate social relations;

– does not allow for differences in the definition of the meaning and content of a legal term, i.e. there should be uniformity in interpretations;

– each legal term, in all cases without exception, must be accompanied by a definition, i.e. a definition that allows to reveal its essence and content by formulating a set of key features that individualise a legal concept, distinguishing it from related legal categories [Vlasenko, 2025: 269].

A number of the above properties are directly reflected in the acts of current legislation. Thus, for example, the property of uniformity of legal terminology is directly enshrined in the text of Article 11 of the Tax Code of the Russian Federation: Institutes, concepts and terms of civil, family and other branches of legislation of the Russian Federation, used in this Code, shall be applied in the meaning in which they are used in these branches of legislation, unless otherwise provided by this Code

[https://www.consultant.ru/document/cons_doc_LAW_19671/]. Thus, the presence of reference norms to acts of other branches of law does not exclude a uniform understanding of legal terms, even in conditions when such application is carried out within the framework of regulation of a separate group of social relations.

It should also be noted that all legal terms, which are the foundation of any legal terminology, are subject for classification depending on the degree of their generality, it is both theoretical and practical in nature, which helps to ensure accuracy, uniformity of legal concepts in law enforcement and lawmaking activities. Understanding of this classification is of high importance for law enforcement practice, as it allows to determine the fact of applicability of this or that term in a particular situation properly, in the conditions of participation in a particular group of social relations regulated by acts of current legislation. So, in accordance with the designated classification, it is customary to distinguish:

1) general legal terms that can be applied within the entire system of law, i.e. in the regulation of the totality of social relations, regardless of the specifics of the legal branch and any other features. Such terms are the concepts of „offence", "right", "legal responsibility", "duty" and so on, these are the categories that represent the foundation of the entire legal system;

2) inter-branch legal terms, the applicability of which is limited to only a few branches of Russian law, going beyond which makes it impossible to make proper practical use of this or that concept. For example, the concepts of "legal fact", "contract", "subject of legal relations" and others;

3) branch legal terms, which are limited by the possibility of application only in the regulation of a narrow range of social relations that are the subject of a particular legal branch, for example, criminal ("offence" and "criminal punishment") or civil law ("contracting" and "leasing").

Compliance with all the properties of legal terms plays a crucial role in ensuring the effectiveness of law enforcement practice and, as a consequence, the fulfilment by the state of its regulatory and managerial functions. If there is no uniformity that allows different interpretations, ensuring the unity of law enforcement practice by default becomes impossible, because in the domestic system precedent is not considered as a source of law, which forces law enforcers to be guided only by those provisions that are directly enshrined in the acts of current legislation [Kuharev, 2023: 128].

In order to prevent the above problems, at the level of normative legal acts of the Russian Federation, specific legal terms are defined, which are to be applied in practice, taking into account the specific content invested in the concept by the legislator himself. An example of a norm fulfilling this task can be Article 5 of the current Code of Criminal Procedure of the Russian Federation, which defines the basic concepts used in this normative legal act [https://www.consultant.ru/document/cons_doc_LAW_34481/].

The definition of such terms in the CPC of the RF indicates that in the framework of criminal proceedings the subjects of law enforcement practice should rely solely on their legislative definition, without any discrepancies and application of the law by analogy in case similar legal concepts are reflected in the text of other normative legal acts.

Thus, we can conclude that in modern times legal terminology retains its high role not only in the theoretical definition of specific legal categories, but also in law enforcement practice. In the conditions of modern society and the functioning of the modern legal system, legal terminology retains its exceptional importance. It is not just a set of special concepts, but an integral system of terms that allows to accurately and unambiguously formulate legal norms, as well as to ensure their correct understanding and application in theory and practice. The importance of legal terminology lies in creating a basis for the effective functioning of legislative, judicial and administrative processes.

The terms used in law must have a strictly fixed meaning, as well as clarity and unambiguity, because the cause of legal conflicts and difficulties in law enforcement practice is the difference of interpretation of legal terms. If legal terms do not possess the totality of their properties, the proper application of legal norms in practice becomes impossible, as the factor of uniformity is excluded. In such conditions, justice and legality in the regulation of social relations are completely excluded, as well as the equality of subjects participating in them.

In addition, not only will there be errors in legal practice, but also violations of the principles of justice, and citizens' trust in the legal system will be undermined. It is for this reason that legal terms used in legislative and subordinate legislation find their proper definition in the text of these very documents, thus preventing discrepancies and other problems. The conditions that are indispensable for effective legal regulation, strengthening the rule of law and increasing the level of trust of citizens in state institutions are accuracy and unambiguity of legal terminology.

References

1. Chernova, E.R. (2022). Rol' i znachenie yuridicheskoj terminologii v sovremennom zakonodatel'stve [The role and significance of legal terminology in modern legislation] // *Pravo i gosudarstvo: teoriya i praktika.* – № 4. – Pp. 54-56. (in Russian)

2. Kuharev, YU.S. (2023). Rol' yuridicheskoj terminologii v normotvorcheskom processe [The role of legal terminology in the rule-making process] // *Nauchnoe obozrenie: aktual'nye voprosy teorii i praktiki.* – № 1. – P. 128. (in Russian)

3. Nalogovyj kodeks Rossiyskoy Federatsii [The Tax Code of the Russian Federation]. – [online]. Available at: https://www.consultant.ru/document/cons_doc_LAW_19671/. (Accessed: 15.03.2025). (in Russian)

4. Ugolovno-processual'nyj kodeks Rossijskoj Federacii [The Criminal Procedure Code of the Russian Federation]. – [online]. Available at: https://www.consultant.ru/document/cons_doc_LAW_34481/. (Accessed: 15.03.2025). (in Russian)

5. Vlasenko, S.V. (2025). Slovarnye perevody yuridicheskih terminov: slozhnosti opredeleniya znachenij [Dictionary translations of legal terms: difficulties in defining meanings] // *Aktual'nye problemy sravnitel'nogo pravovedeniya i yuridicheskoj lingvistiki.* – № 1. – Pp. 269-276. (in Russian)

UDK 342.25

THE PROBLEM OF OPTIONAL ELEMENTS OF A CRIME IN CRIMINAL LAW

Polshikova Viktoria Victorovna,
Student of the Law Institute,
Belgorod State National Research University, Belgorod, Russia,
E-mail: polshikova_04@mail.ru
Praslova Veronika Maksimovna,
Student of the Law Institute,
Belgorod State National Research University, Belgorod, Russia,
E-mail: praslova04@list.ru
Gusakova Natalia Leonidovna,
Ph.D. in Psychology,
Associate Professor of the Department of Foreign Languages and Professional Communication,
Belgorod State National Research University, Belgorod, Russia,
E-Mail: gusakova_n@bsu.edu.ru

Abstract: *The article is devoted to the problem of the definition and meaning of optional elements of a crime in criminal law. An analysis of individual elements of the crime is carried out. Special attention was paid to the issue of the influence of optional features on the qualifications of a crime. The interaction of the parties to the criminal act and the signs under consideration was subject to consideration.*

Keywords: *criminal law, crime, criminal act, corpus delicti, optional signs of a crime, qualification of a crime.*

"Signs of a crime" is a concept that criminal law actively uses. It is customary to identify mandatory elements and optional or additional elements as part of the signs of a crime. The word "optional" is of Latin origin, derived from "facultas" and translates as "opportunity". Ozhegov's explanatory dictionary defines the word "optional" as optional or irregular, additional.

As part of each crime, you can distinguish its object, subject, objective side and subjective. The absence of at least one of the elements means the absence of the crime itself. Optional features are identified in each of the components, which are not inherent in all crimes, they act as constituent elements only if they are indicated by the disposition of the article of the Special Part of the Criminal Code of the Russian Federation. The legislator does not define these signs, but they are of great importance for differentiating criminal acts. In some cases, they are qualifying, that is, burdening responsibility, they are usually indicated in parts two, three, etc. of the relevant article.

Consideration of the significance of optional features for criminal law should begin with the object of the crime. The object of a crime is understood to mean social relations protected by applicable law, which cause harm or create a threat of harm as a result of criminal encroachment. The object of a crime is an object of the material world, affecting which the criminal violates or tries to violate legally protected social relations [Naumov, 2019].

As an example, article 186 of the Criminal Code of the Russian Federation is devoted to counterfeiting, the object of the crime is public relations in the field of financial activity and state security, while the subject is counterfeit securities and bank notes.

The object of the crime does not match its object, the criminal is interested in preserving the object, while the integrity of the object is violated. But there are articles that are exceptions: the Criminal Code of the Russian Federation, Article 167, "Intentional destruction or damage to property."

In addition to the subject, in some crimes, the victim of the crime is singled out, which may be an obligatory feature of certain compounds. A victim is an individual who has suffered physical, material or other harm as a result of a crime, as well as a legal entity that has suffered material harm, CPC art. 42.

The objective side is broader than the object and includes a greater number of optional features, including the following: place, time, tools and means, environment. Article 227 of Part 1 of the Criminal Code of the Russian Federation, which refers to piracy, defines the crime scene, the sea or the river, without this condition, a criminal act cannot exist. A place is defined as the territory where the crime occurred. In other cases, optional signs aggravate the punishment, for example, in article 105, part 2, paragraph "e", murder with special cruelty is indicated, that is, with physical or psychological torment, which is a method of committing a crime.

Time is rarely found in the disposition of the article, in Article 106 of the Criminal Code of the Russian Federation "Murder by a mother of a newborn child" it is a mitigating circumstance, and in Article 337 of part 2 of the Criminal Code of the Russian Federation "Unauthorized abandonment of a unit or place of service", on the contrary, acts as a qualifying factor [Volchkova, 2013].

It is necessary to distinguish between tools and tools, which are an important optional feature. An instrument is an object with which a crime is committed, it can be a thing intended for this purpose or an object used as an instrument adapted for the specified action (pistol, knife, stone, etc.). Electricity, gas, radiation, sound, etc. can act as a means. with their help, crimes are committed more "peacefully" or "calmly."

The above-mentioned time and place are closely related to the crime scene, the objective conditions under which the crime is committed. The same actions in different situations have different consequences [Naumov, 2019]. Failure to comply with an order specified in Article 332, part 2, of the Criminal Code of the Russian Federation will be subject to lesser punishment than the same act committed during martial law, the same article, Part 2.2.

It can be noted that all optional signs of the objective side complement each other. Even if they are not specified in the article, the judge takes them into account when determining the punishment. Thus, the optional signs of the objective side make it possible to individualize a criminal act, outline its external form of expression. The nature of the considered signs determines the degree of public danger of the act. They are of great importance for the qualification of a crime and the procedure for sentencing [Dudurkin, 2020].

The subject and the subjective side are the most difficult issues of criminal law. The subject is a person who has directly committed a crime, possessing all the necessary signs, and can only be a sane individual who has reached the age of criminal

responsibility. In this case, optional features are of great importance, since under certain circumstances, a person who is able to act as the subject of a crime based on mandatory features is not.

Optional signs of the subject of the crime include the following: gender, age, family relations, citizenship, nature of the position, etc. They are indicated in the very article of the Special Part of the Criminal Code of the Russian Federation or implied by it. Returning to Article 106 of the Criminal Code of the Russian Federation, it is worth noting that the subject of this crime is only a woman who is the mother of the child, that is, gender and family ties are mandatory in this case.

Criminal liability for disclosure of the secret of adoption, Article 155 of the Criminal Code of the Russian Federation, will be subject to a person who has access to this type of secret, based on his professional position. Article 305, "The imposition of a knowingly unlawful sentence, decision, or other judicial act," does not explicitly set an age limit, but based on the provisions of the disposition, it can be concluded that a person who has reached the age of 25 will be liable for this composition, since this is the minimum age established by the legislation of the Russian Federation for a judge. Thus, the optional features of the subject determine the range of persons who fall under one or another article of the Criminal Code.

The subjective side of the crime is the internal, mental attitude of the criminal to the action he commits. An obligatory sign of the subjective side is guilt, but it is not able to give a complete answer to the question of why a person committed a crime.

Traditionally, the science of criminal law distinguishes motive and purpose as optional features. The emotional state is not always attributed to this group, arguing that emotions are included in the motive, being the cause of criminal motives. But do not underestimate the emotions of the criminal, because it is on the basis of them that motive and purpose arise. Omission of this component can lead to contradictions and legal errors in the qualification of a crime and the imposition of punishment.

The Criminal Code of the Russian Federation knows such a kind of emotional state as affect. From this, it can be concluded that the emotions of the perpetrator are an integral part of the crime and should be taken into account when imposing punishment. Criminal acts committed in a state of passion are subject to less severe punishment [Maslova, 2012].

Motive is the motivation, the motivating reason for criminal behavior. It is inherent in any illegal action, regardless of whether it was committed intentionally or negligently. The goal is the result that the crime is aiming for. Motive and purpose are mandatory features if they are contained in the disposition of the article, Article 205.3 of the Criminal Code contains provisions on training in order to carry out terrorist activities. They can act as circumstances mitigating or aggravating the punishment. In this case, the motives can be divided into base ones, entailing more severe punishment, and those devoid of a base component [Karaseva, 2016].

In conclusion, it should be noted that optional features are of great importance for criminal law. They allow you to more fully solve crimes, take into account all the features and nuances. The correct definition of optional features contributes to a more accurate qualification of a criminal act, the differentiation of similar compositions, the correct imposition of punishment, and in some cases even exemption from criminal liability.

References

1. Dudurkin, R. R. (2020). Ponyatie i znachenie fakultativnyx priznakov obektivnoj storony prestupleniya [The concept and meaning of optional features of the objective side of the crime] // *Aktual`ny`e issledovaniya.* – № 7. – Pp. 49-52. (in Russian)
2. Karaseva, M. Y. (2016). Motiv i cel kak fakultativnyj priznak subektivnoj storony prestupleniya [Motive and purpose as an optional feature of the subjective side of the crime] // *Mezhdunarodny`j zhurnal prikladny`x i fundamental`ny`x issledovanij.* – № 10-1. – Pp. 158-161. (in Russian)
3. Maslova, E. V. (2012). Ugolovno-pravovoj aspekt fakultativnyx priznakov subektivnoj storony sostava prestupleniya [The criminal law aspect of optional features of the subjective side of the corpus delicti] // *Yuridicheskaya nauka i praktika: Vestnik Nizhegorodskoj akademii MVD Rossii.* – № 19. – Pp. 69-75. (in Russian)
4. Naumov, A. V. (2019). Rossijskoe ugolovnoe pravo. Obshhaya chast [Russian criminal law. The general part]. – M.: Izdatel'stvo Yurajt. – 560 p. (in Russian)
5. Volchkova, A. A. (2013). Znachenie fakultativnyx priznakov v konstruirovanii otdelnyx sostavov prestuplenij [The importance of optional features in the construction of individual crimes] // *Yuridicheskaya texnika*. – № 7-2. – Pp. 168-169. (in Russian)

UDK 343.9.01

MATERNAL DEPRIVATION THEORY AS A THEORY OF THE DEVELOPMENT OF CRIMINALITY

Kononova Alisa Sergeevna,
Student of the Law Institute,
Belgorod State National Research University, Belgorod, Russia,
E-mail: alisakon8702@gmail.com
Platoshina Victoria Vladimirovna,
Ph.D. in Philosophy,
Associate Professor of the Department of Foreign Languages and Professional Communication,
Belgorod State National Research University, Belgorod, Russia,
E-mail: platoshina@bsuedu.ru

Abstract: *This research paper analyzes the origin of crime in connection with maternal deprivation. Attempts are made to analyze works devoted to the study of the theory of maternal deprivation. Much attention is given to the examples of the family influence on the formation of individuals who subsequently embarked on a criminal path.*

Key words: *causes of crime, theories of criminological determination, maternal deprivation theory, the impact of family on children, psychodynamic theories, theory of delinquency.*

Juvenile delinquency, although it is part of the overall crime picture, has unique features, which makes it a separate and important subject for criminological analysis. This is due to the physiological, psychological and moral characteristics of the development of minors, as well as their lack of social maturity. As a teenager grows up, he acquires a variety of experiences, both positive and negative, which may be hidden or manifest later, which makes the study of juvenile delinquency especially difficult.

Maternal deprivation is, first of all, the emotional impoverishment of a child, but the sensory component also plays an important role in the origin of this condition. It is known that the mother for a child of the first years of life is a source of numerous

sensory stimuli (tactile, visual, auditory) necessary for the normal development of mental functions [Kurovsky et al., 2010: 141]. If a child is deprived of such stimuli, they speak of sensory deprivation. Thus, in the presence of one type of deprivation, manifestations of other types of deprivation are possible.

Psychodynamic theories of crime focus on the early emotional experiences of offenders. Criminal activity is considered an attempt to compensate for maternal deprivation in childhood and the inability to resolve, as a healthy person would, internal emotional conflicts related to personal growth. Crime is seen as impaired demonstrative behavior, an adequate response to which is psychotherapeutic intervention.

In the middle of the 20th century, such theories were especially popular with young offenders, but the influence of these theories decreased with the return to the principle of fair retribution.

The theory of maternal deprivation is a psychological theory that provides insight into the development of serial killers. In turn, the mother's indifference and rejection fuels a closed personality [Ushatikov et al., 2007].

According to the theory, in the early years of infancy, the mother is his ego and superego, at this time the child is most dependent on his mother. Gradually, he learns these parts of his personality by himself, and as he develops, his parent teaches him social behavior. Thus, the development of the ego and superego is inextricably linked to the primary human relationships of the child. The consequences manifest themselves in the form of feelings of personal inadequacy, helplessness and alienation from society.

Thus, the family is a place in which a form of perception of the outside world, that is, human consciousness, is formed. It is on this that the development of a full-fledged personality depends in the future, but it is worth noting that not only the family influences the formation of a person as a person, many other factors influence this, but undoubtedly the family is the starting point where a person begins to form.

A definition that fits the description of this problem can be found in Anna Freud's book: “Deprivation (Latin deprivatio – loss, deprivation) is a mental state caused by deprivation of the most essential needs of life (such as sleep, food, shelter, communication between a child and his father or mother, etc.), or by deprivation of benefits to which a person has been accustomed for a long time” [Freud, 1999].

The maternal deprivation theory is a psychological theory that provides insight into the development of serial killers. In turn, indifference and rejection from the mother fuels a withdrawn personality. According to the theory, during the early years of infancy, the mother is his ego and superego, at which time the child is most dependent on his mother. He gradually learns these parts of personality on his own, and as he develops, the parent teaches him social behavior. Thus, the development of the ego and super-ego is inextricably linked to the child's primary human relationships [Romanov, 2009]. The consequences manifest as feelings of personal failure, helplessness, and alienation from society.

This theory can be linked to a theory of delinquency emergence such as the stigmatization theory. If we consider stigmatization within the family, the “stigma” attached within the family has a huge impact on the formation of the child, breaking him or her from society, making him or her “different”. Such individuals are more likely to turn to crime due to their sense of rejection by society and increase their gap with orthodox social norms.

An example of this theory is the maniac Alexander Grebu ("Leshy"), who was active in the Belgorod region in 1996 and 2004. His childhood was difficult, his parents divorced when he was two years old and his mother began abusing alcohol. She blamed Alexander for her problems and took it out on him. Subsequently, Alexander began killing women who resembled his mother. His mother's harsh behavior caused the man at the sight of similar looking women to have outbursts of aggression, which he formed in childhood. An important aspect is the fact that he committed his first murder as a minor, at the age of 16 [Yelnikova, 2021].

John Bowlby also linked maternal deprivation to juvenile delinquency. In 1946, John Bowlby interviewed 44 delinquent boys about their crimes and their relationships with their mothers. He found that 14 of the boys did not feel guilty about their crimes or the victims. When he examined their family life, he found that 12 of the 14 boys had been separated from their primary caregivers before they were 2 years old. He found that only 5 of the other 30 boys who did feel guilty had been separated from their primary caregivers [Mukhina, 1991: 43].

The family is the primary environment that shapes consciousness and perception of the world. Although personality formation is influenced by various factors, family is the most important initial stage. The formation of consciousness and perception of the world begins in the family, which is thus the starting point for personal development. In families with a negative microclimate, children grow up with a "save yourself" attitude, because they do not count on any kind of maternal help. They feel lonely and forced to defend themselves on their own, they have an early desire to retire and not claim attention to themselves.

Children who do not need to survive emotionally in a family environment devote more energy to self-identification, and they are more concerned about their position in society, rather than how they need to defend themselves or hide. Family well-being does not guarantee protection from juvenile delinquency. Children whose parents are constantly busy with work often feel neglected and vulnerable, which makes them more susceptible to negative influences and criminal behavior.

References

1. Freud, A. (1999). Teoriya i praktika detskogo psikhoanaliza [Theory and practice of child psychoanalysis]. – M.: Aprel' Press: Eksmo-Press. – 400 p. (in Russian).

2. Kurovsky, V.N., Pyatkina, G.N. (2010). Materinskaya deprivatsiya i ee strukturnye komponenty [Maternal deprivation and its structural components] // *Vestnik TGPU [Bulletin of TSPU]*. – № 10. – Pp. 141-144. – [online]. Available at: https://cyberleninka.ru/article/n/materinskaya-deprivatsiya-i-ee-strukturnye-komponenty. (Accessed: 24.03.2025). (in Russian).

3. Mukhina, B.C., (1991). Lishennye roditel'skogo popecheniya [Deprived of parental care]. – M.: Prosveschenie. – Pp. 42-57. (in Russian)

4. Romanov, V.V. (2009). Yuridicheskaya psikhologiya [Legal psychology]. – M.: Yurist. – 448 p. (in Russian).

5. Ushatikov, A., Kovalev, O. (2007). Kriminal'naya psikhologiya [Criminal psychology]. – M.: MPSI, MODEK. – 304 p. (in Russian).

6. Yelnikova, O. (2021). Aleksandr Greba: zachem Belgorodskomu Mauqli dali pozhiznennyj srok v „Poljarnoj sove" [Alexander Greba: Why was the Belgorod Mowgli given a life sentence in the Polar Owl]. – [online]. Available at: https://russian7.ru/post/aleksandr-greba-za-chto-belgorodskom/. (Accessed: 13.03.2025). (in Russian).

UDK 336.225.67

TAX CONTROL AS THE MAIN ELEMENT OF THE TAX ADMINISTRATION SYSTEM

Shcherbak Sofya Dmitrievna,
Master Student of the Law Institute,
Belgorod State National Research University, Belgorod, Russia,
E-mail: 1472585@bsuedu.ru
Cherkashin Vladislav Dmitrievich,
Student of the Law Institute,
Belgorod State National Research University, Belgorod, Russia,
E-mail: 1467802@bsuedu.ru
Tsurikova Larisa Vladimirovna,
Ph.D. in Pedagogy,
Associate Professor of the Department of Foreign Languages and Professional Communication
Belgorod State National Research University, Belgorod, Russia,
E-mail: tsurikova@bsuedu.ru

Abstract*: The article is devoted to the consideration of tax control as the main element of the tax administration system. The article presents an analysis of such concepts as "tax control" and "tax administration" and makes a comparative examination of these concepts. The relationship between tax control and tax administration is argued on the basis of unity and commonality of purpose and objectives.*

Keywords*: tax control, tax administration, tax legal relations, tax authorities, tax administration system, legislation on taxes.*

The relevance of the study of tax control as the main element of the tax administration system is due to a number of factors affecting the economic development of countries and ensuring the financial stability of the state. Tax control is a mechanism that allows the state to monitor the correctness and completeness of tax payments, which, in turn, is critically important for generating budget revenues.

In the context of economic globalization, increased interaction between states and an increase in transaction volumes, the importance of tax control is increasing. Effective tax control makes it possible to prevent tax evasion, which contributes not only to an increase in budget revenues, but also to the creation of equal conditions for business entities. This is especially true in emerging economies, where the problems of tax evasion and the shadow economy remain significant.

Modern technologies such as Big Data, artificial intelligence, and process automation are becoming important tools for tax control. Their use makes it possible to improve the quality and effectiveness of control, as well as improve interaction with taxpayers. The introduction of electronic systems and data analysis tools makes tax control more transparent and accessible, which helps to increase citizens' confidence in the tax system.

The purpose of this article is to conduct a legal analysis of tax control as an element of tax administration.

During the execution of the work, the following tasks were set:

1. Determine the role and importance of tax control in the modern world
2. Consider the main forms of tax control

The object of scientific research is tax control, the subject of consideration and study of tax control as an element of tax administration.

The legislation on taxes and fees of the Russian Federation is characterized by a well-developed legal regulation of the system of taxes and fees. However, proper and timely fulfillment of the obligation to pay taxes and fees in the Russian Federation, strict compliance with legislation, in other words, tax discipline, is not possible without tax control and effective management in this area.

Before revealing the content of the problem in this article, it is necessary to determine the definitions of the basic concepts that are used in the article. Speaking about tax administration, it is necessary to state the absence of legislative consolidation of its concept.

In the formal legal sense, the issue of tax administration remains a gap, despite the fact that the concept itself is widely used both in tax and legal doctrine and is periodically found in the naming of legal acts. For example, in the literature on tax law, one can find the point of view that tax administration is "the activity of authorized state bodies for the management of tax relations, within the framework of performing the following functions: tax planning, accounting and control" [Saidulaev, 2019]. Following this definition, tax control is one of the elements of the management activities of tax authorities aimed at complying with the legislation of the Russian Federation on taxes and fees. Therefore, tax control is one of the manifestations of tax administration along with tax planning and accounting.

The concept of tax control has legislative regulation, it is "the activity of authorized bodies for monitoring compliance with legislation on taxes and fees in accordance with the procedure established by this Code" [https://www.consultant.ru/document/cons_doc_LAW_19671/]. First of all, tax control should be characterized as a type of state control. Tax control as a form of state control is carried out by officials of tax authorities. Tax control has an imperative and compulsory character, since the purpose of its implementation is to ensure compliance with tax legislation. Compliance with tax legislation ensures the publicly significant interests of the state in the timely and full fulfillment of taxpayers' obligations to pay taxes and fees.

Consideration of tax control in the context of tax administration involves clarifying the importance of this form of state control for improving the control activities of the state in relation to taxpayers. To determine the place of tax control in the tax administration system, it is necessary to trace the common features or similarities of these types of activities in the tax sphere. For example, tax control, as well as tax administration, are aimed or focused on ensuring legality, tax security, tax discipline, and stability of legal relations.

The unity of purpose presupposes the unity of the system of tasks of tax control and tax administration, which can be "the prevention and detection of tax offenses; minimizing tax risks; creating a perfect taxation system and others" [Saidulaev, 2020: 53].

However, in some scientific studies, one can see such a point of view that tax control aims to improve the taxation system. We believe that it is difficult to agree with

this point of view [Zainulina, 2002: 82]. The issues of improving the tax system and the taxation system are resolved at the stage of legal regulation of legislation on taxes and fees within the framework of law-making activities.

On the other hand, it should be agreed that it is tax control that ensures "... the achievement of such a level of compliance (tax discipline) among taxpayers, tax agents and other persons, in which violations of tax legislation are excluded or their number is insignificant" [Zainulina, 2002: 82]. Tax control plays an important role in the mechanism of bringing to justice for violations of the legislation of the Russian Federation on taxes and fees. Within the framework of tax control, violations may be detected that serve as the basis for bringing to tax or other legal responsibility. At the same time, the preventive value of tax control lies in the fact that formal legal certainty and a place in tax legal relations ensure the prevention of tax offenses. Potential tax audits encourage taxpayers to comply with and fulfill their tax obligations.

The main forms of tax control are inspections conducted by tax authorities. Tax audits are an effective tool for ensuring tax security. The effectiveness of tax audits is the main indicator of the quality of tax control, which, as a result, affects the quality of tax administration. There are two types of tax audits: on-site and on-site.

Tax control, acting as an element of tax administration, provides detailed information on categories of taxpayers, types of taxes, objects of taxation, etc. during various types of tax audits.

Thus, tax control really acts as a part of the tax administration and management activities of tax authorities, allowing them to monitor compliance and enforcement of legal regulations in the tax sphere. The effectiveness of tax authorities depends on properly organized tax control, as well as the effectiveness of such activities aimed at ensuring compliance with the rule of law in the tax sphere and the inadmissibility of an increase in the number of tax offenses

References

1. Nalogovyj kodeks Rossijskoj Federacii [Tax Code of the Russian Federation]. – [online]. Available at: https://www.consultant.ru/document/cons_doc_LAW_19671/. (Accessed: 12.04.2025). (in Russian)

2. Saidulaev, D. D. (2019). Osnovnye podhody k ponyatiyu nalogovogo administrirovaniya [Basic approaches to the concept of tax administration] // *Modern Science*. – № 10-1. – Pp. 64-67. (in Russian)

3. Saidulaev, D. D. (2020). Ponyatie, vidy i principy administrirovaniya nalogovyh otnoshenij v sisteme upravleniya nalogovymi processami [The concept, types and principles of tax relations administration in the tax process management system] // *Ekonomika i biznes: teoriya i praktika*. – № 12-3 (70). – Pp. 52-56. (in Russian)

4. Zainulina, L. S. (2022). Nalogovyj kontrol' kak osnovnoj element sistemy nalogovogo administrirovaniya [Tax control as the main element of the tax administration system] // *Upravlenie social'no-ekonomicheskim razvitiem regionov: problemy i puti ih resheniya. Sbornik nauchnyh statej 12-oj Mezhdunarodnoj nauchno-prakticheskoj konferencii.* – Kursk. – Pp. 81-83. (in Russian)

UDK 343.235.1

PREVENTION OF RECIDIVISM AMONG STUDENTS

Kravtsova Anastasiya Anatolyevna,
Student of the Law Institute,
Belgorod State National Research University, Belgorod, Russia,
E-mail: nastakravcova923@gmail.com
Platoshina Victoria Vladimirovna,
Ph.D. in Philosophy,
Associate Professor of the Department of Foreign Languages and Professional Communication,
Belgorod State National Research University, Belgorod, Russia,
E-mail: platoshina@bsu.edu.ru

Abstract: *The article discusses the issues of combating crime among students as a socially dangerous phenomenon. The need for an integrated approach combining the efforts of the state, society and citizens themselves is emphasized in order to implement measures to prevent deviant behavior among students. The article analyzes the concept of "prevention" in a broad sense and the specifics of preventing illegal behavior of students as a multilevel system of measures aimed at eliminating the causes and conditions conducive to the commission of crimes. The importance of using common criminological approaches in the analysis of student crime is emphasized.*

Keywords: *recidivism, crimes, prevention of recidivism, student crime, deviant behavior, prevention of offenses.*

This study is devoted to the analysis of student crime among full-time students. This is due to the fact that full-time university studies are a period of active formation of a value system, the development of critical thinking and the emergence of new personal needs.

The deformation of value orientations observed among modern students and unfavorable factors affecting personality formation lead to an increase in crime among this category of the population. Official statistics confirm this trend: from 33 to 35 thousand students are prosecuted annually.

The relevance of the presented work is also due to the fact that students are regularly subjected to criminal attacks. A wide range of crimes committed against university students creates a negative attitude towards law enforcement agencies and authorities, promotes the spread of extremist views and encourages self-defense, including through the use of violence.

Scientists consider students as an important social group that has a significant impact on the historical process, and therefore constant research of this group is necessary. In socio-psychological terms, students (aged 17-25 years) They are characterized by a high level of cognitive motivation, social and communicative activity [Sergeev, 2010: 127].

The student age is characterized not only by a high level of cognitive motivation, but also by a developed culture of learning activities. This contributes to a deeper assimilation of knowledge, stimulates a creative approach to learning, forms practice-oriented skills and abilities, and also develops independence and initiative necessary for successful socialization.

In modern society, the university acts as a center of science, culture and education, having a significant impact on the student's personal development. During the period of study, which can be considered as a stage of "secondary socialization", young people go through important stages of searching for identity (personal, gender, professional, family) and determining the values that shape their life path. It should be borne in mind that at present the concept of "youth" covers a wide age range – from 15 to 30 years.

The multidimensional nature of psychological age is manifested in the fact that a person grows up unevenly in different fields of activity, is in search of identity, and overcomes a number of normative crises.

When researching crime among students, it is important to understand that it is part of the general crime in society and it is influenced by the same factors. Therefore, when analyzing student crime, general criminological approaches and characteristics are used. V.A. Lelekov notes that „student crime, as such, has received insufficient development from criminologists" [Lelekov et al., 2016: 254].

V.D. Malkov argues that this concept is inextricably linked to the complex of crimes committed by young people, namely persons aged 17-26 years, who, from the point of view of criminology, are divided into the following age groups: 17-19, 20-23 and 24-26 years [Malkov, 2006: 348].

L.S. Golubnichaya defines student crime as a type of crime, the specifics of which are determined by a certain social environment, criminal legislation and directly by the personality of young people who commit crimes [Golubnichaya, 2011: 13].

The commission of crimes is a socially dangerous phenomenon that imposes on the State the responsibility for developing and implementing measures to reduce the level of criminal activity to the lowest possible level. To effectively counteract crime among students, in particular, and prevent deviant behavior, it is necessary to combine the resources and efforts of the state, society and citizens. This implies the use of an integrated approach to crime prevention both at the level of the Russian Federation and in individual regions.

Prevention is a system of measures implemented by the state and society in various fields (social, hygienic, medical) in order to maintain order, improve public health and prevent diseases. Prevention of offenses among students is a complex, multi–stage system of measures implemented by the state and society. These measures are aimed at eliminating or neutralizing factors contributing to deviant behavior, which in the future should lead to a reduction and complete eradication of crime among students.

The effectiveness of the state policy in the field of combating student crime is assessed according to several criteria: the existence of a holistic concept of criminal policy that defines strategic goals and methods of influencing student crime.; the availability of programs detailing the government's activities in this area; consistency in improving legislation; stability of criminal legislation and its individual norms; the level of their application; the frequency of errors in law enforcement practice and the effectiveness of preventive measures.

The effectiveness of combating crimes committed by students is determined by the ability of the State to develop and implement adequate sets of general measures to combat such crimes. General control measures in this case are understood as measures of an economic, legal, organizational and educational nature aimed at preventing

(preventing), monitoring (collecting information, evaluating, analyzing and predicting) the relevant group of crimes, applying criminal liability measures for crimes already committed and compensating for the harm caused by such crimes [Dolgova, 2010:788].

Systematic surveys of students who have committed crimes about the motives, circumstances and factors that led to their actions make it possible to identify the causes and conditions of crime in this environment. The data obtained can become the basis for the development of effective preventive measures. However, collecting information is only the first stage. The key task is to eliminate or neutralize the identified causes and conditions that contribute to the commission of crimes.

Individual prevention of illegal behavior is aimed at students who are at increased risk of committing crimes, as well as those who have already committed crimes and are under the control of relevant authorities (accounting departments, serving sentences, specialized institutions).

The purpose of individual prevention is to actively counteract criminogenic factors, depending on the stage:

- To prevent the formation of criminal tendencies at an early stage.
- At the stage of committing an offense, it is important to neutralize criminal motives and stop illegal actions.
- After committing a crime, to prevent a relapse.

Student crime is a negative and socially dangerous phenomenon with historical roots and characterized by scale and sustainability. This is a set of crimes committed by students in a certain area over a certain period of time. Despite the downward trend in the crime rate among students in recent years, this problem is still in the focus of attention of law enforcement agencies. One of the key features is the group nature of the commission of crimes, often as part of pre-organized groups. The structure of student crime also differs from the crime structure of other social groups due to the age characteristics of students, their lifestyle and free time.

Prevention of offenses among students is a complex system of activities that are not limited to working only with the student community. Prevention should take into account the types of crimes committed and the identity of the perpetrators, as well as influence environmental factors that have a decisive impact on the formation of a student's personality and behavior.

References

1. Dolgova, A.I. (ed.). (2010). Kriminologiya: uchebnik dlya vuzov [Criminology: a textbook for universities]. – M.: Prosveschenie. – 788 p. (in Russian)

2. Golubnichaya, L.S. (2011). Molodezhnaya prestupnost': kriminologicheskaya harakteristika i problemy preduprezhdeniya [Youth crime: criminological characteristics and problems of prevention]. – Khabarovsk: KSUEL. – 13 p. (in Russian)

3. Lelekov, V.A., Kosheleva, E.V. (2016). Yuvenal'naya kriminologiya: uchebnik dlya studentov vysshih uchebnyh zavedenij, obuchayushchihsya po napravleniyu podgotovki "Jurisprudenciya" [Juvenile criminology: a textbook for students of higher educational institutions studying in the field of "jurisprudence"]. – M.: Aprel' Press: Eksmo-Press. – 254 p. (in Russian)

4. Malkov, V.D. (2006). Kriminologiya: uchebnik dlya vuzov [Criminology: a textbook for universities]. – M.: Prosveschenie. – 348 p. (in Russian)

5. Sergeev, R.V. (2010). Molodezh' i studenchestvo kak social'nye gruppy i ob'ekt sociologicheskogo analiza [Youth and students as social groups and the object of sociological analysis]. – M.: Yurist. – 127 p. (in Russian)

UDK 343.97

CURRENT PROBLEMS OF PREVENTION OF ILLICIT DRUG TRAFFICKING

Aleynikova Valeriya Andreevna,
Postgraduate Student of the Law Institute,
Belgorod State National Research University, Belgorod, Russia,
E-mail: aleynikova_v@bsuedu.ru
Gusakova Natalya Leonidovna,
Ph.D. in Psychology,
Associate Professor of the Department of Foreign Languages and Professional Communication,
Belgorod State National Research University, Belgorod, Russia,
E-mail: gusakova_n@bsuedu.ru

Abstract: *Illicit drug trafficking is a scourge of modern society. Modern benefits of digitalization have a particularly beneficial effect on its development, which simplify life not only for the ordinary citizen, but also for criminals who carry out their criminal activities in the field of drug trafficking. One of the key problems currently facing the prevention of illicit drug trafficking is the prevention of online drug crime. Within the framework of this work, the author, in the course of researching the problems of countering modern drug crime, provides possible ways to solve them through the use of modern information and telecommunication technologies, which determines the purpose of the study.*

Keywords: *drug trafficking, online drug crime, drug business, information and telecommunication technologies, criminal influence.*

Illicit drug trafficking is an urgent problem of the XXI century, posing a threat to society and the State. Everyone knows about the harmful effects of narcotic drugs on human health. Many researchers in various fields of science, ranging from medicine to law, describe in detail the negative effects of drugs on the body, which allows us to consider the thesis "drugs are evil" as an axiom.

At the same time, every year a huge number of people are involved in the drug business: some as criminals, others as consumers. And it is not uncommon for a consumer to later assume a criminal role himself, for example, by acquiring the status of a courier or pawnbroker.

In the Russian Federation, increased attention has been paid to the prevention of illicit drug trafficking, both from the public and from government authorities, which is generally justified. However, it is obvious that certain problems of preventing illicit drug trafficking are still present, despite the special interest of law enforcement agencies in this area.

One of the most urgent problems of drug trafficking prevention is related to the introduction of the benefits of digitalization and informatization into modern life. The study of the specifics of the prevention of illicit drug trafficking in a rapidly changing reality is a topic raised in the writings of many modern researchers. On the one hand, a number of issues related to Internet drug trafficking have already been analyzed in detail by representatives of the legal community. On the other hand, many problems, despite their wide coverage in the literature, remain unresolved, which determines the need for their more detailed analysis. Online drug crime is constantly evolving, acquiring more

and more new forms of its manifestation, which does not allow us to talk about the "hackneyed nature" of this topic in the doctrine.

Drug crime is currently inextricably linked to information and telecommunication technologies. The communication of its participants is often carried out through the use of messengers. The situation in which drug trafficking participants hold face-to-face meetings is quite rare in law enforcement practice. The analysis of court decisions demonstrates that the accomplices keep in touch through messengers. In particular, the Telegram messenger is actively used.

The advantages of using electronic means of communication for a drug offender are obvious. It is much more difficult to establish criminal connections in this case. The active use of information and telecommunication means of communication generates the following law enforcement situation: most often, only traffickers who are at the lowest level of the criminal hierarchy are brought to justice. In turn, the organizers, cashiers, supervisors and other similar subjects of drug crime most often remain unidentified. Establishing their location is a technically difficult and financially costly issue. And this situation is not uncommon even for widespread and well-known social networks on the Internet.

Drug crime on the Darknet is even more difficult. "An important component of drug crime on the Internet is disguise..." – write I.A. Uvarova and I.F. Kolontaevskaya [Uvarova, Kolontaevskaya, 2020]. And this position is fully supported by us. The use of shadow elements on the Internet practically minimizes the chance of establishing not only the real location, for example, of the curator or organizer, but also the identification of the criminal himself as a whole. For example, the organizer of drug crimes, as a rule, remains in the shadows, not revealing his identity to couriers, pawnbrokers, etc. Only a certain limited circle of people keeps in touch with the head.

Therefore, the identification of a low-level criminal almost never leads to the establishment of a senior staff. Such an environment is clearly favored by widespread digitalization. The shadow side of the Internet contains not only personal correspondence, where the details of drug trafficking are determined, but also entire websites and online stores where a Darknet user can purchase the drug he is interested in [Mazur, 2018]. Moreover, such structures have their own specialists in the field of promotion and advertising, human resources specialists and other specialists of a wide profile. The shadow Internet is also known for sites where vacancies for the recruitment of such personnel are located.

Drug crime and drug trafficking largely duplicate modern legal economic relations, with the only exception being their illegality. Drug crime prevention should be aimed not only at the general conditions and factors that give rise to crime in general, but also at the rapidly emerging determinants, in particular, mediated by the rapid development of the Internet. The prevention of drug crime in this area is significantly difficult. The drug problem has acquired an international character and has transformed into a common global problem.

Blocking websites containing illegal information can serve as a means of combating this. In general, Internet regulation in the Russian Federation is currently reaching a qualitatively new level. Illegal information published on the Internet is actively blocked. Access to it is prohibited. However, for a long time the Internet was

practically not subject to "censorship". Information was poorly exposed for filtering illegal activities. In fact, only excessively extreme situations fell under the ban, which did not always include drug trafficking. The current situation is much less favorable for the drug business. It is almost impossible to make information about the sale of drugs publicly available. Such articles on the Internet information and telecommunication network immediately come to the attention of law enforcement agencies.

However, as noted earlier, the problems of preventing illicit drug trafficking are mainly related to the shadow Internet. Personal messages on social networks are also susceptible to criminal influence. Here, law enforcement officers are on the verge between detecting crime and the inadmissibility of violating the constitutional right to privacy of correspondence. Comprehensive monitoring of the Internet space is seen as measures to solve urgent problems, which is now being actively carried out by authorized bodies. In addition, minimizing drug crime on the Internet can be influenced by improving the coordination of website creation, as well as recording site visits.

The creation of websites should require confirmation of the personal data of its creator, this will quickly identify offenders, as well as increase the effectiveness of website moderation on the Internet, including in the field of timely notification and deletion of information such as drug advertising. The issue of the need to identify all Internet users on the territory of the Russian Federation is often raised among the public and representatives of science.

The current situation demonstrates that in Russia, at the legislative level, the issue of mandatory identification of persons for Internet access is not being considered. In June 2023, the head of the Ministry of Finance, M.I. Shadaev, made it clear that "no passport entries are even discussed" [Kakoho, T. G., 2023]. However, it is obvious that such an innovation could actually change the situation in the field of drug crime on the Internet. Although on the other hand, such a potential innovation may entail a lot of restrictions.

It seems to us possible to introduce so-called "bots" into the activities of law enforcement agencies, which will perform a supporting role and mechanically select potentially dangerous information. Such "bots" can work according to the following principle: a code program is formed, called a bot, it is assigned a specific topic, including suspicious formulations such as "bookmark", etc.

The bot determines all the necessary information on the relevant resources, after which the information is already received by the authorized body and the relevant official. Next, the employee evaluates the content of the information that the bot has recognized as suspicious and potentially dangerous with a purely human, non-robotic gaze.

If the information meets the criteria of "illegality", the necessary work continues with this information (removing it from public access, searching for the person who posted this information, etc.). If the bot recognizes the information as potentially dangerous, but the transmitted information is not illegal (for example, an article on the Internet describes the harm of narcotic drugs), the law enforcement agency removes it from the suspicious list.

The course of solving this problem that we are describing is certainly not a panacea for solving all problems related to the illegal drug business. Of course, in our opinion, it is very difficult to introduce a "bot" into the shadow Internet, but in general it is quite possible. We believe that the introduction of such a mechanism will not only

make it possible to successfully search for illegal information, but also reduce the burden on employees responsible for Internet security.

References

1. Kakoho, T. G. (2023). Pravovye osnovy "servisnogo gosudarstva 2.0" v Rossijskoj Federacii [The legal basis of the "service state 2.0" in the Russian Federation] // *Nauka. Obshchestvo. Gosudarstvo*. – № 2 (42). – Pp. 53-64. – M.: Penzenskij gosudarstvennyj universitet. (in Russian)

2. Mazur, A.A. (2018). Aktualnye problemy preduprezhdeniya prestupnosti v socialnoi seti Darknet [Current problems of preventing fraud on the Darktnet social network] // *Vestnik RUK*. – № 3 (33). – Pp. 125-129. – M.: Rossijskij universitet kooperacii. (in Russian)

3. Uvarova, I.A., Kolontaevskaya, I.F. (2020). Rasprostranenie narkoprestupnosti s pomoshchyu informacionno-telekommunikacionnyh tekhnologijt [The spread of drug crime through information and telecommunication technologies] // *Vestnik Moskovskogo universiteta im. S. YU. Vitte*. – № 1 (23). – Pp. 50-55. – M.: Moskovskij universitet imeni S.YU. Vitte. (in Russian)

UDK 342

WIRTSCHAFTLICHE GRUNDLAGEN DES VERFASSUNGSSYSTEMS RUSSLANDS

Kozin Ewgenij Andrejewitsch,
Student des Juristischen Instituts,
Belgoroder Staatliche Nationale Forschungsuniversität, Belgorod, Russland,
E-mail: kozin.yevgeniy.04@mail.ru
Taranowa Elena Nikolayewna,
Kandidatin der philologischen Wissenschaften,
Professorin des Lehrstuhls für Fremdsprachen
und berufliche Kommunikation,
Belgoroder Staatliche Nationale Forschungsuniversität, Belgorod, Russland,
E-mail: taranova_e@bsuedu.ru

Annotation: *Die Wirtschaft spielt eine wichtige Rolle für den Wohlstand eines Landes und das glückliche Leben seiner Bevölkerung. Seine Bestimmungen und Grundlagen sind in einzelnen Gesetzen, Verordnungen und in der Verfassung des Staates verankert. Dieser Artikel ist die Studie, die der historischen Analyse der wirtschaftlichen Grundlagen der Russischen Föderation gewidmet, die für das rechtliche System Russlands sehr wichtig sind.*

Schlagwörter: *das Verfassungssystem Russlands, wirtschaftliche Grundlagen des Verfassungssystems, die Prinzipien des Wirtschaftssystems, die Wirtschaft Russlands, die Phasen der Gründung des Wirtschaftssystems Russlands.*

Das Konzept des Konstitutionalismus spielt eine wichtige Rolle bei der Gewährleistung der Rechtmäßigkeit, der Stabilität und der Einhaltung der Rechte und der Freiheiten der Bürger in der Gesellschaft. Am Anfang des Artikels betrachten wir die Deutung des Begriffs „Konstitutionalismus" und was man darunter versteht.

Es sei wichtig zu erwähnen, dass die Wurzeln dieses Phänomens bis in die Antike zurückreichen, in die Zeit, wann einige Staaten schriftliche Gesetze und Statuten hatten, die die Macht eines Monarchen oder Herrschers einschränkten. Gerade bis zum 19. Jahrhundert dienten die Ideen des Konstitutionalismus als Vorbild für die Schaffung der Grundlage für die Gesetze vieler moderner Staaten. Und bis diesen Zeitraum sind sie einen langen historischen Weg gegangen.

Es ist bekannt, dass in den 17-18. Jahrhunderten die Monarchie aufhörte. Sie war ein Garant für eine stabile Weltordnung und die Möglichkeiten der Macht wurden durch die Verfassung bestimmt.

Die Entwicklung des Konstitutionalismus in Russland fang im 19. Jahrhundert an, wenn die Idee, die absolute Macht des Monarchen zu begrenzen und die verfassungsmäßigen Rechte und Freiheiten der Bürger zu etablieren, sich zu bilden begann. Eine wichtige Etappe in der Geschichte des Konstitutionalismus war die Veröffentlichung des Manifests am 5. Dezember 1905, das die Einführung der Verfassung versprach und die bürgerlichen Freiheiten garantierte.

Nach der Oktoberrevolution im Jahre 1917 wurde Russland zu einem sozialistischen Staat. Die erste Verfassung von Sowjetrussland wurde im Jahre 1918 angenommen. Sie garantierte den Bürgern soziale Rechte, schränkte jedoch aber ihre politischen Freiheiten ein, indem sie dem Staat weitreichende Befugnisse gewährte.

In der Verfassung der UdSSR von 1977 wurde der demokratische Vektor der Rechte und Freiheiten der Bürger festgelegt, und zwar: das Arbeits-, Erholungs-, Bildungsrecht, medizinische Betreuung usw. In dieser ersten Verfassung wurden die politischen Rechte der Bürger garantiert. Das sind folgende Rechte: das Recht auf Teilhabe an der Verwaltung der Gesellschaft und des Staates, das Redefreiheitsrecht und das Versammlungsfreiheitsrecht.

Im Zuge der Perestroikaueit wurde in den Jahren 1980-1990 eine neue Verfassung angenommen, die einen friedlichen Übergang zu Demokratie und Marktwirtschaft gewährleisten sollte. Sie wurde in Jahre1993 verabschiedet.

Heute wird die Verfassungsordnung Russlands durch die Grundlagen des Wirtschaftssystems bestimmt, das einen freien Markt vorsieht, wo der Staat die Wirtschaftstätigkeit reguliert, den Bürgern sozialen Schutz anbietet und nach einer nachhaltigen Entwicklung der Wirtschaft strebt. Die Grundlagen der wirtschaftlichen Ordnung umfassen:

– die Herrschaft der Gesetze und der verfassungsmäßigen Ordnung in der Wirtschaft;

– die Einhaltung der Prinzipien des freien Marktes und der Konkurrenz;

– die Gewaltenteilung in der Wirtschaft.

Daher sind die wirtschaftlichen Grundlagen des verfassungsmäßigen Systems in Russland darauf ausgerichtet, eine stabile wirtschaftliche Entwicklung zu gewährleisten, die Interessen der Bürger zu schützen und soziale Gerechtigkeit zu unterstützen. Das Erreichen solcher Vorteile ist möglich, wenn die Strukturen des Verfassungsinstituts für die Grundlagen der Wirtschaftsordnung zusammenwirken. Das ist in der Verfassung der Russischen Föderation verankert:

– die Verfassungsgrundsätze (die Artikel 8 und 9 der Verfassung der Russischen Föderation);

– die Garantien für ihre Implementierung (die Artikel 74 und 75 der Verfassung der Russischen Föderation);

– die wirtschaftlichen Rechte und persönliche Freiheiten (die Artikel 34-37, 44 der Verfassung der Russischen Föderation);

– staatliche Regulierung der Wirtschaft (die Artikel 71-73 der Verfassung der Russischen Föderation) [Konstitucia Rossiyskoi Federacii prinzataya prinyata na referendume 12 dekabrya 1993 goda].

Die neue gesetzgebende Basis in Form der Verfassung der Russischen Föderation festigt die Einhaltung der Eigentums- und Wirtschaftsfreiheit, die Prinzipien des freien Marktes und der Konkurrenz, die Gewaltenteilung. Dadurch wird sichergestellt, dass diese Anforderungen erfüllt werden, und unsere Freiheit im Wirtschaftssektor nicht beeinträchtigt wird.

Die Rechte und Freiheiten des Menschen sind durch das Gesetz verankert. Diese Tatsache spiegelt sich im Artikel 2 der Verfassung der Russischen Föderation wider: „Der Mensch, seine Rechte und Freiheiten sind der höchste Wert. Die Anerkennung, die Einhaltung und der Schutz der Rechte und Freiheiten des Menschen und des Bürgers sind keine Gnade des Staates, sie sind jedem bereits bei der Geburt gegeben“ [Konstitucia Rossiyskoi Federacii prinzataya prinyata na referendume 12 dekabrya 1993 goda].

Laut dem Artikel 17 der russischen Verfassung „es gibt keine Abhängigkeit von dem Geschlecht, der Rasse, der Nationalität, der Sprache, der Herkunft, dem Wohnort, der Einstellung zur Religion, den Überzeugungen, der Zugehörigkeit zu gesellschaftlichen Vereinigungen und anderen Umständen“, alle sind in ihren Möglichkeiten gleich, über das höchste Gut zu verfügen [Konstitucia Rossiyskoi Federacii prinzataya prinyata na referendume 12 dekabrya 1993 goda].

Nach der Verfassung hat jeder Mensch das Potenzial im Rahmen seiner Tätigkeit gesellschaftliche Güter zu schaffen. Zum Beispiel kann eine Person ihre Fähigkeiten in unternehmerischen Aktivitäten verwirklichen. Die Person kann arbeiten und dabei nicht nur gesellschaftliche Güter schaffen, sondern auch persönliche. Jeder hat das Recht sein Eigentum zu besitzen, zu nutzen und zu verwalten.

Unabhängig von ihrer finanziellen Lage, ihrem Beruf und den zur Verfügung stehenden Gütern haben die Bürger das Recht auf menschenwürdige Lebensbedingungen, zum Beispiel, die medizinische Versorgung, die Bildung und kulturelles Leben.

Eine umfassende Analyse der Verfassung der Russischen Föderation führt uns zu den Elementen des Wirtschaftssystems, die in der Verfassungsordnung geregelt sind:

– die Vielfalt und die Gleichberechtigung der Eigentumsformen (Teil 2, Artikel 8 der Verfassung der Russischen Föderation);

– die Freiheit der Wirtschaftstätigkeit (Artikel 34 der Verfassung der Russischen Föderation);

– die Einheit des Wirtschaftsraums bei freiem Transport von Waren, Dienstleistungen und Finanzmitteln. (Teil 1, Artikel 8 der Verfassung der Russischen Föderation);

– die Konkurrenzunterstützung (Artikel 34 der Verfassung der Russischen Föderation);

- die Arbeitsfreiheit (Artikel 37 der Verfassung der Russischen Föderation) [Konstitucia Rossiyskoi Federacii prinzataya prinyata na referendume 12 dekabrya 1993 goda].

Diese obengenannten Grundsätze bilden die wirtschaftlichen Grundlagen des verfassungsmäßigen Systems der Russischen Föderation. Unter den "wirtschaftlichen Grundlagen der Verfassungsordnung" soll man die Gesamtheit der verfassungsmäßigen Normen und Grundsätze zur Regulierung der wirtschaftlichen Beziehungen verstehen, die auf der Freiheit der wirtschaftlichen Tätigkeit, der Einheit des Wirtschaftsraums, der

Anerkennung und der Gleichheit der wirtschaftlichen Rechte und Freiheiten, der Anerkennung und dem Schutz aller Eigentumsformen beruhen, um eine stabile Entwicklung der Gesellschaft und des Staates zu gewährleisten.

Die Wissenschaftler und Praktiker auf dem Gebiet des Rechtes haben unterschiedliche Meinungen über die Rolle des Staates in der Wirtschaftstätigkeit. Zu Zeiten der UdSSR spielte der Staat eine dominierende Rolle in der Wirtschaft. Alle wichtigen industriellen und landwirtschaftlichen Zweige wurden nationalisiert und standen unter staatlicher Kontrolle. Es wurden Fünfjahrespläne erstellt. Der Staat kontrollierte Preise, Produktionsmengen, Arbeitskräfte und andere Aspekte der Wirtschaft. Persönliches Eigentum war begrenzt und unternehmerische Aktivitäten waren praktisch verboten.

Mit dem Ende der Existenz der UdSSR und dem Übergang zur Marktwirtschaft in Russland am Anfang der 1990-en Jahre begann der Staat seine Rolle in der Wirtschaft schrittweise zu reduzieren. Es gab eine Privatisierung staatlichen Unternehmens, es wurden Reformen in den Bereichen der Besteuerung, der Arbeitsbeziehungen und in anderen Bereichen durchgeführt. Es wurden Gesetze geschaffen, die die Entwicklung des Privatunternehmens, der Konkurrenz und der Marktbeziehungen fördern.

Die vom Staat richtig gewählte Strategie für eine komfortable Existenz der Bürger gibt ihnen Vertrauen in die Zukunft. Sie schließt ein:

– demografische Prozesse;

– die Unterstützungsprogramme der wichtigen Bereiche;

– die Förderung der wirtschaftlichen Aktivität von Arbeitnehmern und Unternehmern;

– der Arbeitsschutz;

– der Schutz des inländischen Herstellers, unter anderem die Einschränkung des Eindringens ausländischer Waren und Dienstleistungen usw.

Fazit: Heute bleibt der Staat in Russland ein aktiver Teilnehmer der Wirtschaft des Landes, indem er die Regulierung und die Unterstützung verschiedener Branchen, die Kontrolle über strategische Branchen sowie den Schutz der Verbraucher- und Unternehmerrechte durchführt. Der Staat übt auch die Kontrolle im Rahmen des Kartell- und Steuerrechts aus.

Das Wesen der Verfassungsordnung wird nicht nur durch die Verfassung der Russischen Föderation, sondern auch durch die gesamte nationale Gesetzgebung bestimmt.

Es ist unmöglich, ein bestimmtes Wirtschaftsmodell und die Rolle des Staates darin in der Verfassung zu verankern, den Grad und die Grenzen der Beteiligung des Staates an der Wirtschaft eines Landes zu bestimmen, denn der Staat darf nicht staatliche Ressourcen nach ständigen, einheitlichen Regeln disponieren. Der allgemeine Inhalt der verfassungsrechtlichen Regulierung der Wirtschaft hat eine wichtige restriktive Funktion, indem er die allgemeinen Ziele einer solchen Intervention identifiziert und geeignete Mittel bereitstellt.

Literaturliste

1. Antsupow, W.W. (2004). Ekonomicheskaya funkcia gosudarstva [Ökonomische Funktion des Staates]. – Krasnojarsk. – S. 28. (in Russisch)

2. Aliyew, A.T., Dyundik, Ye.P., Surtayewa, O.S. (2022). Ekonomicheskiye sistemy [Die Wirtschaftssysteme] // *Osnovateli ekonomicheskikh sistem [Die Gründer der Wirtschaftssysteme]*. – T. №3. – M.: Moskovskiy politekhnicheskiy universitet, Institut ekonomiki RAN, Akademiya promyshlennosti i upravleniya, Moskovskiy gosudarstvennyy universitet pechati. – S. 34-39. (in Russisch)

3. Borisow, A.A. (2021). Kontseptsii spravedlivosti i yevropeyskiye revolyutsii za otchuzhdeniye sobstvennosti v pol'zu natsii: deklaratsii, konstitutsii i dekrety Frantsii kontsa XVIII veka [Die Gerechtigkeitsvorstellungen und europäische Revolutionen zur Eigentumsveräußerung zugunsten der Nation: Erklärungen, Verfassungen und Dekrete Frankreichs am Ende des 18. Jahrhunderts] // *Istoriko-pravovyye problemy: Novyy rakurs* [Historische und rechtliche Probleme: Eine neue Perspektive]. – Nr. 1. – S. 78–94. (in Russisch)

4. Konstitutsiya Rossiyskoy Federatsii: prinyata na referendume 12 dekabrya 1993 goda [Die Verfassung der Russischen Föderation: angenommen durch Volksabstimmung am 12. Dezember 1993]. (in Russisch)

UDK 342.1

NATIONAL SOVEREIGNTY, SELF-DETERMINATION OF THE NATION AND THE CITIZEN IN A STATE GOVERNED BY THE RULE OF LAW

Gaydidey Olesya Evgenievna,
Student of the Institute of Law,
Belgorod State National Research University, Belgorod, Russia,
E-mail: olesya.gaydidey@gmail.com
Grigorenko Svetlana Evgenievna,
Ph.D. in Pedagogy,
Associate Professor of the Department of Foreign Languages and Professional Communication,
Belgorod State National Research University, Belgorod, Russia,
E-mail: sgrigorenko@bsuedu.ru

Abstract: *The article is devoted to the consideration of the historical development and formation of national sovereignty, self-determination of the nation, and the individual in the rule of law. The concepts are analyzed from the perspective of legal scholars, focusing on national self-determination, state sovereignty, and personal sovereignty. Special attention is given to the dialectical relationship between collective rights of nations and individual human rights, as well as the evolution of these principles in international and constitutional law. The study also explores the challenges of balancing national sovereignty with democratic values and human rights in modern multi-ethnic states.*

Keywords: *national sovereignty, rule of law, self-determination of the nation, human and civil rights, constitutional order.*

The theory of national sovereignty is relevant for any modern state, and, first of all, for such a state, which calls itself a state governed by the rule of law.

The rule of law is a characteristic of the constitutional and legal status of the state, which implies unconditional subordination of the state to the following principles: democratic legal regime, popular sovereignty, inviolability of human rights and freedoms by the state, binding of the state by the constitutional system, supremacy of the constitution, separation of powers, mutual responsibility of the state and the individual, independence of the court, priority of international law norms over the norms of national law [Harraz, 2011].

First, it should be noted the fact that most of the states of the world are multi-ethnic. That is, the population is represented by a variety of nations and nationalities. Secondly, since the national factor today is the cause of various social conflicts in different countries, the emergence of unstable territories with an uncertain international status entails, as a consequence, massive violations of human rights, increased migration activity of the population and a decrease in the level of international security.

At the same time, the constitutions of foreign countries designate the nation as the source of power and bearer of sovereignty, and the adjective "national" is used to define the state: flag, coat of arms, currency, and economy. Thirdly, the general goal of the rule of law in the modern understanding is the inadmissibility of the concentration of public power in one person, body or group of people, in the real observance of the legal form of relations between the individual and the authorities, in the guarantee and practical realization of constitutionally enshrined rights and freedoms of man and citizen.

In constitutional law, national sovereignty is understood as the full power of the nation, its ability and capacity to independently determine the nature of its life, to realize its right to self-determination up to secession and formation of an independent state. The key principle of the theory of national sovereignty is the right of nations to self-determination. The historical and legal basis for the emergence of this right was the proclamation of the "Declaration of the Rights of Man and the Citizen" by the Great French Revolution of 1789, the principle of sovereignty of nations, which in the process of its evolution evolved into the principle of nationalities, which was interpreted as the right of European nations to form a sovereign nation-state [Harraz, 2011].

The emergence of the thesis about the "right of the people to self-determination" is associated with the name of American President Woodrow Wilson, who formed his ideas in the so-called "14 points". However, the term "self-determination" itself was absent in the work. The idea in Wilson's understanding was the right to autonomy and the protection of cultural and linguistic rights of minorities. That is, it was about the right of peoples to determine the forms and nature of government for themselves, rather, it was about the "right to democracy" [Rumyantsev, 1994].

It should be taken into account that the concept of nation in English means the population of the state and the state itself. In this meaning "nation" is used in the names of international organizations, for example, the League of Nations and the UN (United Nations). This is due to the peculiarities of the formation of nations (states) on the American continent, where the ethnic component was not essential. In Europe, the formation of nation-states on the wreckage of great empires took place on the ambush of nationalist ideologies, on the notions of the existence of a certain community, the nation of Czechs, Poles and Frenchmen.

The problem of interpreting the principle of "the right of nations to self-determination" regained its relevance after the Second World War, especially with the intensification of the anti-colonial movement. From that time the principle moved into the sphere of international law, first in the UN General Assembly Resolutions of 1960 and 1962, and later in 1976 in the Covenant on Civil and Political Rights, as well as in the Covenant on Economic, Social and Cultural Rights, where the "right to self-determination" is already fixed.

In accordance with the Universal Declaration of Human Rights: "All peoples have the right to self-determination. By virtue of this right they freely determine their political status and freely pursue their economic, social and cultural development" [The Declaration of Human and Civil Rights and Freedoms, 1789].

One of the many debatable aspects of this principle is the issue of correlation between the principle of self-determination of the nation and self-determination of the individual.

In constitutional practice, the term "nation" is used as an ethnic community of people that has been formed historically, as a rule, on a certain territory, the attributes of which are close economic ties, language, and cultural features.

Understanding the nation as a political community justifies claims to protect national interests, independent choice of further state formation or defending internal unity, which can be realized only through a set of sovereign rights of the state. In this case, the sovereignty of the nation coincides with the sovereignty of the country – the latter is the expression and face of the nation itself.

The concept of "sovereignty of the nation" means the full power of the people through the realization of the already repeatedly mentioned principle of "the right of the nation to self-determination". In turn, self-determination is a right of the people, a collective right, a prerogative that belongs to peoples (nations). This right means a free choice of both internal status (form of government and state structure) and foreign policy – creation of an independent state, joining unions and commonwealths, etc. The idea of self-determination is special and special.

The idea of self-determination of the individual and the theory of individual sovereignty is one of the modern theories that evolved based on the ambushes of natural law theory. Natural law theory is a trend in jurisprudence that holds that there are universal principles of law that are independent of time, culture, and society. These principles are considered "natural" or inherent parts of human nature. According to this theory, justice and morality have a higher priority than laws established by the government. Natural law theory is often associated with the concept of "human rights" and the importance of protecting the basic rights and freedoms of individuals.

The beginning of this theory comes from the teachings of Kant, who develops the idea of political sovereignty of an individual and the right of public use of personal reason. The development of this theory can also be traced in the doctrines of J.G. Fichte, in whom free individuals, having arranged contracts on property and security, united in a union (state), remain free, – everyone acts as a co-participant of the supreme power, sovereignty, and in his private sphere, not as a subject, but as a free man. At the same time, in Fichte's case, everyone can at any moment abandon the contract and withdraw from the state or unite with others and create a new union. With the development of the idea of human rights, the idea of individual sovereignty attracted more and more attention of legal scholars.

Nevertheless, domestic jurist O.G. Rumyantsev believes that "an important feature of the constitutional system is the advancement of individual sovereignty over the sovereignty of the state: it is not the state that grants rights, but a person consciously and responsibly uses the totality of inalienable fundamental rights and freedoms given to her by nature and society" [Rumyantsev, 1994].

In the context of the theory of national sovereignty, the rights of the individual are quite often treated above the rights of the nation, respectively, the supreme bearer of sovereignty is defined as the individual, not the nation. In this regard, it was proposed to replace the right of the nation to self-determination with the concept of self-determination of the individual [Harraz, 2011]. Such views are explained by the theoretical unresolved issues of the subjects of self-determination (people, nation or individual) and the subject of sovereignty as a whole (state, people or nation).

The right of nations to self-determination is known to belong to a separate category of human rights. UN General Assembly Resolution 637 (U11) of December 16, 1952 states that the right of peoples and nations to self-determination is a prerequisite for the exercise of all fundamental human rights [Rumyantsev, 1994].

Regarding the term "self-determination of an individual" itself. it, unlike the term "self-determination of a nation" has neither political science nor legal content. This term, as well as many other philosophical concepts in the Russian language came from the German language, from the times when neither political science nor psychology had not yet been separated into independent sciences in philosophy. Today this term has different meanings in different sciences. In political science, self-determination means self-assertion, independence from external influence. In psychology "self-determination of a person" is a conscious formation of personal position in different life situations. From the legal point of view "self-determination of a person" can be referred to in connection with his/her right and ability (legal) to realize his/her rights and freedoms.

In determining the correlation between the principles of the right of the nation to self-determination and self-determination of the specialty, we will come to the conclusion that the right to self-determination is inextricably linked to human rights, as it creates guarantees against discrimination on the basis of nationality, i.e. against national inequality and oppression. It is the source and condition of all other human rights, because without the realization of the right to self-determination a person cannot realize a number of other individual rights. In resolving disputes about the collective principle of self-determination and individual human and civil rights, the existence of a dialectical relationship between these principles should be taken into account. The right of a nation to self-determination in a state governed by the rule of law means maximizing human rights and freedoms through the responsibility of the state to each citizen, increasing the authority of the law and its strict enforcement – both by all state bodies and by each individual [The International Covenant on Civil and Political Rights, 1966].

National sovereignty is ensured by the combination and complementarity of the principles of "the right of the nation (people) to self-determination" and "the right of the individual (person, citizen) to self-determination". This means that the right of the nation is dependent on ensuring the needs of the development of human and civil rights and freedoms.

Compliance with these important principles will contribute to the fact that Russia in the international arena should take the place of a democratic state based on the rule of law. Nevertheless, apart from observing international standards, observing human rights and freedoms and realizing the set goal of creating a state based on the rule of law, one should not forget about the processes that are taking place today, including the state of Russia in

the international political and economic arenas, when the problems of national identification and self-determination may become more and more acute.

References

1. Harraz, M. A. (2011). Mezhdunarodno-pravovaya reglamentaciya principa prava nacij i narodov na samoopredelenie [International legal regulation of the principle of the right of nations and peoples to self-determination]. – [online]. Available at: https://cyberleninka.ru/article/n/mezhdunarodno-pravovaya-reglamentatsiya-printsipa-prava-natsiy-i-narodov-na samoopredelenie/viewer. (Accessed: 03.05.2025). (in Russian)

2. Rumyantsev, O.G. (1994). Osnovy konstitucionnogo stroya Rossii: ponyatie, soderzhanie, voprosy stanovleniya [Foundations of the constitutional system of Russia: concept, content, issues of formation]. – M.: Jurist, – 39 p. – [online]. – Available at: https://cyberleninka.ru/article/n/95-04-009-rumyantsev-o-g-osnovy-konstitutsionnogo-stroya-rossii-ponyatie-soderzhanie-voprosy-stanovleniya-m-yurist-1994-288-s-predm-imen-ukaz/viewer .
(Accessed: 03.05.2025). (in Russian)

3. The Declaration of Human and Civil Rights and Freedoms of 1789. – [online]. – Available at: https://diletant.media/articles/37033615/. (Accessed: 03.05.2025)

4. The International Covenant on Civil and Political Rights of 1966. [Electronic resource]. – [online]. – Available at: https://www.un.org/ru/documents/decl_conv/conventions/pactpol.shtml. (Accessed: 03.05.2025)

UDK 341.1

THE ROLE OF RUSSIA IN THE PROGRESSIVE DEVELOPMENT OF INTERNATIONAL LAW

Kirichenko Oleg Artemovich,
Student of the Institute of Law,
Belgorod State National Research University,
Belgorod, Russia,
E-mail: okirichenko3313@yandex.ru
Grigorenko Svetlana Evgenievna,
Ph.D. in Pedagogy,
Associate Professor of the Department of Foreign Languages and Professional Communication,
Belgorod State National Research University, Belgorod, Russia,
E-mail: sgrigorenko@bsuedu.ru

Abstract: *The article examines the contribution of Russia to the creation and support of global legal norms. Special attention is paid to the comparison with the activities of other countries, such as China and the United States, in the context of their influence on the international community and institutions. The authors analyze the evolution in developing new branches of international law.*

Keywords*: international law, global norms of law, international relations, legal regulation, international organizations.*

Russia's role in the development of international law has been and remains one of the key ones in the context of global changes and the formation of the modern legal order [Badaeva, 2021; Kalamkarian, 2012]. The country actively participates in the creation and maintenance of universal norms, influencing international organizations and contributing to the regulation of various aspects of interstate relations [Khlestov, 1994].

The purpose of the article is to study Russia's contribution to the development of international law, analyze its role in shaping global legal norms and compare it with the actions of other leading states, which allows us to identify key features and trends in modern legal regulation.

Russia's historical contribution to the development of international law has a centuries-old tradition, which can be traced back to the era of Ancient Russia. Signs of this influence on international relations are already evident in the treaties of the Russian princes with Byzantium: in documents such as the "Treaty of 911", one can observe not only formulations corresponding to the international norms of that time, but also the practice of diplomatic negotiations based on mutual obligations [Kalamkarian, 2012]. For example, tools such as mediation, border commissions, as well as the use of arbitration and arbitration in dispute resolution were widespread, indicating that even in the Middle Ages, Russia participated in progressive international practices for its time.

The proposals put forward by Russia in the first half of the 19th century deserve special attention. In 1815, Emperor Alexander I proposed a new concept of international relations focused on the universal ideals of law and justice: according to this concept, international law should be based on the recognition of the right to life and justice, which became the theoretical basis for the reform of the international legal order [Bekyashev, 2019]. These proposals, supported by the actions of Russian diplomacy, led to the emergence of a new type of legal norms, where interstate relations began to be regulated not only by bilateral and multilateral treaties, but also by international law as such.

One of Russia's key contributions to the development of international law was the initiation and participation in the Hague Peace Conferences in 1899 and 1907, events that became the basis for the formation of international norms in the field of armed conflict and diplomatic relations. These conferences laid down the principles of humane warfare, and Russia actively supported the idea of regulating military operations in order to minimize the suffering of civilians and limit the use of violence.

In the 20th century, Russia continued to actively participate in the formation of the modern international legal framework. The October Revolution and Soviet Russia had a significant impact on the consolidation of the right of people to self-determination by adopting the Declaration of the Rights of the People of Russia in 1917, and on economic and social human rights by adopting the Declaration of the Rights of the Working and Exploited People in 1918. These documents granted workers and peasants unprecedented rights, including the right to land, basic means of production, and ownership of banks, and enshrined the right of nations to self-determination in the 1918 Constitution of the RSFSR and the 1936 Constitution of the USSR, guaranteeing citizens the rights to work, education, recreation, and democratic freedoms.

As one of the founders of the United Nations, the Soviet Union initiated many important international documents, such as the 1960 Declaration on the Granting of Independence to Colonial Countries and People, as well as the 1974 Definition of Aggression, which became the cornerstone in defining concepts related to threats to international peace.

An important stage in the evolution of international law was the post-war period, when Russia, being one of the founders of the United Nations, actively promoted the

preservation of the UN Charter as the main regulator of international relations. This position made it possible to avoid fragmentation of the international legal order and preserve a unified system aimed at maintaining peace and security in the world. In addition, Russia has made a significant contribution to the development of international human rights law by participating in the drafting of the International Covenants of 1966 and the consolidation of social rights. The Russian Federation, as the legal successor of the USSR, ratified both Pacts on September 18, 1973, and has been participating in them since October 16 of the same year. The Soviet delegation proposed extending the provisions of the Covenants to Non-Self-Governing Territories, which required using the full authority of the Commission on Human Rights and other UN bodies to approve them.

Russia's role in global legal norms and their evolution remains significant and indisputable. The country actively participates in the development of international law, influencing its formation and adaptation to modern challenges.

Russia's modern initiatives in the context of international organizations actively contribute to strengthening international law and order, protecting national interests and adhering to established principles. One of the most striking examples is the support of the Charter of the United Nations and the Declaration on the Principles of International Law, which indicates Russia's desire to prevent arbitrary interpretation of international norms [Bekyashev, 2019; Kalamkarian, 2012; Khlestov, 1994].

Another important aspect is the active use of judicial mechanisms to resolve international disputes, which is confirmed by the fact that at the end of 2002, Russia initiated a case at the International Tribunal for the Law of the Sea, a precedent that emphasized the importance of legal instruments in resolving issues related to the use of marine resources and the protection of national interests in international waters.

Russia pays special attention to protecting the interests of its citizens abroad in the context of modern geopolitical challenges. In the context of increasing anti-Russian sentiment and discrimination against Russian compatriots, a number of initiatives are being implemented in some countries aimed at providing legal and psychological support to Russians living abroad. One of these projects is For the Rights of Compatriots, which unites the efforts of the Russian Bar Association, the Synergy Corporation, and other organizations to help compatriots who face various forms of discrimination.

The signing of the Rome Statute of the International Criminal Court (ICC) in 2000 was also an important step for Russia in shaping the international legal system: although the country did not ratify the document, its signing signaled its willingness to participate in global efforts to create a mechanism for bringing international crimes to justice. This act demonstrated the importance for Russia of participating in international legal institutions, even if it did not always mean unconditional acceptance of all norms.

The most important part of Russia's foreign policy remains the maintenance of peace and stability through peaceful means of conflict resolution, which underlines its commitment to the principles of diplomacy and multilateral cooperation. Russia actively uses the mechanisms of diplomacy, negotiation, mediation, and good offices to resolve international disputes, while maintaining the principles of mutual respect and compromise. For example, in 2022, Russian diplomacy actively worked towards the peaceful settlement of international conflicts. Moscow has contributed to the comprehensive normalization of relations between Azerbaijan and Armenia, the

unblocking of transport communications between them, the delimitation of the border, the negotiation of a peace treaty and the resolution of humanitarian problems.

Russia's role in the development of international law differs from the positions of other countries, as it actively supports the central role of the United Nations and insists that international law remain a universal instrument for regulating interstate relations. Russia constantly emphasizes the need to respect the principles of equality, mutual respect and cooperation within the international community, which vividly reflects its approach to multilateral negotiations and cooperation with States that share its values.

Unlike Russia, China finds its niche in developing new branches of international law, such as regulation of cyberspace and issues related to climate change and deep sea resources. Despite certain contradictions with international legal norms, China is actively adapting its legislation to global standards and fulfilling international obligations [Kalamkarian, 2012].

The United States, on the other hand, has remained one of the leading players on the world stage for decades in the context of the formation of new international norms and the maintenance of existing agreements [Kalamkarian, 2012]. Nevertheless, the history of the United States shows the ambiguity of their approach to international law: despite the active support of the rule of law, in some cases this country violated international norms, which causes criticism and creates problems in their global legal practice [Badaeva, 2021; Khlestov, 1994]. Russia focuses on maintaining equality and consensus in international affairs, but the United States often takes a more pragmatic approach, focusing on its strategic interests, which sometimes leads to contradictions with the international community.

Thus, Russia's role in the progressive development of international law is not limited to its historical contribution, but continues in modern initiatives such as support for the UN Charter and active participation in international judicial mechanisms, for example, in cases before the International Tribunal for the Law of the Sea. Russia consistently defends the principles of sovereignty and human rights, which is reflected in its participation in international treaties, such as the International Labour Organization Convention on the Worst Forms of Child Labour.

References

1. Badaeva, D. S. (2021). Rol' rossijskogo gosudarstva v razvitii mezhdunarodnogo prava [The role of the Russian state in the development of international law] // *Yuridicheskoe obrazovanie: sbornik nauchnyh statej.* –V. 18. – Rostov-na-Donu: Rostovskij-na-Donu institut (filial) Federal'nogo gosudarstvennogo byudzhetnogo obrazovatel'nogo uchrezhdeniya vysshego professional'nogo obrazovaniya "Vserossijskij gosudarstvennyj universitet yusticii (VGPU Ministerstva yusticii Rossii)\" v Rostove-na-Donu. – Pp. 29-34. (in Russian)

2. Bekyashev, K. A. (2019). Vklad Rossijskoj Federacii v razvitie sovremennogo mezhdunarodnogo prava [The contribution of the Russian Federation to the development of modern international law] //*Aktual'nye problemy rossijskogo prava.* – № 7(104). – Pp. 106-114. – DOI 10.17803/1994-1471.2019.104.7.106-114. (in Russian)

3. Kalamkarian, R. A. (2012). Vklyuchennost' Rossii v process kodifikacii i progressivnogo razvitiya mezhdunarodnogo prava [Russia's involvement in the process of codification and progressive development of international law] // *Grazhdanin i zakon.* – № 4. – Pp. 27-42. (in Russian)

4. Khlestov, O. N. (1994). Mezhdunarodnoe pravo i Rossiya [International Law and Russia] // *Moskovskij zhurnal mezhdunarodnogo prava.* – № 4. – Pp. 52-59. – DOI 10.24833/0869-0049-1994-4-52-59. (in Russian)

UDK 340.143

COMPARISON OF THE FUNCTIONING OF PENITENTIARY SYSTEMS IN RUSSIA, THE UK AND THE USA

Shepelev Maxim Ruslanovich,
Student of the Institute of Law,
Belgorod State National Research University,
Belgorod, Russia,
E-mail: 1627565@bsuedu.ru
Miroshnichenko Natalia Sergeevna,
Ph.D. in Philology,
Associate Professor of the Department of Foreign Languages and Professional Communication,
Belgorod State National Research University,
Belgorod, Russia,
E-mail: miroshnichenko_n@bsuedu.ru

Abstract: *The article presents the main characteristics of the functioning of the penitentiary system in Great Britain and the United States. On the basis of the comparison of these countries the peculiarities of the Russian Federation system are described. Differences, peculiarities of development and formation in relation to geographical, political and other basic structures of the state are presented. It is important to note that when restructuring the general system in the 20-21st century it is necessary to take into account the structure of foreign countries. It is this aspect of the difference that is considered in this article.*

Keywords: *the penitentiary system, prison system, the FBT, the privatisation of prisons, the International Centre for Prison Studies, the Federal Bureau of Prisons.*

The penitentiary system is an important part of the legal system of every country. It is responsible for the detention and rehabilitation of convicted persons, as well as for ensuring the safety of society. In this article we will look at the penitentiary system of Russia and compare it with the systems of other countries.

The penitentiary system of Russia has its own history, which began in the times of the Russian Empire. Since then, it has undergone many changes and improvements. Today, the penitentiary system of Russia is based on the principles of legality, humanism and social orientation. It includes correctional colonies, remand centres, settlement colonies and other institutions. One of the basic principles of the Russian penitentiary system is the rehabilitation of convicts.

Correctional institutions provide programmes for social and professional adaptation, educational and employment activities, and psychological assistance. The aim of these programmes is to prepare convicts for their return to society and to prevent re-offending. However, as in many other countries, the penitentiary system in Russia faces certain problems. One of them is overcrowding in correctional institutions. In some colonies, the number of inmates exceeds the permissible norm, which hampers the normal functioning of the system and complicates rehabilitation programmes. Compared to other countries, the penitentiary system in Russia has its own peculiarities [Goryainov, 2009: 116].

The purpose of this work is to analyze the difference between the penitentiary systems of foreign countries and Russia.

In the process of executing the work, the following tasks were set:

1. Find out about the structure of execution of punishment in the USA.
2. Find out about the structure of execution of punishment in the UK.
3. Compare the three systems and identify common patterns, as well as significant differences.

The system of the Federal Penitentiary Service has undergone several changes and modifications. The basis of changes in the Federal Penitentiary Service is based on foreign penitentiary systems. Undoubtedly, it would be desirable to maintain the standards of work and quality of organisation at the same level as in European countries, but due to the peculiarities of the state, such as population density, size of the country, geographical location, etc., it is not possible to fully adopt the system of the West. As a comparison of different conditions for the formation of FSIN systems, we can cite the analysis of the International Centre for Prison Studies (ICPS), which divides countries into 3 main groups:

- Group 1: countries with a population of more than 10 million and a GDP per capita of more than $10,000 per year, i.e. countries with more or less comparable economic volumes and living standards.
- Group 2: BRICS countries, i.e. countries currently at a similar stage of socio-economic transformation.
- Group 3: countries of the former USSR, i.e. countries that have recently undergone similar socio-economic transformations that have had a negative impact on crime rates.

The first group includes 27 countries accounting for 56 per cent of prisoners, of which 7.6 per cent are Russian prisoners. In quantitative terms, there are about 460 prisoners per 100,000 inhabitants. According to this indicator, Russia is surpassed only by the United States, where the disproportionate development of the prison system is also noticeable. If we look at this group of countries without the USA and Russia, there are only 165 prisoners per 100,000 inhabitants, which is three times lower than in Russia [Gnedova, 2018: 110].

In the second group, there are 98 prisoners per 100,000 inhabitants, which is four times less than in Russia. And finally, in the third group, the countries of the former USSR, the rate of prisoners in Russia is two times higher. It is difficult to say with certainty that crime is lower in the former republics; it is more likely that imprisonment is used less often as a punishment. Based on this, we can make an intermediate conclusion that the number of prisoners in Russia is much higher than in other countries with a similar level of development, with the exception of the USA. Apart from Russia and the USA, no other country can basically afford to keep such a large number of prisoners, which means that the system is constantly in need of reorganisation and finding a better way of managing the structure.

The period of market reforms has brought Russia much closer to the leading foreign countries, which has had a direct impact on the penitentiary system. However, despite the active influence of the West, our country has its own peculiarities, as already mentioned [Aliev, 2012: 132].

For a better understanding, let's look at the difference with the two leading authoritative countries: America and the representative of Europe – Great Britain.

The penitentiary system of the United States, being a federal country consisting of 50 subjects, has two levels. However, unlike in the Russian Federation, there is no direct vertical chain of command between the Federal Bureau of Prisons, which is part of the US Department of Justice and executes sentences against convicts on the basis of federal court decisions, and the structure of the states, which are responsible for the execution of sentences in relation to local courts.

The Bureau of Prisons consists of 8 divisions and has 117 correctional facilities. The budget allocated by the state for the operation of the prison system is mainly used to pay staff ($6 billion, 820 million). The staff are essentially the backbone of the overall operation of the system, as they coordinate all activities within the prisons and ensure discipline and order. The majority of employees are men (28,000 – 72.6%), as the work is heavy and life-threatening. However, women also take part in the general work, accounting for 27.4 per cent (10.6 thousand). About 2.7 million people are incarcerated in more than 4,000 prisons throughout the country. The individual prisons in the states are supervised by departments of the same states, and some entities have special juvenile justice departments. As the main funding comes from the state, the quality control system has been tightened over time to reassure the public not only about safety but also about the financial component of the costs.

Let us now look at the British prison system, which differs significantly from the American and Russian systems. The first peculiarity is that the whole system is divided into three relatively autonomous structures: England and Wales, Scotland and Northern Ireland. England and Wales have their own hierarchy of staff. The Prison Service and the Probation Service form the National Offender Management System (NOMS). The Director of Prisons reports directly to the Director of NOMS and is supervised by the Directors of the 11 prison districts, the Director of High Security Prisons and the Mental Health Unit. There are a total of 141 state prisons in Wales and England. There are a total of 45,000 staff working in these establishments. The main role of these institutions is to ensure security and transparency of the process in order to maintain public order. In total, there are approximately 94 thousand people in the whole of the UK, for which 3.4 billion ft.st. is allocated [Bykov, 2013: 170].

We now turn to the Scottish system, where SPS prisons are at the heart of the work. Their role is to manage young offenders and non-custodial sentences. In Northern Ireland, on the other hand, there are only three main institutions: a young offenders' colony and colleges for the training of officers. In general, the principles and provisions of the Irish penal system are very similar to those of England and Wales. The only difference is the territorial limitation of the institutions. It is worth noting that private prisons deserve special attention here, as they improve the quality of work and reduce the financial burden on the state. The very idea of privatising prisons in the US and the UK has a positive impact not only on the problem of overcrowding in state institutions, but also on public order.

References

1. Aliev, U.L., Sal'nikov, P.P. (2012). Mezhdunarodnye pravokhranitel'nye traditsii i traditsii politssii Rossii [International law enforcement traditions and traditions of the Russian police] // *Pravovaya nauka: istoriya i sovremennost'*. – № 8. – Pp. 130-150. (in Russian)

2. Bykov, A.V. (2013). Penitentiarnye sistemy SShA, Germanii, Frantsii, Velikobritanii: osobennosti organizatsii i deyatel'nosti [Penitentiary systems of the USA, Germany, France, Great Britain: peculiarities of organization and activity] //*Pravovaya nauka: istoriya i sovremennost'*. – № 11. – Pp. 165-174. (in Russian)

3. Gnedova, N.P. (2018). Sravnitel'nyi analiz funktsionirovaniya penitentiarnykh sistem nekotorykh stran Zapadnoi Evropy i SShA [Comparative analysis of the functioning of the penetration systems of some countries of Western Europe and the USA] // *Pravo i zakon*. – № 11. – P. 110. (in Russian)

4. Goryainov, V.P. (2009). Tsennostnye suzhdeniya v Rossii i Zapadnoi Evrope: sravnitel'nyi analiz [Value judgments in Russia and Western Europe: a comparative analysis] // *Sotsiologicheskie issledovaniya*. – № 5. – Pp. 115-120. (in Russian)

5. Mikhaylovna, F.A. (2011). Angliyskaya progressivnaya sistema tyuremnoi zaklyucheniya: istoriya i sovremennost' [English progressive prison system: history and modernity] // *Penitentiarnaya nauka*. – № 16. URL: https://cyberleninka.ru/article/n/angliyskaya-progressivnaya-sistema-tyuremnogo-zaklyucheniya-istoriya-i-sovremennost. (in Russian)

SECTION 3
SOCIAL AND HUMANITARIAN SCIENCES, ECONOMICS

UDK 612.06

INDICATORS OF ENERGY CONSUMPTION OF ATHLETES SPECIALIZING IN CYCLIC SPORTS

Golovaneva Ekaterina Konstantinovna,
Student of the Institute of Economics and Management,
Belgorod National Research University, Belgorod, Russia,
Email: katya.golovanyova@gmail.com
Grigorenko Svetlana Evgenievna,
PhD in Pedagogy,
Associate Professor of the Department of Foreign Languages and Professional Communication,
Belgorod National Research University, Belgorod, Russia,
E-mail: sgrigorenko@bsuedu.ru

Abstract: *The article is devoted to the issues that reveal the peculiarities of nutrition of modern athletes, taking into account the type of sport. The emphasis is on the study of nutrition of athletes engaged in cyclic sports. Unfortunately, until now, coaches allow violations in their nutrition, which leads to low performance at competitions. To solve this problem, at the end of the article, recommendations are proposed that allow rationally organizing the nutrition process for athletes specializing in cyclic sports.*

Keywords: *energy consumption indicators, athlete, cyclic sports, athletes' nutrition, regime, diet, caloric content.*

Introduction. In any sport, in order to achieve high results, an athlete needs to make great physical and mental efforts. Moreover, both during training and during participation in competitions. High-quality exercise performance during the training process depends on a number of factors, including the athlete's energy resources. The rational distribution and replenishment of energy consumption depends on the characteristics of nutrition, which must take into account the specifics of the sport that a person is engaged in. In this regard, it can be argued that energy costs are calculated for each individual sport. In the framework of this article, the energy consumption indicators of athletes specializing in cyclic sports will be considered in detail.

Main part. The energy consumption indicators of athletes are primarily related to physical and mental stress. In the process of training and performing at competitions, athletes spend a lot of energy, which then needs to be restored through rest and rational nutrition. Modern developers of training programs promote the development of individual diets, taking into account the physiological and biochemical characteristics of physical activity.

The consequences of a violation of the recovery process can have a very negative impact on the athlete's health. The main reason is that strenuous training and participation in competitions lead to exhaustion of the nervous system. If the program for restoring resources and energy consumption is worked out incorrectly, then a

person may enter a stressful state. Its consequences can be: disruption of the digestive system, diseases of the gastrointestinal tract, tachycardia and other cardiovascular diseases [Alessio et al., 2019].

Depending on the type of sport, energy costs and physical activity are determined. At the moment, it is customary to distinguish five groups of sports:

– sports related to minor physical activity;
– sports related to short-term physical activity;
– sports related to constant and intense physical activity;
– sports related to prolonged physical activity;
– sports related to strenuous routines during training and competitions.

When making up a diet for an athlete belonging to a particular group, it is necessary to take into account the peculiarities of physical activity. So, for the first group, it can be recommended using easily digestible foods. The diet of athletes belonging to the second group is more diverse, but its features depend on the type of sport. For the third group, substances that form strength qualities are important, primarily endurance. For this purpose, products that contribute to the formation of glycogen reserves are used. Endurance is also important for the fourth group of athletes, and this indicates the need to consume carbohydrates. In the fifth group, the emphasis is on the consumption of proteins, fats and carbohydrates.

It is fair to note that the nature of the work performed also determines the energy consumption of athletes. In this context, we are talking about the stage of preparation for the competition.

In the context of this work, special attention will be paid to the third and fourth groups characteristic of cyclic sports. "Cyclical sports include cross-country athletics disciplines, swimming, academic rowing, kayaking and canoeing, cycling, short track, as well as winter sports – ice skating, cross-country skiing. Within the group itself, however, there are some differences that are worth keeping in mind" [Allen et al., 2019].

Based on the above-mentioned sports, a general definition of the concept of "cyclic sports" can be given. So, these are primarily those sports that require athletes to have a high level of endurance. Their specificity lies in the fact that the movements performed by the athlete are constantly repeated and the result of the athlete depends on the frequency and intensity of their repetitions. In the course of training, cyclic exercises are performed based on a rhythmic motor reflex, which, in turn, manifests itself automatically.

Once again, let's pay attention to the fact that cyclical sports require endurance from athletes, which is closely related to movement coordination. As a result, athletes require a greater expenditure of energy resources than, for example, in other sports. The average indicators are such that about 4000-6000 kcal can be spent during training. When there are competitions, bike races or marathons, this figure may be several times higher. In this regard, the diet of athletes should be saturated with proteins, which they receive in fractional portions 5-6 times a day.

The ratio of proteins, fats and carbohydrates for athletes specializing in cyclic sports according to various sources is in the range of 13-15:24-25:58-61. It is also important to provide the body with carbohydrates, which, as a percentage, should take up at least 70% of the total caloric content of the daily diet. It should also be noted that

carbohydrates in the athlete's diet should be in large quantities primarily due to a decrease in the proportion of fats.

However, it is impossible to unify all types of cyclical sports and offer athletes a single diet. The difficulty lies in the fact that the energy consumption for each individual type of muscle work is different. Running is a good example. When running short distances (up to 200 meters), the main emphasis is on speed and strength training, where maximum muscle work is required, while when running long distances, for example, 1 kilometer, the body is already being rebuilt and goes into aerobic mode. The above allows us to conclude that each individual athlete from a particular sport can show high results only in his discipline, since training allows him to use his available energy resources correctly and as efficiently as possible.

The need to take these features into account led to the fact that cyclical sports were divided into sprinting and stayer sports. The fact is that if an athlete needs energy expenditure for less than three minutes, anaerobic mechanisms – ATP-KF and glycolysis – are activated. Further, when the athlete has been working for a longer period of time, other mechanisms are connected that work simultaneously. Loads of more than 10 minutes already receive full energy from the aerobic mechanism. This once again highlights the need for a different approach to nutrition for sprinters and stayers. In terms of energy consumption and the needs to replenish them, sprinters are close to speed and power sports.

The energy supply of athletes and their physical characteristics are determined by their need for constant training and participation in competitions. In this regard, stayers have a small constant weight, but at the same time they are very hardy due to glycogen reserves. If we are talking about athletes working for short distances, then their main task is to ensure that the body has sufficient protein levels. For stayers, there is a need, first of all, to provide the body with fats and carbohydrates in order to withstand aerobic loads.

The amount of water in the body also affects the replenishment of energy consumption of athletes. The fact is that when a person performs prolonged loads, his body becomes dehydrated. Moreover, mineral salts are washed out. Therefore, the reserves of water and trace elements should be gradually replenished [Ashmaig et al., 2021].

All of the above highlights the importance of nutrition for athletes. It is the diet that allows you to ensure the endurance of the body and its physical performance. It is also important that with proper nutrition of the body, the rehabilitation process after training or competition is easier, which has a positive effect on the health and physical well-being of the athlete. Approaches to nutrition of athletes depend on many factors, including general trends. So, in the last 10 years, a complex of food products has been selected for athletes to replenish energy consumption. The problem is that this diet does not always have a medical and biological basis.Our research is due precisely to the presence of this problem, and the need to identify violations of the consumption of nutrients and energy in athletes specializing in cyclic sports.

Methods and organization of research. The respondents were 87 people, 60 of whom were men and 27 women, engaged in cyclical sports. In the survey, respondents noted that they are professionally engaged in one of the following sports – swimming, cross-country skiing, athletics, cycling or rowing. To implement the study, the method of

24-hour power reproduction was chosen. The bottom line is that with the help of a survey, respondents find out what dishes they ate during the day. The study was conducted during the training period. The results of the study were entered into a special automated system that allowed us to obtain accurate averages and interpret the data.

The results of the study and their discussion. Analyzing the data obtained, it was noted that women mainly get energy from foods containing protein, while men mainly eat carbohydrates-containing foods for this purpose. The main problem that was identified as a result of the study is that both men and women in large quantities, almost twice the norms accepted for athletes, consume foods with a high content of fatty acids, as well as cholesterol. It should also be noted that both women and men consume a lot of sugar and salt. In general, men receive about 40% more dietary fiber than women.

Based on Figure 1 and the results of the study, we conclude that in the experimental group, athletes in the diet lack such important components for the formation of endurance as vitamins C, B1, B2, A, PP, calcium and iron. The average intake of vitamins and minerals is shown in Figure 1 in a comparative section with the norm.

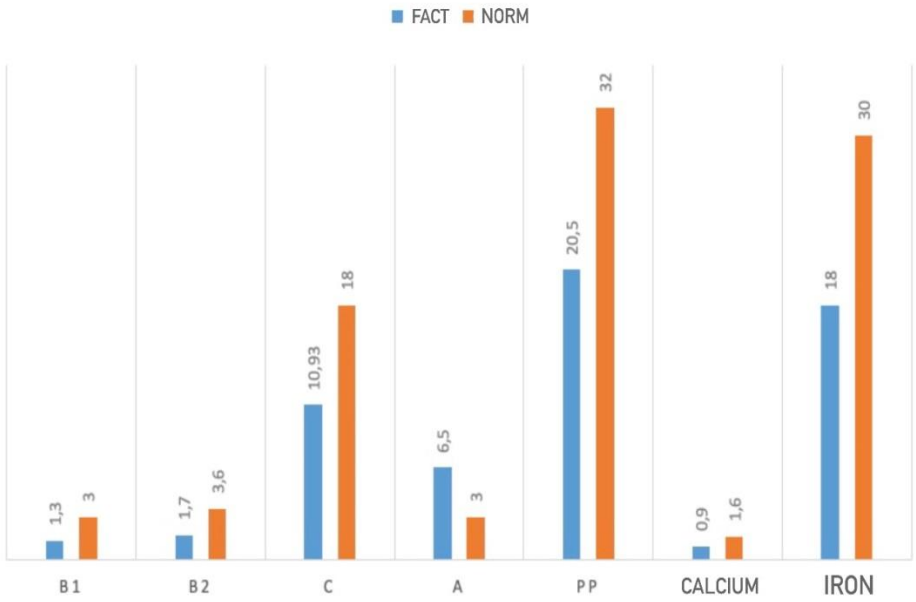


Figure 1. Average intake of vitamins and minerals

As can be seen from Figure 1, there is a deficiency in all indicators except vitamin A, which is caused by an unbalanced diet of the respondents, despite the fact that they are engaged in cyclic sports and must follow a diet regime to meet energy costs. Iron is one of the key elements in the body of an athlete specializing in cyclic sports. It is iron that allows you to provide the body with a sufficient amount of hemoglobin and ensure a high-quality process of respiration and hematopoiesis. There is a significant iron deficiency in the body of the respondents, almost half of it. This is primarily due to the desire of athletes to get energy from fats, but they do not take into account the need for other trace elements. As a result, one can observe a lack of many important components for the formation of endurance and strength abilities, which are so important for athletes.

Next, in Figure 2, we determine the ratio of protein, fat and carbohydrate intake in men and women according to the results of the study.

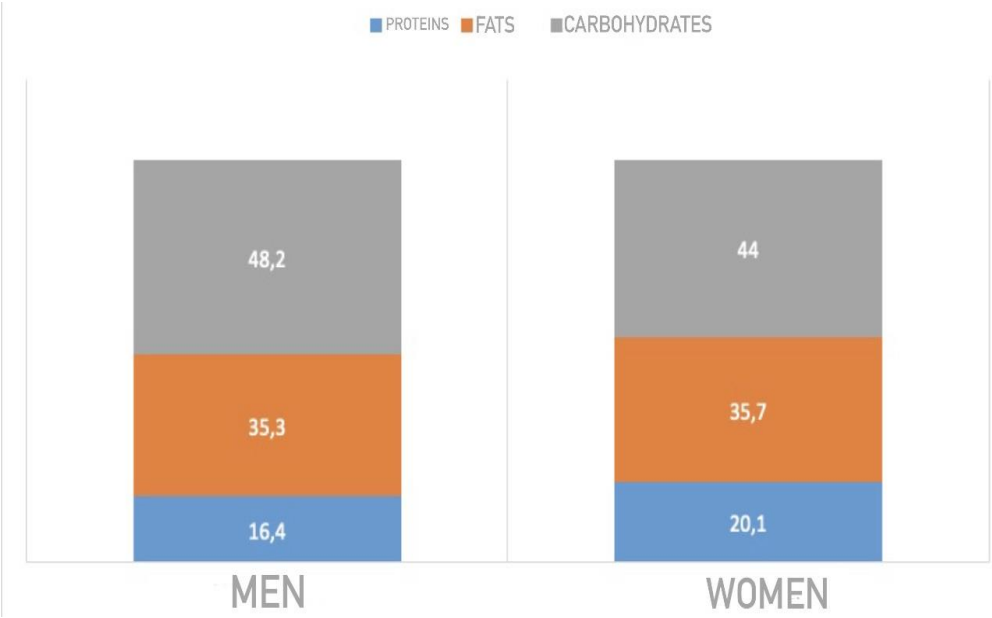


Figure 2. Consumption of protein, fat and carbohydrates by caloric content of the diet of athletes specializing in cyclic sports

Figure 2 also clearly shows the imbalance of proportions, which was indicated at the beginning of this article for athletes engaged in cyclic sports. The respondents mainly get protein from meat. It is consumed daily by 95% of the respondents. However, the disadvantage is that meat also includes sausages, which were noted in the diet of 35% of respondents.

The use of fermented dairy products by athletes (20%) and cottage cheese (38%) is positive. Also, the consumption of fruits and dried fruits (57%), as well as vegetables (77%) can be attributed to a rational diet Potatoes occupy a large share in the diet of athletes. About 54% of the respondents use it. A significant disadvantage is that athletes practically do not eat fish. It was noted in only 10% of respondents in the menu.

Conclusion. Summing up the results of the analysis, we conclude that the experimental group of respondents has an unbalanced diet. The main problem lies in the high proportion of fat intake, LFA, added sugar (in % of calories), cholesterol, added salt, which is a risk factor for the development of alimentary-dependent diseases. Low levels of consumption of vegetables and fruits, low-fat dairy products, fish products and high levels of sausages, sugar and confectionery were noted.

The conducted research indicates that a balanced, proper diet, which includes 6 food groups, is important for athletes to replenish energy.

The first group includes milk, cheeses and fermented dairy products. The survey of respondents showed that they mainly consume cottage cheese, which leads to a lack of important elements. It is required to diversify the diet of athletes by using products such as kefir, yogurt and yogurt.

The second group consists of meat, poultry, fish and eggs. The survey showed that athletes consume meat products in sufficient quantities, but semi-finished products such as sausages should be excluded. In addition, athletes practically do not eat fish, namely, it is the basis for improving the performance and endurance of the human body.

The third group includes flour, bakery products, cereals, sugar, pasta, confectionery, potatoes. Respondents consume products from this category in quite

large quantities. Especially sugar and flour. They should be reduced in favor of other products to maintain balance.

The fourth group is fats. Currently, respondents have a lot of foods containing fats, they should be reduced, but they should not be completely removed from the diet.

The fifth group is vegetables. They should be consumed in large quantities, including in combination with meat products.

The sixth group is fruits and berries. It is especially important for women to consume, as research has shown that they do not have enough of these elements.

The main part of the diet should contain products of the first and second groups in order for the body to obtain the necessary proteins.

In the course of the study, it was also revealed that athletes have a lack of vitamins, which can be replenished by eating enough vegetables, fruits and berries.

Numerous modern studies indicate that a rational diet is primarily a variety of foods and the right combination of them. If an athlete's diet consists of all 6 of the above food groups, then he will be able to provide his body with the necessary micro and macronutrients.

Providing energy to the athlete's body is possible if the principles of rational nutrition are followed. In the conducted study, it was revealed that athletes, for the most part, use the principles of unilateral nutrition. In other words, their diet contains an excessive amount of foods such as meat, eggs and milk. This approach can be considered incorrect, as it leads to metabolic disorders, as well as negatively affects the functioning of the liver and kidneys.

As recommendations, it was proposed to create a menu that includes 6 food groups. Meat and dairy products should make up the main part of such a menu, since it is thanks to them that protein enters the body of athletes. The consumption of meat and fish must necessarily go in combination with vegetables. The diet of athletes specializing in cyclic sports should also contain fruits, which are easily digested and at the same time supply the body with the necessary amount of carbohydrates.

References

1. Alessio, H.M., Goldfarb, A.H. (2019). Lipid peroxidation and scavenger enzymes during exercise: adoptive response to training // *Applied Physiology*. – № 64. – Pp. 1333-1336.

2. Allen, D.L., Linderman, J.K., Roy, R.R. et al (2019). Apoptosis: a mechanism contributing to remodelling of skeletal muscle in response to hindlimb unweighting // *Physiology-cell Physiology.* – № 273. – Pp. 579-587.

3. Ashmaig, M.E., Starkey, B.J., Ziad, A.M. et al (2021). Changes in serum concentrations of markers of myocardial injury following treadmill exercise testing in patients with suspected ischaemic heart disease // *Medical Science Monitor.* – № 7. – Pp. 54-57.

4. Bemben, M.G. (2017). Creatine supplementation and exercise performance: recent findings // *Sports Medicine.* – № 35. – Pp. 107-125.

UDK 32.323

INFORMATION WARS: HISTORY AND MODERNITY

Ivanova Ksenia Olegovna,
Student of the Institute of Social Sciences and Mass Communications,
Belgorod State National Research University, Belgorod, Russia,
E-mail: ivanovaksenia361@gmail.com
Sagalaeva Irina Vladimirovna,
Ph.D. in Pedagogy,
Associate Professor of the Department of Foreign Languages
and Professional Communication,
Belgorod State National Research University, Belgorod, Russia,
E-mail: sagalaeva@bsuedu.ru

Abstract: *The article reveals information about information wars. The author considers information as the most important source, which can both increase well-being and lead to some losses. The author also examines the history of the emergence and development of the concept of "information war". In addition, the ways and methods of conducting information wars are also touched upon. The article concludes about the importance of owning and using information.*

Keywords: *information war, disinformation, maneuvers, manipulations, technologies, information warfare.*

In the modern world, people often hear about information wars and no longer attach much importance to it. Many people believe that this concept appeared recently, approximately in the 20th century, but this is not so. Now, in order to harm someone, be it a country, a city or a person, humanity can do without physical violence, using only information.

For the first time, the definition of "information warfare" was given approximately in the mid-80s of the 20th century, due to the new tasks that appeared for the Armed Forces of the United States of America after the end of the Cold War. This term was the result of the work of two military theorists G.E. Eccles and G.G. Summerza. Subsequently, this term began to be actively used after the 1991 Operation Desert Storm in Iraq, where for the first time information technologies were used for military purposes [Abdullaeva, 2016].

Information warfare is a fight using exclusively information weapons, i.e. information technologies based on the production, distribution and imposition of information. This is a specially thought-out manipulation of meanings over subjects: creation, destruction, transformation, imposition and obstruction of meaning carriers by information methods. Basically, a series of such well-thought-out and successfully carried out information procedures leads to the rapid achievement of the goal, the essence of which is to control the control systems of opponents (states), or to destroy this system and introduce in its place one that is easy to control.

In the works of ancient authors, there are very often stories about how inventive the politicians of antiquity were. For example, Genghis Khan's troops had a reputation for being very cruel and bloodthirsty, which in turn terrified their opponents, demoralized them and contributed to Genghis Khan's victories. For example, the Ancient Athenian

politician Themistocles, during the war with the Persians, called on the Ionians to unite with the inhabitants of Athens against foreign invaders. During the movement of troops, he visited all the ports and left a message on the stones to the Ionians, urging them to either fight on his side or not join the army of the Persian king Xerox.

The earliest known form of influence is intimidation. The first cases of the use of information-psychological influence were recorded around the 5th century BC, when the Persian king Xerox decided to frighten his enemies by spreading the rumor that his army was enormous. A little later, already in the 4th century BC. the same method was used by the Chinese general Sun Tzu. In his treatise "The Art of War", he was the first to try to describe the method of information influence on the enemy: "Winning a hundred victories in battles is not the limit of art. To conquer the enemy without battle is the crown of art". Arguing about this, the Chinese commander wanted to say how great the power of information influence is: "Decompose everything good that is in the enemy's country. Incite quarrels and clashes among citizens of the enemy side" [Rastorguev, 2016]. History knows many similar examples that have been used by various countries throughout human history.

With humanity's transition to the industrial age, information warfare began to have a stronger impact. During World War I, both sides of the conflict made extensive use of print media. Great Britain used these methods the most. Thus, in London, a body was established that specialized in the production and distribution of leaflets containing propaganda, which were scattered over the positions of German troops.

Thus, it was in London that bodies began to be created that specialized in the development and distribution of leaflets containing propaganda. Which were later simply scattered over the location of the German troops. This little trick provided a very unexpected positive effect, such that by the end of the war the Entente parties formed a separate headquarters for the moral and psychological disintegration of the forces of Germany and its allies. To develop it, the British involved many artists, writers, as well as journalists of the time. This trick, according to many historians, played an important role in the outcome of the war.

During World War II, great attention was paid to the propaganda disseminated by Nazi Germany. The theory of propaganda that Goebbels formulated included the following positions: mental simplification, limitation and filtering of material, "drilling" repetition and emotional escalation [Grinyaev, 2016].

Many believe that the propaganda campaign carried out by German forces during World War II was one of the most effective in history. The Germans managed to take cities without even using firearms; the city's population simply gave up their territories without even trying to resist. Due to the fact that the media formed an image of the German army as a "superarmy" that could defeat any enemy without making much effort, the opponents were under strong psychological pressure. But later Goebbels's unit still had to face a significant problem. The truth is destined to come out, so the false propaganda of the German troops, as a "super army" that easily subjugated cities, was revealed. When information reached the people that the image of the German army was false, they ceased to obey, as a result of which it became more difficult to control them. Because of this, the Germans were forced to find out information about how things were going on at the fronts by listening to news broadcast on the radio from the

Soviet and British media. And as a result, listening to foreign radio broadcasts began to be equated with high treason.

The main opponent of Nazi Germany in this war, the Soviet Union, also actively used methods of waging information wars. For example, Soviet scientists developed synchronous broadcasting. With its help, it became possible to broadcast their broadcasts on frequencies used by German troops [Grinyaev, 2016].

Over time, it became apparent that information could be both a weapon and a target, which was used against the USSR in the 1980s. Some scholars argue that American propaganda contributed to the collapse of the Soviet Union as people began to see a more attractive life behind the Iron Curtain.

Today, the media are the main information weapon, they include: radio, Internet, television and the press. It is very important that information on the Internet is not controlled or regulated by law. But the media now plays such an important role that it has become the main means of achieving the political goals of states. Their power is so great that doubts arise not only about the freedom of the losing state, but also about the very fact of the existence of this nation as a national community.

In ancient times, there were much fewer methods of waging information wars. The main methods were: spreading rumors about the size of one's army, using intimidating flags and masks, also, when the army went into battle, it made very intimidating sounds and because of this action the enemy became scared. Because the military leaders of those times realized that the emotional state of your army and the army of your enemy also plays a very important role in the battle. And this is how they worsened the psyche of their opponents and increased the morale of their army. But there was also another very important method, which was to give the opponent false information about the attack and strike the enemy suddenly.

An excellent example is the Trojan Horse, which was the main figure in the war when the Greeks decided to become the main ones in the Aegean Sea, but they were greatly hampered by Troy. And then they came up with a cunning action, pretending that they had sailed away, they simply went around the island, built a Trojan horse and hid in it. Telling the Trojans that this is a symbol of victory, and if they accept it, they will certainly win. The Trojans accepted this gift and dragged it into their city, but at night the Greeks crawled out of it and destroyed the inhabitants not only of the Trojan people, but also of Troy itself to the ground. Later, the phrase "Trojan horse" began to mean misinforming the enemy and was even included in dictionaries. There are many more similar cases in history, when the opponent received false information about the attack of his enemy, they waited, but then they were attacked suddenly, for example, at night.

Now there are two **spheres of information functioning**, which have slightly different tasks, but each has its own methods.

The first area is **humanitarian**. It is interpreted as the imposition of a certain concept, due to which people's behavior changes, as is necessary for the state. Today, influencing people through electronic media plays a very important role, because this is the best option, because many people around the world use the Internet every day, read any information, sometimes without even thinking about its reliability.

And the second area is **technical**. The main methods of conducting technical information warfare are:

• electronic warfare;
• warfare using electronic reconnaissance and guidance;
• psychological impact;
• fight against hackers;
• cybernetic warfare [Frolov, 2005].

Nowadays, every person is exposed to a flow of information. All people are influenced by various channels for transmitting information messages: television, radio, print media, social networks, Internet resources, etc. With the development of history and humanity, the ways and methods of waging information wars have also developed. Increasingly, they were used during military conflicts in which opponents attempted to intimidate or destabilize enemy troops. The spheres of influence of information wars on humans are especially wide in the 21st century, and in the future information wars will have an even greater impact on humanity due to the increase in channels of information dissemination, and the spheres of their influence will expand.

References

1. Abdullaeva, R.A. (2016). Informatsionnaia voina: proshloe I nastoiashchee [Information war: past and present] // *International Journal of Applied and Fundamental Research.* – [online]. – Vol. 12. – Pp. 544-548. Available at: https://applied-research.ru/ru/article/view?id=10880. (Accessed 05.04.2024). (in Russian)

2. Frolov, D.B. (2005). Informatsionnaia voina: evoliutsiia form, sredstv I metodov [Information war: evolution of forms, means and methods] // *Journal Sociology of Power.* – [online]. – Vol. 5. – Pp.121-146. Available at: https://cyberleninka.ru/article/n/informatsionnaya-voyna-evolyutsiya-form-sredstv-i-metodov/viewer. (Accessed 05.04.2024). (in Russian)

3. Rastorguev, S.P. (1999). Informatsionnaia voina [Information War]. – Moskva: Radio i svyaz`. – [online] – Pp. 416. – Available at: http://www.textfighter.org/text4/58_vozdeystviya_sistemyi_voynyi_14.php. (Accessed 05.04.2024). (in Russian)

UDK 659.118.1

BACKGROUND MUSIC A FACTOR INFLUENCING THE MEMORIZATION OF AN ADVERTISING MESSAGE

Bykovtsova Polina Alexandrovna,
Student of the Institute of Social Sciences and Mass Communications,
Belgorod State National Research University, Belgorod, Russia,
E-mail: polina120775@gmail.com
Sagalaeva Irina Vladimirovna,
Ph.D. in Pedagogy,
Associate Professor of the Department of Foreign Languages and Professional Communication,
Belgorod State National Research University, Belgorod, Russia,
E-mail: sagalaeva@bsu.edu.ru

Abstract: *The article reveals information about the influence of background music on advertising. The author examines music in advertising, what significance and influence it has on the audience's perception of the advertised product or service. The author also examines what kind of emotional response the soundtrack evokes from potential buyers, whether it can evoke associations*

with certain qualities or values of the brand. The article concludes that the effective use of music in advertising can significantly increase its memorability and effectiveness, as well as contribute to the formation of a positive brand image.

Keywords: *advertising, background music, soundtrack, consumer, advertised product, composition.*

The majority of advertisements use music of some kind, demonstrating the importance of music in advertising. It is becoming more and more important in online advertising in addition to being widely used in radio and television ads. In advertising, music can be used for a variety of objectives, such as enjoyment, authority establishment, lyrical language use, structure and continuity preservation, and memorability enhancement.

Additionally, music has the power to arouse feelings in listeners and appeal to their emotions, which in turn influences their decisions. Melodies have a strong effect on customers' moods, which can be helpful in building connections, therefore using music to control emotional states is effective. The use of music in advertisements increases audience engagement and captures their attention. Making strategic and innovative choices in music selection can distinguish ads, redefine branding, and make them stand out in a competitive market [Gorn, 2010].

The British market research company Kantar estimated that 84% of advertising worldwide contains music. Based on its research, the company claims that the most important reason for adding background music is that its absence makes it much more difficult to emotionally connect with the audience. Kantar also cites data that the constant use of the same composition and the inclusion of the brand name in the music helps to create an association with the advertised brand.

Katar data can be confirmed by D. Huron's research. He identified six main ways in which music increases the effectiveness of advertising: 1) entertainment, 2) structure/continuity, 3) memorability, 4) text in music, 5) targeting and 6) establishing authority. For example, in practice, the first point is confirmed by the fact that the use of entertainment music that matches the mood in advertising contributes to the creation of a more effective advertising message that can attract more attention from customers.

Consumers may perceive advertising on television or radio as an unwelcome intrusion into their own free time, but advertising can be more acceptable and attractive if it is able to entertain the viewer. The study also examined the impact of the presence and absence of music and how this makes advertising more attractive to consumers. It turned out that music in advertising attracts the attention of customers, and when used effectively, the soundtrack is able to hold the viewer's attention [Huron, 1999].

The use of music helps to create a consistent and continuous message in advertising. Music acts as a mediator between disparate images, giving the advertisement a clear structure by linking a sequence of visuals or episodes to each other. In terms of structure/continuity, music can play different roles in advertising. J. Alpert and M. Alpert believe that music can play a dominant role and be a distinctive element of an advertisement. But it can also be completely secondary in an advertisement where the main message is conveyed through voice-over or written information. A number of their studies emphasize the role of music in creating structure and continuity in advertising messages. From their works, it can be concluded that

music improves the memorability of advertising messages. It serves as an element that helps to memorize the brand and information [Alpert et al., 2005].

The effect of music on the memorization of advertising information has been extensively studied by other researchers. For example, Guido et al. proved that background music that is suddenly interrupted distracts customers' attention and reduces brand and advertising message memorization. But if the music is played continuously or fades smoothly then the memorability of the advertising information increases or remains unchanged.

Consumers often prefer brands that are familiar, easily recognizable or popular. A soundtrack that is associated with a brand helps to increase the recognizability of that particular brand or product. It can be hypothesized that the reason music is retained in memory better than verbal components is because, unlike language, music is processed in different hemispheres of the brain rather than in one area of the brain, aiding the memorization process and improving the recall of messages [Guido et al., 2016].

Music and brand can be closely linked in the minds of consumers. Music can be an ideal form for communicating a message in a way that consumers do not realize they are being influenced. A soundtrack conveys an advertising message without words. But using the right combination of words and sounds gives advertisers even more opportunity for influence through the use of verbal and non-verbal components. Using background music to accompany the lyrics of a song helps the advertisement appear more appealing to consumers and helps them remember the advertisement better.

Chow and Lien argue that the relevance of song lyrics to the advertised brand helps to deliver the advertising message. For example, Microsoft's advertisements used The Rolling Stones' song "Start Me Up" when launching their Windows 95 operating system. Microsoft did make one of the many examples of advertisements that used music to capture the attention and interest of consumers by evoking the right feelings. However, advertising producers should be aware of the distracting effects of song lyrics on consumer message processing when music or song lyrics are used inappropriately [Chou et al., 2010].

One of the most effective ways to target particular customer groups in advertising is to use music. Companies can more effectively target their audience by associating certain musical genres and artists with particular demographics. Studies indicate that young people are more likely to favor rap and hip-hop, whereas men are more likely to enjoy rock and heavy metal music. Businesses can choose music for their marketing campaigns more wisely if they take into account the musical tastes of certain demographic groups.

Acquiring credibility and employing music to boost advertising trust are strongly linked to the targeted function. Establishing proper authority can lead to effective targeting, as D. Huron notes. There are many strategies for establishing authority, like employing music as a powerful nonverbal cue and a link to a certain performer or musician. This is particularly true when taking into account well-known and previously recorded/heard music in advertisements, as a person's faith in musicians may be linked to the promoted product.

Many studies have been conducted on the behavioral and cognitive reactions to advertising music within the last 25 years. Although numerous studies have not been able to corroborate the notion that the structural components of music – tempo, pitch, and so on – have a substantial impact on consumer reactions, some academics have made this argument. Another study looked at the impact of promotional music within the context of classical conditioning, which states that if there is a connection between the music and the product and if listening to the music is expected to elicit a favorable reaction, then a favorable attitude towards that specific promotional product can be formed.

A distinct explanation of the musical influence in advertising has been put up by other researchers, who contend that music can create emotions that improve how consumers perceive and evaluate things. J. Alpert and M. Alpert provided an alternative viewpoint to classical conditioning by delving deeper into the connection between music and emotional reactions in advertising. According to their theory, music preferences can influence customer reactions in low-engagement scenarios and when advertisements don't provide useful material. This can help shape consumers' views of the product, brand, and advertising without needing cognitive processing. Still, the popularity of music may not be the only factor influencing its use in advertising. A few contend that this perspective ignores the idea of "musical congruency" in order to explain why consumers react the way they do to the music that is presented in advertising.

Background music has been used in advertising for a long time, only now scientific studies are proving that a soundtrack can improve the memorability of an advertising message. The conclusions that can be drawn from current research confirm that the use of background music in advertising messages can help make information more memorable.

In addition, the repetition of the soundtrack often evokes emotions in listeners, which also contributes to the memorization of the advertising message. Since recognizable music has the ability to evoke vivid and recall memories, an emotional response can enhance memorization. In addition, when a soundtrack is included, listeners' emotional response to an advertising message is heightened. This increases the effectiveness of all marketing communications, as customers who experience strong emotions are likely to interact with the brand more often.

References

1. Alpert, J.I., Alpert, M.I. (2005). Contributions from a musical perspective on advertising and consumer behavior // *NA-Advances in Consumer Research*. – Pp. 232-238. Available at: https://www.researchgate.net/publication/222646056_Purchase_occasion_influence_on_the_role_of_music_in_advertising. (Accessed 05.04.2024).

2. Chou, H.Y., Lien, N.H. (2010). Advertising effects of songs' nostalgia and lyrics' relevance // *Asia Pacific Journal of Marketing and Logistics*. – Pp. 314-329. Available at: https://www.emerald.com/insight/content/doi/10.1108/1355585101 1062278/full/html. (Accessed 01.04.2024).

3. Gorn, G.J. (1982). The effects of music in advertising on choice behavior: A classical conditioning approach // *The Journal of Marketing*. – Pp. 94-101. Available at: https://journals.sagepub.com/doi/10.1177/0022242982046 00109. (Accessed 05.04.2024).

4. Guido, G., Peluso, A.M., Mileti, A., Capestro, M., Cambo, L., and Pisanello, P. (2016). Effects of background music endings on consumer memory in advertising // *International Journal of Advertising*. – Pp. 504-518. Available at:

https://www.researchgate.net/publication/307597757_Effects_of_Background_Music_Endings_on_Consumer_Memory_in_Advertising. (Accessed 03.04.2024).

5. Huron, D. (1999). Music in advertising: An analytic paradigm. The Musical Quarterly. – Oxford University Press. – Pp. 557–574. Available at: https://www.researchgate.net/publication/249239998_Music_in_Advertising_An_Analytic_Paradigm. (Accessed 03.04.2024).

UDK 504.064.2.001.18

ECONOMIC AND STATISTICAL ASSESSMENT OF THE PRODUCTION OF THE MAIN TYPES OF TOBACCO PRODUCTS IN RUSSIA

Goncharova Anastasia Andreevna,
Student of the Institute of Economics and Management,
Belgorod State National Research University, Belgorod, Russia,
E-mail: 1429817@bsuedu.ru
Pakhomova Daria Konstantinovna,
Student of the Institute of Economics and Management,
Belgorod State National Research University, Belgorod, Russia,
E-mail: 1427219@bsuedu.ru
Mariasova Elena Anatolyevna,
Ph.D. in Philosophy,
Associate Professor of the Department of Foreign Languages and Professional Communication,
Belgorod State National Research University, Belgorod, Russia,
E-mail: mariasova@bsuedu.ru

Abstract: *This article examines the production of key tobacco products in Russia using economic and statistical analysis. The authors analyze the production trends of cigarettes, papirosy (Russian cigarettes), and cigars, as well as their export and import. The study is based on data from the Federal State Statistics Service (Rosstat) for recent years. The article also discusses the development trends of the Russian tobacco market and its impact on the country's economy.*

Keywords: *statistical analysis, industry analysis, economic and statistical methods, production dynamics, tobacco industry.*

Within the sphere of consumer goods production, the tobacco industry stands as a pivotal sector, representing a significant element of the Russian economy. The production of primary tobacco products – encompassing cigarettes, pipe and smoking tobacco, and cigars – is of considerable socio-economic significance to both the industry and the nation. This article undertakes an economic and statistical evaluation of the evolution of primary tobacco product manufacturing in Russia, scrutinizing production dynamics and discerning influential factors within the industry, aiming to enhance comprehension of its current standing and future developmental trajectories. Moreover, we will implement relevant analytical methodologies to afford readers a more comprehensive understanding of the industry's context and project potential trends in the immediate future [Dudin, Lyasnikov, Lezina, 2024: 285].

To initiate the analysis of primary tobacco product manufacturing, data retrieval from the Rosstat website is requisite [Dolgova, Medvedeva. 2024. 100]. This data is compiled in Table 1.

Table 1

Production of Major Types of Tobacco Products

	2018	2019	2020	2021	2022
Cigarettes, billion units	257	229	233	239	222
Papirosy made from tobacco or tobacco substitutes, million units	219	161	120	123	149

Knowing the data, we can calculate analytical and average metrics for the time series (Tables 2, 3).

Table 2

Cigarette Production Analysis

	2018	2019	2020	2021	2022
Absolute Growth (Base)	-	-28	-24	-18	-35
Absolute Growth (Chain)	-	-28	4	6	-17
Growth Rate (Base)	-	89,11	90,66	93,00	86,38
Growth Rate (Chain)	-	89,11	101,75	102,58	92,89
Rate of Increase (Base)	-	-99,11	-99,09	-99,07	-99,14
Rate of Increase (Chain)	-	-99,11	-98,98	-98,97	-99,07
Absolute Value	-	2,29	2,33	2,39	2,22

Table 3

Production Analysis of Papirosy Made from Tobacco or Tobacco Substitutes

	2018	2019	2020	2021	2022
Absolute Growth (Base)	-	-58	-99	-96	-70
Absolute Growth (Chain)	-	-58	-41	3	26
Growth Rate (Base)	-	73,52	54,79	56,16	68,04
Growth Rate (Chain)	-	73,52	74,53	102,50	121,14
Rate of Increase (Base)	-	-99,26	-99,45	-99,44	-99,32
Rate of Increase (Chain)	-	-99,26	-99,25	-98,98	-98,79
Absolute Value	-	1,61	1,20	1,23	1,49

Following this, it is necessary to find the average level of the time series. It is found using the formula [Eliseeva, 2024: 254]:

$$\overline{y} = \frac{\Sigma y}{n}, \text{ where}$$

n is the number of levels in the series.

From this formula, we obtain the following values for:

1. Cigarettes:

$$\overline{y} = \frac{257 + 229 + 233 + 239 + 222}{5} = 236$$

2. Papirosy made from tobacco or tobacco substitutes:

$$\overline{y} = \frac{219 + 161 + 120 + 123 + 149}{5} = 154{,}4$$

Next, we determine the average absolute increase separately for each type of production using the formula [Melkumov, 2023: 81]:

$$\Delta\overline{y} = \frac{\Delta y_n}{n}$$

From this equation, we obtain the following results for:

1. Cigarettes:

$$\Delta\overline{y} = \frac{-17}{4} = -4{,}25$$

2. Papirosy made from tobacco or tobacco substitutes:

$$\Delta\overline{y} = \frac{26}{4} = 6{,}5$$

Then, it is required to determine the average growth rate using the formula [Yakovenko, 2022:111]:

$$\overline{STR} = \sqrt[n]{Tn}$$

From this equation, we find the following results for:

1. Cigarettes:

$$\overline{STR} = \sqrt[4]{22{,}2} = 2{,}171$$

2. Papirosy made from tobacco or tobacco substitutes:

$$\overline{STR} = \sqrt[4]{14{,}9} = 1{,}965$$

We determine the average growth rate increase using the formula:

$$\overline{TPR} = \overline{TR} - 100$$

Therefore, the following values are obtained for cigarettes and papirosy:

1. Cigarettes:

$$\overline{TPR} = 217{,}1 - 100 = 117{,}1$$

2. Papirosy made from tobacco or tobacco substitutes:

$$\overline{TPR} = 196{,}5 - 100 = 96{,}5$$

Using the data, it is also necessary to identify the main development trends of the phenomenon using the method of analytical smoothing with a straight line (Tables Melkumov, 2023; Yakovenko, 2022).

Table 4

Cigarette Production Analysis

Years	**Cigarette Production**	**t**	**t^2**	**y*t**	**y_t**	**$(y-y_t)^2$**
2018	257	-2	4	-514	248	81
2019	229	-1	1	-229	242	169
2020	233	0	0	0	236	9
2021	239	1	1	239	230	81
2022	222	2	4	444	224	4
Total	1180	0	10	-60	1180	344

To determine yt, a system of normal equations must be formulated.

$$\begin{cases} 5a_0 + a_1 0 = 1180 \\ a_0 0 + 10a_1 = -60 \end{cases}$$

$$\begin{cases} 5a_0 = 1180 \\ 10a_1 = -60 \end{cases}$$

$$\begin{cases} a_0 = 236 \\ a_1 = -6 \end{cases}$$

Then, the equation of the straight line takes the form:

$$236 - 6 * t$$

Table 5

Production Analysis of Papirosy Made from Tobacco or Tobacco Substitutes

Years	Papirosy Production	t	t^2	y*t	y_t	$(y-y_t)^2$
2018	219	-2	4	-438	190	841
2019	161	-1	1	-161	172,2	125,44
2020	120	0	0	0	154,4	1183,36
2021	123	1	1	123	136,6	184,96
2022	149	2	4	298	118,8	912,04
Total	772	0	10	-178	772	3246,8

The identical analytical process is applied to this data as was used for the cigarette data.

$$\begin{cases} 5a_0 + a_1 0 = 772 \\ a_0 0 + 10a_1 1 = -178 \end{cases}$$

$$\begin{cases} 5a_0 = 772 \\ 10a_1 = -178 \end{cases}$$

$$\begin{cases} a_0 = 154,4 \\ a_1 = -17,8 \end{cases}$$

Then, the equation of the straight line takes the form:

$$154,4 - 17,8 * t$$

The results of the calculations will be presented graphically.

For cigarettes (Figure 1):

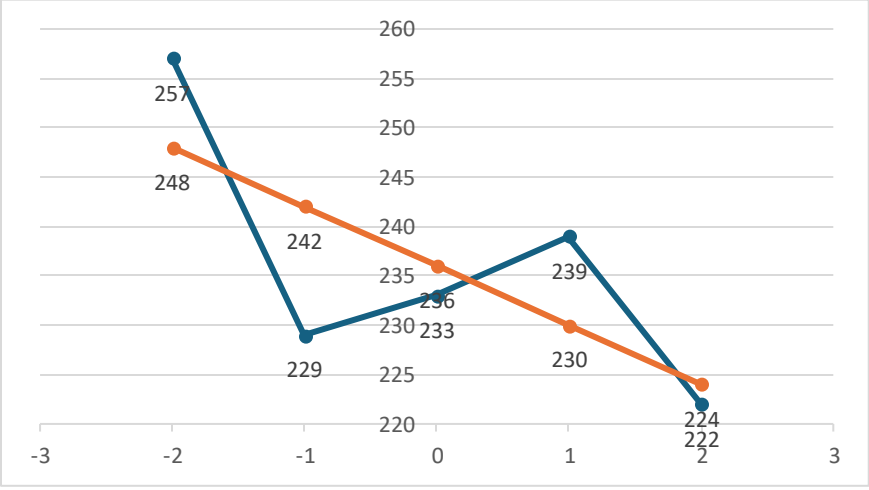


Figure 1. Cigarette Production Chart

For papirosy made from tobacco or tobacco substitutes (Figure 2):

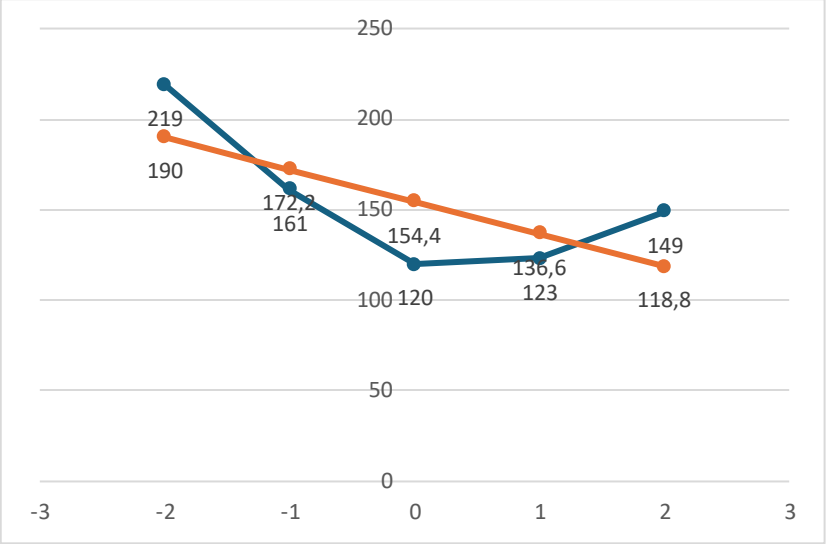


Figure 2. Production Chart of Papirosy Made from Tobacco or Tobacco Substitutes.

As a result of the analytical smoothing with a straight line, there is a main trend towards decreasing production of cigarettes and papirosy made from tobacco or tobacco substitutes in 2018-2022.

Next, we will determine the forecast for cigarette production for 2025 based on:

1. Based on the average absolute increase:

$$y_{25} = 222 + (-4{,}25) * 3 = 209{,}25$$

2. Based on the average growth rate:

$$y_{25} = 222 * 2{,}171^3 = 2271{,}6$$

3. Based on the analytical smoothing with a straight line:

$$y_{25} = 236 - 6 * 7 = 194$$

With a number of degrees of freedom of n-m=3 $t\alpha = 3{,}1825$.

$$Sy = \sqrt{\frac{841 + 125{,}44 + 1183{,}36 + 184{,}96 + 912{,}04}{3}} = 32{,}9$$

$$194 - 3{,}1825 * 32{,}9 \leq y \leq 194 + 3{,}1825 * 32{,}9$$

$$89{,}3 \leq y \leq 298{,}7$$

With a probability of 0.95, we can state that in 2025 the expected sale of cigarettes will be in the range of 159.70 to 228.30.

Forecast of papirosy production (from tobacco or tobacco substitutes) for 2025 based on:

1. Based on the average absolute increase:

$$y_{25} = 149 + 6{,}5 * 3 = 168{,}5$$

2. Based on the average growth rate:

$$y_{25} = 149 * 1{,}965^3 = 1130{,}5$$

3. Based on the analytical smoothing with a straight line:

$$y_{25} = 154{,}4 - 17{,}8 * 7 = 29{,}8$$

With a number of degrees of freedom of n-m=3 $t\alpha = 3{,}1825$.

$$Sy = \sqrt{\frac{81 + 169 + 9 + 81 + 4}{3}} = 10{,}7$$

$$29{,}8 - 3{,}1825 * 10{,}7 \leq y \leq 29{,}8 + 3{,}1825 * 10{,}7$$
$$-4{,}2 \leq y \leq 63{,}8$$

With a probability of 0.95, we can state that in 2025 the expected sale of papirosy made from tobacco or tobacco substitutes will be in the range of -4.55 to 64.15.

Analysis of the economic and statistical data on the production of major types of tobacco products in Russia allows us to draw the following conclusions. A significant amount of tobacco products are produced in Russia, which indicates a high demand for them among the population.

The production of tobacco products has a significant impact on the country's economy, thanks to the creation of new jobs and the increase in production volume.

At the same time, it is necessary to take into account the negative consequences of tobacco consumption for the health of the population, which requires the adoption of appropriate measures to regulate this market.

Thus, an economic and statistical assessment of the production of major types of tobacco products in Russia allows for a deeper understanding and study of the dynamics of this sector of the economy, which is important for making informed decisions in this area.

References

1. Dolgova, V.N. (2024). Statistika [Statistics]. – M.: Izdatel'stvo YUrajt. – 278 p. (in Russian)

2. Dudin, M.N. (2024). Statistika: uchebnik i praktikum dlya vuzov [Statistics: textbook and practical guide for universities]. – M.: Izdatel'stvo YUrajt. – 381 p. (in Russian)

3. Eliseeva, I.I. (2024). Statistika: uchebnik i praktikum dlya vuzov [Statistics: textbook and practical guide for universities]. – M.: Izdatel'stvo YUrajt. – 388 p. (in Russian)

4. Melkumov, YA.S. (2023). Social'no-ekonomicheskaya statistika: uchebnoe posobie [Socio-economic statistics: textbook]. – M.: NIC INFRA-M. – 186 p. (in Russian)

5. Yakovenko, L.I. (2022). Statistika: cocial'no-ekonomicheskaya statistika [Statistics: socio-economic statistics]. – Novosibirsk: Novosibirskij gosudarstvennyj tekhnicheskij universitet. – 244 p. (in Russian)

UDK 339.721

DIGITALIZATION OF THE ECONOMY: HOW TECHNOLOGIES ARE CHANGING FINANCIAL OPERATIONS AND CONSUMER HABITS

Ivanisova Kseniya Eduardovna,
Student of the Institute of Economics and Management,
Belgorod State National Research University, Belgorod, Russia,
E-mail: ivanisova135790@gmail.com
Mariasova Elena Anatolyevna,
Ph.D. in Philosophy,
Associate Professor of the Department of Foreign Languages and Professional Communication,
Belgorod State National Research University, Belgorod, Russia,
E-mail: mariasova@bsuedu.ru

Abstract: *The article examines the impact of digitalization of the economy and the development of financial technologies on the financial sector and consumer behavior. The main digital financial technologies are analyzed, such as blockchain, artificial intelligence, big data, cloud*

computing etc., as well as digital financial products and services created on their basis. It is shown how the introduction of digital innovations transforms traditional financial operations and business models, changing the role of banks and other financial organizations. The advantages and risks of digital finance in terms of accessibility, efficiency and security are considered. The conclusion is made about the need for further study of the impact of digitalization on the financial sector and consumer behavior.

Keywords: *digitalization of the economy, financial technologies, fintech, blockchain, cryptoassets, digital financial assets, transformation of the financial sector, digital financial services*.

Digital technologies are rapidly penetrating all spheres of the economy and public life, radically transforming established processes, business models and consumer behavior. This process is especially pronounced in the financial sector, where digital innovations are creating new products, services and entire markets, as well as changing the role of traditional players – banks, insurance companies, investment funds. As noted by A.S. Linnikov and O.V. Maslennikov, "the development of financial technologies leads to fundamental transformations of the traditional financial system" [Linnikov, 2019].

The scale and speed of digital changes in the financial industry are unprecedented. According to Y.A. Altynov, we are witnessing the formation of "financial metaverses," in which the boundaries between the real and virtual worlds are blurring, and all financial transactions take place in a digital environment [Altynov, 2023]. However, this process involves not only new opportunities, but also serious challenges and risks that require careful analysis and understanding.

In this article, we will examine what digital financial technologies are being introduced at the current stage, how they affect traditional financial services and consumer behavior, and analyze the main advantages and risks of digitalization of the financial sector. This will allow us to form a holistic picture of the digital transformation of finance and better understand the essence of the changes taking place.

The methodological basis of the study consisted of general scientific methods of analysis, synthesis, comparison, generalization, as well as a systematic approach. The information base was scientific articles by Russian researchers devoted to the development of digital financial technologies and their impact on the financial sector, as well as statistical data from open sources.

Results The main digital financial technologies and products The digital transformation of the financial sector is taking place thanks to the introduction of a whole range of interrelated technologies, collectively called "fintech". Key fintech technologies include blockchain and distributed ledgers, big data and analytics, artificial intelligence and machine learning, cloud computing, Internet of Things, open APIs, robotics, biometrics [Linnikov, 2019]. These technologies not only change the way traditional financial services are delivered, making them faster, more convenient and accessible, but also create fundamentally new products and entire markets.

One of the most well-known and discussed fintech innovations is cryptocurrencies and the underlying blockchain technology. Blockchain allows the creation of decentralized distributed ledgers in which transactions are verified and recorded by all network participants without a central controlling authority. This paves the way for the development of "decentralized finance" (DeFi) – an ecosystem of financial applications and protocols

built on the blockchain. DeFi offers an alternative to traditional financial intermediation, providing the ability to make payments, lending, investing, and trading assets directly between participants through smart contracts without banks [Smirnova, 2023].

A new class of assets is emerging on the basis of blockchain – digital financial assets (DFAs), representing property rights in electronic form. DFAs can include digital currencies, tokens, crypto assets, and their issuance, accounting and circulation takes place entirely in information systems [Dudikova, 2023]. This creates opportunities for tokenization of real assets, increasing the liquidity and accessibility of investments. At the same time, risks arise associated with the high volatility and speculation of the crypto market, the need for regulation and protection of consumer rights.

Big data, artificial intelligence and machine learning are used by financial organizations to analyze huge arrays of structured and unstructured customer information, their behavior and transactions. This allows them to better understand the needs and preferences of consumers, create personalized offers for them, automate scoring and underwriting when issuing loans, and detect fraud. Big data processing technologies give financial companies competitive advantages and the ability to provide previously unavailable services [Filippov, 2019].

Cloud computing provides access to computing resources and services over the Internet, allowing financial organizations to reduce IT infrastructure costs and quickly deploy and scale new products and services. Open APIs enable secure data exchange between various financial market participants, including non-bank organizations, and the construction of innovative services on top of existing systems.

Mobile financial applications are becoming the main channel for consumer interaction with financial services. Thanks to smartphones, users can check their balance, make a payment, transfer, apply for a loan or insurance, consult with a chatbot at any time and anywhere. Biometric identification technologies by face, voice, and fingerprint make mobile banking even more secure and convenient.

The impact of digital technologies on financial services and consumers Digital technologies are radically changing the landscape of the financial services industry, creating new products, business models and ways of interacting with customers. Thanks to the introduction of fintech, the following is happening:

1. Transformation of payments and transfers. Online and mobile payment services, instant peer-to-peer (p2p) transfers, contactless and biometric payments are emerging. This makes transactions faster, cheaper and more convenient.

2. Development of alternative online lending. Consumers and small businesses gain access to loans through specialized P2P platforms that directly connect borrowers and investors. The process of obtaining a loan becomes completely digital, simpler and more personalized.

3. Democratization of investment and trading. Thanks to robo-advising, social trading, algorithmic trading, the barriers for private investors to enter financial markets are significantly reduced. Anyone with a smartphone can create an investment portfolio or start trading on the exchange.

4. Personalization of financial services. Analysis of big data on customer behavior and preferences allows financial organizations to offer products and services that best meet individual needs – be it a mortgage, insurance or investment plan.

5. Increasing financial inclusion. Digitalization removes many barriers (geographical, price, information) to accessing basic financial services, making them more inclusive. People not covered by the traditional financial system can gain access to payments, savings, loans through a mobile phone.

At the same time, digitalization brings new risks and problems that need to be addressed:

- Security of customer data and funds. As financial transactions move online, the risks of cyber attacks, personal data leaks, and digital fraud increase. Consumer protection mechanisms are needed.
- Stability of the financial system. The rapid growth of fintech companies and products can increase systemic risks and create the preconditions for "bubbles" in new markets. Regulators need to find a balance between supporting innovation and ensuring the stability of the financial sector.
- Digital inequality and protection of vulnerable categories. Despite the expansion of access to digital financial services, there are still groups of the population (elderly people, rural residents, low-income people) who may experience difficulties using them. It is important to provide mechanisms for their support and training in digital literacy.

In conclusion, it can be stated that under the influence of digital technologies, the financial industry is experiencing tectonic shifts. Traditional financial institutions are forced to compete or cooperate with dynamic fintech startups offering innovative solutions. The usual service delivery and customer interaction models are changing. New markets and value creation methods are emerging.

Digitalization opens up enormous opportunities for increasing the accessibility, efficiency, speed and personalization of financial services. Thanks to the introduction of digital technologies, the financial system is becoming more open, inclusive and focused on the needs of customers. At the same time, new risks and challenges arise for regulation, ensuring stability, security and consumer protection.

It is obvious that the digital transformation of the financial sector will only accelerate, covering new products and market segments. Further research in this direction should be aimed at a comprehensive analysis of the impact of digitalization on the business models of financial organizations, consumer behavior and preferences, the functioning of capital markets, as well as regulatory and supervisory methods in the new environment. This will provide a better understanding of the nature of the changes taking place and allow the potential of digital financial innovations to be harnessed for the benefit of society while minimizing possible negative consequences.

References

1. Altynov, Y.A. (2023). Institucional'nye osnovy sozdaniya i funkcionirovaniya finansovyh metaversov v obshchestvennom sektore [Institutional foundations for the creation and functioning of financial metaverses in the public sector] // *Ekonomika i upravlenie: problemy, resheniya*. – T. 1. – № 5 (137). – Pp. 81-87. (in Russian)

2. Dudikova, E.I. (2023). Asimmetriya vospriyatiya modernizacii denezhnogo obrashcheniya v vektore izmeneniya ekonomicheskogo uklada [Asymmetry of perception of modernization of money circulation in the vector of changing the economic structure] // *Intellekt. Innovacii. Investicii*. – № 3. – Pp. 28-41. (in Russian)

3. Filippov, D.I. (2019). Finansovye innovacii v usloviyah razvitiya cifrovoj ekonomiki [Financial innovations in the conditions of development of the digital economy] // *Kreativnaya ekonomika*. – T. 13. – № 8. – Pp. 1503-1520. (in Russian)

4. Linnikov, A.S., Maslennikov, O.V. (2019). Harakteristiki otdel'nyh elementov sistemy finansovyh tekhnologij [Characteristics of individual elements of the financial technology system] // *Izvestiya vysshih uchebnyh zavedenij*. – Seriya: ekonomika, finansy i upravlenie proizvodstvom. – № 4 (42). – Pp. 38-47. (in Russian)

5. Smirnova, V.V., Pravkin, S.A. (2023). Pravovye aspekty regulirovaniya cifrovyh prav na finansovom rynke [Legal aspects of regulation of digital rights in the financial market] // *Aktual'nye problemy razvitiya social'no-ekonomicheskih sistem: praktika i teoriya. Sbornik nauchnyh statej Vserossijskoj nauchno-prakticheskoj konferencii*. – Kursk. – Pp. 217-220. (in Russian)

UDK 006.071

ANALYTICAL CAPABILITIES OF STATISTICAL METHODOLOGY FOR ASSESSING THREATS TO ECONOMIC SECURITY

Shevelyova Daria Vitalievna,
Student of the Institute Economics and Management,
Belgorod State National Research University, Belgorod, Russia,
E-mail: 1688726@bsuedu.ru
Mariasova Elena Anatolyevna,
Ph.D. in Philosophy,
Associate Professor of the Department of Foreign Languages and Professional Communication,
Belgorod State National Research University, Belgorod, Russia,
E-mail: mariasova@bsuedu.ru

Abstract: *The authors of the article carried out statistical modeling in the context of clusters formed during the study, reflecting the specification of their constituent regions based on the application of statistical methodology for the typologization of regions of the Russian Federation and the construction of multifactorial statistical models that quantify the impact of factors on the level of economic crime.*

Keywords: *economic security, economic crime, material damage from economic crimes, statistical modeling of economic security.*

In accordance with the Strategy of Economic Security of the Russian Federation for the period up to 2030, our country strives to ensure economic stability, prioritizing the fight against corruption, fraud with public funds and crimes in the economic sphere. These problems, recognized as serious threats to the economic well-being of the country, require active actions and targeted policies.

The country's internal affairs agencies focus their efforts on countering economic crime, and the effectiveness of such efforts directly depends on the depth and accuracy of the analysis of these crimes. A key element of the strategy is the development of effective mechanisms to identify and minimize risks, which ultimately should contribute to strengthening the economic security of the state [Vorob'eva, 2023].

Quite large amounts of statistical data collected from various regions of Russia require a comprehensive organization. This is achieved through their careful systematization and classification. To optimize this process, the use of multidimensional classification techniques is assumed. This approach makes it possible to fully take into account the impact of all available indicators and form data groups characterized by internal similarity.

Crimes of an economic nature form a complex social problem characterized by many factors and having a long history of development that goes hand in hand with the history of society itself. As an object of statistical analysis, economic crime demonstrates the need for a multidimensional study to develop effective counteraction measures [Dolbilov, 2022].

Economic crime introduces a huge variety of different variables, which are collected and analyzed by the statistical units of the Ministry of Internal Affairs of the Russian Federation. These data are carefully compiled and quickly integrated into national reporting.

To measure the impact of economic crimes, the indicator of total material damage (designated as Y) was chosen, which is directly related to the consequences of the crimes committed. Additional variables that influence this result (designated as X1, X2, ..., X7), including their characteristics and time frames, are presented in detail in Table 1. This structured information contributes to a deeper understanding of the dependencies and interactions between various aspects of economic crimes.

Due to the time delays between the manifestations of economic crimes and the identified consequences, a time lag is detected that does not exceed one year. In other words, certain factors can serve as predictors for future developments in this area. This means that when conducting a time-dependent analysis, the factors are usually considered as preceding the results.

Within the framework of this study, it is desirable to use the cluster analysis method with single metric indicators in the "ball space" for spatial modeling, as recommended in the statistical scientific literature and confirmed by repeated practice.

Carrying out statistical verification, after excluding certain subjects such as Moscow, St. Petersburg and the Leningrad Region, the Moscow and Astrakhan regions, as well as the Republic of Tatarstan, the coefficient of variation stabilized. This indicates that this coefficient no longer changes in response to fluctuations in the number of elements under consideration, even if the coefficient value still slightly exceeds the critical level.

Based on this, for the purposes of multidimensional clustering, the data array used will include 79 regions. For the subsequent integrated multifactorial regression analysis, it is necessary that the number of regions in the analyzed dataset exceed the number of factors included in the regression model, in accordance with the principles of mathematical statistics. This will ensure that the data is sufficient for reliable dependency modeling [Borshchenko, 2019].

As part of the typological analysis, five clusters were formed, the number of each of which meets or exceeds the minimum criterion in nine regions. The results of the distribution of these clusters are presented as follows: the first cluster has 15 regions, the second – 23, the third and fourth – 15 and 14 regions each, respectively, and the fifth includes 12. This distribution, together with the variation of the average indicators reflecting the level of economic crime in each cluster, is visually presented in Figure 1.

To fulfill the conditions imposed by mathematical statistics on the data structure in regression analysis, i.e., the ratio between the number of observations (rows) and the number of analyzed indicators (columns), it was necessary to combine some clusters. Such data manipulations ensure compliance with the criterion that the number of

observed units should be greater than the number of variables that describe these units, in this case regions, and, as a result, the cluster itself. As a result of this adjustment, table 1 shows the updated division of regions into adjusted clusters.

Table 1

Multidimensional grouping of Russian regions by main indicators of socio-economic development and economic crime, billion rubles

Cluster№	Number of regions	2022						2023	
		Investments in fixed assets	Agricultural products	Commissioning of residential buildings, thousand square meters of total area	Retail trade turnover	Net financial result (profit minus loss) of organizations' activities	Expenses of consolidated budgets	The number of economic crimes identified by the units of the Department of Internal Affairs	The amount of material damage caused in completed and suspended criminal cases, thousand rubles.
		X1	X2	X3	X4	X5	X6	X7	Y
	15	41,1	14,5	186,9	67,9	32,8	47,8	156,8	274988,0
2	23	112,9	41,0	454,6	202,3	71,8	90,0	420,0	510796,3
3	15	211,3	71,2	636,3	270,6	276,9	183,5	710,3	852605,8
4	14	299,4	133,9	1055,9	458,6	340,3	186,6	762,1	1529525,0
5	12	312,2	210,8	1817,3	710,7	383,4	225,6	1648,0	2173673,7

The study identified five thematically similar and structurally homogeneous clusters, each of which has its own unique characteristic. The first cluster unites regions with relatively small territories and populations, where economic activity is on a smaller scale than in other regions of the country. These regions are distributed across the entire geography of Russia – from Karelia to Sevastopol and from Ingushetia to Primorsky Krai.

The next, second cluster, economically has features similar to the first cluster, but differs in key quantitative parameters, which is confirmed by the analysis of the data in Table 1.

The third and fourth clusters can also be noted for their unique features in the absolute values of economic activity indicators and the level of economic crime. However, both have similar economic characteristics, which can be described as a combination of agricultural and industrial elements.

Finally, the fifth cluster is a group of large industrial regions with expanded development of manufacturing industries and agricultural processing, engaged in the export of grain crops and well-developed recreational and tourist infrastructure.

Figure 1 shows the structure of the distribution of Russian regions by individual clusters. Additionally, this figure illustrates the average level of material damage and the number of economic crimes in each cluster in 2023.

There is a noticeable pattern in the distribution of data: the Z vector, which integrates the entire range of studied indicators reflecting both the socio-economic development of regions and the level of economic crime, obeys the normal distribution of random numbers [Afanas'ev, 2022].

Table 1 is an organized display of average indicators that only emphasize the existing relationship: as the group increases in order, all indicators also increase in average quantitative terms. This suggests that the growth in such areas as investment activity, agriculture, housing construction, as well as manufacturing, which is characterized by balanced financial results and budget expenditures, leads to an increase in economic crime. This is reflected both in the frequency of offenses that occur and in the full amount of material damage associated with completed and suspended criminal cases.

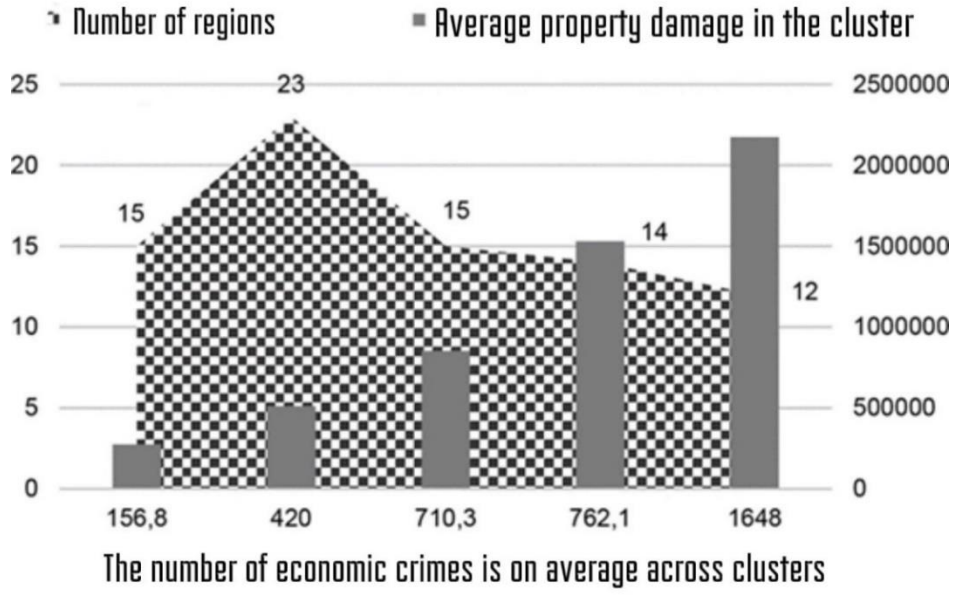


Figure 1. Distribution of Russian regions by cluster, average indicators of material damage (thousand rubles) and the number of economic crimes in 2023.

In international statistical practice, there are observations indicating situations where an increase in the number of economic crimes does not lead to a commensurate increase in material damage. Such a phenomenon can be interpreted as a decrease in the average severity of each individual crime, reflecting the "lightness" of such crimes as a socio-economic phenomenon. This can also be considered a merit of the law enforcement system and the legislature, indicating the effectiveness of their work in preventing and combating crime. Nevertheless, analyzing the situation in Russia, we do not find sufficient grounds for such conclusions when it comes to the Russian economy as a whole.

References

1. Afanas'ev, V.I., Suslov, D.A., Chuev, S.V. (2022). Sovetskii opyt razvitiia ekonomicheskogo i promyshlennogo potentsiala v usloviiakh sanktsii [The Soviet experience of developing economic and industrial potential under sanctions] // *Neftianoe khoziaistvo*. – № 22. – Pp. 156-160 (in Russian)

2. Borshchenko, A.I. (2019). Primenenie statisticheskikh metodov v izuchenii deiatel'nosti ubytochnykh organizatsii [The use of statistical methods in the study of the activities of unprofitable organizations] // *Vestnik Moskovskogo universiteta MVD Rossii*. – № 7. – Pp. 289-299 (in Russian)

3. Dolbilov, A.V. (2022). Otdel'nye aspekty protivodeistviia sovershenіiu kiberprestuplenii v finansovo-kreditnoi sfere [Selected aspects of countering the commission of cybercrimes in the financial and credit sphere] // *Kriminologicheskii zhurnal*. – № 1. – Pp. 87-90 (in Russian)

4. Vorob'eva, S.V. (2023). Ekonomicheskaia bezopasnost' Rossiiskoi Federatsii v svete kriminalizatsii ekonomicheskikh otnoshenii [Economic security of the Russian Federation in the light of the criminalization of economic relations] // *Aktual'nye problemy gosudarstva i prava*. – T. 7. – № 2 (26). – Pp. 249-262. (in Russian)

UDK 338.2

THE ECONOMIC SECURITY OF A PERSON IN MODERN CONDITIONS OF THE RUSSIAN FEDERATION DEVELOPMENT

Matvienko Valeria Gennadievna,
Student of the Institute of Economics and Management,
Belgorod State National Research University, Belgorod, Russia,
E-mail: Valeria.matvienko.04@mail.ru
Mariasova Elena Anatolyevna,
Ph.D. in Philosophy,
Associate Professor of the Department of Foreign Languages
and Professional Communication,
Belgorod State National Research University, Belgorod, Russia,
E-mail: mariasova@bsuedu.ru

Abstract: *The article focuses on the economic security of a person in modern conditions of the Russian Federation development. Nowadays the economic security of a person is a part of national economic security. It should be considered as a part of a system which includes society-person-country.*

Keywords: *the economic security, the economic security of Russia, nation, the country economic security, the national security, individual, development of the state.*

There are different kinds of personal security. That is because of that fact that a person is a biosocial system and takes part in both sides of life simultaneously. On the one hand he is a member of society. He needs a protection by the government and a country. That means that a person should be protected by social norms and traditions which exist in the certain country. Furthermore, citizens should have a protection by the law. In the state where a person lives he must have material security (protection of his property,

economic etc.), everyday security (his life support system, protection of housing etc.), the economic security. On the other hand, a human is a living organism existing in the surrounding environment. That means that his physical state also must be protected and safe. The state must protect all kinds of security of a person. The government should protect people, all social groups of the country and the nation in general.

The economic security of a person is a part of the country economic security and the main part of the national security. At the moment, the modern world needs the economic security of a person as a priority. The significance of human capital has become more important then ever. The connection between the development of the state and the personal development are growing up very quickly [Beloviczkij, 2021].

The main and the most important factor of the stable development of the state is the economic security. It is also important to mention that personal, social and state security are interconnected. One of them cannot be provided if the other two are not taken into consideration.

The economic security of a nation is a fundamental pillar of its overall stability and growth, particularly in the context of the Russian Federation's ongoing development. In modern conditions, the economic security of Russia must be understood as an intricate interplay between national interests and individual well-being.

The concept of economic security encompasses not only the safeguarding of state resources but also the assurance that individuals can achieve a decent standard of living. This dual focus is critical for fostering both personal prosperity and national resilience against external shocks. The development of the state hinges on its ability to create an environment where citizens feel secure in their economic pursuits, thereby contributing to collective growth [Gureeva, 2016].

Furthermore, as Russia navigates complex geopolitical landscapes and domestic challenges, it becomes increasingly imperative to prioritize strategies that bolster both country-wide economic security and individual financial stability. The alignment of these objectives will ultimately enhance national security, allowing for sustainable development that benefits all segments of society.

Many famous researchers study the question of the economic security. For example, such scientists as Senchagov, Savin, Abalkin. In Russia, there is a lack of consensus on the definition of this category. However, the prevailing interpretation suggests that economic security for an individual encompasses the sphere of personal activities aimed at safeguarding one's interests from economic and legal perspectives. The scientists say that in the absence of economic security of the individual, security in general sense is impossible, and vice versa. That means that social and state stability are under threat. The state's ignorance of personal interests makes the citizens of the country unpleased with their government and as a result social tension grows.

In Russian legislation, security is viewed as a collective concept encompassing the individual, society, and the state. National security in the Russian Federation is understood as the collective safeguarding of individuals, society, and the state from internal and external threats. This approach enables the realization of individuals' rights and freedoms as outlined in the Constitution while also establishing quality standards for the population's well-being, territorial integrity, sustainable development, and overall security.

The interconnected relationship between the individual, society, and state forms the essence of national security, each with distinct characteristics that collectively contribute to the overall security framework. These characteristics are not isolated within individual components but rather interact and intertwine in a specific direction during the process of their interplay. This interconnection underscores the holistic nature of national security, where the collaboration and alignment of these components are essential for ensuring a comprehensive security framework [Kuzneczova, 2021].

As a result of the above is that the fact that national security determines a three-level hierarchy. In this hierarchy every component is equally significant and important. Below there is the hierarchy of the component of the national security (Figure 1).

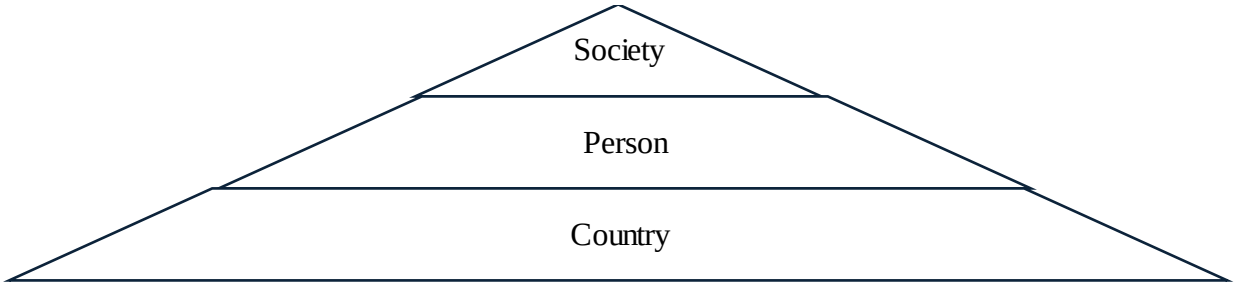


Figure 1. The place of economic security of the individual in the hierarchy of Russian national security

The hierarchical structure outlined above emphasizes that personal economic security is intricately linked to the moral and legal framework, as well as public institutions that facilitate opportunities for individuals to develop their skills and meet their needs. Similarly, public economic security is established through the construction of public institutions, legal norms, and a collective consciousness that enables the realization of rights and freedoms for all segments of the population. It is important to note that economic security relies on effective management mechanisms and coordinated functioning of public groups and protective institutions. In essence, separating the economic security of an individual, society, or state is challenging, as they often face common threats and risks, underscoring the interconnected nature of economic security within the broader societal context [Kuzneczova, 2021].

Nowadays in the Russian Federation there are some problems with providing the economic security. The absence of a comprehensive legal framework for implementing economic reforms poses a significant challenge to addressing this issue effectively. Ensuring economic security necessitates a combination of political, economic, social, legal, specialized, and propagandistic measures. These measures should be integrated into a cohesive program with a conceptual approach that aligns with a unified set of goals and objectives. By harmonizing these various components into a unified strategy, a more holistic approach can be adopted to safeguard economic security and address the complexities associated with it [Beloviczkij, 2021].

All the questions of unified Russian economic security can be solved only by the stable functioning of all sectors of the economy of the country. For this high technology must be used. Furthermore, it is essential that the key sectors correspond by offering raw materials of high quality, services, and products that meet the needs of the

population, as well as competitive values for the trading market. This implies that economic security must be guaranteed across all levels of the aforementioned hierarchy to achieve security at both individual levels and overall national economic security. Failing to ensure economic security at each level may impede the attainment of security at various levels and hinder the overall economic security of the nation.

A critical issue facing economic security in Russia currently is the lack of a consolidated definition of "economic security" within the country's legislation, despite numerous definitions available in academic literature. In normal market conditions, both at the state and international levels, the interests of business entities are often in conflict with one another as they compete. Consequently, achieving absolute, complete, and ultimate economic security in parallel can be challenging, as enhancing the economic security of one entity may result in the other side. Conversely, the other party may experience a reduction in resources, decreased income, and face socio-economic losses, ultimately leading to a decrease in economic security. These dynamic underscores the complexities involved in balancing economic interests and security concerns in a competitive market environment [Kuzneczova, 2021].

Considering everything that was said above it is important to mention that there should be a balance between personal, public and country interests in the national economic complex. The fulfillment of interest is the result of protective measures in countering any threats, in other words, the unity of circumstances and factors representing potential damage.

In conclusion it should be mentioned that nowadays the question of the economic security of a person became much more interesting for scientific world. Nowadays much attention is paid to interests of a person in the aggregate complex of implementing the economic security at the national level. A citizen is the main part in each of the components of the economic security structure.

The economic security of a person is its consideration in the form of personal capabilities and readiness to create an appropriate degree of independent security and his own development in the circumstances of the formation by state institutions of such levers for the implementation and protection of significant personal interests, according to which it is possible to implement a constant and balanced improvement of the state economy and the country as a whole as a modernizing system independent of the outside world.

Good economic security of a person determines the most stable economic complex and more developed economic security. The modern world dictates the development in the future for the procedures of providing economic security, which is interpreted from the position of its growth for the individual, associated with the stability of personal processes and actions.

References

1. Beloviczkij, K.B. (2021). Osnovy` e`konomicheskoj bezopasnosti [Fundamentals of economic security]. – M.: Dashkov i K. – 218 p. (in Russian)

2. Gureeva, M.A. (2016). E`konomicheskaya bezopasnost` lichnosti v sovremennoj Rossii [Economic security of the individual in modern Russia] // *Simvol nauki*. – №4-1. – Pp. 57-63. (in Russian)

3. Kuzneczova, E.I. (2025). E`konomicheskaya bezopasnost` [Economic Security]. – M.: Izdatel`stvo Yurajt. – 338 p. (in Russian)

UDK 528.9

DEVELOPMENT OF LADDER DEPOSITS OF BANKS

Sukhomlinova Darya Yurievna,
Student of the Institute of Economics and Management,
Belgorod State National Research University, Belgorod, Russia,
E-mail: 1631579@bsuedu.ru
Zubko Antonina Dmitrievna,
Student of the Institute of Economics and Management,
Belgorod State National Research University, Belgorod, Russia,
E-mail: 1627749@bsuedu.ru
Mariasova Elena Anatolyevna,
Ph.D. in Philosophy,
Associate Professor of the Department of Foreign Languages
and Professional Communication,
Belgorod State National Research University, Belgorod, Russia,
E-mail: mariasova@bsuedu.ru

Abstract: *This article is devoted to ladder deposits and their features. Ladder deposits are an innovative financial tool that allows you to increase the profitability of bank deposits. The depositor can independently form a "ladder" of deposits or use ready-made offers from banks. In the course of the study, some offers from such leading Russian banks as Sberbank, T-Bank, Alfa-Bank and VTB were analyzed. As a result of the study, the authors identified both the advantages and disadvantages of ladder deposits, as well as assessed the prospects for further development of this tool.*

Keywords: *ladder deposits, bank deposits, deposits, banks, capital preservation and multiplication, savings.*

Thousands of people use bank deposits in order to save and increase their own capital. This is really convenient – if you have a free amount of money, you can put it at an interest rate in the bank for a long period of time, and after it expires, you can withdraw a large amount. However, one of the huge disadvantages of deposits is the fact that if you need срочноto withdraw funds urgently, and the term for which размещеныthe money was placed has not yet passed, the amount of accrued interest is burned out, or it is charged at the minimum rate (for example, if the deposit is closed early in Sberbank, the rate will be 0.01%). In addition, banks periodically increase the deposit rate, which makes a previously opened deposit less profitable.

More experienced users of bank deposits use ladder deposits, as they help to avoid the above difficulties and extract maximum profit without much risk. Ladder deposits are the opening of several deposits (usually 3 or more) with a high interest rate for different periods in two or more banks. Such deposits can be opened for the same period with a short time interval, or on the same day for different periods (for example, 3, 6, 9 and 12 months) [Usheva, Romanova, 2024]. This method will be most effective when investing a relatively large amount of money, and if the interest income is only a few thousand rubles, the meaning of the ladder is lost.

Special features of such deposits include:

1. Deposits must be opened for a short period of time (for example, 2-3 months). This will provide quick access to funds without losing interest, some of which, if necessary, can be withdrawn for further use, and the second part can be put on the next

deposit. Also, most banks offer the maximum rate for short-term deposits, and by typing the number of deposits they need, they worsen the terms of the offer. However, if you managed to put money at an attractive interest rate, it will remain unchanged for you. You can also regularly study new offers from banks, and for the convenience of tracking new offers, various forums are created where information about new deposits of various banks is published (for example, the Depositor's Bulletin).

2. New deposits should be opened every month or two, which will help you not to miss out on attractive offers and quickly respond to changes in the economy.

3. For deposits, you should choose offers with the maximum percentage. Here it is important to take into account that banks often do not offer the maximum percentage to those customers who have recently opened a deposit, so you have to use the services of several banks;

4. It is advisable to choose deposits with the possibility of depositing and withdrawing funds. The choice of the deposit to be replenished allows you to start with the minimum investment, and at the end of it transfer the main amount of funds.

Of course, banks do not benefit from such customer behavior. In this regard, the former often introduce restrictions. For example, they offer deposits for a long period without the possibility of withdrawal and replenishment, attracting a high percentage, which will be accrued only after the deposit expires. Or they introduce a limit on the number of open deposits.

It should be remembered that deposits in one bank with a total amount of up to 1.4 million rubles, including interest accrued at the time of the insured event, are subject to insurance compensation [Lossan, 2024]. Therefore, it is worth investing large amounts by distributing them to different banks.

Today, banks offer deposits with an already built-in ladder scheme. This means that the deposit is divided into 6-8 periods with a differentiated rate. Let's look at some offers from Russian banks for October 2024. Sberbank offers the "Best" ladder deposit, where the minimum investment amount will be 100,000 rubles. The deposit is divided into 6 periods with a maximum rate of 20%. The size of the rate in accordance with the deposit term is shown in Table 1.

Table 1

Deposit rates "The best" (Sberbank)

Term, month.	1-2	3-6	7-9	10-12	18-24	36
%	12,5	18,5	20	18	14,5	12

T-Bank offers a product called SmartVclad, which also has a differentiated rate for eight periods. You can get the highest percentage when choosing a non-top-up deposit. The minimum investment amount is 50,000 rubles, and the possible term of the deposit is from 2 months to 2 years. Table 2 shows the deposit rates and terms.

Table 2

Deposit rates "SmartVklad deposit rates" (T- Bank)

Term, month.	2	3	4-5	6	7-11	12	13-17	18-24
%	18,38	18,97	19,32	19,56	18,97	20,01	18,79	19,39

The maximum Alfa-Deposit rate in Alfa-Bank is 21%. The minimum deposit amount is 50,000 rubles. The deposit is available from 3 months to 3 years. Available conditions: with or without interest capitalization. Table 3 shows data on the deposit with a percentage capitalization.

Table 3

Alfa-Deposit rates (Alfa-Bank)

Term	92 days	123 days	184 days	276 days	1 year old	550 days	2 years old	3 years old
%	16,5	18	18,51	17	18,51	19,5	17	21

VTB also offers its clients a deposit with a differentiated rate – "VTB Deposit", which does not imply deposits or withdrawals. The minimum term is 3 months, and the maximum term is 3 years. The offer has several conditions: "Basic", "New depositor" and "New Money". The latter two have an increased rate of 21%. You can open a deposit starting from 10,000 rubles. In table 4, we will consider the contribution under the "New Money" condition.

Table 4

VTB Deposit rates (VTB)

Term, month.	3	6	12	18	24	36
%	18,4	19,4	21	17,5	17,5	15

In addition to the above-mentioned banks, deposits with a differentiated rate are offered by Yandex Bank (Save deposit), Gazprombank (Plus deposit), Sovcombank (Autumn Maximum with Halva deposit), Promsvyazbank (Income Formula deposit) and many others. The offer is very popular and almost every bank has it. However, there is no information on the real profitability of such deposits on the bank's websites. As can be seen from the tables below, the maximum interest rate is valid only for a short period of time (on average, six months or even less). You can calculate the effective rate in the following way: you need to add up the amount of interest, and then divide the amount received by the number of periods.

Thus, the effective rate on the best deposit from Sberbank is 15.9%, on the Smart Deposit from T-bank-19.2%, on the Alfa deposit» o from Alfa-bank – 18.3%, and the deposit rate from VTB – 18.1% was slightly lower. A good example of why you should not trust information from advertising offers. On their websites, banks indicate only the highest percentage on the deposit, thus misleading their customers. Therefore, deposits with the ladder system already enabled are not always profitable, because their profitability often does not exceed the market average. Having considered deposits, the stages of which are formed by the depositor independently, as well as ready-made offers from banks, the advantages of the first ones become obvious. Offers with already built-in ladders are often not effective.

As the study showed, the effective rate of such deposits is often either equal to ordinary deposits, or it turns out to be even less. Despite this, they are quite popular among users, as they are easy to use. Such deposits should be opened if the average

rate still exceeds the rates for other offers, if the deposit conditions allow you to close the deposit ahead of time without losing interest or withdraw a certain part of the funds without closing the deposit. However, deposits without a differentiated rate may also have such characteristics.

We conclude that such deposits do not have any special advantages. The same can't be said about the option of ladders carried out by investors on their own. Of course, this method requires energy consumption – constant tracking of new offers from banks, which takes a lot of time. But this is overlaid by a good interest income. However, the choice is always left to the depositor.

References

1. Lossan, A. (2024). Kak bol'she zarabotat' s pomoshch'yu "lesenki vkladov" [How to earn more with the help of the "deposit ladder"]. – [online]. Available at: https://www.sravni.ru/text/kak-bolshe-zarabotat-s-pomoshyu-lesenki-vkladov/?ysclid=m4iph6ybpx490973879&upd=true. (Accessed: 21.10.2024). (in Russian)

2. Usheva, Yu., Romanova, N. (2024). Vverh po lestnice [Up the ladder]. – [online]. Available at: https://www.banki.ru/news/daytheme/?d=5055716&ysclid =m4iplq4vnz256800110. (Accessed: 21.10.2024). (in Russian)

3. Vklady s lestnichnym nachisleniem procentov [Deposits with interest accrual on a step-by-step scale]. – [online]. Available at: https://vbr-ru/turbopages/org/turbo/vbr.ru/s/banki/help/vklady/lestnichnoe/. (Accessed: 21.10.2024). (in Russian)

UDK 311.3

ROLE, NECESSITY AND IMPORTANCE OF STATISTICAL OBSERVATION IN SCIENTIFIC RESEARCH

Astakhova Daria Ivanovna,
Student of the Institute of Economics and Management,
Belgorod State National Research University, Belgorod, Russia,
E-mail: astakhova_dasha2004@mail.ru
Kabanenko Yulia Vladimirovna,
Student of the Institute of Economics and Management,
Belgorod State National Research University, Belgorod, Russia,
E-mail: kabanenko.iulia@mail.ru
Mariasova Elena Anatolyevna,
Ph.D. in Philosophy,
Associate Professor of the Department of Foreign Languages and Professional Communication,
Belgorod State National Research University, Belgorod, Russia,
E-mail: mariasova@bsuedu.ru

Abstract: *The article examines the importance of statistical observation, its importance for making informed decisions and developing effective development strategies. Examples of statistical analysis in various spheres of society and their significance are presented. Furthermore, the article emphasizes that statistical observation is crucial in scientific research as it provides a reliable foundation for validating hypotheses and drawing meaningful conclusions from data.*

Keywords: *statistical observation, scientific research, statistics, statistical methods, statistical research, data analysis.*

Statistical observation holds a pivotal position in contemporary society, as the evaluation and analysis of data have become essential components across diverse domains. Decisions grounded in objective and credible statistical information exert a profound influence on various sectors, including economics, social policy, education, healthcare, and numerous other fields.

Thus, we can say that statistical observation allows us to identify patterns and development trends in various areas of life. For clarity, the analysis of economic data can be used as an example. This allows us to predict market development, make informed investment decisions, and, in turn, determine the effectiveness of economic policy. In another branch of medicine, statistical observation allows you to determine the prevalence of diseases, evaluate the effectiveness of treatment, and also allows you to develop preventive programs. In sociology, statistics help to study social processes, demographic changes, and the level of well-being, as well as to analyze the quality of life of the population [Konyuk, 2017].

Thus, in the process of statistical research, observation plays an important role, since the accuracy of the research results depends on the quality, completeness, truthfulness, and comprehensiveness of the information collected. Therefore, the process of statistical observation must be given great attention. Statistical observation is the first stage of statistical research, which is the collection of data on socio-economic phenomena and processes organized according to a single program by recording their essential features in order to obtain primary statistical information [Knyazevskaya, 2005].

The use of statistical methods allows scientists to assess the extent to which the results of their experiments can be due to random factors. This is especially important in experiments that study complex systems or processes influenced by many variables. Statistics also plays an important role in determining the sample sizes for experiments in order to minimize risks and errors, as well as the use of resources, including experimental animals [Godin, 2012].

In addition, statistical observation is necessary for generalizing the results to wider populations. This is especially important in medical, social and psychological research, where the results obtained on a limited sample are assumed to be applicable to wider groups [Dobrodomova, 2017].

Table 1

Practical application of statistical methods in various fields of scientific research

Scope of application	**Statistical methods**	**Application objectives**	**Results**
Clinical trials	Randomized controlled trials	Evaluation of vaccine effectiveness	Determining the significance of the result in practice
Psychological research	Correlation analysis	A detailed study of the relationship of various factors	Developing a management strategy
Environmental research	Time series, regression analysis	Analysis of various climatic changes	Forecasting weather conditions based on statistical data
Genetic research	GWAS-analysis	Identification of genetic markers	Identification of correlations with various diseases and application of methods for their prevention

Statistical observation methods can be used in various scientific studies, allowing for accurate data analysis and informed conclusions. For example, the statistical observation method can be used in clinical trials to assess the effectiveness and safety of new drugs. For example, in the development of a COVID-19 vaccine, statistical analysis of randomized controlled trials allowed scientists to assess whether the vaccine significantly reduced the risk of infection compared to a placebo. This required careful sample size planning and statistical tests to confirm the significance of the results.

Statistical methods are used to analyze changes in the environment. For example, studies of changes in the Earth's temperature over time use time series and regression analysis to identify trends and predict future changes. Statistical analysis of data from weather stations and satellites helps scientists determine how sea surface temperatures affect weather patterns and climate [Ilmushkina, 2020].

In the field of psychology, statistical observation is necessary to analyze the relationship between psychological factors and behavior. For example, studies of the relationship between stress and job performance often use correlation analysis to assess the extent to which one factor is associated with another. This allows for the development of effective workplace stress management strategies [Mannapova, 2012].

In genetics, statistical methods are used to analyze DNA sequence data to identify genetic markers associated with diseases. For example, genome-wide association studies (GWAS) analyze data from thousands of people to find variations in genes that correlate with certain diseases, such as cancer or diabetes. It is necessary to take into account individual genetic variations, and the influence of the environment and lifestyle on the development of diseases.

In the field of education, statistical methods are used to evaluate the effectiveness of educational programs, analyze student performance, and optimize curricula.

Thus, statistical observation undoubtedly occupies an important place in scientific research, playing a key role in ensuring its accuracy, reliability, and objectivity. The role of statistics in science is multifaceted: it not only helps in collecting and analyzing data, but also serves as an indispensable tool for testing hypotheses and theories, which is fundamental to the scientific method.

The need for statistical observation is primarily due to the need for reliable and representative information that allows the scientific community to make informed conclusions about patterns and processes in various areas of research. Without the use of statistical methods, many scientific discoveries would remain inaccessible and conclusions would be unfounded [Popova, 2015].

The importance of statistical observation is great, as it allows us to expand the boundaries of knowledge, making research more accurate and large-scale. Statistics helps to generalize data, making it possible to adapt results to large groups or different conditions, which is critical in such areas as medicine, ecology, and social sciences. In addition, statistical analysis contributes to the development of new technologies and methods, making a significant contribution to technological and social progress.

The development of digital technologies and the increase in data volumes create new opportunities for statistical analysis, which opens up prospects for a deep understanding of the phenomena and processes studied at various stages.

References

1. Dobrodomova, T.N., Tavaldieva, K.O. (2017). Formirovanie sistemy tsennostey, znaniy i kompetentsiy v sfere statistiki [Formation of a system of values, knowledge, and competencies in the field of statistics] // *Statisticheskie metody issledovaniya sotsialno-ekonomicheskikh i ekologicheskikh sistem regiona: materialy I Mezhdunarodnoy nauchno-prakticheskoy konferentsii, Tambov, 26–27 oktyabrya 2017 goda*. – V. 1. – T. II. – Tambov: Tambovskiy gosudarstvennyy tekhnicheskiy universitet. – Pp. 436-439. (in Russian)

2. Godin, A.M. (2012). Statistika [Statistics]. – M.: Dashkov I.K. – 451 p. (in Russian)

3. Ilmushkina, A.A., Ilyamakova, E.D. (2020). Statistika vokrug nas [Statistics around us] // *Yunyy uchenyy*. – № 4 (34). – Pp. 49-52. (in Russian)

4. Knyazevskaya, N.V. (2005). Voprosy ucheta i statisticheskogo nablyudeniya [Issues of accounting and statistical observation] // *Uchet i statistika*. – № 7. – P. 16. (in Russian)

5. Konyuk, A.O. (2017). Osnovy statisticheskogo analiza dannykh [Fundamentals of statistical data analysis] // *Aktualnye problemy gumanitarnykh i estestvennykh nauk.* – № 1-4. – P. 14. (in Russian)

6. Mannapova, R.A., Zalilova Z.A. Neobkhodimost statisticheskogo nablyudeniya [The need for statistical observation]. – [online]. Available at: https://scienceforum.ru/2012/article/2012003265. (Accessed: 20.02.2025). (in Russian)

7. Popova, A.A. (2015). Statisticheskoe nablyudenie kak etap statisticheskogo issledovaniya [Statistical observation as a stage of statistical research] // *Fundamentalnye i prikladnye issledovaniya v sovremennom mire*. – № 12-2. – Pp. 275-276. (in Russian)

UDK 332.1

CORRUPTION AS A THREAT TO THE ECONOMIC SECURITY OF THE COUNTRY

Shkrudneva Marina Vitalievna,
Student of the Institute of Economics and Management,
Belgorod State National Research University, Belgorod, Russia,
E-mail: 1462821@bsuedu.ru
Belousov Stanislav Viktorovich,
Student of the Institute of Economics and Management,
Belgorod State National Research University, Belgorod, Russia,
E-mail: 1441918@bsu.edu.ru
Mariasova Elena Anatolyevna,
Ph.D. in Philosophy,
Associate Professor of the Department of Foreign Languages and Professional Communication,
Belgorod State National Research University, Belgorod, Russia,
E-mail: mariasova@bsuedu.ru

Abstract: *The article examines aspects of the impact of corruption on various areas of the country's economic stability. The dynamics of the Corruption Perception Index in the Russian Federation are considered. Statistics on the number of registered and solved corruption crimes in Russia in 2022-2024 are provided.*

Keywords: *corruption, economy, corruption crimes, Corruption Perception Index, level of corruption in the country.*

The economic security of the state depends on the intensity of the influence of threats and the system's resistance to them, while corruption creates significant risks

for the country's economic sector. Corruption has a negative impact on the socio-economic system of the state, destroys free economic relations, creates threats due to violation of technical regulations, distorts the procedure for resolving issues in an incorrect form, leading to a decrease in the level of economic security of the state [Vladyka, 2023].

Corruption crimes limit the financing of real sectors of the economy, redistributing monetary resources illegally and facilitating the export of capital from the state. Corruption causes irrational barriers to investment funds and a slowdown in the level of economic development due to underfunding of industries. As a result, corruption reduces the potential revenues of the country's budget due to the limitation of production programs of companies in different sectors.

Corruption-related offenses are recognized as a serious threat to the normal implementation of the goals of public service, as well as to national security in general [Aliyev, 2023]. Corruption is defined as the use of public position for personal gain. Corruption as a threat to the economic security of the state and the loss of stability of its functioning and development is manifested in the form of illegal implementation of administrative powers and official rights.

Corruption contributes to the inefficiency of the mechanism for redistribution of income in favor of persons with power or influence, worsening the financial situation of their clients, forming irrational barriers to economic activity, allowing the functioning of objects that do not comply with legal norms. The shadow sector of the economy is both the cause and the consequence of corruption. Illegal entrepreneurship and income generation, tax evasion create an unfavorable environment for the functioning of the country's economy.

The higher the level of corruption in the country, the lower the efficiency of management and the legal system. Corruption understates the real value of the product created in the country, distorts the level of welfare of citizens, increases the stratification of the population and the gap in their income [Nikolaienko, 2024]. Corruption destroys the competitive mechanism, creating advantages for some participants in economic relations and limiting the opportunities of others, more promising and talented. Corruption violations create barriers and obstacles to entrepreneurship, increase the material burden on participants in economic relations and investors to the detriment of state interests.

Corruption becomes a factor in the devaluation of national currencies and the growth of prices for goods and services, since the costs of bribery and bribes are transferred to the prices of finished products, and, consequently, are shifted to buyers and consumers. Corruption in the sphere of budget expenditures contributes to the irrational distribution of resources, reducing opportunities for the development of important sectors and areas. Corruption in the sphere of legislation creates ineffective legal norms, worsening the conditions for the functioning of representatives of entrepreneurship and the population, which slows down economic growth in the country.

In social terms, corruption and the lack of proper punishment for them increase public dissatisfaction with government policy, create political risks and threats of mass unrest. In Russia, at the state level, corruption is considered a source of threats to national and economic sustainability. A number of legislative acts and regulations are

devoted to the problem of corruption in the country, and measures are being implemented to counteract relevant violations.

According to the legislation of the Russian Federation, a corrupt official is an employee of the state or municipal sector, in respect of whom guilt for the committed violation of the law has been proven in court or other similar procedure. The dynamics of the Corruption Perceptions Index in the Russian Federation for 2022-2024 are presented in Table 1.

Table 1

Dynamics of the Corruption Perceptions Index in the Russian Federation for 2022-2024

Indicator	**Recommended value of the indicator**	**2022**	**2023**	**2024**
Corruption Perceptions Index (CPI)	Scale from 0 to 100. 0 points – the lowest level of corruption. 100 points – the highest level of corruption.	28	26	22
Russia's place among the countries of the world in terms of the level of corruption perception index	The higher a country's place in the ranking, the lower its level of corruption	53	57	56
Level of corruption in the Russian Federation according to Transparency International	–	high	high	High

Compiled based on data from the non-governmental international organization for the fight against corruption and research into the level of corruption, Transparency International.

Thus, in the Corruption Perceptions Index (CPI), compiled by the international organization Transparency International, Russia in 2023 scored 28 points out of 100 and took 53rd place out of 180 in the Corruption Perceptions Index. In 2023, the Corruption Perceptions Index of Russia was 26 points, which corresponded to 57th place in the world. In 2024, Russia was in 56th place in the Corruption Perceptions Index with 22 points. In general, we can conclude that there was a positive trend in corruption crime in Russia from 2022 to 2024; according to the index values, our country saw an annual decrease in the level of corruption.

To conduct the procedure for analyzing the current state and level of corruption in Russia, we will consider the general indicators of the state of corruption crime (Table 2).

Table 2 shows an annual increase in the number of detected and registered corruption crimes in Russia in 2023, the number of cases was 36,407, which is 3.02% higher than the level of 2022, in 2024 this figure increased by 5.76% to 38,503. At the same time, the number of solved corruption crimes has a negative trend of decline from 2022 to 2024. The number of corruption crimes related to bribery in Russia in 2023 increased by 4.05% and amounted to 20,279, and in 2024 by another 14.60% to 23,240.

In the total number of such crimes, the number of cases of receiving a bribe, giving a bribe and petty bribery prevailed. For all types of offenses in this group, there

was an annual increase in the number of detected crimes. The number of corruption crimes related to commercial bribery in Russia in the period under study also increased. In 2023, the number was 2136, which is 37.36% compared to 2002; in 2024, this figure grew by 7.91% to 2305 units. The increase in this type of offense occurred due to an increase in the number of large-scale commercial bribery, while in 2024 the number of cases of petty commercial bribery decreased. Thus, it can be concluded that corruption is a threat to economic, social and other types of national security.

Table 2

General indicators of the state of corruption crime in Russia in 2022-2024

Types of crimes	Crimes have been registered			Crimes solved						Absolute deviation of reported crimes		The growth rate of registered crimes	
				in total			criminal cases that have been sent to court			2023/ 2022	2024/ 2023	2023/ 2022	2024/ 2023
	2022	2023	2024	2022	2023	2024	2022	2023	2024				
All corruption-related crimes	35340	36407	38503	34946	33853	33729	28511	27863	27959	1067	2096	103,02	105,76
of these													
related to bribery	19490	20279	23240	18446	17908	19506	13481	13527	15082	789	2961	104,05	114,60
including:													
receiving a bribe	5540	5960	7610	4710	4866	5907	4596	4754	5844	420	1650	107,58	127,68
giving a bribe	4716	5657	6749	4599	5055	5868	2582	3034	3592	941	1092	119,95	119,30
mediation in bribery	1881	2256	2634	1607	1765	1808	796	1066	1065	375	378	119,94	116,76
petty bribery	7353	6406	6247	7530	6222	5923	5505	4673	4581	-947	-159	87,12	97,52
related to commercial bribery	1555	2136	2305	1441	1899	2016	1016	1215	1399	581	169	137,36	107,91
including:													
commercial bribery	1270	1571	2039	1183	1353	1760	890	973	1232	301	468	123,70	129,79
minor commercial bribery	285	565	266	258	546	256	126	242	167	280	-299	198,25	47,08

Compiled by the authors according to the Ministry of Internal Affairs of the Russian Federation

The study showed that corruption negatively affects many aspects of the state, which together leads to a decrease in stability and economic security, and poses threats to further development. A high level of corruption has been identified in Russia, which leads to high risks for the country's economic and social sphere.

References

1. Aliyev, S., Babayev, F., Galandarova, U., Gafarli, G., Balajayeva, T. (2023). E`konomicheskaya bezopasnost` regionov: predposy`lka diversifikacii e`konomiki Azerbajdzhana

[Economic security of regions: A prerequisite for diversifying the Azerbaijan economy] // *Journal of Eastern European and Central Asian Research (JEECAR)*. – No. *10* (5). – Pp. 827-840. (in Russian)

2. Nikolaienko, A., Nikolaienko, O., Avanesov, H., Koshmal, S., Lukashuk, O. (2024). Korrupciya kak ugroza nacional`noj bezopasnosti: analiz antikorrupcionny`x mexanizmov i ix e`ffektivnosti [Corruption as a Threat to National Security: Analysis of Anti-corruption Mechanisms and their Effectiveness] // *Economic Affairs.* – No. 69. – Pp. 23-31. (in Russian)

3. Vladyka, M. V., Chistnikova, I. V., Burdinskaya, D. M., Tikunov, V. I. (2023). Metodicheskiy bazis otsenki prodovol'stvennoy bezopasnosti regionov [Methodological basis for assessing food security of regions] // *APK: Economy, management*. – No. 8. – Pp. 3-10. (in Russian)

UDK 314.143

DEMOGRAPHIC TRENDS AND ECONOMIC SECURITY OF THE STATE: CHALLENGES AND OPPORTUNITIES

Stepanov Alexander,
Student of the Institute Economics and Management,
Belgorod State National Research University, Belgorod, Russia,
E-mail: 1626780@bsuedu.ru
Kutnyakov Alexander Andreevich,
Student of the Institute Economics and Management,
Belgorod State National Research University, Belgorod, Russia,
E-mail: 1686722@bsuedu.ru
Mariasova Elena Anatolyevna,
Ph.D. in Philosophy,
Associate Professor of the Department of Foreign Languages and Professional Communication,
Belgorod State National Research University, Belgorod, Russia,
E-mail: mariasova@bsuedu.ru

Abstract*: The article is devoted to the analysis of the demographic situation in Russia as a key factor affecting the economic security and stability of the state. The effects of population aging, declining fertility, regional inequality and migration processes on the social and economic sphere are considered. Special attention is paid to the need to adapt government policy to regional specificities, as well as to integrate demographic factors into strategic planning. The author emphasizes the importance of investments in human capital, infrastructure development and employment promotion as conditions for sustainable development of the country in the context of demographic decline.*

Keywords: *Demographic trends, economic security, development opportunities, economic growth.*

The demographic situation is one of the most important indicators of the sustainability of the state and its ability to ensure long-term development. In the 21st century, when most industrialized countries are facing demographic decline, population aging, and declining birth rates, economic security issues are becoming particularly important. Russia is no exception: these processes are taking place against the background of economic, social and geopolitical transformations.

The problems of population reproduction, regional inequality and migration have a multifaceted impact on the economy: from changes in the employment structure

to pressure on the budget system. Public policy has to take these challenges into account when shaping socio-economic development strategies. In Russia, there is a sharp contrast between demographically stable megacities (Moscow, St. Petersburg, Kazan) and regions where the population is decreasing from year to year. In a number of subjects of the Russian Federation, this decline is accompanied by the degradation of social infrastructure, the outflow of youth and the able-bodied population.

As N.V. Zubarevich notes, "the demographic situation in most regions of Russia is characterized by a steady decline in the population and an aging of its structure". This requires an individualized approach to regional policy: for some regions, it is necessary to support labor migration and create jobs, for others, the development of the social sphere and youth retention programs [Zubarevich, 2020].

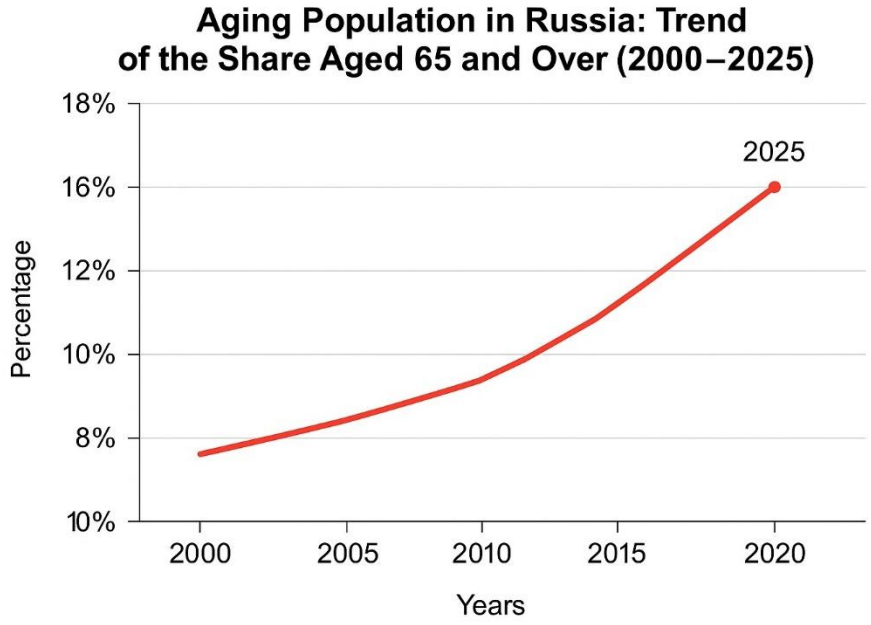


Figure 1. Aging population in Russia of the share Aged 65 and over (2000-2025)

Using the example of the Pskov or Kostroma regions, one can see how population decline leads to the closure of schools and hospitals, which, in turn, increases migration outflow. This is a vicious cycle that needs to be broken through comprehensive measures. The increase in the proportion of people over working age is becoming not only a social but also an economic problem. The pension burden on the budget is growing rapidly, while the number of employees is decreasing. In 2023, there were more than 72 dependents (children and pensioners) per 100 employees in Russia, and this ratio continues to grow.

As N.M. Rimashevskaya emphasizes, "demography is becoming an increasingly important factor determining the prospects for economic growth and stability". At the same time, the elderly population requires a specific infrastructure: medical care, an accessible environment, and social protection. All these are additional expenses that fall on both the state and regional budgets. Another problem is the departure of experienced specialists and the shortage of qualified young staff. This weakens the country's production potential and requires large-scale professional training and retraining programs, especially in high-value-added industries [Rimashevskaya, 2018].

Demographic risks directly affect the stability of the economy, slowing GDP growth, reducing domestic demand and increasing the burden on the fiscal system. If the trend does not change, Russia may face a situation in which the costs of the pension system will exceed the income from taxes on labor.

As E.A. Kvasha rightly notes, "the decline in the working-age population poses a threat to the stability of the pension system and GDP growth". At the same time, there is already a shortage of personnel in industry, agriculture, education and healthcare. Automation and digitalization partially compensate for this deficit, but do not solve the problem completely [Kvasha, 2021].

In addition, the shortage of workers stimulates the growth of the gray sector and a decrease in the tax base. All this increases the country's macroeconomic vulnerability in the long term. Modern government policy in the field of demography should combine rapid response and strategic planning. It is not enough to simply increase payments for children or simplify obtaining citizenship – we need to establish sustainable mechanisms for population growth and quality.

According to V.N. Polovinkin and D.A. Makarov, "the adaptation of economic security strategies requires taking into account not only current demographic indicators, but also forecasts of their changes". This means the need to create demographic development models for each region, on the basis of which economic policy is formed, including subsidizing the birth rate, developing infrastructure and stimulating employment [Polovinkin, Makarov, 2022].

An example is the Zemsky Uchitel program, aimed at attracting teachers to rural areas. Such targeted measures should be complemented by systematic work in the field of family policy, including affordable housing, kindergartens, support for large families and increasing the prestige of parenthood. Demographic problems do not automatically mean a decline in the country's economic potential. The key to the solution is to increase the efficiency of using human resources. This includes investments in health, education, culture, and an innovative environment. A well-trained specialist with a high level of competence is able to produce more with fewer people involved.

According to O.S. Sukharev, "investments in human capital can partially compensate for the negative effects of demographic downturns". This is especially true in the era of the digital economy, where labor resources can effectively work remotely, creating added value through knowledge and technology [Sukharev, 2023].

A special role in this is played by the system of continuing education, professional mobility opportunities, as well as the development of scientific and creative industries. The state should consider education and science as a strategic investment in economic security, and not as an expenditure item of the budget. Demographic trends in Russia are shaping a difficult but manageable situation. The aging of the population, the decline in the birth rate and the outflow of able-bodied citizens are an objective reality that requires a systematic approach. The economic security of the state in these conditions is impossible without an active, flexible and anticipatory state policy.

It is necessary to shift the focus from crisis response to strategic management of demographic development. This requires the integration of demographic factors into economic planning, the adaptation of institutions and legislation, as well as stimulating

investment in human capital as the main resource for sustainable development in the 21st century. It is only through the synergy of demographic policy, economic reforms, and social support that it is possible to preserve and strengthen Russia's stability and security in the long term.

References

1. Kvasha, E.A. (2021). Vliianie demograficheskikh izmenenii na ekonomicheskuiu bezopasnost' Rossii [The impact of demographic changes on Russia's economic security] // *Ekonomicheskaia bezopasnost'*. – № 4. – Pp. 120–129. (in Russian)

2. Polovinkin, V.N., Makarov, D.A. (2022). Strategii obespecheniia ekonomicheskoi bezopasnosti v usloviiakh demograficheskogo riska [Strategies for ensuring economic security under demographic risk] // *Vestnik Natsional'nogo issledovatel'skogo universiteta "MIEP"*. – № 6. – Pp. 34–41. (in Russian)

3. Rimashevskaya, N.M. (2018). Demograficheskie faktory sotsial'no-ekonomicheskogo razvitiia Rossii [Demographic factors of socio-economic development in Russia] // *Obshchestvennye nauki i sovremennost'*. – № 2. – Pp. 88–98. (in Russian)

4. Sukharev, O.S. (2023). Chelovecheskii kapital i demografiia: vzaimosviaz' s ustoĭchivym ekonomicheskim razvitiem [Human capital and demography: interrelation with sustainable economic development] // *Ekonomicheskaia teoriia*. – T. 20 – № 1. – Pp. 11–25. (in Russian)

5. Zubarevich, N.V. (2020). Demograficheskie problemy regionov Rossii: tseli i resursy dlia razvitiia [Demographic problems of Russian regions: goals and resources for development] // *Voprosy Ekonomiki*. – № 3. – Pp. 45–63. (in Russian)

UDK 336.7

IMPROVEMENT OF LOYALTY PROGRAMS OF COMMERCIAL BANKS

Kuznetsov Danil Alekseevich,
Student of the Institute of Economics and Management,
Belgorod State National Research University, Belgorod, Russia,
E-mail: 1631661@bsuedu.ru
Mariasova Elena Anatolyevna,
Ph.D. in Philosophy,
Associate Professor of the Department of Foreign Languages and Professional Communication,
Belgorod State National Research University, Belgorod, Russia,
E-mail: mariasova@bsuedu.ru

Abstract: *This article is aimed at determining the degree of importance of loyalty programs in the development of commercial banks in Russia. The loyalty programs among the commercial banking market have become widespread relatively recently and have not yet reached their peak. The article examines loyalty programs of well-known commercial banks in Russia; determine the degree of importance of loyalty programs in the development of the bank; analyze the prospects for the development of programs.*

Keywords: *economics, loyalty programs, commercial banks, management, marketing, strategic marketing, supply and demand.*

In today's rapidly developing world of capitalism, the number of commercial banks competing in the market is growing. At the level of the trend of increasing the

number of credit institutions, consumers are paying more attention to banking products, which forces the latter to take a better approach to the products and services provided. Thus, the strategy of any modern commercial bank is aimed at gaining a larger share of the user market. This fact leads to an increase in the volume of loyalty programs offered by banks [Abramova, 2019].

As part of the study of the problem of the topic, it is necessary to define the basic terminology related to the activities of commercial banks, identify the main trends in this industry, and identify the main ways of the so-called "struggle" for the buyer. Moreover, within the framework of this work, it is necessary to determine the packages of offers of the main and most popular modern commercial banks along with the above-mentioned aspects.

First of all, the concept of loyalty programs should be defined as fully as possible. A loyalty program is a system for encouraging and rewarding existing customers, aimed at retaining them in order to sell a product or service again. In most cases, loyalty program participants receive a reward from the bank for performing a certain action that is currently necessary for this bank. For example: Razvitie Bank provides additional benefits to regular customers who use a specific business card and recommend it to their friends.

Among the main goals of loyalty programs, the following should be highlighted:

– increasing the volume of repeat purchases;

– strengthening the company's brand;

– an increase in the average receipt or the volume of services purchased by the buyer;

– collecting data on target groups of clients and their needs.

Thus, it is necessary to draw an interim conclusion that loyalty programs play an important role in the development and functioning of large commercial banks, since they allow us to determine the main consumer needs, the target audience, and most importantly: to keep the buyer already brought in and repeat the transaction [Alekseev, 2021].

As part of this study, it is also necessary to identify loyalty programs and specific offers from the main and most well-known commercial banks in Russia. The sample of loyalty programs includes various bank programs for providing detailed information about possible bank products in various fields.

Based on the comparative table for loyalty programs of the most common commercial banks, the following conclusions should be drawn:

1. The structure of all loyalty programs of banks includes cashback. The most profitable program in this category is provided by T-Bank, since the interest rate and cashback limit are relatively higher than other banks.

2. The selected loyalty programs of banks in most cases included additional discounts or benefits when purchasing other products of the same bank. Sberbank offers the most optimal and favorable conditions, since the limits on the volume of money transfers in this bank are relatively higher relative to others.

3. Loyalty programs additionally included conditions and benefits for the user that are not directly related to the bank's activities. Within the framework of this criterion, it is objectively impossible to establish a leader, since banks offer additional advantages in completely different areas.

Table 1

Comparative table of loyalty programs of major commercial banks

Criterias	Sberbank	T-Bank	Alfa-Bank	Gazprombank	VTB
Name of the loyalty program	"SberPrime+" subscription	The "Pro" package	Alpha Card	Gazprombank Privileges	Multibonus
The cost of maintenance of the program product	399 rubles/year	299 rubles/year	990 rubles/year	199 rubles/year	It is free, but it is possible to connect only to a debit card worth 3,000 rubles/year.
Funded programs	Points for purchases, payments for Sberbank services, and other services.	Points for purchases, access to services, discounts from partners	Points for purchases, access to partner services		Points for purchases with VTB cards. It can be exchanged for discounts from partners, gift certificates, and goods.
Cashback	2-12%	5-10%, lower 5.000	1-7%, lower 5.000	5-7%, lower 5.000	1,5-10%, lower 2.000
Discounts on banking products	1 million/ month payments and transfers without commission, 1.5% deposit bonus, 1.5% discount on loans	3% of the interest on the savings account, 5% discount on Casco and CTP insurance	Transfers to other banks up to 100,000 rubles/month; Withdrawal of up to 100,000 rubles without commission	150,000 rubles/month free transfers to other people 30,000 rubles/month free withdrawal	
Additional conditions	Free online cinemas, SMS notifications, a 30 GB virtual disk	Free alerts about operations on the T-Mobile operator	Free alerts on operations Bonus air and railway miles	2% discount on fuel at Gazpromneft gas station	

The commercial banks that participated in the sample provide a variety of additional benefits as part of their loyalty programs, so it is impossible to compare disparate benefits. For example, Alfa-Bank offers air and railway miles as a reward for using its card, and Gazprombank provides discounts to its customers in a network of affiliated gas stations.

Additionally, the prospects for the development of loyalty programs for commercial banks should be considered. Firstly, there is a tendency in the banking services market to increase the volume of loyalty programs [Levin, 2021]. This means that the consumer gets more and more options and services at a lower cost. Secondly, there is competition among commercial banks in the field of loyalty programs, and the management staff of each bank is trying to develop the best loyalty program on the market to attract more users.

This dependence is present due to the price factors of the law of demand. All other things being equal, they will purchase more goods at a lower cost. The activities

of commercial banks also include measures to attract customers of other banks on more favorable terms. All of the above trends will continue until the onset of a non-equilibrium price, at which a further reduction in the value of the offer will no longer be beneficial for the commercial bank [Sidorova, 2015].

Based on the above-mentioned and analyzed loyalty programs of commercial banks, it should be concluded that one of the main objectives of each of the programs is to attract and retain customers within the Bank in order to generate additional profits. Thus, it is necessary to deduce an additional purpose and function of loyalty programs-marketing. Banks form a positive background for a reliable and strong company that provides the user with expanded opportunities, thanks to which the latter will be able to conduct business more efficiently. So, in addition to existing users, banks attract additional customers with loyalty programs.

Moreover, it is important to additionally emphasize the importance of choosing a commercial bank for the buyer. The rational use of loyalty programs of commercial banks will allow the buyer to extract the greatest amount of benefits. This fact will allow the buyer to save a significant part of the money needed to service banking products.

Thus, the loyalty program in the structure and economic policy of a commercial bank has a high degree of importance due to its high efficiency and effectiveness.

References

1. Abramova, A.V. (2019). Programmy` loyal`nosti kak instrument povy`sheniya konkurentosposobnosti banka [Loyalty programs as a tool to increase the competitiveness of the bank] // *Finansy` i kredit.* – № 3. – Pp. 617-631. (in Russian)

2. Alekseev, I.I. (2021). Programmy` loyal`nosti v bankovskoj sfere: teoriya i praktika [Loyalty programs in the banking sector: theory and practice]. – M: Izdatel`skij dom IDV. – 250 p. (in Russian)

3. Levin, G.Y. (2021). Programmy` kak instrument konkurentosposobnosti. [Programs as a competitiveness tool] // *Social`no-e`konomicheskaya statistika*. – Nizhny Novgorod: Izdatel`skij dom Dekom. – 180 p. (in Russian)

4. Sidorova, M.V. (2015). Loyal`nost` klientov i ee znachenie dlya bankovskoj otrasli [Customer loyalty and its importance for the banking industry] // *Molodoj uchyony`j*. – №10. – Pp. 32-37. (in Russian)

UDK 070.1:79 + 004.032.6 + 7.01 + 004.77:070.11 + 316.75

BILD DES JOURNALISTEN IN MODERNEN VIDEOSPIELEN

Linnik Ksenija Jewgenjewna,
Studentin des Instituts für Sozialwissenschaften und Massenkommunikationen, Belgoroder Staatliche Nationale Forschungsuniversität, Belgorod, Russland, E-mail: 1639889@bsuedu.ru
Sopowa Irina Walentinowna,
Kandidatin der philologischen Wissenschaften, Professorin des Lehrstuhls für Fremdsprachen und berufliche Kommunikation, Belgoroder Staatliche Nationale Forschungsuniversität, Belgorod, Russland, E-mail: sopova@bsuedu.ru

Annotation: *Der Artikel wird sich der Analyse des Bildes des Journalisten in modernen Videospielen und dessen Evolution im Kontext des Mediendiskurses gewidmet. Die Spielprojekte am Beispiel von „Fallout 4“ und „Dead Rising“ werden untersucht, in denen die*

Journalistencharaktere eine bedeutende Rolle spielen. Der Einfluss dieser Bilder wird auf die Wahrnehmung des Berufs durch die Spieler erforscht und beschrieben. In der Arbeit werden Fragen von Stereotypen im Zusammenhang mit Journalismus und deren Reflexion im Spielprozess behandelt. Die Videospiele formen die Meinung in der modernen Gesellschaft über die Rolle des Journalisten als Spielcharakter.

Schlagwörter: *der Journalist, die Videospiele, die Spielcharaktere, die Stereotypen, der Medienraum, das Bild des Journalisten*

In der modernen Welt, in der sich der Medienraum mit unglaublicher Geschwindigkeit entwickelt, haben die Videospiele eine besondere Nische in der kulturellen und sozialen Sphäre eingenommen. Früher waren sie ein Hobby für eine kleine Gruppe von Menschen, heute sind sie ein echtes globales Phänomen, das einen erheblichen Einfluss auf die Massenkultur ausübt.

Die Spiele sind zu einer Art von „Lebensstil" geworden, der Mode, Musik, Filmkunst und andere Aspekte der Kultur prägt [Kotlyarewskaya, 2019: 17]. Sie sind ein mächtiges Werkzeug, um komplexe soziale Prozesse, Identität, Macht und Einfluss zu erforschen und zu verstehen.

Auch der Einfluss digitaler Medien auf das öffentliche Bewusstsein wächst. Unter den vielen Charakteren und Berufen, die in Videospielen dargestellt werden, ist oft die Figur des Journalisten zu finden. In einer Ära, in der traditionelle Medien unter dem Druck der Digitalisierung und sich ändernder Verbraucherpräferenzen bestimmte Transformationen durchlaufen, sind die Videospiele zu einem neuen Feld für die Erforschung von Fragen der Moral und Ethik im Journalismus geworden. Die Spieler haben die Möglichkeit, die Rolle von Journalisten zu übernehmen, die in den ungewöhnlichsten und manchmal extremsten Bedingungen um die Enthüllung der Wahrheit kämpfen.

Dieses Interesse am Journalismus in der Spielwelt beschränkt sich nicht nur auf virtuelle Welten. Es ist erwähnenswert, dass die Spieljournalistik in Form von Zeitschriften an Popularität gewonnen hat. In der Mitte der neunziger Jahre gab es in Russland 2 Spielzeitschriften. Am Anfang der 2000er Jahre waren es bereits 5, und heute sind es schon 14. Die meisten Zeitschriften erscheinen sowohl in elektronischer als auch in gedruckter Form.

Neben diesen Zeitschriften gibt es Hunderte von verschiedenen Webseiten, die ebenfalls der Spieljournalistik zugerechnet werden können. Was die USA betrifft, so begann die Spieljournalistik dort bereits in den 1970er Jahren, im „goldenen Zeitalter der Arcade-Automaten". Seitdem sind zahlreiche Publikationen erschienen, und mit der Popularisierung des Internets sind die meisten Spielpublikationen auf das Web-Format umgestiegen. Die Artikel der „neuen Spieljournalistik" sind keine Spielrezensionen im herkömmlichen Sinne. Sie sind eher eine Analoge zur Reisejournalistik, bei der der Autor über die Begegnung mit einer subjektiven Erfahrung berichtet, die ihm die Spielwelt bietet, oder über die Interaktion mit anderen Spielern [Yaremchuk, 2020: 5].

Somit schaffen Videospiele nicht nur einen Raum für die Erforschung des Journalistenbildes, sondern werden selbst zum Untersuchungsgegenstand innerhalb der sich aktiv entwickelnden Spieljournalistik, die sich weiterhin zusammen mit den Technologien und den kulturellen Bedürfnissen des Publikums weiterentwickelt.

Heute können die Videospiele sowohl bestehende Stereotype verstärken, als auch kritisches Denken fördern, indem sie soziale Probleme aufzeigen und verschiedene Perspektiven auf vertraute Phänomene bieten. Auf diese Weise fungieren Videospiele als eine Art Werkzeug in der sozialen Kommunikation, das den Wandel und die Entwicklung kultureller und sozialer Paradigmen beeinflusst. Der heutige Realismus in Videospielen ist ein vielschichtiges Konzept, das nicht nur visuelle Aspekte betrifft, sondern auch die Tiefe der Handlung, die psychologische Glaubwürdigkeit der Charaktere sowie die Komplexität und Realitätsnähe der Spielwelt. Entwickler können verschiedene Ansätze verfolgen, um Realismus zu erreichen und dabei bestrebt sein, ein fesselndes und immersives Spielerlebnis zu schaffen [Busel, 2021: 202].

In letzter Zeit sind Spiele auch zu einem Medium für die Diskussion sozialer, politischer und kultureller Themen geworden. Ein Beispiel dafür ist "Detroit: Become Human" – ein Spielprodukt, das sich auf künstliche Intelligenz und Roboterrechte konzentriert. Es lädt Spieler dazu ein, über zukünftige Interaktionen zwischen Menschen und Technologie, sowie über die moralischen und ethischen Aspekte der Erschaffung von Wesen nachzudenken, die zu Gefühlen und Selbstbewusstsein fähig sind. "The Last of Us Part II" ist ein Spiel, das die Spieler in eine postapokalyptische Welt eintauchen lässt, in der die Menschheit mit den Folgen einer globalen Katastrophe konfrontiert ist. Es behandelt die Themen wie Überleben, Rache, Vergebung und die Komplexität moralischer Entscheidungen unter extremen Bedingungen. Die Beziehungen zwischen den Charakteren und ihre inneren Konflikte ermöglichen es den Spielern, die emotionalen und ethischen Aspekte der menschlichen Natur tiefer zu verstehen.

Um zu verstehen, wie Spiele das professionelle Image von Journalisten darstellen, lohnt sich ein Blick auf Titel wie "Fallout 4" und "Dead Rising". "Fallout 4" ist ein postapokalyptischer Ego-Shooter mit Rollenspielelementen, in dem der Spieler einen Überlebenden steuert, der eine verwüstete Welt erkundet, gegen Mutanten, Zombies und andere Gefahren kämpft sowie verschiedene Gegenstände und Ressourcen zum Überleben sammelt. Das Spiel ermöglicht es dem Spieler, seinen Charakter nach eigenen Vorstellungen zu gestalten – inklusive Aussehen, Geschlecht, bestimmten Eigenschaften und Fähigkeiten.

Piper Wright ist einer der Schlüsselcharaktere des Spiels. Sie verkörpert die Rolle der Medien in einer Gesellschaft, deren "Lebensregeln" sich nach der nuklearen Katastrophe verändert haben [Omelyanenko, 2019: 162]. Piper ist Chefredakteurin und Hauptautorin der Zeitung "Publick Occurrences", die sie in Diamond City veröffentlicht. Die Journalistin scheut sich nicht, schwierige Themen wie Korruption und Machtmissbrauch anzusprechen, und stellt Autoritäten infrage, um den Bewohnern von Diamond City die Wahrheit zu offenbaren. Ihre Artikel lösen oft öffentliche Debatten und kontroverse Reaktionen aus, sind aber stets darauf ausgerichtet, Fakten aufzudecken und die Gesellschaft zu informieren.

Betrachten wir die Handlung des Spiels genauer, um die Funktionen und Eigenschaften eines Journalisten in der realen Welt zu verstehen, die der Charakter widerspiegelt. Einer ihrer interessantesten Artikel handelt von einer Verschwörung der Karawanenhändler, die die Lebensmittelpreise in Diamond City in die Höhe treiben

wollten. Der Artikel wurde unter den Stadtbewohnern populär, was zu einem Boykott der Waren der Händler führte. Diese beschlossen daraufhin, sich an Piper zu rächen, indem sie einen Barkeeper bestachen. Dieser vergiftete das Bier, das Piper bestellt hatte. Sie überlebte den Anschlag, und die Händler landeten schließlich im Gefängnis.

Piper verfügt über eine Reihe von Eigenschaften, die für viele Vertreter dieses Berufs in der realen Welt typisch sind:

– Mut und Entschlossenheit: Piper hat keine Angst, gegen das System anzugehen und unangenehme Fragen zu stellen, selbst wenn sie sich damit in Gefahr bringt.

– Gerechtigkeitssinn: Sie wird nicht nur von der Sensationsgier getrieben, sondern auch von einem tiefen Streben nach Gerechtigkeit. Sie möchte gewöhnlichen Menschen helfen.

– Kontaktfähigkeit: Piper kann mit jedem ins Gespräch kommen, was ihr bei der Informationsbeschaffung und bei Recherchen hilft.

– Intelligenz und Scharfsinn: Die Protagonistin besitzt einen scharfen Verstand und die Fähigkeit, komplexe Situationen schnell zu analysieren.

– Empathie: Sie ist nicht gleichgültig gegenüber den Problemen anderer, was sich in ihrem Bestreben zeigt, verschiedene Geschichten zu beleuchten, die oft den Stadtbehörden und anderen Charakteren im Spiel missfallen.

In "Dead Rising" erleben wir die ähnliche Geschichte. Dieser Zombie-Actiontitel aus der Third-Person-Perspektive mit Survival- und Rollenspielelementen wurde 2006 von Capcom entwickelt und veröffentlicht. Der Spieler übernimmt die Rolle von Frank West – einem Journalisten, der in einem Einkaufszentrum eingeschlossen ist, wo ein Zombie-Ausbruch stattfindet. Das Gameplay besteht darin, das Einkaufszentrum zu erkunden, gegen Zombies und andere Gefahren zu kämpfen sowie Aufgaben zu erfüllen, die mit Überleben und Erforschung der Spielwelt verbunden sind.

Werfen wir einen Blick auf die Hintergrundgeschichte des Charakters: Bevor er in der Stadt Willamette strandete, arbeitete Frank West als Fotojournalist. Er verfügt über alle notwendigen Fähigkeiten eines Journalisten: Neugier, Beharrlichkeit, die Fähigkeit, unkonventionelle Lösungen zu finden, und die Bereitschaft, Risiken einzugehen, um an Informationen zu gelangen. Er reiste in die Stadt, um seltsame Vorkommnisse zu untersuchen. Schließlich beschloss Frank West, die Wahrheit über die Epidemie aufzudecken und der Gesellschaft genaue Informationen über die Geschehnisse zu liefern.

Während des gesamten Spiels nutzt Frank seine journalistischen und fotografischen Fähigkeiten, um die Ereignisse zu dokumentieren. Er sammelt verschiedene Notizen, die er in einem Notizbuch festhält, fotografiert gefundene Gegenstände und Leichen. Mehrfach trifft Frank im Spiel auf Überlebende und führt mit ihnen sogar "Interviews" durch. Der Journalist Frank West wird im Spiel als Symbol unbeugsamen Willens, entschlossenen Handelns und kompromisslosen Strebens nach Wahrheit dargestellt. Frank ist nicht einfach nur ein Fotojournalist – er ist ein Kämpfer für die Wahrheit, der sich nicht nur der Zombie-Apokalypse, sondern auch den mächtigen Kräften hinter der Katastrophe entgegenstellt. Der Journalist hat ein tiefes Verantwortungsbewusstsein gegenüber der Gesellschaft und einen unerschütterlichen Glauben daran, dass die Menschen die Wahrheit über die Welt um sie herum verdienen.

Gemeinsam ist beiden Charakteren ihr unbeirrbares Streben nach Wahrheit – ungeachtet der Risiken und Gefahren, die diese mit sich bringt. Die Entwickler betonen die Bedeutung des Journalismus als Mittel im Kampf gegen Ungerechtigkeit und Machtmissbrauch sowie seine Rolle bei der Förderung von gesellschaftlicher Aufklärung und kritischem Denken. Piper und Frank nutzen ihre einzigartigen Fähigkeiten und Ressourcen für Recherchen, wodurch die Spieler die Macht des Wortes und des Bildes im Kampf für Wahrheit und Gerechtigkeit erleben können.

Fazit: Das Bild des Journalisten in modernen Videospielen ist ein einzigartiges Phänomen, das sowohl realistische Berufsmerkmale als auch Elemente der Fiktion vereint, die der Spielebranche eigen sind. Dieses Bild verkörpert oft Schlüsseleigenschaften, die mit Journalismus assoziiert werden: Wissbegierde, Beharrlichkeit, Gerechtigkeitssinn, der Umgang mit Informationen und natürlich Kreativität. Diese Eigenschaften machen die Charaktere nicht nur für Spieler wiedererkennbar, sondern unterstreichen auch die Bedeutung des journalistischen Berufs in der heutigen Welt.

Die Videospiele, in denen Journalisten eine zentrale oder bedeutende Rolle spielen, zeigen, dass interaktive Medien nicht nur Unterhaltungsprodukte, sondern auch leistungsstarke Bildungsinstrumente sein können. Sie können für Journalistikstudenten zu einer Art Simulator werden, der ihnen die Möglichkeit bietet, in eine virtuelle Umgebung einzutauchen, in der sie Fähigkeiten wie Informationsrecherche, Datenanalyse, Faktenprüfung und Quellenarbeit üben können. Spiele lehren kritisches Denken, die Fähigkeit, schnell Entscheidungen unter Zeitdruck zu treffen, und unkonventionelle Lösungsansätze zu finden.

Kreativität, die sowohl integraler Bestandteil des Gameplays als auch des Journalismus ist, spielt eine besondere Rolle im Leben von Journalisten. In Videospielen sehen sich Journalisten oft mit unerwarteten Wendungen, komplexen ethischen Dilemmata und der Notwendigkeit konfrontiert, originelle Wege der Informationsvermittlung zu finden. Dies macht nicht nur das Spielerlebnis spannender, sondern unterstreicht auch, dass Journalismus keine bloße Routinearbeit ist, sondern ein kreativer Prozess, der geistige Flexibilität und Experimentierfreudigkeit erfordert.

Somit werden die Videospiele, die das Bild des Journalisten darstellen, zu einem wichtigen kulturellen Phänomen, das nicht nur moderne Vorstellungen von Medien und ihrer gesellschaftlichen Rolle widerspiegelt, sondern auch neue prägt. Sie zeigen, dass Spiele nicht nur der Unterhaltung dienen können, sondern auch Plattformen für Lernen, Inspiration und berufliche Weiterentwicklung sein können.

Für Studenten und angehende Journalisten können solche Spiele eine Art Trainingsgerät sein, das hilft, notwendige Fähigkeiten zu entwickeln und das Wesen des Berufs besser zu verstehen. Gleichzeitig eröffnet dies der Spielebranche die Möglichkeit, die Grenzen des Geschichtenerzählens zu erweitern und tiefgründigere, gesellschaftlich relevante Geschichten zu schaffen.

Literaturliste

1. Busel', S.W. (2021). Videoigry kak element sociokul'turnogo prostranstva [Videospiele als Element des soziokulturellen Raums] // *Novye nauchnye issledovaniya: sbornik statej Mezhdunarodnoj nauchno-prakticheskoj konferencii*. – Penza: “Nauka i Prosveshchenie”. – T. 1. – S. 202-210. (in Russisch)

2. Kotlyarewskaya, N.W. (2019). Vliyanie gejmerizacii na industriyu mody [Der Einfluss der Gamification auf die Modeindustrie] // *Kostyumologiya*. – M.: Izdatel'skij dom "Kostyum". – № 4. – S. 17. (in Russisch)

3. Omel'yanenko, M.W. (2019). Tema XX veka v igrovoj serii „Fallout“ [Das Thema des 20. Jahrhunderts in der Spieleserie „Fallout"] // *Trudy Sankt-Peterburgskogo gosudarstvennogo universiteta kul'tury i iskusstv*. – Sankt-Peterburg: SPbGUKI. – T. 186. – S. 160-164. (in Russisch)

4. Yaremchuk, A. (2020). Videoigrovaya zhurnalistika i mediaindustriya: istoriya razvitiya i segmentaciya [Videospieljournalismus und Medienindustrie: Entwicklungsgeschichte und Segmentierung] // *A-faktor: nauchnye issledovaniya i razrabotki (gumanitarnye nauki)*. – Sankt-Peterburg: Izdatel'stvo SPbGU. – № 1. – S. 5-11. (in Russisch)

UDK 930.85:316.421

THE SPECIFICS OF THE REPRESENTATION OF ENVIRONMENTAL ISSUES IN MODERN MEDIA

Antsiferova Anastasia Igorevna,
Student of the Institute of Social Sciences and Mass Communications,
Belgorod State National Research University, Belgorod, Russia,
E-mail: miss.antziferova2015@gmail.com
Petrunova Tatyana Vladimirovna,
Ph.D. in Psychology,
Associate Professor of the Department of Foreign Languages and Professional Communication,
Belgorod State National Research University, Belgorod, Russia,
E-mail: petrunova @bsuedu.ru

Abstract: *This article examines the specifics of the representation of environmental problems in modern media. For the analysis, such types of media as television, the Internet and periodicals were taken. Individual media outlets were also reviewed, including magazines "Toshka and Company", GEOlenok, The Guardian and The Times newspapers.*

Keywords: *ecology problems, environmental problems on television, environment in print media, Internet, modern mass media, newspapers, specialized magazines, reportage.*

In recent years, ecology has become one of the leading and popular sciences in the world. Environmentalists are trying to find ways to solve these problems, and the media are actively promoting. In different countries of the world (including Russia) there are many television programs, Internet sites, specialized magazines and newspapers devoted to environmental issues. Thus, the relevance of our research lies in the growing interest of the media and its consumers in environmental issues.

The purpose of our research is to study modern media dealing with environmental issues.

In the process of executing the work, the following tasks were set:

1. To consider the peculiarities of the representation of environmental problems on television;

2. To characterize the specifics of reproducing the topic of ecology on the Internet;

3. To study the specifics of publications about the environment in print media.

The object of our research is environmental problems, and the subject is the coverage of environmental problems in the media.

With the increasing popularity of ecology, interest in it has increased among the public far from this science, in this regard, the media of various broadcasting methods provide information for their consumers. Newspapers, magazines, radio, TV, Internet space – a list of resources where anyone can learn about ecology, environmental problems, methods of solving them, any interesting facts, etc. But the media, covering environmental issues, performs not only an entertainment function, it is impossible not to take into account its influence on the views and worldview of the public.

Environmental issues are considered both in the international media and in the Russian media (including regional ones). Due to the consideration of environmental problems through media communications, we have the opportunity to understand their essence, sometimes rethink, conduct discussions and discussions. The main goal of a journalist is not only to tell the reader or viewer about an environmental problem, but also to increase the level of knowledge in society on this topic. The importance of this goal was especially evident in 2017, the year of ecology in Russia. Basically, the media receives special orders from the state, so the information in them is often dictated, but it is worth clarifying that this does not apply to all media [Batanina et al., 2021].

First of all, We would like to draw attention to television – free and publicly available media. However, on television, you can watch small-scale and short-duration stories about environmental problems, especially on federal channels. This topic is not rated very highly and is usually included in the second part of the issue. Viewers are more likely to learn about disasters or emergencies, as well as about the measures taken to eliminate them. Visualization occupies a leading position in television news in order to evoke an emotional response from the viewer. Viewers are shown a convincing video report depicting the environmental disaster from all possible angles, interviews with victims, eyewitnesses and sometimes rescuers [Khairullina, 2022].

Regional TV channels, on the contrary, focus on local environmental issues and do not have a global character. They mainly report on the local environmental situation and the weather. Summarizing the representation of environmental problems on TV, it can be noted that television proves a person's consumer attitude to nature and to the environment in general, people begin to be interested in it and pay due attention only in case of danger.

The Internet is an open platform for discussing environmental issues, collecting petitions and donations. Anyone can publish an article, a note, or create a thematic website [Holbreich, 2019]. But at the same time, the free access of any author to Internet platforms can be called one of the disadvantages of spreading information on the Web, often unreliable data is published there, which can mislead the reader, therefore it is worth contacting only verified sources. As for the media itself, it can be noted that both print media devoted to ecology and magazines and newspapers that are far from this science, but publish thematic issues, have their own websites.

Electronic articles and notes are supported by photographs and videos, and surveys and discussion forums are sometimes created. Large environmental companies create websites on the Internet where news is published, experts share small articles, and a report on the work done is posted. As an example, the most famous non-profit economic organization, namely GreenPeace, can be cited. It has not only the main official website,

but also a Russian one, which is intended for Russian-speaking users [Khakimova, 2018]. Here you can find all the necessary information about ecology. The site hosts news, blogs, stories, podcasts, expert opinions and instructions that will tell you how to behave during natural disasters, solve environmental problems and save resources.

Modern media allow children to get to know the world around us from an early age, presenting information about ecology and nature in an accessible language. The magazine "Toshka and Company" provides interesting facts about animals and fauna of our planet, contains posters with photos of animals, as well as the heading „In the world of animals with Nikolai Drozdov", which teaches kids to take care of animals from an early age [Kanaeva, 2020]. For older children, the Geolenok magazine is offered – a children's version of the famous GEO. It is dedicated to travel, but on its pages you can find articles and reports about ecology. The magazine attracts both children and adults, one of the reasons for this is its catchy and memorable visualization: bright, color-saturated photos on a juicy green background.

Natural problems are topical topics for English-language media such as The Guardian and The Times, which actively publish articles on the topic of the environment in special sections of Environment. Also, information about ecology can be presented in other sections, such as science, health or travel [Filippova, 2018]. The authors of articles can be not only journalists, but also scientists, politicians (with corrections by the editor), sometimes their interviews or comments are inserted into the text. In proven and reputable publications, you can find really interesting and useful information about the environment, in this news from the Web is significantly inferior to the print press, readers of newspapers and magazines have confidence in high-quality material created and processed by professionals. There are several hundred print publications worldwide that cover environmental issues (many of them have electronic versions).

Summarizing all the above, it can be noted that in recent decades the importance of environmental problems has been increasing in the human consciousness. Scientists, developed countries and caring people are actively fighting to save nature.

At the moment, many plans have been developed to change the state of the planet. Ecology and people are directly interconnected and co-dependent, therefore anthropogenic interference in nature is negative for the person himself. This influence is manifested not only directly on health, but also through the spheres of life. Each person is responsible for the future of our planet, it is important to realize this and make their own attempts to solve environmental problems.

The media can be called one of the types of power that exerts influence (and pressure) on society. Media dealing with environmental issues help to form a sense of responsibility towards them, increase people's knowledge of this science, and share up-to-date information about ongoing changes in nature and the world around them.

References

1. Batanina, I.A. et al. (2021). Ekologicheskaya povestka v rossiyskom segmente sotsialnyh media: rezultaty analiza bolshih dannyh [The environmental agenda in the Russian segment of social media: results of big data analysis] // *Izvestiya TulGU. Nauki o zemle*. – No.2 – [online]. Available at: https://cyberleninka.ru/article/n/ekologicheskaya-povestka-v-rossiyskom-segmente-sotsialnyh-media-rezultaty-analiza-bolshih-dannyh. (Accessed: 29.04.2024). (in Russian)

2. Filippova, T.A. (2018). Ponyatie i osnovnye harakteristiki ekologicheskogo diskursa na materiale angloyazychnyh SMI [The concept and main characteristics of ecological discourse (based on the material of English-language media)] // *Lingvistika*. – P. 98. – [online]. Available at: https://cyberleninka.ru/article/n/ponyatie-i-osnovnye-harakteristiki-ekologicheskogo-diskursa-na-materiale-angloyazychnyh-smi/viewer. (Accessed: 30.04.2023). (in Russian)

3. Holbreich, V.B. (2019). Sotsialnye media v lokalnyh ekologicheskih konfliktah [Social media in local environmental conflicts] // *Vestnik Sankt-Peterburgskogo gosudarstvennogo universiteta*. – V.12. – No.4. – [online]. Available at: https://cyberleninka.ru/article/n/cotsialnye-media-v-lokalnyh-ekologicheskih-konfliktah/viewer. (Accessed: 05.09.2023). (in Russian)

4. Kanaeva, A.V. (2020). Formirovanie tsennostnogo otnosheniya studentov k rodine v protsesse chteniya zhurnala "Geolenok" [Formation of students' value attitude to the Motherland in the process of studying the journal " Geolenok "] // *Nachalnoye filologicheskoye obrazovaniye i podgotovka uchiteley v aksiologicheskom aspekte*. – [online]. Available at: https://www.elibrary.ru/item.asp?id=42949499. (Accessed: 30.04.2023). (in Russian)

5. Khairullina, A.R. (2022). Otnoshenie k teme okruzhayushchey sredy na sovremennom televidenii [The relevance of the environmental topic on modern television] // *Molodezhnaya nauka*. – No.1. – [online]. Available at: https://naukaip.ru/wp-content/uploads/2022/01/MK-1294.pdf#page=25. (Accessed: 29.04.2024). (in Russian)

6. Khakimova, E.M. (2018). Ob instrumentah prodvizheniya organizatsii v internete na primere NKO Grinpis Rossii [About the tools for promoting an organization on the Internet (using the example of the NGO "GREENPEACE of Russia")] // *Gumanitarnaya paradigma*. – №4 (7). – [online]. Available at: https://cyberleninka.ru/article/n/ob-instrumentah-prodvizheniya-organizatsii-v-internete-na-primere-nko-grinpis-rossii/viewer. (Accessed: 30.04.2024). (in Russian)

UDK 316.454.52

THEORETICAL FOUNDATIONS OF THE INFLUENCE OF THE MEDIA ON THE FORMATION OF PUBLIC OPINION

Dotsenko Irina Pavlovna,
Student of the Institute of Social Sciences and Mass Communications,
Belgorod State National Research University, Belgorod, Russia,
E-mail: id0tsenko@yandex.ru
Petrunova Tatyana Vladimirovna,
Ph.D. in Psychology,
Associate Professor of the Department of Foreign Languages
and Professional Communication,
Belgorod State National Research University, Belgorod, Russia,
E-mail: petrunova@bsuedu.ru

Abstract: *This article is devoted to the theoretical basis for studying the influence of the media on the formation of public opinion. The social functions of the media, which contribute to the formation of public opinion, are considered. Part of the article is also devoted to the methods of influence that the media are directly guided by in order to form a certain worldview of their audience.*

Keywords: *public opinion, social media functions, formation of public opinion, the communicative function of the media, media information function, the value-regulating function of the media.*

The mass media have the opportunity to influence the mass consciousness. People who do not have the opportunity to double-check the facts and arguments put

forward by the media when providing information, blindly believe every word of a journalist, firmly believe that everything that is written in a newspaper, magazine, Internet, what is shown on television, what is said on the radio is true.

The purpose of the work is to identify the peculiarities of the influence of the media on the formation of public opinion through social functions and methods of psychological influence.

In the process of executing the work, the following tasks were set:

1. Analyze the necessary literature on the topic;

2. Get acquainted with the social functions of the media;

3. To consider all existing methods of media influence on the formation of public opinion

The object of the study is the influence of the media on the formation of public opinion.

To begin studying the influence of the media on the formation of public opinion, it is necessary to turn to the initial aspects of the impact of the media on society and, most importantly, to their social functions.

First of all, it is worth noting that social functions are a group of functions, each of which is responsible for a certain component of the existence of the media in society [Grigoriev, 2010]. There are 5 such functions in total: communicative, informational, value-regulating, socio-organizational, mental regulation or psychological discharge.

As for the communicative function of the media, it is that it is an integral part of the functioning of the media as a whole. By definition, the communicative function of the media is the coverage of dispersed people and communities for communication, receiving, exchanging information, mutual adjustment and organization of this type of social communication with the expectation of positive effects [Berezhkova, 2014: 7]. This means that information is exchanged through this function, which is the most important aspect of the existence of the media as the widest institution for the exchange, detailing, processing and consumption of socially significant information.

Through communication, people from time immemorial have transmitted the most necessary "instructions of life" for existence, which means that society is savvy in consuming information, interested in the work of the media, in ensuring that the facts provided are read, seen, heard by the consumer. Only when the above three points are fulfilled, the information that the media provide to the audience becomes socially significant.

The second, and the most important social function of the media, is considered to be the information function. It is not only a social, but also a universal, integral, obligatory function of the press. The information function of the mass media is the production and dissemination of information to a mass audience, taking into account its diverse characteristics (composition, requests, needs, interests) in order to ensure the joint activity of people [Fomicheva, 2007].

The next function we characterize will be the value-regulating one. Harold Dwight Lasswell (political scientist, sociologist, known for publishing his theory of linear communication model in 1948, author of the monograph "Propaganda Technique in the World War") called this function the function of correlation, or mutual coordination of society's attitude to what is happening in the world of interaction between people and media.

The definition of the value-regulating function as a whole sounds as follows: This universal function is performed not so much through the exchange of knowledge about reality, as through the formation of attitudes towards them, bringing them into connection with what in sociology is called values and norms, or a value-normative system [Fomicheva, 2007]. This means that it is through this function that the mass media influence people's consciousness, instilling in them certain values and attitudes towards the material and spiritual aspects of society.

The social organizational function is defined as the ability of the media, being channels for connecting people, to support their joint existence, that is, social communities [Fomicheva, 2007]. This definition can be interpreted in different ways. On the one hand, people, through reading, watching, listening to media products, become part of the media audience, regardless of their desire, they form into a community that is subject to the influence of the media. On the other hand, people can unite into societies of their own free will, finding allies in their interests, that is, forming a circle of people interested in a particular field of activity on which the media provides information.

The final function that we will consider will be the function of mental regulation or psychological relaxation. The function of mental regulation or psychological discharge is the effect on the psycho-emotional tone of people which is achieved through the influence of not only the content, but also the forms of presentation, priorities in the selection of content, design, repeatability of releases at the usual time and all characteristics related to media.

This function is the main one in studying the influence of the media on the formation of public opinion. It is directly proportional to the psychology and consciousness of people [Beseda, 2017: 312], through it the mass media regulate people's behavior with regard to specific situations, have the opportunity to build mass opinion in a way that is beneficial to them. With the help of a specialized selection of content, the media can build the information provided so that the viewer, reader or listener delves into the problem, connects what is happening with his life, gets into it and is influenced by it.

Thus, having studied the social functions of the mass media, we can conclude that the function of mental regulation or psychological discharge and the value-regulating function are fundamental in studying the influence of the mass media on the formation of public opinion, because it is through them that control over mass consciousness is carried out.

We have already become familiar with the value-regulating function and the function of mental regulation or psychological discharge, which allow the media to influence mass consciousness. Now we should investigate the methods of influence of the mass media on the formation of public opinion.

First of all, it should be said that methods of influence are formed in certain conditions, which are divided into objective and subjective. In objective conditions, the methods become generally digestible, suitable for all typologies of society. In subjective conditions, not all methods of influencing public consciousness are working. Here, the influence on the mass consciousness depends on the degree of development of society, its evolutionary position of compliance with value orientations and generally accepted norms.

So, there are four methods of influencing public opinion:

• Suggestion is a way of influencing human consciousness, in which the suggestible does not comprehend the information consumed, which is explained by a high degree of trust in the suggestor;

• Infection occurs through the rapid transmission of information affecting consciousness. In this case, people do not have time to comprehend the information received, panic and public dissonance appear;

• Imitation is a process of socialization and a way of influencing public consciousness, in which there is an involuntary repetition of someone's thoughts, actions, etc.;

• Persuasion is a method by which social reality is comprehended according to those factors that express the consumer's attitude towards it. It usually depends on the context in which convincing information is contained based on values and views close to the person being convinced.

W. Lippman considers public opinion to be a product of purposeful informational influence and uses the concept of "stereotype" as a starting point for the analysis of public opinion [Pyadysheva, 2017: 77]. A stereotype is an established perception of reality, a traditional canon of behavior and thoughts. A stereotype as a method of influencing public consciousness includes such signs as:

• Emergence based on established ideas about the world;

• Broadcasting habits and traditions;

• Having a negative or positive impact on the creation of new moral attitudes;

• Contains an assessment of the attitude towards something new, not yet familiar to the consumer;

• It is inextricably linked with the moral norms and traditions established in society;

• It is aimed at the unity of society.

The concept of attitude is important in studying the influence of the media on the formation of public consciousness. Attitude is a certain psychological experience by a specific individual regarding some social value, the meaning of a social object. Attitude is a social attitude, another method of mass media influence on the formation of public opinion, divided into three components of influence on public consciousness: cognitive, emotional and behavioral. With continuous assistance from each other, these components form the regulatory function of the installation, through which people's consciousness is influenced. Practice shows that a person most often perceives reality through its reflection in the media.

Thus, in the context of modernity, under objective conditions of formation of methods of influence, the media are a means of manipulation in creating a person's worldview, a means of destroying and building stereotypes about the surrounding reality and complete stereotyping of mass consciousness.

References

1. Berezhkova, E. A. (2014). Sotsialnaya funktsiya SMI v kontekste zakonov rynochnoy ekonomiki [The social function of the media in the context of the laws of the market economy] // *Metody vozdeystviya SMI na formirovaniye obshchestvennogo mneniya. Idei i innovatsii*. – No. 2. – Pp. 7-14. – Nizhnevartovsk: NGU. (in Russian)

2. Beseda, D. Y. (2017). Formirovaniye obshchestvennogo mneniya cherez sredstva massovoy informatsii [Formation of public opinion through the mass media] // *Metody vozdeystviya SMI na formirovaniye obshchestvennogo mneniya*. – No. 2. – Pp. 312-314. – Nizhnevartovsk: NGU. (in Russian)

3. Fomicheva, I. D. (2007). Sotsiologiya sredstv massovoy informatsii: uchebnik dlya studentov vysshikh uchebnykh zavedeniy, obuchayushchikhsya po spetsialnosti „Zhurnalistika" [Sociology of Mass media: a textbook for students of higher educational institutions studying in the specialty "Journalism"]. – 334 p. – M.: Aspect Press. (in Russian)

4. Grigoriev, V.V. (2010). Rossiyskiy rynok periodicheskikh izdaniy: sostoyaniye, tendentsii i perspektivy razvitiya: otraslevoy obzor [The Russian market of periodicals: state, trends and prospects of development: an industry report]. – 100 p. – M.: Federalnoye agentstvo po pechati i massovym kommunikatsiyam. (in Russian)

5. Pyadysheva, T. G. (2017). Metody vozdeystviya na obshchestvennoye mneniye [Methods of influencing public opinion] // *Metody vozdeystviya SMI na formirovaniye obshchestvennogo mneniya. Seriya: Sotsialnyye nauki*. – Vol. 3. – № 4(12). – Pp. 77-85. (in Russian)

UDK 659

THE EVOLUTION OF THE RUSSIAN MEDIA SYSTEM IN THE ERA OF NEW MEDIA

Durnev Ilya Viktorovich,
Student, Institute of Social Sciences and Mass Communications,
Belgorod State National Research University, Belgorod, Russia,
E-mail: 1540536 @bsuedu.ru
Petrunova Tatyana Vladimirovna,
Ph.D. in Psychology,
Associate Professor of the Department of Foreign Languages
and Professional Communication,
Belgorod State National Research University, Belgorod, Russia,
E-mail: petrunova@bsuedu.ru

Abstract: *This article examines the factors of media transformation in Russia. The concept of a media system and its features are also revealed. The article presents some aspects of the specifics of information consumption by the online media audience and evolution of the Russian media system.*

Keywords: *new media, media system, web media, media space, digitalization.*

With the development of an information (post-industrial) society, a person is increasingly immersed in a parallel reality, a kind of illusory world of the Internet, in the vastness of which he can receive information that is not available to him in real life, openly express his opinions, declare himself. As a result, there is an active influx of consumers of digitized content.

Naturally, changes in the way modern readers perceive information, their transition from print media to digital media, forces the media to adapt to the new habits of their audiences, transform into a digital media environment, some kind of "new media". To summarize, we can say that "new media" is all communication technologies in digitized form, and the Internet is the main source of access to information in this form.

The purpose of this work is to study the causes of the transformation of the Russian media system, as well as to consider the specifics of information consumption by the online media audience.

In the process of executing the work, the following tasks were set:

1. To analyze the main trends in the development of new media in Russia.

2. To study the peculiarities of adaptation of traditional media to the conditions of the digital age and their interaction with new media.

3. To assess the prospects for the development of the Russian media system in the context of globalization and increased competition in the information market.

The object of the study is the diversity of new media in the information space of Russia. The subject of the research is the technical, genre and audience features of new media.

“It is obvious that the current state of Russian media is significantly differs from the previous one, and changes in the media system have become complex result of multilateral and multi-layered transformations media sphere in general, as well as media and journalism at the national and global levels under the influence of geopolitical, economic, especially neoliberal, political, mainly at the national level, as well as current social, interethnic and intercultural processes" [Tertychny, 2000].

To understand what the transformation of media systems is, you first need to find out the reasons for this transformation, and then what it manifests itself. Firstly, the key role in media transformations has been played by digitalization, which has changed the technical media environment. Nowadays, it is much easier for a person to find information on the phone by looking into the network.

The Internet is better than buying a newspaper and diligently extracting the necessary information from the entire issue. Accessibility is the key parameter to choose the source of information. Thus, in print media, the reader is provided with a limited amount of information, let's say ten pages of a newspaper, while in the Internet space the user can open millions of Internet resources and familiarize yourself with the material. Of course, it is more economically profitable to consume millions of gigabytes of information on the Internet for a small fee than to buy a new issue of a newspaper every time, the materials of which will be read quickly. Thus, it is worth noting that accessibility and economic benefits force a person to choose the Internet space and all the media included in it.

Secondly, the emergence of new advertising models has become an important factor in changing the Russian media system. Advertising in the Russian media is often a source of funding. Advertising from the economic point of view is invaluable for the modern Russian media system. The volume in the media in 2021. It reaches 394 billion rubles (+25% by 2020). This means that large companies in the media industry have some stability. Also, do not forget about the adjustments in the distribution of advertising, which are achieved by the changing structure of the media system. According to ACAR data for 9 months of 2021, the volume of television advertising in Russia amounted to 131-133 billion rubles, and the volume of online advertising amounted to 214-216 billion rubles. This means that advertisers prioritize online promotion of their services. Although 5 years ago, television occupied a leading position in advertising (according to ACAR data, 150.8 billion rubles), while the Internet's advertising volume in its distribution media amounted to (136 billion rubles).

Thus, it can be concluded that currently the distribution of advertising has become more popular on the Internet than on television. It follows that another reason

for the changes in the media system in Russia is the transition from traditional media to new media in the field of advertising. In the end, we want to note how the transformation of media systems itself manifests itself. It has recently touched on such an aspect as the foundation of the publication (a large number of private publications appeared), the characteristics of the typology (status changes) were also affected publications from official to opposition ones). The change in the media space is also expressed in deviations from the norms of media functions.

The so-called aberration leads to the fact that the information function of the media is significantly deviates from its beginning. Currently, they have stopped writing about heroes, about brave men and women. Nowadays, the media consumer's attention is focused on scandals of media personalities, criminal stories and various curious situations. Information about the negative has become several times higher than information about something good. Such a decrease in information.

The functions of the media are related to the pursuit of profit. It has become more profitable for the press to sell sensationalism and scandals for a lot of money than just to publish ordinary, everyday news that does not bring much income. Because of media aberrations. The relaxation function is hypertrophied. Pop culture overshadows the values of life. More and more airtime is devoted to talk shows and entertainment content in general, and only part of the time is devoted to cultural and educational programs. "In order to avoid processes related to the aberration of media functions, it is worth changing the direction of their development from commercialization towards sociojournalism" [Trifonova, 2014].

"The transformation of the domestic media system is an interesting and perhaps historically unique example of changes under the influence of hybrid influences: on the one hand, the market nature of media a business that is widespread on a global scale, on the other hand, a historically deterministic path of national development determined by internal factors" [Vartova, 2021].

Due to the process of globalization, the media system has undergone significant changes. Information can be delivered from one end of the earth to the other without the slightest effort. Traditional media become outdated, cease to meet the needs of users, and then new media appear in the media space – Online media. Online media are large sites visited by a relatively large number of people, which are updated several times a day and provide exactly the journalistic products that are socially significant" [Nikitenko, 2009].

The Internet media can be divided into two groups: electronic versions of traditional media and a separate group is network media, whose activities take place only in the Internet space. The first group includes electronic versions of printed publications. The second group tends to pursue an independent information policy.

Online media has a lot of advantages over traditional media, with the help of which they occupy a leading position in the media space, namely: interactivity, personalization, multimedia. With the help of these and other advantages of web media, you can see exactly what the specifics of information consumption by the online media audience are. It so happened that in the era of digitalization, the content produced by the media is growing in volume.

More and more new radio stations are being created, television is creating more and more hours of original programs, and the Internet space is being uploaded millions

of gigabytes of information. So, it turns out that a person cannot hypothetically, consume as much media product as is created for it. Hence the problem arises, the user is forced to sort huge amounts of information and try to find content for himself. The specificity of this phenomenon lies in the fact that the consumer should not search for information, he should sort it, as well as divide it into true and false.

The first feature of Internet consumers' media is filtering search the material. It consists in the fact that out of a million proposed articles on therefore, you need to isolate for yourself the truthful and simply extracted information. A person strives to simplify the consumption of information. Previously, it was the reading of the collected material by journalists in newspapers. Now, with the development of technology, the consumer can watch a two-minute video on the Internet and learn the essence of an entire news release of the print press. And in order to choose the right content, the user must open and familiarize himself with hundreds of sites in order to choose the one that suits him. The choice should stop at a resource that is considered to be leading in the field media, and most importantly, the information should be provided in an accessible, understandable way with your tongue. Thus, one of the distinctive properties of consumption is the content of online media is a multi-level filtering of the material.

The second clearly expressed aspect of the specifics of the consumption of online media material is the consumer's transition not to the main page of the publication, but immediately to the desired article. That is, the classical scheme of information consumption has changed, which previously represented a user's transition to the main media page, searching for suitable material on it, and then the very reading of the information. Users are currently clicking on hyperlinks from social networks, immediately to the desired publication material. That is why traffic to the main page decreases year-round. So thus, consumers have changed the classical scheme of information consumption.

Thirdly, users have become much more demanding of the information they receive. And this is just a feature of the consumer of the 21st century, because this has not been observed before. There is a lot more content being released now than a person can consume, which is why the user needs to be interested in their materials, because the competition is extremely high. The user needs 3-8 seconds to visually evaluate the content and in case of inconsistency with your own the requirements are simply to close the site. Consumption has become fragmented. The reader has stopped reading the essence of the information, it plays an increasingly important role interactive design. The user will choose a site with a "colorful" design, where there will be more pictures, an unusual font and other comprehensive interactive products. Summing up all of the above, it is worth noting that the features of online media consumption are content filtering. Summing up all of the above, it is worth noting that the specifics of online media consumption are multifaceted.

Thanks to digitalization, the media space is changing at a rapid pace. The evolution of the Russian media system is primarily due to consumer demands. The demand for print media in our country is decreasing. Therefore, traditional media are moving into the Internet space, because almost the entire target audience uses the World Wide Web to search for information. People began to consume more entertainment content. Readers need sensations, scandals, incidents. Cultural and

educational information ceases to interest readers. Therefore, all media content is aimed at entertainment function. Also, the media began to specialize as a wide platform for advertising. The information function reduces its importance; the media becomes a commercial product. They began to produce not the content that is considered socially significant, but one that can be sold more expensively. Because of such changes, the evolution of the Russian media system is taking place.

References

1. Kroychik, L.E. (2000). Sistema publitsisticheskikh zhanrov [The system of journalistic genres] // *Osnovy tvorcheskoy deyatelnosti zhurnalista* / Pod red. S.G. Korkonosenko. – Pp. 125-168. – Sankt-Peterburg. (in Russian)

2. Nikitenko, A.A. (2009). Interaktivnost, multimediynost, gipertekstualnost kak opredelyayushchiye tipologicheskiye priznaki setevykh izdaniy [Interactivity, multimedia, hypertextuality as determinative typological features of online publications] // *Vestnik VGU. Seriya: Filologiya. Zhurnalistika*. – №1. – [online]. Available at: http://www.vestnik.vsu.ru/pdf/phylolog/2009/01/2009-01-35.pdf. (Accessed: 04.05.2024). (in Russian)

3. Savinova, O.N. (2008). Transformatsiya mediasistemy v sovremennykh usloviyakh: k voprosu ob aberratsii mediafunktsiy [Transformation of the media system in modern conditions: on the issue of aberration of media functions] // *Vestnik Nizhegorodskogo universiteta im. N.I. Lobachevskogo*. – №3. – [online]. Available at: https://cyberleninka.ru/article/n/transformatsiya media systems-in-modern-conditions-to-question-aberration-of-functions-media/viewer. (Accessed: 12.04.2024). (in Russian)

4. Tertychny, A.A. (2000). Zhanry periodicheskikh izdaniy [Genres of periodicals] // *Aspect Press*. – [online]. Available at: http://www.evartist.narod.ru/text2/01.htm. (Accessed: 05.03.2024). (in Russian)

5. Trifonova, Yu.V. (2014). Osobennosti internet-SMI [Features of Internet media] // *YAzyk. Kultura. Kommunikatsii*. – №6. – [online]. Available at: https://journals.susu.ru/lcc/article/view/45/90. (Accessed: 29.03.2024). (in Russian)

6. Vartova, E.A. (2019). K voprosu o ramkakh teoreticheskogo analiza i natsionalnykh osobennostyakh rossiyskoy mediasistemy [On the issue of the framework of theoretical analysis and national peculiarities of the Russian media system] // *Media Almanakh*. – No.2. – [online]. Available at: https://cyberleninka.ru/article/n/k – the question-about-the-framework-of-theoretical-analysis-and-national-features- media system-rossii/viewer. (Accessed: 18.04.2024). (in Russian)

SECTION 4
COMPUTER SCIENCES

UDK 656.132.6

TRENDS AND DEVELOPMENT OF FRONTEND

Gulyaev Vitaly Igorevish,
Student of the Institute of Engineering and Digital Technologies,
Belgorod National Research University, Belgorod, Russia,
E-mail: VitalyG-17@yandex.ru
Grigorenko Svetlana Evgenievna,
PhD in Pedagogy,
Associate Professor of the Department of Foreign Languages
and Professional Communication,
Belgorod National Research University, Belgorod, Russia,
E-mail: sgrigorenko@bsuedu.ru

Abstract: *The article provides an overview of frontend development, covering fundamental concepts such as HTML, CSS, and JavaScript, as well as an introduction to popular tools such as preprocessors and frameworks. In addition, the authors discuss different approaches to creating dynamic and interactive web applications and provide insight into the evolution of technology.*

Keywords: *development, frontend, framework, library, JavaScript, TypeScript, HTML, CSS, Angular, Vue, React.*

Introduction. The frontend of a web application is the user interface (UI) – the visual elements and functionality that users interact with while browsing the web. This area of software development plays a key role in shaping user experience (UX) and increasing user engagement. In this article, we will review the core technologies used in modern frontend development, including fundamental languages such as HTML (Hypertext Markup Language), CSS (Cascading Style Sheets), and JavaScript, as well as common frameworks and libraries.

After a fundamental overview of these core languages, considerable attention has been paid to the discussion of the usefulness of preprocessors to simplify CSS development. The role of JavaScript as the cornerstone of frontend interactivity is then examined, as well as the emergence of TypeScript as a solution for improving code maintainability and addressing the limitations of dynamic typing.

The growing trend of using frameworks and libraries in frontend development will be discussed. The article makes a clear distinction between these entities: libraries offer out-of-the-box functionality, while frameworks offer comprehensive platforms for web application development. The article analyzes three well-known frameworks – Angular, Vue, and React – highlighting their strengths, weaknesses, and suitability for different scales of projects. The final part summarizes the results of this work and draws conclusions.

Main part. All development is significantly divided into two primary areas – the frontend and the backend. Let us delve deeper into the frontend, as it constitutes the user interface encountered daily by network users, crafted through frontend technologies.

The frontend of a website encompasses everything visible to users and with which they can interact via a browser. It encompasses all elements perceivable by users when accessing a web page, including buttons, banners, and animations. While closely related to the business logic, which is the server-side of the application, the frontend is developed by backend programmers.

One can easily immerse oneself in the realm of web development by right-clicking on any web page and opening the console, where one can observe the work of frontend developers. But how are modern web resources created, and what technologies are employed? For frontend development, the foundational tools employed are HTML for structuring page content, CSS for styling the appearance, and JavaScript for incorporating interactivity. This toolset is also utilized in crafting progressive web applications, which mimic native applications but are developed using frontend technologies [https://habr.com/ru/companies/otus/articles/674748].

While we have acquainted ourselves with the standard toolkit, it extends far beyond, encompassing CSS processors, frameworks, libraries, and more. Let us scrutinize each technology of the basic stack in detail before delving into a more comprehensive examination.

Commencing our exposition with HTML, it is tailored for creating accessible websites viewable through internet access. HTML primarily serves to structure web documents, defining elements such as headings or paragraphs and facilitating the insertion of media files. Markup delineates the attributes attributed to text within HTML tags, which determine, how browsers format and present page content. Renowned for its simplicity, HTML employs basic syntax and straightforward concepts, rendering it accessible for novices and facilitating their entry into web development.

While HTML specifies the elements on a web page, it does not style them. In contemporary web development, CSS is indispensable – a language delineating the style and design of web pages. CSS collaborates with HTML to determine the display of elements like text, images, and media. It furnishes developers with a plethora of style properties and selectors for creating appealing and consistent designs across web pages. CSS enables control over various visual attributes of a webpage, encompassing color, font size, background image, and spacing. Moreover, it facilitates responsive design, where pages adapt their layout based on the device utilized [blog.back4app.com/front-end-programming-languages].

However, composing CSS code can become laborious, with tasks like finding color values or closing tags proving time-consuming. Herein lies the utility of a preprocessor. A CSS preprocessor, such as Sass (Syntactically Awesome Stylesheets) or LESS (Leaner Style Sheets), augments the capabilities of CSS. Sass, for instance, introduces nested rules, parent selector references, nested properties, and template selectors, thereby enhancing code organization and comprehension. Conversely, LESS permits variable extraction and manipulation, easing code maintenance by centralizing control over properties.

Transitioning to JavaScript, it stands as the bedrock of all frontend development. According to GitHub, JavaScript reigns as the most prevalent programming language globally, with support from all major browsers. JavaScript facilitates interactivity on

web pages, manipulating HTML and CSS via the Document Object Model (DOM) – a browser-generated model enabling object manipulation based on HTML code [blog.back4app.com/front-end-programming-languages].

JavaScript, often referred to as a scripting language, executes scripts comprising instructions triggered upon page loading. The browser autonomously interprets JavaScript code, obviating the need for compilation. JavaScript scripts can be embedded within page code or appended to HTML as separate files. User actions on the page, precipitating events like clicking on a button or moving the mouse cursor, prompt JavaScript operations. However, the language's dynamic typing, allowing variables of any data type without strict specification, may engender unpredictable behavior, especially in extensive projects. To address this, TypeScript emerges as a solution.

TypeScript rectifies numerous JavaScript shortcomings, boasting a syntax akin to JavaScript and facilitating seamless adoption for frontend developers. TypeScript code compiles into JavaScript, rendering it suitable for any browser-bound project. Static typing in TypeScript precludes many JavaScript pitfalls, offering distinct data types and access modifiers like public, private, and protected.

In contemporary web development, a growing number of practitioners eschew conventional JavaScript or TypeScript coding in favor of frameworks and libraries. Before delving into popular choices, it's imperative to differentiate between these terms. Libraries encompass collections of prebuilt functions and code inherent to a programming language, easing developers' tasks and obviating redundant coding. Conversely, frameworks extend beyond libraries, constituting platforms for deploying software products replete with database interaction, file system management, component styling, error handling, and more.

One such prominent framework is Angular, developed by Google. It serves as a multifaceted environment for crafting web applications of varying complexity. Equipped with proprietary libraries and debugging tools, Angular facilitates the development of interactive and single-page websites. Notable advantages include support for the NativeScript framework for mobile application development and scalability in application architecture. However, Angular's intricate structure and extensive codebase may predispose it to performance issues, necessitating code optimization techniques.

Vue.js, another increasingly popular option, also hails from Google programmers. Operating on similar principles but boasting a more streamlined design, Vue excels in crafting compact interactive applications. Its flexibility in customization and ease of learning makes it suitable for projects of diverse scales. However, Vue lags behind its counterparts in tool availability.

React, a cutting-edge library fostered by Facebook, stands out for crafting interactive user interfaces for web and mobile applications. Leveraging reusable components, React enables data display and updating sans page reloads. Renowned for its high performance, seamless integration with various frameworks, and JSX syntax, React remains at the forefront of frontend development. Nonetheless, React's complexity and necessitation of separate build tools for integration with other

components and frameworks pose challenges [https://thecode.media/js-framelibs/?ysclid=lu1p8xu2jn505868362].

Conclusion. This paper has clearly shown that frontend development burgeons incessantly, propelled by the perennial quest for engaging and responsive user experiences. Developers wield a profusion of tools, from foundational languages like HTML, CSS, and JavaScript to sophisticated frameworks such as Angular, Vue, and React. As frontend technologies evolve, developers must remain abreast of trends and best practices to navigate the ever-changing digital landscape. Whether harnessing new frameworks or mastering the fundamentals, frontend development promises an exhilarating and dynamic realm ripe with opportunities for innovation and creativity.

References

1. Back4App. "Top Front-end Programming Languages in 2022: Key Takeaways." Back4App Blog. – [Online]. Available: https://blog.back4app.com/front-end-programming-languages/#Key_Takeaways. (Accessed: April 12, 2024).

2. Habr. "Frontend development: key technologies and concepts " Habr.com. – [Online]. Available: https://habr.com/ru/companies/otus/articles/ 674748/. (Accessed: April 12, 2024).

3. The Code. "JS frameworks comparison: what is the best choice in 2024." The Code. – [Online]. Available: https://thecode.media/js-framelibs/?ysclid=lu1p8xu2jn505868362. (Accessed: April 12, 2024).

UDC 636.082

DEVELOPMENT OF A VIRTUAL LOCAL NETWORK FOR A RESTAURANT

Efremova Elizaveta Viktorovna,
Student of the Institute of Engineering and Digital Technologies,
Belgorod National Research University, Belgorod, Russia,
Email: 1560329@bsu.edu.ru
Grigorenko Svetlana Evgenievna,
PhD in Pedagogy,
Associate Professor of the Department of Foreign Languages and Professional Communication,
Belgorod National Research University, Belgorod, Russia,
E-mail: sgrigorenko@bsuedu.ru

Abstract: *This article presents the development of a virtual local area network for a restaurant. The introduction provides an overview of VLAN technology and its advantages for network management, security, and performance. The study analyzes the subject area, including the organizational structure and existing network infrastructure of the restaurant. The methodology involves selecting optimal active and passive network components based on performance, scalability, security, and cost criteria.*

Keywords: *VLAN, local network, network, development of a local network, virtual local network.*

Introduction. In the modern world, the restaurant business has become a highly competitive environment, where success depends not only on the quality of food and service but also on the efficient organization of internal processes. One of the key

factors contributing to increased productivity and improved interaction between employees is the presence of a reliable local network.

The development of a local network for a restaurant is a relevant task that will increase work efficiency, improve communication, ensure data security, and create conditions for the implementation of modern technological solutions.

Main part. A virtual local network (VLAN) is a way to divide a network into several logical groups that can exchange data with each other, but are isolated from other groups. VLAN allows more efficient network management, increased security, and improved performance, as traffic within a VLAN does not interfere with other groups. This approach is used in large offices, universities, and other organizations where the network needs to be divided into separate functional areas [http://supervideoman.narod.ru/s9/5_8.html].

The goal of this article is to build a virtual local network for a restaurant. To achieve this goal, the following tasks need to be performed:

- Conduct an analysis of the subject area;
- Select passive and active equipment;
- Calculate the project costs.

The restaurant has a work group of 32 people: 15 cooks, 10 waiters, a head chef, a sous-chef, a director, a technologist, a chief accountant, a junior accountant, and a manager. Separate workstations equipped with personal computers (PCs) are provided for the chef, accounting, and the manager. Each PC is connected to a scanner, printer, and interconnected through a switch, with all PCs having Internet access. In each workshop and in the bar, all-in-one sensor devices with the R-Keeper software complex are installed and connected to the manager's server [https://www.posland.ru/articles/r-keeper].

All PCs and the manager's server are connected to the main server in the director's office. The main server stores all the necessary information for optimal network operation. The server receives and processes data from other computers and manages the information databases.

The most optimal type of computer connection in the common network will be the "Tree" topology [https://www.sites.google.com/site/arhitekturalvs/home/drevovidnaa-topologia]. Let's move on to building the virtual local network.

PCs are located in 3 offices: 2 in the accounting office, 1 in the director's office, and 1 in the head chef's office. The server is located in the director's office. The database is stored on the server, and the computers transfer information to and from the server. The server is the control device. The Acer Aspire TC-1660 system unit was chosen for the server [Bolgova et al., 2020].

The Mikrotik RB2011UiAS-2HnD-IN router was selected due to its adequate 0.6 GHz processor, 128 MB RAM, support for 802.11n Wi-Fi standard, and ample 10 LAN ports, meeting the networking requirements while offering a cost-effective solution.

The Mikrotik CSS326-24G-2S+RM switch was chosen for its ample 24 port count, high 10 Gbps data transfer rate, versatile rack or desktop mounting options, and cost-effective price point of 25,999 rubles per unit. This switch model offers a

compelling combination of performance, flexibility, and affordability, making it well-suited for the project's networking needs.

It was chosen for the ease of installation and the number of ports. Its high data transfer speed is also a significant advantage. On all computers, except the server and the manager's PC, Windows 10 x64 Home is installed. A more professional version, Windows 10 x64 Professional, is installed on the manager's PC. The server was installed with a special operating system, Windows Server 2022.

Next, passive equipment was selected.

The Ural PAK double-lock cable channel was chosen for laying the cables.

Twisted pair cable was used to connect all PCs together.

Twisted pair is used to transmit data through network cables, such as Ethernet or telephone lines. Twisted pairs protect the transmitted signal from interference, improving the quality of the connection.

RJ-45 8P8C CAT 5e REXANT jack for connecting the central device to the twisted pair cable. It has mounting sockets, which are necessary for connecting PCs to the network. It is installed opposite each computer, connected to the "twisted pair" coming from the central device.

The total cost of passive network equipment was calculated, and is 9104 rubles.

Conclusion. As a result of this work, a plan for building a virtual local network for a restaurant was created. Optimal active and passive network components were selected, and the costs of implementing the project were calculated.

The following tasks have been completed:

- The subject area was analyzed;
- Active and passive network equipment was selected.

Meticulous consideration was given to choosing the most suitable active and passive networking hardware to ensure an efficient and high-performing network infrastructure.

The cost of the local network was estimated, the cost amounted to 509,803.00 rubles. This method of selecting active and passive equipment aids in reducing the expenditures associated with procuring said equipment, thereby facilitating an increase in the additional revenue streams for the restaurant enterprise.

References

1. Bolgova, E.V., Nesvoeva A.A. (2020). Postroenie virtualnoy lokalnoy seti agropromishlennogo predpriyatia [Building a Virtual Local Area Network for an Agricultural Enterprise] // *Modern Science*. – № 5(4). – Pp. 300-303. (in Russian)

2. Drevovidnaya topologia [Tree topology]. – [online]. Available at: https://www.sites.google.com/site/arhitekturalvs/home/drevovidnaa-topologia. (Accessed: 05.03.2024). (in Russian)

3. R-Keeper: i eto vse o nem. – [online]. Available at: https://www.posland.ru/articles/r-keeper/. (Accessed 05.03.2023). (in Russian)

4. Virtualnie lokalnie seti (VLAN) [Virtual local network]. – [online]. Available at: http://supervideoman.narod.ru/s9/5_8.html. (Accessed 05.03.2024). (in Russian)

UDK 681.3.05

SOFTWARE IMPLEMENTATION OF THREE-DIMENSIONAL SCENES

Ismailova Kamilla Sandjarovna,
Student of the Institute of Information Systems and Technologies,
Belgorod State National Research University, Belgorod, Russia,
E-mail: ismailovakamilla193@gmail.com
Grigorenko Svetlana Evgenievna,
Ph.D. in Pedagogy,
Associate Professor of the Department of Foreign Languages
and Professional Communication,
Belgorod State National Research University, Belgorod, Russia,
E-mail: sgrigorenko@bsuedu.ru

Abstract: *The article discusses the significance and technical implementation of three-dimensional graphics in modern programming, emphasizing its importance in various life spheres. The stages of creating three-dimensional scenes, including modeling, visualization, and model output are examined, along with key concepts such as models, lighting, and cameras.*

Keywords: *three-dimensional graphics, virtual reality, models, lighting, cameras, programming, 3D visualization.*

Introduction. Currently, three-dimensional graphics assumes a pivotal role across diverse programming domains, permeating nearly every facet of human life. Three-dimensional graphics encompasses a suite of tools and methodologies employed in the creation of volumetric entities. From sophisticated training simulations to systems facilitating the control of dynamic entities, the principles underpinning virtual reality and three-dimensional graphics are actively harnessed to craft immersive and lifelike visual scenarios.

Creating 3D objects provides an opportunity to see objects that do not exist at the moment, or those that exist but cannot be seen in real life [Boguslavsky, 2016].

Main part. Let's discuss where 3D modeling is encountered and into which spheres of human life it penetrates. Today, the creation of various character models is utilized in the production of cartoons and in the design of modern computer video games. 3D visualization is particularly prevalent in construction and in the creation of 3D models of interior items.

Design companies often execute them to showcase the aesthetic properties of presented exhibitions. Three-dimensional graphics play a significant role in advertising and marketing when demonstrating a service, allowing for a more impactful impression on interested parties. Professional artists and jewelers also employ specialized programs to create original and unique sketches. The medical field is no exception. For instance, during plastic surgery or surgical interventions, three-dimensional graphics are increasingly utilized to visually demonstrate to the patient how the procedure will proceed and what the outcome will be.

The process of creating a three-dimensional model includes three stages:

– modeling;
– visualization;

– model Output (printing or on the monitor).

Modeling involves creating a model from scratch, designing with software tools, specifying appropriate sizes, textures, and lighting. A framework of objects is created, described by mathematical formulas and the next stage of this process is rendering – the transformation of the raw framework into a visually pleasing form, rounding corners, displaying light, displaying textures and it is carried out using software tools. Output to print or to the monitor of the obtained visual model is the final stage of 3D objects creating. Advanced technologies do not stand still; scientists invent new technical innovations, among which are 3D monitors and 3D printers.

This study also delves into fundamental terms and concepts integral to three-dimensional graphics, including model, lighting, camera, landscape, and sky. Understanding these concepts is key to creating realistic three-dimensional scenes and effective software implementation.

The initial element in the creation of three-dimensional model is the model, representing an object or entity in 3D graphics that can be generated and showcased on a computer screen.

Following this, lighting emerges as a critical term, elucidating how objects interact with light to engender visual effects essential for crafting realistic three-dimensional scenes. This encompasses aspects such as light sources, surface reflections, and shadow rendering.

A camera is the next element in three-dimensional graphics defines the viewpoint of the scene and parameters of visual display, which allows determining the viewing angle, perspective, and depth of the scene. It demonstrates what will be visible on the user's screen.

The next term is landscape represents the visualization of the Earth's surface, including relief, vegetation, water bodies, and other natural and artificial elements of the environment.

The last component of creating a three-dimensional model is sky, which represents the visualization of the Earth's atmosphere, including clouds, sun, moon, stars, and other astronomical objects.

The concept of a three-dimensional scene encompasses:

– representation of terrain (landscape, sky);
– static (stationary: camera, lighting) objects;
– dynamic (moving: models) objects.

Each of these points includes polygon texturing, transparency, and, for distant objects, fog [Vishnyakova, 2022].

In three-dimensional models, the characteristics of terrain or objects are functions of three coordinates (X, Y, Z), what eliminates ambiguity, and each point of the model corresponds to a set of topographic characteristics of only one object. Creating and using such models is accompanied by a sharp increase in the volume of processed information and modeling three-dimensional objects and scenes (plots) requires considering the three-dimensionality of space and objects, as well as the presence of lighting sources and cameras [Zhurkin et al., 2012].

Presently, there exists a plethora of software and hardware technologies dedicated to the creation of three-dimensional scenes, including but not limited to

Blender, Unity, and Unreal Engine. Each of these platforms affords developers extensive functionalities for the creation, modification, and composition of three-dimensional models, as well as the integration of visual effects.

In this article, first of all, we would like to consider the Blender program. Compared to other programs, it is widely used in various fields and is compatible with popular operating systems. One of the main features of the Blender package is its small size in contrast to other popular 3D modeling programs. Within the Blender 3D modeling package, the graphical interface can contain one or several screens, each of which can be divided into sections where any parts of the Blender interface can be located. The graphical components of any part can be controlled by the same tools that control the 3D space. For example, buttons can be resized or moved, similar to 3D viewing. Users have complete control over the layout and arrangement of the interface, making it possible to tailor it to specific functions and tasks. For example, video editing, texturing, UV mapping, and removing interface components not relevant to the task at hand. Thus, the workspace of the Blender package is one of the most advanced concepts in graphical interface design [Blender 4.0 has been released].

The second tool discussed in the article is Unity. This software is designed for creating both two-dimensional and three-dimensional applications and games on various platforms. Applications developed in Unity support DirectX and OpenGL libraries. This engine is popular among both major developers (such as Blizzard, EA, QuartSoft, Ubisoft) and indie game developers because of its free version, user-friendly interface, and ease of use.

Projects in Unity are divided into scenes (levels), which are separate files containing their game worlds with a specific set of objects, scripts, and settings. Scenes may contain objects and models, as well as empty game objects. Each object contains sets of components that interact with scripts. Additionally, Unity has all the necessary components for creating multiplayer games.

The third tool examined is the Unreal Editor, used for creating games based on the Unreal Engine game engine. The editor may be called by different names, such as Rune Editor for the game Rune, but it is still a modified Unreal Editor. The editor is presented as a single application for editing various levels of the game and all other content associated with them, such as creating script scenes and importing resources from other applications. Unreal Editor includes everything needed to create a full-fledged level, with no additional programs required. Over time, the functionality of the editor has been improved, but there have been no major changes.

When creating levels, constructive block geometry is applied, resulting in a tree based on it, as in many other engines. However, in Unreal, it is noteworthy that the level is initially completely filled with matter, and the level developer cuts out volumes in it, such as rooms. This approach greatly simplifies the creation of closed levels since creating a simple room only requires cutting out a cube, rather than creating walls, floor, and ceiling separately. If necessary, a large cube can be cut out, and a texture of the sky can be displayed on its walls (skybox) [Zhurkin et al., 2012].

Conclusion. Summing up the results, it can be concluded that the work examined the significance and implementation of three-dimensional graphics in various programming areas, as well as its influence on modern life. Three key tools for

creating three-dimensional scenes and applications were studied: Blender, Unity, and Unreal Editor. Additionally, the fundamental terms and concepts used in three-dimensional graphics, their practical application, and future prospects were discussed.

References

1. Blender 4.0 has been released. *HABR*. – [online]. Available at: https://habr.com/ru/news/775116/. (Accessed: 07.03.2024).

2. Boguslavsky, S.A. (2016). Modelirovanie virtual`nogo prostranstva sredstvami 3D-grafiki [Modeling of virtual space by means of 3D graphics]. – [online]. Available at: http://elar.uspu.ru/bitstream/uspu/3390/1/22 Boguslavski2.pdf. (Accessed: 05.03.2024). (in Russian)

3. Vishnyakova, D.Yu. (2022). Programmnaya realizaciya trexmerny`x scen [Program realization of three-dimensional scenes]. *Cyberleninka*. – [online]. Available at: https://cyberleninka.ru/article/n/programmnaya-realizatsiya-trehmernyh-stsen. (Accessed: 07.03.2024). (in Russian)

4. Zhurkin, I. G., Khlebnikova, T. A. (2012). Digital modeling of measured three-dimensional video scenes: a monograph // *Rossiyskaya Gosudarstvennaya Biblioteka [Russian State Library]*. – [online]. Available at: https://search.rsl.ru/ru/record/01006599592. (Accessed: 09.03.2024). (in Russian)

UDK 004.65

METHODS OF PROTECTING DATABASES FROM SQL INJECTION

Andrushchenko Daria Aleksandrovna,
Student of the Institute of Engineering and Digital Technologies,
Belgorod State National Research University, Belgorod, Russia,
E-mail: 1694161@bsuedu.ru
Maslova Angelina Viktorovna,
Student of the Institute of Engineering and Digital Technologies,
Belgorod State National Research University, Belgorod, Russia,
E-mail: 1645583@bsuedu.ru
Gusakova Natalya Leonidovna,
Ph.D. in Psychology,
Associate Professor of the Department of Foreign Languages and Professional Communication,
Belgorod State National Research University, Belgorod, Russia,
E-mail: gusakova_n@bsuedu.ru

Abstract: *This article discusses various methods to protect databases from SQL injection, including input validation, prepared statements, web application firewalls, and role-based access control. The study highlights the importance of security measures in database management to prevent data breaches and ensure the integrity of stored information. With the growing reliance on digital storage systems, protecting databases against cyber threats has become a critical aspect of cybersecurity.*

Keywords: *SQL injection, database security, input validation, prepared statements, web application firewall, role-based access control, cybersecurity.*

SQL injection is one of the most dangerous cybersecurity vulnerabilities that can be used to hack web applications by injecting malicious SQL code into queries. Hackers can use this to pass the authentication system, pick up sensitive information or even gain control of a database. The constant rise in the number of cyberattacks indicates that there is a need for enforceable and robust database SQL injection

security. Over the last ten years, a number of the largest data breaches have occurred because of SQL injection security weaknesses and have impacted millions of users globally [OWASP Russia, 2023]. The best approaches to thwart such attacks and provide a framework for securing databases shall be delineated herein.

Whitelisting should be undertaken as a primary RFC to prevent SQL injection. It requires assurance that the input follows the predefined patterns and limitations of the previous content which further polishes every developer because surrogate control of special characters such as a double quotation mark, semicolon, and double hyphen will reduce the capability of executing the SQL code maliciously. Regular expressions and checking the data type are still much common within the input validation [Petrenko & Ivanov, 2018].

Length constraints for the input need to be strictly implemented too which would check for overflow from the buffer attacks. Developers should use a whitelist-based approach to validate user input, not a blacklist-based method because blacklists are regularly bypassed by attackers encoding the input or translating it into an alternative representation.

Prepared statements and parameterized queries turn out as two most effective ways to secure SQL statements. Traditional SQL queries concatenate user input directly; in contrast, parameterized queries separate SQL commands from user-provided data, hence protecting attackers from injecting malicious SQL code into queries. Most modern programming languages – PHP, Java, Python included –support prepared statements [Sidorov, 2020]. The same can be said about the built-in support for parameterized queries within MySQL, PostgreSQL, or SQL Server. Dynamic SQL query construction can be eliminated as a risk if prepared statements are used uniformly.

Through monitoring and filtering HTTP traffic for users and web applications, Web application firewalls (WAFs) add another level of security to the system. By reviewing the request patterns and flagging any unusual behavior, WAFs are able to effectively spot and stop attempts at SQL injection attacks. They help even if an application has some vulnerabilities. The majority of modern WAFs use algorithms of machine learning to catch on to new techniques of using attacks. For large web applications where there is a high strain of user interactions, implementing a WAF helps lessen the chances of an SQL injection tremendously. Organizations need to consistently modify the configurations and rules of the firewall because of everchanging threats.

Applying the least privileged principle means granting permissions to database users narrowly scoped to only what is required for their role. Privilege restriction lowers the risk exposure from an SQL Injection attack. For instance, a user with read-only access is unable to execute any commands that modify data, so the level of damage that could be done by polemic queries is lessened. Database administrators must implement policies on permission allocation aligning them with job functions and consistently audit access policies to avoid privilege escalation abuse. Multi-factor authentication (MFA) along with role-based access control (RBAC) increases the level of security by restricting sensitive database activity only to relevant staff members [GosSOPKA, 2023].

Regular security audits pinpoint the weaknesses found in web applications and databases. Automated scanners can identify SQL injection threats and offer ways to fix

them. Further, regular updates to database management systems, web servers, and applications helps safeguard against recently uncovered security issues. The security updates, also known as patches, that are made available by other software vendors deal with issues that the software is known to have and attempts to solve automatically without user intervention. Enterprises need to be more aggressive when it comes to security by carrying out penetration testing, establishing some security monitoring systems, and educating employees on cybersecurity issues [Roskomnadzor, 2023].

Apart from the methods stated above, some additional countermeasures are capable of providing enhanced security to the database. These are:

1. Though this cannot thwart SQL injections absolutely as much as prepared statements can, correctly escaping the special characters would not allow the potentially malicious input to be interpreted as part of the command. It will be an added measure of security for you.

2. DAM solutions monitor and log all database activity in real time (including queries), detecting and reporting any anomalous activity or attempted access.

3. Encryption of Sensitive Data: Passwords, credit card numbers, and personal information that are typically sensitive may be kept encrypted. Such data will remain meaningless even to the hacker, without the original key to attempt decryption.

4. Intrusion Detection Systems (IDS): This will track network traffic, and where it identifies a pattern for an SQL Injection Attack, it can also raise an alarm for immediate mitigation [Kaspersky Lab, 2021].

SQL injection is still one of the major cybersecurity threats that affect the organization, though putting proper preventive measures can definitely help protect the database from such attacks. In this respect, input validation, prepared statements, web application firewalls, access control, and routine security audits are actively involved in providing security to the database. Moreover, additional advanced countermeasures like monitoring activity within the database, encrypting data, and intrusion detection systems could double the extent of protection.

Prioritizing measures for database protection will be able to keep sensitive information safe and preserve the integrity of systems. Due to the fact that cyber threats are constantly changing, a lot of vigilance and proactive security is required to prevent SQL injections.

References

1. GosSOPKA. (2023). Luchshie praktiki po bezopasnosti baz dannykh // *Vestnik Informatsionnoy Bezopasnosti.* – M.: GosSOPKA. – Pp. 67-72. (in Russian)

2. Kaspersky Lab. (2021). SQL Injection: ugrozy i metody protivodeystviya // *Kaspersky Security Bulletin.* – M.: Kaspersky Lab. – Pp. 112-117. (in Russian)

3. OWASP Russia. (2023). *SQL Injection Prevention Cheat Sheet.* – M.: OWASP Foundation. – 32 p. (in Russian)

4. Petrenko, A., Ivanov, S. (2018). Metody zaschity ot SQL-in'ektsiy v sovremennykh informatsionnykh sistemakh. – St. Petersburg: IT Security Press. – 215 p. (in Russian)

5. Roskomnadzor. (2023). Metodicheskie rekomendatsii po zaschite personal'nykh dannykh v bazakh dannykh. – M.: Roskomnadzor. – 48 p. (in Russian)

6. Sidorov, V. (2020). Kiberbezopasnost' v web-prilozheniyakh: prakticheskoe rukovodstvo. – Ekaterinburg. – 189 p. (in Russian)

UDK 004.315.2

THE PRINCIPLE OF CONSTRUCTION AND OPERATION OF A TERNARY ADDER

Ivanov Daniil Vitalyevich,
Student of the Institute of Engineering and Digital Technologies,
Belgorod State National Research University,
Belgorod, Russia,
E-mail: 1559491@bsuedu.ru
Martynov Ilya Romanovich,
Student of the Institute of Engineering and Digital Technologies,
Belgorod State National Research University, Belgorod, Russia,
E-mail: 1645590@bsuedu.ru
Gusakova Natalya Leonidovna,
Ph.D. Psychology,
Associate Professor of the Department of Foreign Languages
and Professional Communication,
Belgorod State National Research University,
Belgorod, Russia,
E-mail: gusakova_n@bsuedu.ru

Abstract: *This article is dedicated to the principles of construction and operation of a ternary adder – specialized devices that perform arithmetic addition operations in the ternary numeral system. Unlike binary adders, ternary adders operate with three states: -1, 0, and 1. The principle of constructing a ternary adder is based on the use of single-digit adders that form an intermediate sum and carry to the next higher digit. The article discusses in detail the structure of the ternary adder, including half-adders, full single-digit adders, and their combinations to create multi-digit adders. Special attention is given to the algorithms for forming the intermediate sum and carry, as well as their implementation at the logic circuit level.*

Keywords: *ternary adder, single-digit adder, half-adder, sum, carry, intermediate sum, intermediate carry, multi-digit adder, serial ternary adder, parallel ternary adder, trits, ternary number system.*

A ternary adder is a device that performs the addition of two ternary numbers, each consisting of several digits that can take values of -1, 0, or 1. The ternary number system achieves the most economical representation of numerical information, as evidenced by the evaluation function:

$$F(S)=\frac{S*\log_S N}{2*\log_2 N},$$

where S is the base of the numeral system and N is the number of represented values [Pospelov,1970]. However, this assertion holds true only under the condition that the computing machine's circuitry employs elements with three stable states.

The ternary adder is based on the half-adder. The half-adder performs bitwise addition of two trits, generating a sum digit and a carry for the next higher digit.

The bitwise addition table for the ternary half-adder is as follows:

Table 1

A **(first addend)**	***B*** **(second addend)**	***s*** **(sum)**	***e*** **(carry)**
0	0	0	0
1	0	1	0
0	1	1	0
-1	0	-1	0
0	-1	-1	0
1	-1	0	0
-1	1	0	0
1	1	-1	1
-1	-1	1	-1

The ternary half-adder is implemented using ternary XOR and AND gates. The ternary XOR gate is used to calculate the sum of two trits (or the sum of a trit and a carry). It returns the result of the addition modulo 3. The ternary AND gate is used to calculate the carry. It determines whether an overflow occurs when adding two trits.

Let us derive the ternary sum and carry functions:

$$s = (A + B)\ mod\ 3,$$
$$e = \begin{cases} 1, if\ A + B \geq 2, \\ -1, if\ A + B \leq -2, \\ 0, otherwise. \end{cases}$$

The circuit of the ternary half-adder is presented in Figure 1.

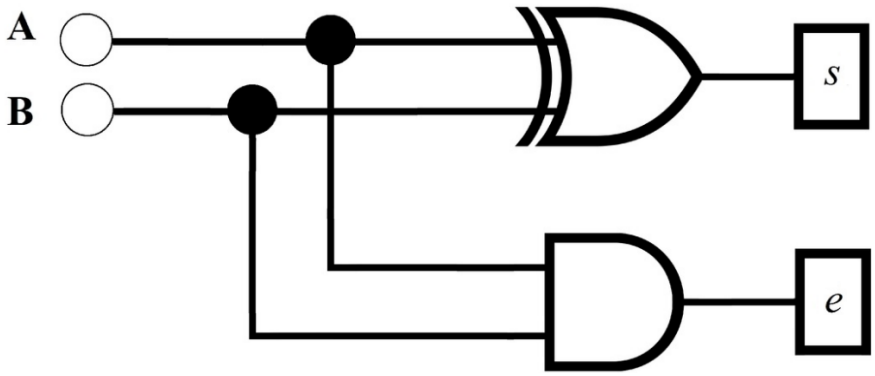


Figure 1. Ternary half-adder

Based on the half-adder, a full ternary adder is constructed, which takes into account the carry from the lower digit. The full adder consists of two half-adders and additional logic to handle the carry. The output of the adder includes the intermediate sum and the intermediate carry. To fully account for the carry from the lower digit, a second half-adder is used, which adds the intermediate sum to the carry and produces the final sum digit and the carry to the next higher digit [Brusentsov, et all, 1965].

The circuit of the single-digit ternary adder is presented in Figure 2.

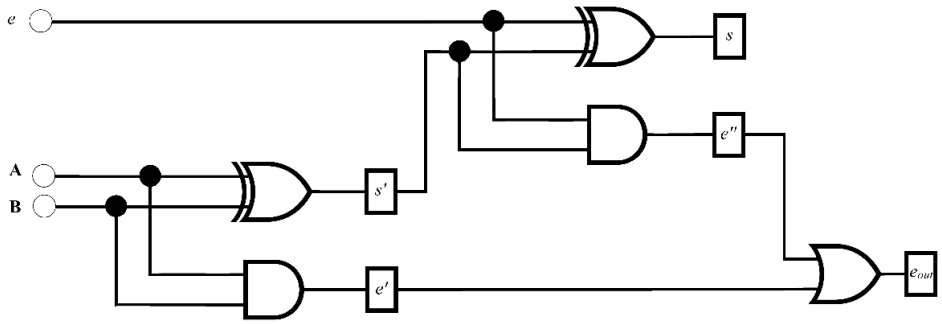


Figure 2. Single-digit ternary adder

The full operation algorithm of a single-digit ternary adder can be described as follows. Let there be two addends A and B, as well as a carry from the lower digit e. The intermediate sum s' and the intermediate carry e' are calculated according to the rules:

$$s' = (A + B)\ mod\ 3,$$
$$e' = \begin{cases} 1, if\ A + B \geq 2, \\ -1, if\ A + B \leq -2, \\ 0, otherwise. \end{cases}$$

Then, the final sum s and the intermediate carry e'' are calculated as:

$$s = (s' + e)\ mod\ 3,$$
$$e'' = \begin{cases} 1, if\ s' + e \geq 2, \\ -1, if\ s' + e \leq -2, \\ 0, \quad otherwise. \end{cases}$$

The final carry e_{out} is computed as $e_{out} = e' \vee e''$.

A multi-digit ternary adder is constructed by sequentially connecting single-digit adders. Each digit of the adder receives the digits of the addends and the carry from the lower digit as input, and outputs the sum digit and the carry to the higher digit.

The circuit of an example of a multi-digit ternary adder is shown in Figure 3.

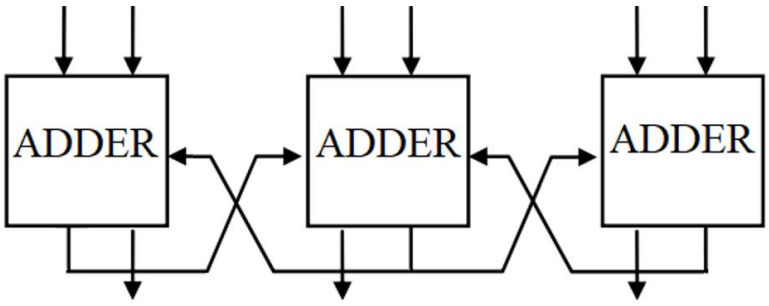


Figure 3. Multi-digit ternary adder

Multi-digit ternary adders can be designed with different architectures – parallel or serial – distinguished by their approach to inter-digit carry processing. A ternary serial adder is a device that performs digit-by-digit addition of ternary numbers using just a single one-digit adder. This approach saves hardware resources, as instead of processing all digits in parallel, the digits are processed sequentially, starting from the least significant digit.

Algorithm of serial ternary adder operation:

1. The least significant digits of the operands are fed into inputs A and B, while input e is set to 0 (or a control signal if initialization with carry is required);

The one-digit adder computes the sum of the current digits and any carry from the previous step.

2. The output s produces the current sum digit, while the output e_{out} contains the carry-out to the next digit;

3. The resulting carry e_{out} is stored and fed back into the e input in the next cycle;

4. In each new cycle, the next digits of the operands are supplied to A and B, while the e input receives the stored carry. The process repeats until all digits are processed.

Since addition is performed sequentially, the total computation time depends on the number of digits.

The initial carry can be set externally, which is useful for cascading adders or performing subtraction.

The circuit of a serial ternary adder is shown in Figure 4.

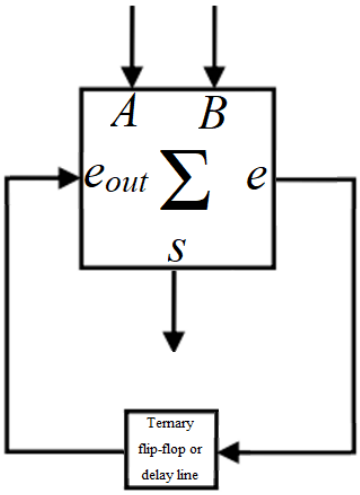


Figure 4. Serial ternary adder

In a parallel adder, each digit is processed independently using a separate single-digit ternary adder. The number of such adders matches the digit capacity (word length) of the operands. The digits of each position are fed into the inputs A and B of the corresponding adder, while the carry input e (except for the least significant digit) is connected to the carry output e_{out} of the previous digit.

Least significant digit: The carry input e is typically set to 0, but in the case of end-around carry (circular carry), it may be looped back from the output of the most significant digit. Most significant digit: The carry output e_{out} generates an additional digit of the sum.

The key advantage of a parallel adder is its high speed, as all digits are processed simultaneously. However, the carry propagation delay across all digits can limit performance for large operand sizes.

The circuit of a parallel ternary adder is shown in Figure 5.

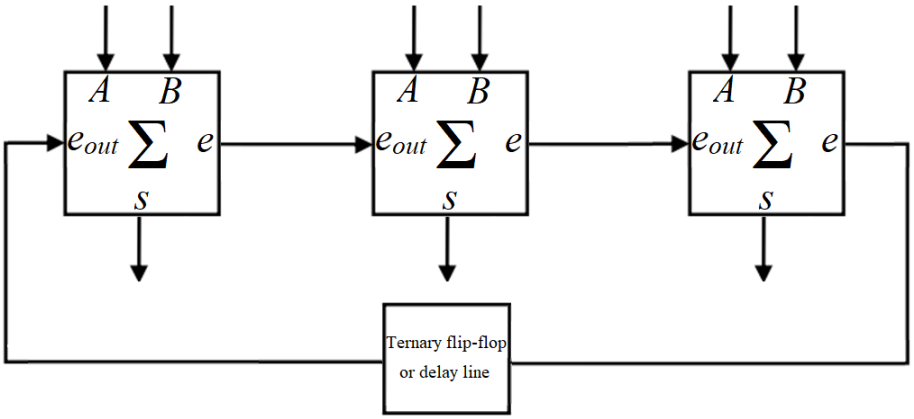


Figure 5. Parallel ternary adder

To increase the performance of multi-digit adders, parallel carry computation methods are employed [Potemkin, 1988]. Let us derive the carry generate and carry propagate functions:

- Carry Generation Function

Indicates that a digit generates a carry independently of its input carry:

$$\gamma_i = \begin{cases} 1, if\ A_i + B_i \geq 2, \\ -1, if\ A_i + B_i \leq -2, \\ 0, otherwise. \end{cases}$$

- Carry Propagation Function

Determines whether a digit propagates a carry from the next lower digit:

$$\pi_i = \begin{cases} 1, if\ |A_i + B_i| = 1, \\ 0, otherwise. \end{cases}$$

The carry into the *i*-th digit can then be expressed as:

$$e_{out,i} = \gamma_{(i-1)} \vee (e_{(i-1)} \wedge \pi_{(i-1)}).$$

For a multi-digit adder with parallel carry, the expression expands to account for all possible carry paths:

$$e_{out,i} = \gamma_{(i-1)} \vee (\gamma_{(i-2)} \wedge \pi_{(i-1)}) \vee \cdots \vee (e_0 \wedge \pi_1 \wedge \cdots \wedge \pi_{(i-1)}).$$

This approach reduces delay but increases hardware complexity, making it suitable for high-performance systems with limited digit width.

References

1. Brusentsov, N.P., Maslov, S.P., Rozin, V.P., Tishulina, A.M. (1965). Malaya tsifrovaya vychislitel'naya mashina „Setun”. – M.: Izdatel'stvo Moskovskogo universiteta MGU. – Pp. 56-57. (in Russian)

2. Pospelov, D.A. (1970). Aritmeticheskie osnovy vychislitel'nykh mashin diskretnogo deistviya. – M.: Vysshaya shkola. – 156 p. (in Russian)

3. Potemkin, I.S. (1988). Funktsional'nye uzly tsifrovoy avtomatiki. – M.: Energoatomizdat. – Pp. 127-128. (in Russian)

UDK 621.01

INFORMATION AND ANALYTICAL SUPPORT FOR MANAGING THE RELIABILITY OF TECHNICAL SYSTEMS

Chebotarev Vyacheslav Alekseevich,
PhD Student of the Institute of Engineering and Digital Technologies,
Belgorod State National Research University, Belgorod, Russia,
E-mail: 1319286@bsuedu.ru
Kalyuzhnaya Elena Vyacheslavovna,
Ph.D. in Pedagogy,
Associate Professor of the Department of Foreign Languages and Professional Communication,
Belgorod State National Research University, Belgorod, Russia,
E-mail: kaludgnaya@bsuedu.ru

Abstract: *This research examines software systems for managing the reliability of technical systems. To conduct a comparative analysis of these systems, a modified Analytic Hierarchy Process (AHP) method was applied. It was also identified that the primary issue with existing systems is the insufficient explainability of the recommended decisions, which reduces trust in the system and limits its application in critical areas.*

Keywords: *reliability management, technical systems, decision support systems, comparative analysis, Analytic Hierarchy Process, explainability, software systems, trust, critical applications.*

Reliability management of technical systems is a critically important task in various industries, including aviation, energy, transportation, and manufacturing. Modern information and analytical systems play a key role in monitoring, forecasting, and ensuring the reliability of these systems. However, despite the progress made, decision support systems face limitations related to trust in the recommended solutions.

As part of the research, the following software systems for managing the reliability of technical systems were considered: RAM Commander, Isograph Reliability Workbench, ReliaSoft, and APM (Asset Performance Management) from GE Digital [Singh & Tewari, 2023]. A modified Analytic Hierarchy Process (AHP) method [Lomakin et al., 2017], implemented in the Decision Support System (DSS) "Decision", was used to perform the comparative analysis of the above-mentioned software systems. The main evaluation criteria include: effectiveness (forecast accuracy, functionality, scalability); adaptability (ease of integration, configuration flexibility, support for new technologies); cost and resources (license cost, implementation costs, operating expenses); user interface and support (ease of use, technical support, documentation, and training); reliability (resistance to failures and crashes). The criteria and alternatives tree is presented in Figure 1.

It should also be noted that the comparison of criteria revealed that the most important criterion in the presented set is effectiveness (41.4%). Meanwhile, the consistency ratio (CR) of the pairwise comparison matrix was 1%. A consistency ratio (CR) of less than 10% is considered acceptable. Therefore, the matrix can be considered consistent (Figure 2).

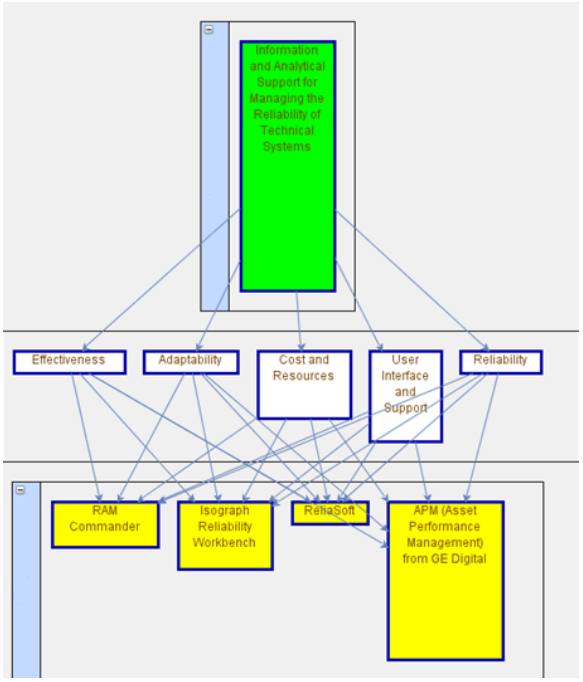


Figure 1. Criteria and Alternatives Tree

1. Effectiveness	1/1	2/1	3/1	4/1	4/1	0,414
2. Adaptability	1/2	1/1	2/1	3/1	3/1	0,258
3. Cost and Resources	1/3	1/2	1/1	2/1	2/1	0,153
4. User Interface and Support	1/4	1/3	1/2	1/1	1/1	0,088
5. Reliability	1/4	1/3	1/2	1/1	1/1	0,088

Figure 2. Pairwise Comparison Matrix

Next, pairwise comparison matrices for the alternatives were created based on all criteria. As a result of the analysis, key advantages and disadvantages of each software system for managing the reliability of technical systems can be identified.

RAM Commander is distinguished by high forecasting accuracy and supports various types of analyses, such as reliability analysis, failure prediction, and risk assessment. However, the system is complex to use and unstable to failures and crashes, which limits its reliability for long-term analysis tasks.

Isograph Reliability Workbench offers extensive modeling capabilities, including Failure Modes and Effects Analysis (FMEA), process modeling, and Reliability Block Diagram (RBD) analysis. The program integrates with other systems, making it convenient for large enterprises. However, its usage cost is relatively high, and the system, like RAM Commander, is prone to failures and crashes.

ReliaSoft supports multiple analysis methods, such as statistical data analysis, failure modeling, and maintenance optimization. The system is known for its high accuracy and relatively low cost, making it accessible to most organizations. However, the ReliaSoft interface is complex, and the system is also prone to crashes, which can be a problem for long-term analysis.

APM (Asset Performance Management) from GE Digital integrates well with the Industrial Internet of Things (IIoT), providing equipment condition monitoring and scalability. The system is user-friendly and resistant to failures. However, APM is

costly and relatively less effective in accurate forecasting and analysis compared to other software programs.

As a result of the analysis, the ReliaSoft software solution showed the highest overall rating (34.3%), making it the preferred option based on the aggregate criteria (Figure 3).

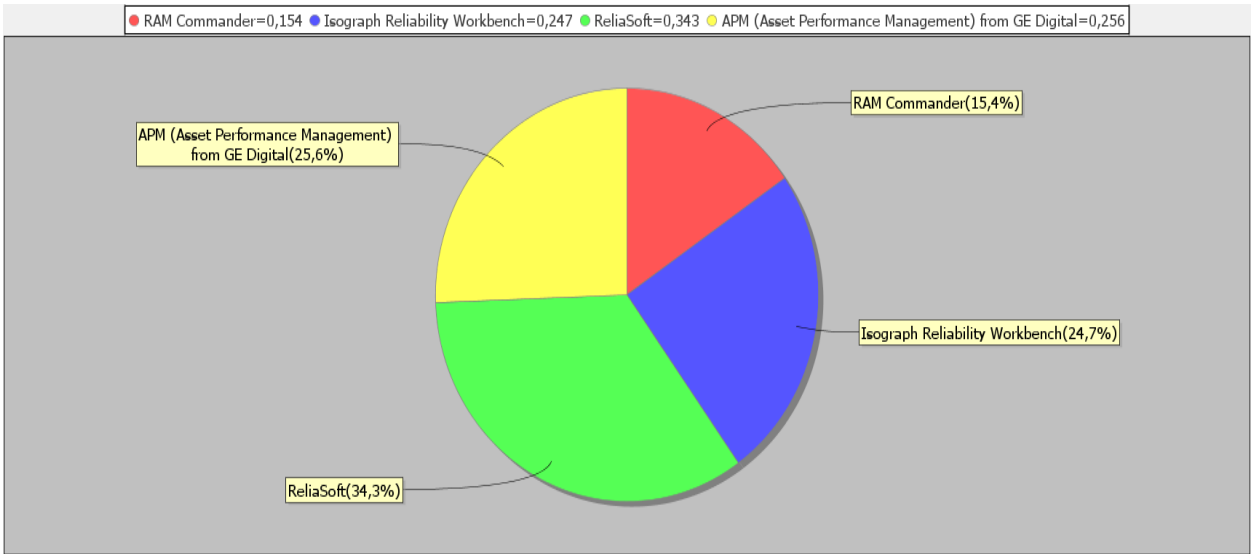


Figure 3. Pie Chart

The main problem with existing systems is the insufficient explainability of the recommended decisions. Users often cannot understand the data and algorithms on which the system based its conclusions. This reduces trust in the system and limits its application in critical areas. To address this issue, it is proposed to use the methodology of Explainable Artificial Intelligence (XAI) [Minh et al., 2021], which aims to create models that not only provide sufficiently accurate predictions but can also explain their decisions in a way that is understandable to the user. At the same time, the fuzzy linguistic approach currently used for analyzing the reliability of technical systems (e.g., [Lomazov et al., 2024]) provides a relatively high level of transparency in procedures but does not fully meet the requirements of XAI, which justifies the need for further research.

References

1. Lomakin, V.V. et al. (2017). Linear distribution algorithm concerning the weights of alternatives during decision making support // *Journal of Engineering and Applied Sciences*. – V. 12. – No. 5. – Pp. 1134-1139.

2. Lomazov, A.V. et al. (2024). Multicriteria fuzzy statistical analysis of biogas energy systems dependability // *E3S Web of Conferences : VII International Conference on Actual Problems of the Energy Complex and Environmental Protection (APEC-VII-2024)*. – France: EDP SCIENCES S A. – V. 524. – P. 01020. – DOI 10.1051/e3sconf/202452401020.

3. Minh, D. et al. (2021). Explainable artificial intelligence: a comprehensive review // *Artificial Intelligence Review*. – [online]. Available at: https://doi.org/10.1007/s10462-021-10088-y. (Accessed: 31.03.2025).

4. Singh, A.K., Tewari, P. C. (2023). An Overview of Reliability, Availability, Maintainability, and Safety Strategies for Complex Systems in Various Process Industries // *International Journal of Performability Engineering*. – V. 19. – No. 12. – Pp. 788-796.

UDK 004.432

OVERVIEW OF METAPROGRAMMING TOOLS IN THE PYTHON PROGRAMMING LANGUAGE

Kashirsky Konstantin Igorevich,
Student of the Institute of Engineering and Digital Technologies,
Belgorod State National Research University, Belgorod, Russia,
E-mail: 1645613@bsuedu.ru
Kosinov Alexey Vitalievich,
Student of the Institute of Engineering and Digital Technologies,
Belgorod State National Research University, Belgorod, Russia,
E-mail: 1645552@bsuedu.ru
Gusakova Natalya Leonidovna,
Ph.D. in Psychology,
Associate Professor of the Department of Foreign Languages
and Professional Communication,
Belgorod State National Research University, Belgorod, Russia,
E-mail: gusakova_n@bsuedu.ru

Abstract: *The paper presents metaprogramming techniques in the Python programming language. It examines the capability of introspection, decorators, metaclasses, and dynamic code generation. The study shows how these mechanisms enable precise control of program behavior. Their applications in popular projects are given as examples to demonstrate how they are used to enhance functionality.*

Keywords: *Programming, Python, introspection, functions, classes, dynamic code generation*.

Metaprogramming is a type of programming where programs are constructed to produce other programs as outputs of their processing or modify themselves during execution. This approach allows one to automate repetitive tasks, increase abstraction and flexibility in code, and speed up the coding process.

Introspection refers to a program's ability to inspect and understand its own makeup during execution. This powerful facility enables dynamic inspection of objects, retrieval of metadata, and even runtime modification. Introspection is highly available in Python in the form of many built-in functions and libraries. The type() and id() functions aid in finding the type and id of an object, and dir() provides the list of attributes and methods of its own. Additionally, getattr() and hasattr() support dynamic access to object attributes, which simplifies the handling of unknown or dynamically created objects.

For more in-depth introspection, Python has the inspect module that provides access to live object inspection, source extraction, function signature inspection, and even stack frame inspection. It thus makes introspection particularly relevant for debugging, dynamic programming, and metaprogramming. Using these resources, programmers are able to write more adaptable, dynamic, and self-aware applications [Satwik, 2018].

Introspection is used actively in the Django framework, especially when working with ORM, which is a technology bridging databases and object-oriented

frameworks. With its help, Django infers model fields, their types, and relations, and it becomes possible for SQL queries to be generated automatically without explicitly describing the database structure [Trudeau, 2024].

Another project that actively uses introspection is the pytest library for testing code. When running tests, pytest automatically analyzes the project structure, looks for modules, classes, and functions with names matching certain patterns (e.g., starting with "test"), and dynamically forms a list of test cases. Introspection allows pytest to check for special methods (like setup or teardown), extract test parameters from decorators (e.g., @pytest.mark.parametrize), and analyze exceptions. This significantly simplifies writing tests, as developers don't need to explicitly register tests in the configuration; the framework does this automatically by examining the code with tools like inspect, getattr(), and function signature analysis [Okken, 2022].

Decorators are a way to change behaviors of a function or a class [Satwik, 2018]. This is achieved by wrapping the original function or class within another function, which takes the original object as an argument and returns a modified version with enhanced functionality. By using decorators, developers can inject additional behavior such as logging, access control, caching, or performance monitoring in a clean and modular way. This promotes code reusability and separation of concerns, making it easier to maintain and extend software systems.

In Django, decorators are used to implement various aspects of application behavior. For example, the @login_required decorator is used to check if a user is authenticated before executing a view. This prevents unauthorized users from accessing protected pages. The @csrf_exempt decorator is used to disable CSRF protection for specific views, which can be useful in certain situations, such as when working with external services [Trudeau, 2024].

In the NumPy library for scientific computing, decorators play a crucial role in optimizing and managing the behavior of functions. They allow functions to be automatically modified to handle arrays efficiently, eliminating the need for explicit loops. One of the most commonly used decorators in NumPy is @vectorize, which enables element-wise operations on arrays, significantly improving performance compared to traditional iteration-based approaches. By applying this decorator, functions can operate seamlessly on scalars and arrays alike, ensuring flexibility and ease of use.

Another useful decorator in NumPy is @jit from the Numba library, which can be used alongside NumPy to further accelerate computations. The @jit decorator compiles Python functions into highly optimized machine code, reducing execution time and improving performance, especially for complex numerical operations. This makes it particularly valuable for computationally intensive tasks where efficiency is critical [Johansson, 2019].

It's important to recognize that decorators are far more than just syntactic sugar; they can fundamentally alter how a program executes by dynamically modifying functions, methods, or classes at runtime. While they often provide a convenient way to streamline code and reduce redundancy, their impact goes beyond simple wrapping. Decorators have the power to change a function’s execution context by modifying input parameters, transforming return values, or injecting pre- and post-processing logic.

This enables them to implement cross-cutting concerns such as security enforcement, logging, and resource management in a centralized and non-intrusive manner.

Metaclasses are "classes of classes" that provide the ability to modify the behavior of classes during their creation. They allow controlling the class creation and configuration process, adding new attributes, methods, or changing their functionality without altering the class itself [Satwik, 2018]. In Python, metaclasses are a powerful tool for metaprogramming, used to create flexible and dynamic systems.

In Django, the ModelBase metaclass plays a key role in implementing ORM. When a model is declared, the metaclass analyzes its fields, generates necessary methods such as save() and delete(), and integrates the model with the migration system. For example, when a developer defines a new field, the metaclass transforms it into an object representing a database column, registers it with the ORM, and generates the corresponding SQL query to create the column in the table. Thus, metaclasses allow the framework to automatically link classes to the database, minimizing the need for manual configuration [Trudeau, 2024].

Another prominent example of metaclass usage is the SQLAlchemy library. In it, metaclasses are used for declarative table schema definition. They allow the developer to describe the database model using Python classes, while automatically generating SQL structures based on those classes. This simplifies database interaction and improves code readability [Myers, 2015].

Dynamic code generation in Python involves creating and executing program constructs during runtime. This can include creating functions, classes, or expressions based on data obtained during the program's execution. In the context of metaprogramming, dynamic code generation allows for more versatile and expandable solutions, such as class factories, dynamic creation of attributes and methods, and plugin implementations.

One of the key tools for dynamic generation is the built-in exec() function, which allows executing a line of Python code generated during runtime. The eval() function is also used to evaluate and return the result of expressions [Beazley, 2022].

Dynamic code generation provides flexibility in solving tasks that require the program to adapt to changing conditions. However, its use can increase debugging complexity and pose security risks, as executing arbitrary code can lead to unpredictable results and vulnerabilities, such as code injections.

Python metaprogramming is widely used in real-world applications, not just theory. Introspection allows programs to examine and modify their own structure at runtime. Decorators provide a way to extend functionality without altering original code. Metaclasses automate class creation and enforce custom behavior patterns. Dynamic code generation enables advanced design patterns that static code cannot achieve.

Python’s key advantage is its straightforward implementation of these techniques. Unlike other languages requiring complex workarounds, Python offers a clear and efficient approach. This simplicity makes Python ideal for projects requiring flexibility, scalability, and maintainability. The language’s design ensures metaprogramming remains practical rather than overly complicated. As a result, Python continues to be a top choice for dynamic and adaptable software development.

References

1. Beazley, D.M. (2022). Python Distilled. – Boston: Addison-Wesley. – 352 p.
2. Johansson, R. (2019). Numerical Python: Scientific computing and data science applications with Numpy, SciPy and Matplotlib. – Berkeley: Apress. – 723 p.
3. Myers, J. (2015) Essential SQLAlchemy: Mapping Python to Databases. – Sebastopol: O'Reilly Media. – 208 p.
4. Okken, B. (2022) Python Testing with pytest: Simple, Rapid, Effective, and Scalable. – Raleigh: Pragmatic Bookshelf. – 216 p.
5. Satwik, K. Metaprogramming in Python. – [online]. Available at: https://developer.ibm.com/tutorials/ba-metaprogramming-python. (Accessed: 20.03.2025).
6. Trudeau, C. (2024). Django in Action. – Shelter Island: Manning Publications. – 400 p.

UDK 004.5

C++ IN THE MODERN WORLD: RELEVANCE, ADVANTAGES, AND COMPARATIVE ANALYSIS WITH NEW PROGRAMMING LANGUAGES

Zhuravlev Pavel Pavlovich,
Student of the Institute of Engineering and Digital Technologies,
Belgorod State National Research University, Belgorod, Russia,
E-mail: 1627022@bsuedu.ru
Leonov Egor Yevgenyevich,
Student of the Institute of Engineering and Digital Technologies,
Belgorod State National Research University, Belgorod, Russia,
E-mail: 1645606 @bsuedu.ru
Gusakova Natlya Leonidovna
Ph.D. in Psychology,
Associate Professor of the Department of Foreign Languages and Professional Communication,
Belgorod State National Research University, Belgorod, Russia,
E-mail: gusakova_n@bsuedu.ru

Abstract: *This article is a reflection on the future of C++ by surveying some key trends and directions in the language's development. It surveys improvements made in some of the newer standards, namely C++11, C++20, and the one awaiting us in the future, namely C++23. The discussion pays special attention to the directions of simplification of syntax, improvement of safety and reliability of code, and support for parallelism and multi-threading and modernization of the Standard Template Library (STL). The author emphasizes the importance of community support, the growth of educational resources, and the emergence of new development tools that are among the factors making the language competitive in contemporary programming.*

Keywords: *language development, modern standards, code safety, parallelism, competitiveness.*

C++ is a very powerful and efficient programming language that has been a mainstay of software development since its invention by Bjarne Stroustrup in the early 1980s. Originally designed as an extension to the C programming language, C++ introduced object-oriented features that enhanced portability and reusability of code. Throughout the decades, C++ has updated itself through new modern standards to stay in

touch with this ever-changing world of technology. We are now comparing and contrasting C++ with the other newer programming languages that are on the market today such as Rust, Go, Swift, and Python to highlight both C++ weaknesses and strengths.

Some of its biggest strengths is the fact that C++ is a high-performance language. C++ allows programmers direct access to system resources, which is necessary for programs that require high-performance computing. Such control is especially welcome in the fields of game development, real-time simulations, and systems programming where every microsecond counts. For instance, in game development, the ability to directly manipulate memory management directly affects graphics rendering and the overall game experience. Stroustrup notes that the tight coupling to hardware provides developers with a means of optimizing their applications for performance [Stroustrup, 2018].

In return, recent languages such as Rust appeared with safety concerns in mind without losing performance. Rust makes use of a proprietary ownership model that ensures data races are forbidden at compile time to provide memory safety features while retaining the efficiency [ISO C++ Standards Committee, 2023]. This model helps in writing concurrent code without any fear of side effects that might appear unintendedly, thus working differently towards memory management.

Whereas C++ leaves the management of memory virtually entirely in the hands of developers, it is their burden to ensure that they manage resources efficiently. This requirement gives rise to issues like memory leaks and buffer overflows when not properly managed. In an endeavor to eliminate such issues, Rust focuses on a safer ecosystem without undermining performance benefits that have kept C++ programmers hooked on C++ for so long.

One of the biggest criticisms for C++ is the complexity compared to some more modern programming languages like Python and Go, which can claim a much simpler syntax with a more gradual learning curve. Python's readability and simplicity of syntax often make programming concepts so much more accessible to learn, Lippman et al. [2014]. This has propelled Python into the stratosphere for fields such as data science, machine learning, and web development.

Go, developed by Google, has been designed very explicitly for being easy to use and efficient. The language allows garbage collection wherein the memory will be automatically handed over to management of object lifetimes. Hence, this particular feature decreases developers' cognitive burdens, enabling the developers to ponder more on finding solutions rather than managing memory itself. Additionally, Go's model of concurrency combined with in-build documentation tools appeal to the requirements of developing more distributed systems or microservices.

Swift, Apple's iOS and macOS programming language, has a clean syntax close to Python but with powerful features appropriate for system-level programming. Swift's type inference and safety features will enable developers to write much more stable code, hence cutting down on the runtime errors. This power with simplicity has made Swift very popular among the mobile developers.

C++ has a huge, mature community in which sufficient libraries and frameworks are easily accessible to support the development process. The extensive ecosystem comprises graphics libraries like OpenGL and SDL and scientific computing libraries

like Eigen and Armadillo, while game development libraries also benefit, like Unreal Engine. Among such abundant resources, C++ is still an efficient language in programs that demand high performance and detailed control over resource use [CppCon, 2021].

The community of Python is also very strong, with large libraries like NumPy, Pandas, and TensorFlow that have established it as the default language for data analysis and machine learning. The open-source nature of Python promotes collaboration and quick exchange of knowledge among its users, which can accelerate development and problem-solving for teams.

In the same vein, Go has witnessed a thriving ecosystem with frameworks and libraries specific to cloud-native apps. Go's inherent support for concurrency and network-centric programming has fostered a robust developers' community, leading to a rich set of open-source projects and tools for users to adopt.

C++ is applied in a wide range of fields including system programming, game developing, and the application that demands computationally intensive performance. For example, in the development of current operating systems like Windows and Linux, at least partly depends on C++ for fast resource usage and performance enhancement. Moreover, in game development, in addition to the Unreal Engine and Unity game engines that use a significant percentage of C++ for high-performance applications so that developers can create graphically enhanced games to stress the hardware to its limits [Sutter, 2020].

As opposed to this, Rust is being adopted now in systems programming, specifically in the domains of highest safety. The language's capability to prevent typical errors in memory programming that result in failure makes it a viable choice for programmers who develop secure programs. The popularity of Rust in finance and embedded systems is an example of its potential to solve problems of contemporary programming.

Go and Python have also carved out niches for themselves in web development and cloud computing, respectively, due to the fact that they are more productivity-focused and rapid iteration-centric. Go's great performance and its streamlined concurrency model make it the top pick for microservices architecture, and Python's ecosystem is powering its usage in machine learning and data analytics.

Although C++ is advantageous in so many ways, it is not without its flaws. Its heavy syntax and learning curve can cause a lot of difficulty for fresh developers, increasing onboarding times and confusion. With rapid development and deployment in vogue these days, C++'s complexity can often impede productivity in fast-paced environments where the need for a rapid time-to-market is key [Lippman et al., 2014].

This introduces trade-offs required by C++. On the one hand, developers have to balance performance and control on one side and possible heightened development time on the other. Where this type of task does not call for some such scaling being provided by C++, such languages as Python or Go can significantly simplify workflow or economy out on some fundamental economy being required.

C++ is evolving, and its future looks bright in the wake of continuous improvement of the language by new standards, like C++20 and C++23. The new standards add features to the syntax, optimize safety features, and enhance the functionality of the standard library [ISO C++ Standards Committee, 2023].

Developers and companies are embracing these standards. Thus, C++ will definitely be a key player in software development in the future.

The boom in the C++ ecosystem, comprising newer frameworks and libraries, also puts it at an advantage. It is quite evident that C++ codebases and libraries coexist peacefully with other programming languages, allowing developers to re-engineer existing C or C++ code and still apply newer technologies effortlessly. Therefore, C++ will still account for a major stake in the current programing landscape, particularly for applications needing runtime checks, performance, and resource efficiency.

References

1. CppCon. Modern C++: The Good Parts. – [online]. Available at: https://CppCon.org. (Accessed: 27.04.2023).

2. ISO C++ Standards Committee. ISO/IEC JTC1/SC22/WG21 N4861: C++20 Standard Draft. – [online]. Available at: http://www.open-std.org/jtc1/sc22/wg21/docs/papers/2023/n4861.pdf. (Accessed: 01.05.2023).

3. Lippman, S. B., Lajoie, J., & Moo, B. E. C++ Primer. – [online]. Available at: https://www.pearson.com/store/p/c-primer/P100000016029. (Accessed: 01.05.2023).

4. Stroustrup, B. The C++ Programming Language. – [online]. Available at: https://www.pearson.com/store/p/c-programminglanguage/P100000013663. (Accessed: 10.04.2023).

5. Sutter, H. C++ Trends: A Look at the Future of C++. – [online]. Available at: https://www.drdobbs.com/cpp/c-trends-a-look-at-the-future-of-c/240164121. (Accessed: 08.05.2023).

UDK 004.934

ENCRYPTION OF VOICE DATA: METHODS AND ALGORITHMS

Dotsenko Polina Evgenievna,
Student of the Institute of Engineering and Digital Technologies,
Belgorod State National Research University, Belgorod, Russia,
E-mail: 1646597@bsuedu.ru
Grigorenko Svetlana Evgenievna,
Ph.D. in Pedagogy,
Associate Professor of the Department of Foreign Languages and Professional Communication,
Belgorod State National Research University, Belgorod, Russia,
E-mail: sgrigorenko@bsuedu.ru

Abstract: *The paper explores modern methods of voice data encryption in real-time communication systems. It analyzes the specific characteristics of voice signals, such as latency sensitivity, the need for compression, and the impact of encryption-compression sequencing on system security. Particular attention is paid to symmetric and stream encryption algorithms, as well as the practical implementation of voice data protection in popular messaging platforms. The paper presents a comparative analysis of the architectural solutions used in Telegram, VK Messenger, and Yandex. Messenger with respect to voice security.*

Keywords: *voice encryption, symmetric algorithms, stream ciphers, voice data protection, messengers.*

Introduction. Modern digital technologies have enabled the transmission, storage, and processing of voice data in electronic form with high speed and

convenience [Katsikeas et al., 2020]. However, this has created a significant need to protect transmitted speech from eavesdropping, interception, or tampering. This issue is particularly relevant given the widespread use of IP telephony, voice interfaces, and other systems where voice is transmitted in real time.

The purpose of this study is to analyze and evaluate existing methods and algorithms for voice data encryption, as well as to identify their advantages, disadvantages, and prospects for application. The main hypothesis is that traditional encryption methods developed for textual information are not always suitable for protecting voice due to its specific characteristics.

Main part. Unlike text, voice data is an audio signal converted into digital form. This type of signal has features that create particular challenges for encryption. First, speech is time-sensitive: a transmission delay of more than 150–200 milliseconds can already interfere with normal conversation [Daemen et al., 2002]. Therefore, encryption algorithms must be as fast and lightweight as possible so as not to hinder transmission. Second, speech contains many repetitive and predictable elements, which could be exploited by attackers attempting to break the encryption. Furthermore, voice streams are often compressed to save bandwidth, which influences the choice of whether encryption should be applied before or after compression.

In practice, symmetric encryption methods – where the same key is used for both encryption and decryption – are most commonly applied. These include block and stream algorithms [Rivest et al., 1978]. Block ciphers such as AES (Advanced Encryption Standard), Camellia, or Blowfish offer high reliability but operate on fixed-size blocks of data, which requires additional processing and may increase delay. To adapt them to voice streams, special modes such as CTR (Counter Mode) or GCM (Galois/Counter Mode) are used, which allow sequential data processing without accumulating large blocks. However, these modes require precise synchronization between the parties; otherwise, decryption errors may occur.

Stream ciphers, such as RC4 (Rivest Cipher 4), Salsa20, or ChaCha20, encrypt data byte by byte or even bit by bit, which significantly reduces latency [Chen et al., 2016]. Among them, ChaCha20 is considered one of the most promising due to its high speed and resistance to cryptographic attacks. It is actively used in modern security protocols such as TLS 1.3. At the same time, stream ciphers require special care in key management and synchronization, especially in unstable network conditions.

Asymmetric encryption methods (such as RSA, elliptic curve algorithms, etc.) are not used directly for voice data because they are too slow for real-time transmission. Nevertheless, they are widely used to protect encryption keys and to establish secure connections. On this basis, hybrid schemes are built: the voice encryption key is transmitted using an asymmetric method, and then the voice stream itself is encrypted using a faster symmetric algorithm.

Figure 1 shows a typical architecture for secure voice transmission. It presents the main processing stages sequentially–from capturing the voice signal to decoding it on the receiving side. Each block represents key technological stages: compression, encryption, use of a secure transport protocol, and transmission over the network. This architecture underlies most modern secure voice communication systems.

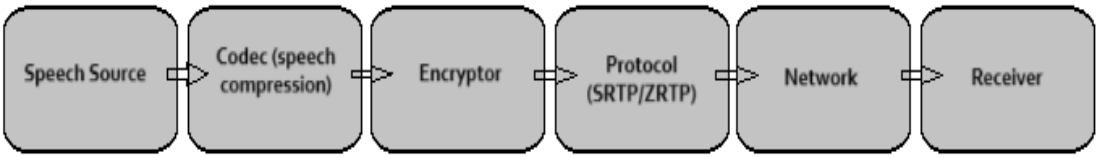


Figure 1. Architecture of secure voice data transmission

Special attention should be given to the question of when voice encryption should occur – before or after compression. Encrypting the signal before encoding provides a higher level of security but makes it impossible to use standard audio codecs. Encryption after compression, on the other hand, allows the use of efficient codecs but may weaken cryptographic protection, as the structure of the compressed stream can give attackers clues about potential vulnerabilities. Thus, the hypothesis that the sequence of compression and encryption does not matter is refuted: their order significantly affects the overall effectiveness and security of the system.

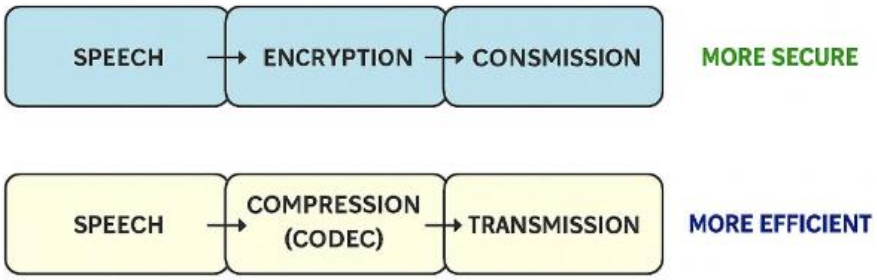


Figure 2. Comparison of two processing sequences for voice data

To address this issue, new approaches are being explored – for example, simultaneous encryption and compression, or the use of specialized codecs that incorporate security requirements. Although these solutions are still in the development stage, early results indicate strong potential.

An analysis of existing secure voice communication protocols shows that SRTP (Secure Real-time Transport Protocol) provides reliable voice protection using AES and HMAC (Hash-based Message Authentication Code) and can be effectively used in real-time systems [Menezes et al., 1996]. ZRTP (Z and Real-time Transport Protocol), in turn, allows key exchange without involving servers and includes mechanisms that ensure protection even if the keys are later compromised [Zhang et al., 2012].

Promising developments in this field are associated with new strategies. For instance, work is underway on quantum-resistant algorithms capable of withstanding future threats posed by quantum computers [Bernstein, 2008]. Another area of interest is perceptual cryptography, which considers how humans perceive sound and allows the preservation of intelligible speech despite acceptable signal distortions. Methods that combine compression and encryption in a single process are also being developed [Buchmann, 2004], offering improvements in both efficiency and security – especially for mobile devices and networks with limited resources.

Modern messengers and VoIP services have become an integral part of digital communication. Voice calls are increasingly used not only in personal communication but also in professional settings. This makes the task of securing voice data – against interception, tampering, or unauthorized access –particularly relevant. This section

examines platforms officially allowed in the Russian Federation and commonly used in practice.

Telegram is one of the most widely used messaging platforms in Russia. It supports voice calls, which are encrypted using built-in security mechanisms. To verify the authenticity of a connection, users compare a sequence of symbols (emojis) displayed during the call. This is intended to prevent man-in-the-middle attacks. However, Telegram does not apply end-to-end encryption in all scenarios: group and conference calls are routed through central servers and are not fully controlled by users. Moreover, Telegram's security protocol (MTProto) is proprietary and has not undergone formal cryptographic review. Thus, while Telegram offers an acceptable level of security for everyday use, it should not be considered a high-assurance solution for the transmission of sensitive voice data [Chen et al., 2016].

VK Messenger, integrated into the VKontakte social network, supports both voice and video calls. The developers state that encryption is applied to protect these communications, but no detailed technical documentation is publicly available. As a result, the actual level of security cannot be independently assessed. VK servers are located within the Russian jurisdiction, in accordance with local data storage laws [Katsikeas et al., 2020]. However, this also implies the possibility of access to user data upon request by state authorities. VK Messenger is suitable for regular communications but not for situations requiring strict confidentiality.

Yandex.Messenger is part of the Yandex digital ecosystem and is used for both personal and business communication. Yandex states that all voice calls are automatically encrypted [Daemen et al., 2002]. Yet, as with VK, the system's architecture and methods of data protection are not disclosed, which prevents expert-level evaluation of its reliability. At the same time, integration with other Yandex services makes it a convenient tool for everyday use. However, its applicability in environments that demand elevated levels of data protection remains uncertain.

To evaluate the level of voice data protection objectively, it is useful to compare these platforms based on a set of relevant criteria. The key parameters include the presence of end-to-end encryption, openness of protocols, user control over encryption keys, and the jurisdiction under which server infrastructure operates.

Table 1

Comparison of voice call protection mechanisms in popular messaging services

Messenger	**End-to-End Encryption (E2EE)**	**Protocol Transparency**	**User Key Verification**	**Server Jurisdiction**
Telegram	Partial (only P2P calls)	Partial	Yes (visual confirmation via emoji)	Unspecified / Global
VK Messenger	Absent	Absent	No	Russia
Yandex.Messenger	Absent	Absent	No	Russia

As shown in the table, Telegram is the only service among those considered that implements elements of end-to-end encryption and allows the user to verify the security of the connection. However, its protocol is only partially transparent, and encryption is

not consistently applied across all call types. VK and Yandex use centralized, closed architectures without user-controlled encryption, though their servers being hosted in Russia may be considered an advantage in certain regulatory contexts.

Overall, the protection level provided by these platforms is generally sufficient for everyday communication. However, when dealing with sensitive information, it is important to consider the limitations: the lack of full transparency and the impossibility of independent security audits. This becomes especially important in educational, corporate, or administrative environments, where the requirements for data protection are significantly higher.

Conclusion. Protecting voice information in real-time communication requires cryptographic solutions that combine high security with low latency. As the analysis has shown, symmetric encryption algorithms – particularly stream ciphers – are the most effective in practice. Asymmetric methods are mainly used for key exchange. The sequence of compression and encryption significantly affects system security, and emerging approaches such as integrated compression and encryption offer promising directions for further research.

The review of popular messengers (Telegram, VK, Yandex.Messenger) demonstrates that their level of protection is generally sufficient for everyday use but may not meet the requirements for handling sensitive information. The lack of full transparency and limited user control reduce trust in such platforms. In the future, robust voice data protection will require not only technical advancement but also deeper integration of security principles into the architecture of communication systems.

References

1. Bernstein, D. J. (2008). ChaCha, a Variant of Salsa20. – Pp. 436-439. [online]. Available at: https://cr.yp.to/chacha/chacha-20080128.pdf. (Accessed: 28.04.2025).

2. Buchmann, J. (2004). Introduction to Cryptography. 2nd ed. New York: Springer. – 300 p.

3. Chen, L., Chen, L.-K. (2016). Report on Post-Quantum Cryptography. National Institute of Standards and Technology. – [online]. Available at: https://nvlpubs.nist.gov/nistpubs/ir/2016/NIST.IR.8105.pdf. (Accessed: 28.04.2025).

4. Daemen, J., Rijmen, V. (2002). The Design of Rijndael: AES – The Advanced Encryption Standard. Springer. – 238 p.

5. Katsikeas, S., Katsikas, S., Gritzalis, D. (2020). A Survey of Voice Encryption Techniques for VoIP and Their Application in Wireless Networks. *Journal of Communications and Networks.* – Vol. 22. – № 1. – Pp. 1–14. – [online]. Available at: https://doi.org/10.1109/JCN.2020.000001. (Accessed: 28.04.2025).

6. Menezes, A., van Oorschot, P., Vanstone, S. (1996). Handbook of Applied Cryptography. Boca Raton: CRC Press. – 780 p.

7. Rivest, R., Shamir, A., Adleman, L. (1978). A Method for Obtaining Digital Signatures and Public-Key Cryptosystems. *Proceedings of the IEEE.* – Vol. 67. – № 3. – Pp. 397–404. – [online]. Available at: https://doi.org/10.1109/PROC.1979.11342. (Accessed: 28.04.2025).

8. Zhang, N., Lou, W., Hou, Y. T. (2012). Enhancing the Security of Voice Communications in Mobile Networks. *IEEE Transactions on Wireless Communications.* – Vol. 11. – № 6. – Pp. 2105–2115. – [online]. Available at: https://doi.org/10.1109/TWC.2012.040612.111217. (Accessed: 28.04.2025).

UDK 004.056

PROTECTION OF SPEECH DATA IN THE DIGITAL AGE

Dotsenko Evelina Evgenievna,
Student of the Institute of Engineering and Digital Technologies,
Belgorod State National Research University, Belgorod, Russia,
E-mail: 1646580@bsuedu.ru
Grigorenko Svetlana Evgenievn*a*,
Ph.D. in Pedagogy,
Associate Professor of the Department of Foreign Languages
and Professional Communication,
Belgorod State National Research University, Belgorod, Russia,
E-mail: sgrigorenko@bsuedu.ru

Abstract: *The article explores current aspects of speech data protection as a biometric and personal resource in the context of rapidly evolving speech synthesis and recognition technologies. Special attention is paid to threats such as voice forgery, biometric template leakage, and insufficient legal safeguards. The paper discusses existing methods of encryption, voice authentication, artificial intelligence technologies, and new approaches such as contextual and multi-factor authentication, federated learning, and anonymization of speech signals. Educational and ethical aspects of voice data processing are also addressed. Future trends in speech protection technologies are presented.*

Keywords: *speech data, voice biometrics, information security, speech synthesis, spoofing, artificial intelligence, voice authentication, privacy, voice forgery, speaker identification*.

Introduction. In today's digital society, the human voice is used not only for communication. Increasingly, it is becoming a means of authentication, access to services, and a subject of analysis in automated systems. Speech data is not just what a person says, but *how* they say it: tone, intonation, speed, rhythm, accent, and articulation features. These parameters are individual and linked to a person's anatomy and habits. Therefore, voice is considered a biometric identifier –alongside fingerprints and iris scans [Abramovich et al., 2019].

These characteristics make speech not only a tool for interaction but also a potential target for malicious use. As digital systems increasingly rely on voice for authentication and identification, understanding how such systems are structured becomes essential for assessing both their capabilities and vulnerabilities.

Main part. Figure 1 shows the architecture of a typical speech data protection system, including signal processing, authentication, verification, and encryption stages.

Legally, speech data is classified as biometric personal data. In Russia, it is protected under Federal Law No. 152-FZ "On Personal Data," and in the European Union by the General Data Protection Regulation (GDPR). Any recording, storage, or analysis of voice requires the person's prior consent. However, in practice, such data is increasingly collected through voice assistants, smartphones, remote learning platforms, and other digital tools without full user awareness [Kuimov et al., 2020].

Voice is especially vulnerable when used as an authentication method. Many banks and companies now offer voice verification for access. While convenient, it is risky: if a voice template is compromised, it cannot simply be replaced like a password.

Modern speech synthesis technologies can create a realistic copy of a voice from just 5–10 seconds of audio. Systems like Tacotron, VITS, and Vall-E can mimic tone, speech style, pauses, and even emotional nuances [Goodfellow et al., 2016].

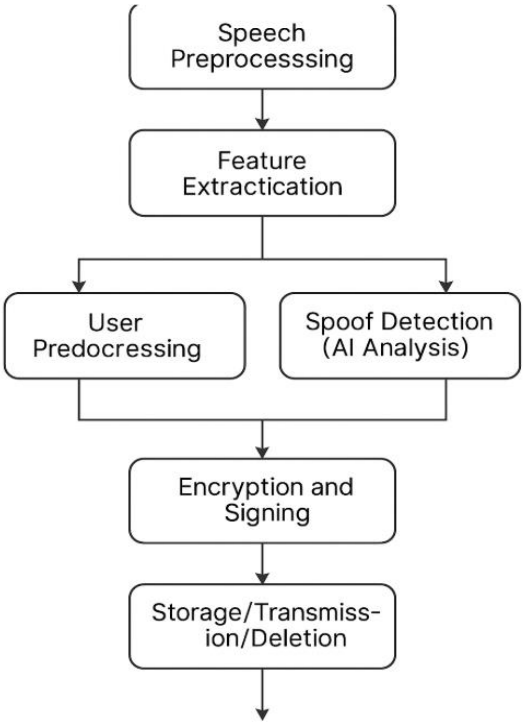


Figure 1. Architecture of a Speech Data Protection System

This opens the door to new types of attacks, such as spoofing – using synthetic speech to deceive a system. There have already been cases where fraudsters used a fake CEO voice to issue false commands [Lavrentyeva et al., 2019]. Various protection strategies are used in such cases. The first is encryption during transmission. Protocols like Secure Real-time Transport Protocol (SRTP), Transport Layer Security (TLS), and Zimmermann Real-time Transport Protocol (ZRTP) provide secure voice transmission over networks. They use the Advanced Encryption Standard (AES) algorithm with key lengths of 128 or 256 bits [Kuimov et al., 2020]. While this effectively protects data in transit, it does not prevent voice forgery or protect stored templates from internal threats.

Another question is whether a speaker can be identified even if their voice is altered. Modern algorithms, especially those based on Convolutional Neural Networks (CNN) and Recurrent Neural Networks (RNN), are trained to identify deep vocal features: frequency patterns, vocal cord vibrations, and spectral characteristics. Mel-frequency cepstral coefficients (MFCCs) are also used. These features are resistant to pitch changes, noise, and intentional distortions. However, even these systems can be deceived by well-synthesized speech [Kinnunen et al., 2010].

This has spurred the development of anti-spoofing technologies. These systems, also based on AI, are trained to detect unnatural prosody, flat intonation, digital artifacts, and lack of pauses. Adversarial training is used to prepare models to counter attacks [Lavrentyeva et al., 2019]. Figure 2 illustrates the classification of key threats to speech data – from spoofing and leaks to biometric hacking and privacy violations.

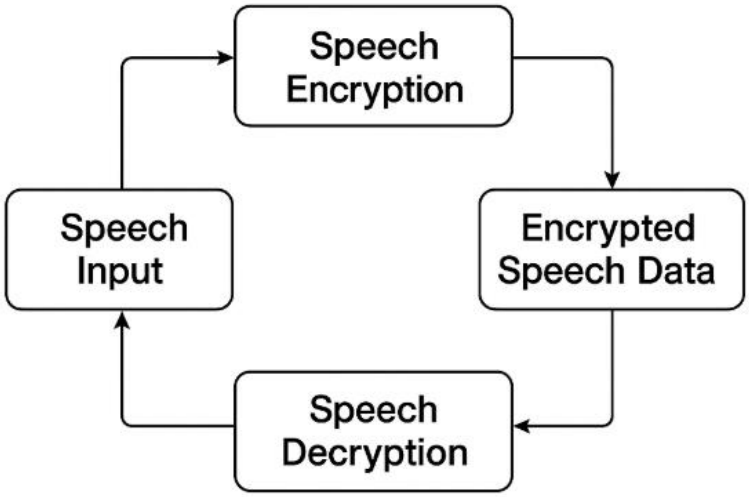


Figure 2. Classification of Speech Data Threats

Another promising direction is embedding hidden markers in speech signals, such as audio watermarks, digital signatures, or time stamps, which are inaudible but technically verifiable [Abramovich et al., 2019]. To enhance privacy, differential privacy techniques are being developed – adding noise to the speech signal to hide personal traits without reducing intelligibility. Federated learning is also being used, where the model is trained locally on user devices without transferring audio data to servers [Goodfellow et al., 2016].

However, even with local training methods, the security of voice data remains a concern. It is crucial to understand the full spectrum of threats – ranging from data leakage and spoofing to unauthorized analysis and misuse of biometric templates. Figure 3 shows the principle of federated learning, in which user data is not transferred to the cloud but used only to locally update model weights.

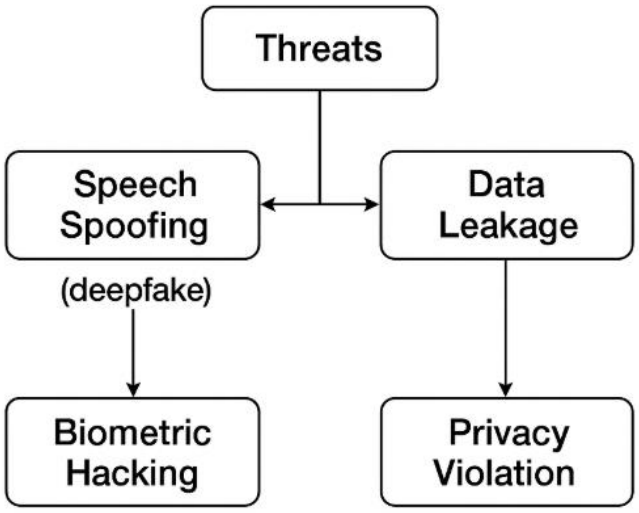


Figure 3. Principle of Federated Learning

In the field of education, protecting speech data is particularly important. During remote exams, lectures, and proctoring, voices of students and teachers may be recorded,

analyzed, and stored. Users are often unaware of who stores the data, for how long, and with what rights. This raises ethical questions and underscores the need for digital literacy and responsible data practices in educational institutions [Kinnunen et al., 2010].

One major development direction is the integration of multiple layers of protection. For example, multimodal biometrics will combine voice with emotion recognition, behavioral patterns, or context. The system will verify identity not only by voice but also by how and where it is used [Abramovich et al., 2019].

Another important direction is second-level AI – where one AI monitors the behavior of another, especially in speech processing. This enables systems to recognize synthetic speech patterns, creating an "AI versus AI" model [Goodfellow et al., 2016]. There is also growing development of personal voice protection tools embedded in smartphones. These can alert the user if their voice is found in suspicious recordings or online content by comparing it with locally stored voice signatures [Kuimov et al., 2020].

In parallel, interest is growing in legal and ethical regulation: increasing transparency in voice data use, requiring labels for synthetic voices in media, and giving users control over how and where their voice is used [Kinnunen et al., 2010]. Finally, speech anonymization technologies are being explored – removing identifying features while preserving meaning. This will allow safe use of speech data in medicine, education, and research [Goodfellow et al., 2016].

The rapid development of speech synthesis technologies also raises social and psychological concerns. As synthetic voices become indistinguishable from real ones, trust in audio communication may erode. People might begin to doubt the authenticity of what they hear in news, phone calls, or even court recordings. This creates a risk of so-called "reality fatigue," where users no longer trust any digital information without visual or contextual confirmation [Kuimov et al., 2020]. Such trends highlight the importance of digital media literacy and the need for clear labeling of synthetic content to preserve public trust. Figure 4 shows how the presence of authenticity labels affects trust across different types of audio content.

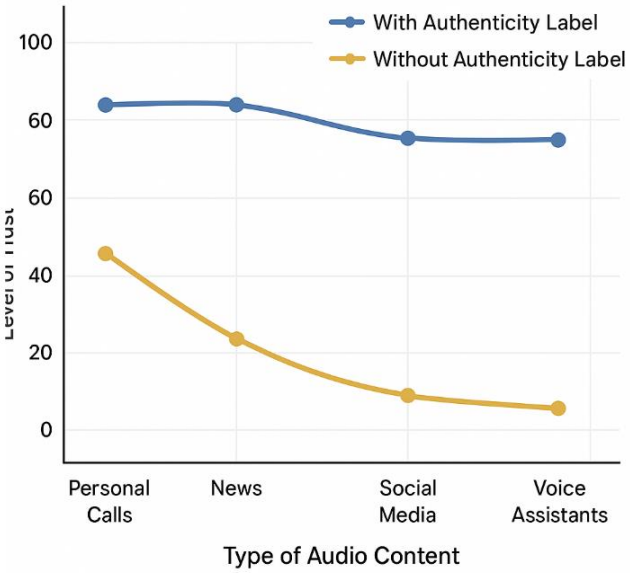


Figure 4. Trust Level in Audio Content With and Without Authenticity Labels

The graph demonstrates that user trust significantly increases when audio content is accompanied by an authenticity label, especially in sensitive areas like personal calls and news. One of the potential future developments in speech data protection is the concept of a “digital voice passport.” This would be a secure, cryptographically signed voiceprint stored on a personal device and linked to a verified identity. When used in authentication or communication, systems could verify the integrity of the voice signal against this trusted source. Combined with blockchain or decentralized identity systems, this could prevent unauthorized use of a person’s voice in synthetic media or fraud. However, implementing such a system would require strong international cooperation, standardization, and public awareness [Lavrentyeva et al., 2019].

Figure 5 illustrates the working principle of such a digital voice passport system.

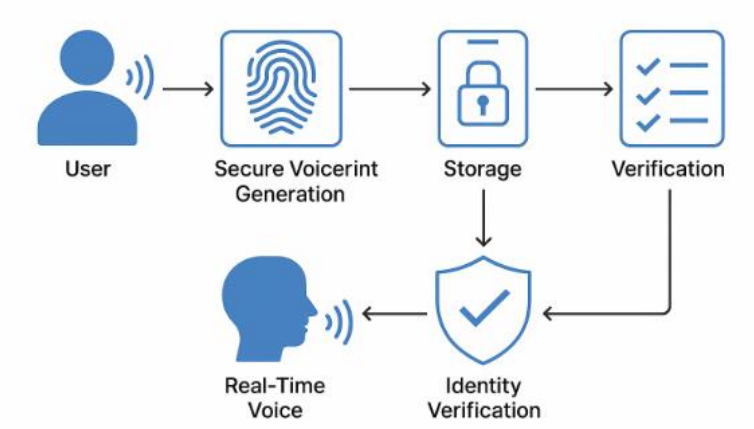


Figure 5. Principle of Digital Voice Passport

A flowchart showing the sequence from voiceprint generation and secure storage to real-time identity verification, forming a personal voice-based authentication loop.

Such technologies mark a shift in the perception of voice not just as a signal, but as a protected element of digital identity. In the future, the concept of "owning one's voice" may become as fundamental as data ownership or digital signature rights today. This will require not only technical tools but also changes in legal systems, standardization frameworks, and global ethical norms. It is essential to begin forming this infrastructure now – before synthetic voices become completely indistinguishable and untraceable.

Conclusion. Speech data is becoming an important element of digital identity and human-technology interaction. Its uniqueness makes it both a powerful tool and a vulnerable asset. Modern threats such as synthesis and forgery of speech require comprehensive protection methods – from encryption and biometrics to AI-based spoof detection. A holistic approach combining technology, law, and ethics is essential. Protecting the voice signal is not only a security matter but a sign of respect for the digital identity of individuals.

References

1. Abramovich, M. G., Kruglov, S. V. (2019). Biometricheskie tekhnologii i zashchita informacii: Uchebnoe posobie dlya vuzov [Biometric Technologies and Information Protection: Textbook for Universities]. – M.: Radiotekhnika. – 289 p. (in Russian)

2. Goodfellow, I., Bengio, Y., Courville, A. (2016). Deep Learning. Cambridge: MIT Press. – [online]. Available at: https://www.deeplearningbook.org. (Accessed: 04.05.2025).

3. Kinnunen, T., Li, H. (2010). An overview of text-independent speaker recognition: From features to supervectors. *Speech Communication.* – V. 52(1). – Pp.12–40. – [online]. Available at: https://doi.org/10.1016/j.specom.2009.08.009. (Accessed: 04.05.2025).

4. Kuimov, V. A., Zakharov, V. V. (2020). Informacionnaya bezopasnost' i zashchita personal'nyh dannyh: Uchebnoe posobie [Information Security and Protection of Personal Data: Textbook]. – M.: KNORUS. – 345p. (in Russian)

5. Lavrentyeva, G., Makarov, P., Novoselov, S., Shchemelinin, V., Kozlov, A. (2019). Sistemy zashchity ot spufinga STC dlya konkursa ASVspoof2019 [STC anti-spoofing systems for the ASVspoof2019 challenge] //*Proceedings of Interspeech.* – Pp. 1033-1037. – [online]. Available at: https://www.isca-speech.org/archive/Interspeech_2019/abstracts/1924.html. (Accessed: 04.05.2025). (in Russian)

UDK 00.008

FORMALIZED EVALUATION OF STREAMING MUSIC SERVICES

Mochalkin Ivan Andreevich,
Student of the Institute of Engineering and Digital Technologies,
Belgorod State National Research University, Belgorod, Russia,
E-mail: mochalkin.ivan.08@gmail.com
Grigorenko Svetlana Evgenievna,
Ph.D. in Pedagogy,
Associate Professor of the Department of Foreign Languages and Professional Communication,
Belgorod State National Research University, Belgorod, Russia,
E-mail: sgrigorenko@bsuedu.ru

Abstract: *The article presents a formalized method for evaluating the effectiveness of various music streaming services. Using a criteria-based approach, we identified and classified the characteristics into positive and negative ones. As a result, the advantages and disadvantages of versions Apple Music, Spotify and VK Music are presented in the article.*

Keywords: *music service, choice of music service, music, efficiency assessment.*

Introduction. The problem of choosing streaming music services [Obshchaya informaciya o muzykal'nykh servisakh] is due to the growing audience of these information resources. They are used not only by young people, but also by other age groups of the population. With their help, you can conveniently listen to music, make your own playlists and learn about new developments in the music field.

The market of services is rapidly progressing and changing, new ones are appearing and old ones are leaving [Pechishcheva, 2018], so it is important to choose a stable, high-quality and affordable service for people's activities among a huge number of offers.

In researching the problem of selecting streaming services, a criteria assessment method was employed. Various features were identified and classified into two categories: positive and negative.

Main part. In the class of positive signs, the following data and their gradations are accepted for evaluation:

1) The „Sound Quality" attribute evaluates the accuracy or legibility of playing an audio file from the device. This feature can be differentiated by 3 gradations:

– “Often illegible” It is often impossible to make out the words in a song;

– “Rarely illegible”. It's rare to get caught in an illegible fragment of a song;

– “Everything is legible”. Each song has high sound quality, there is not a single obscure place.

2) The “Quality of recommendations” shows how advanced the algorithms for selecting songs according to the user's taste preferences are. This feature is characterized by the following 5 gradations:

– “Terrible”. IR-information resource, can't find a single suitable song;

– “The bad ones”. It is a rare time that IR algorithms can find something suitable for the user;

– “Passable”. Half of the selected songs are considered suitable by the user;

– “Good ones”. Most of the songs are approved by the user;

– “Great”. It is rare that IR algorithms can find something unsuitable for the user.

3) The “Number of songs” reflects the size of the library of IR. This feature can be characterized by the following 3 gradations:

– «<=30 million». The IR library is sparse;

– «>30 and <=55 million». The IR library has more than enough volume;

– «>55 million». The IR library is extensive.

4) The “trial period” shows the number of the first free months, which give the user time to master the service and make a decision about the possible continuation of its use. This feature can be characterized by 3 criteria:

– “Missing”. IR does not provide a period of free use of the service for the user;

– “1 month”. The IR provides a standard period of free use of the service for the user;

– “>1 month”. The IR provides an extended period of free use of the service for the user.

5) “Download your own songs” reflects the ability to download songs of your own writing, various kinds of covers, as well as songs that are not in the library of the IR. This feature can be characterized by 2 criteria:

– “Missing”. The IR library cannot be supplemented with your own songs;

– “Present”. You can add your own songs to the IR library.

6) “User communication” shows the degree of possible user communication. This feature can be characterized by the following 2 gradations:

– “Missing”. The IR does not have user communication capabilities;

– “Present”. IR has user communication capabilities.

In the class of negative signs, the following data and their gradations are accepted for evaluation:

1) The “Price” attribute reflects the cost of one month of subscription to the IR, it can be differentiated by 3 gradations:

– “Low”. All IR features are available at a low price;

– “Acceptable”. All IR features are available at an affordable price;

– “High”. All IR features are available at a very high price.

2) The “User-friendliness of the interface” sign shows ease of use and friendliness to users of the IR. This criterion can be characterized by the following 3 gradations:

– “User-friendly” – the IR interface is intuitive and does not interfere with use;

– "Acceptable" – the IR interface is understandable to the user, but there is a difficulty in using it;

– "Inconvenient" – the IR interface is not clear, it is difficult for the user to adapt to it.

3) The "Download speed" sign shows the total time required to start playing the song, after switching to it, it can be differentiated by 3 gradations:

– "Fast". The download takes place within a short period of time, most often one second;

– "Average". The download takes place within an average period of time, most often two or three seconds;

– "Slow". The download takes place over a long period of time, four seconds or more.

4) "Listening offline" reflects the ability to listen to music without an internet connection. This criterion can be characterized by the following 2 gradations:

– "Present". IR allows you to listen to downloaded music without an Internet connection;

– "Missing". IR does not allow you to listen to music without an Internet connection.

Weights and values of gradation levels:

Positive signs:

– Sound quality ($k_{sq} = 5$; $P_{sq}(1) = 0$, $P_{sq}(2) = 14$, $P_{sq}(3) = 28$)

– Quality of recommendations ($k_{qr} = 2$, $P_{qr}(1) = 0$, $P_{qr}(2) = 2$, $P_{qr}(3) = 5$, $P_{qr}(4) = 8$, $P_{qr}(5) = 11$)

– Number of songs ($k_n = 3$; $P_n(1) = 0$, $P_n(2) = 8$, $P_n(3) = 17$)

– Trial period ($k_t = 1$; $P_t(1) = 0$, $P_t(2) = 2$, $P_t(1) = 5$)

– Uploading your songs ($k_u = 4$; $P_u(1) = 0$, $P_u(2) = 22$)

– User communication ($k_{uc} = 3$; $P_{uc}(1) = 0$, $P_{uc}(2) = 17$)

Negative signs:

– Price ($k_p = 3$; $P_p(1) = 0$, $P_p(2) = 15$, $P_p(2) = 30$)

– User- friendliness of the interface ($k_f = 2$; $P_f(1) = 0$, $P_f(2) = 10$, $P_f(3) = 20$)

– Download speed ($k_d = 1$; $P_d(1) = 0$, $P_d(2) = 5$, $P_d(3) = 10$)

– Listening offline ($k_l = 4$; $P_l(1) = 0$, $P_l(1) = 40$)

According to the above criteria, we analyzed and compared 3 streaming music services: Apple Music [1], Spotify [2], VK Music [3].

We have highlighted in each table the level of manifestation of a positive sign when using this resource, the value of the corresponding gradation and put it down as an assessment of the sign.

Total cumulative assessment of positive properties: Apple Music – 73, Spotify – 75, VK Music – 79.

We have identified the highlighted level of manifestation of a negative trait when using this resource, the value of the corresponding gradation and put it down as an assessment of the trait.

Table 1. Positive signs

Name: Apple Music

Sign	**Sound quality**			**Evaluation %**
Gradation	Often unintelligible	Rarely illegible	everything is legible	**28**
Value	**0**	**14**	**28**	

Sign	**The quality of recommendations**					**Evaluation%**
Gradation	Terrible	Bad	Passable	Good	Excellent	**11**
Value	**0**	**2**	**5**	**8**	**11**	

Sign	**Number of songs**			**Evaluation%**
Gradation	<=30	30> and <=50	>50	**17**
Value	**0**	**8**	**17**	

Sign	**Trial period**			**Evaluation%**
Gradation	Missing	1 month	> 1 month	**0**
Value	**0**	**2**	**5**	

Sign	**Uploading your songs**		**Evaluation%**
Gradation	Missing	Is present	**0**
Value	**0**	**22**	

Sign	**User communication**		**Evaluation%**
Gradation	Missing	Is present	**17**
Value	**0**	**17**	

Name: Spotify

Sign	**Sound quality**			**Evaluation %**
Gradation	Often unintelligible	Rarely illegible	everything is legible	**28**
Value	**0**	**14**	**28**	

Sign	**The quality of recommendations**					**Evaluation%**
Gradation	Terrible	Bad	Passable	Good	Excellent	**11**
Value	**0**	**2**	**5**	**8**	**11**	

Sign	**Number of songs**			**Evaluation%**
Gradation	<=30	30> and <=50	>50	**17**
Value	**0**	**8**	**17**	

Sign	**Trial period**			**Evaluation%**
Gradation	Missing	1 month	> 1 month	**2**
Value	**0**	**2**	**5**	

Sign	**Uploading your songs**		**Evaluation%**
Gradation	Missing	Is present	**0**
Value	**0**	**22**	

Sign	**User communication**		**Evaluation%**
Gradation	Missing	Is present	**17**
Value	**0**	**17**	

Name: VK Music

Sign	**Sound quality**			**Evaluation %**
Gradation	Often unintelligible	Rarely illegible	everything is legible	**28**
Value	**0**	**14**	**28**	

Окончание табл. 1

Sign	**The quality of recommendations**					**Evaluation%**
Gradation	Terrible	Bad	Passable	Good	Excellent	**2**
Value	**0**	**2**	**5**	**8**	**11**	

Sign	**Number of songs**			**Evaluation%**
Gradation	<=30	30> and <=50	>50	**8**
Value	**0**	**8**	**17**	

Sign	**Trial period**			**Evaluation%**
Gradation	Missing	1 month	> 1 month	**2**
Value	**0**	**2**	**5**	

Sign	**Uploading your songs**		**Evaluation%**
Gradation	Missing	Is present	**22**
Value	**0**	**22**	

Sign	**User communication**		**Evaluation%**
Gradation	Missing	Is present	**17**
Value	**0**	**17**	

Table 2. Negative signs

Name: Apple Music

Sign	**Price**			**Evaluation%**
Gradation	Low	Acceptable	High	**30**
Value	**0**	**15**	**30**	

Sign	**User-friendliness of the interface**			**Evaluation%**
Gradation	Comfortable	Acceptable	Uncomfortable	**0**
Value	**0**	**10**	**20**	

Sign	**Download speed**			**Evaluation%**
Gradation	Fast	Average	Slow	**0**
Value	**0**	**5**	**10**	

Sign	**Listening offline**		**Evaluation%**
Gradation	Missing	Is present	**0**
Value	**0**	**40**	

Name: Spotify

Sign	**Price**			**Evaluation%**
Gradation	Low	Acceptable	High	**15**
Value	**0**	**15**	**30**	

Sign	**User-friendliness of the interface**			**Evaluation%**
Gradation	Comfortable	Acceptable	Uncomfortable	**0**
Value	**0**	**10**	**20**	

Sign	**Download speed**			**Evaluation%**
Gradation	Fast	Average	Slow	**0**
Value	**0**	**5**	**10**	

Sign	**Listening offline**		**Evaluation%**
Gradation	Missing	Is present	**0**
Value	**0**	**40**	

Окончание табл. 2

Name: VK Music

Sign	**Price**			**Evaluation%**
Gradation	Low	Acceptable	High	**15**
Value	**0**	**15**	**30**	

Sign	**User-friendliness of the interface**			**Evaluation%**
Gradation	Comfortable	Acceptable	Uncomfortable	**10**
Value	**0**	**10**	**20**	

Sign	**Download speed**			**Evaluation%**
Gradation	Fast	Average	Slow	**5**
Value	**0**	**5**	**10**	

Sign	**Listening offline**		**Evaluation%**
Gradation	Missing	Is present	**0**
Value	**0**	**40**	

From these data, the total assessment of negative properties are calculated: Apple Music – 30, Spotify – 15, VK Music – 30

When re-selling, we calculated the overall assessment of the information resource by subtracting the overall assessment of the positive properties from the overall assessment of the negative properties, and we get an overall assessment of the effectiveness of use

Information resource $=\Sigma P^{+}_{i}(s) - \Sigma P^{-}_{j}(s)$ in % of the total: in Apple Music – 43, in Spotify – 60, in VK Music – 49.

Conclusion. The criteria-based evaluation method effectively quantified the performance and user experience of three prominent streaming music services: Apple Music, Spotify, and VK Music.

Spotify emerged as the most efficient service, offering superior sound quality, better recommendations, and a more extensive library, alongside acceptable pricing and offline listening features.

VK Music performed moderately well but was hampered by a less user-friendly interface and slower download speeds.

Apple Music, despite having high sound quality and an extensive library, scored the lowest due to higher costs and limited positive features.

This structured evaluation provides valuable insights for users to make informed decisions when choosing a streaming music service. Future research could expand the criteria or explore additional services to further refine the evaluation process.

References

1. Apple Music website. – [Online]. Available at: https://music.apple.com/us/browse. (Accessed 03.10.2014).

2. Obshchaya informaciya o muzykal'nykh servisakh [General information about music services]. – [Online]. Available at: https://blog.barnsly.ru/pt/review/audio-stereaming-services-for-audiophilie. (Accessed 03.10.2024). (in Russian)

3. Pechishcheva, E.M (2018). Strimingovye servisy v muzykal'noj industrii [Streaming Services in the Music Industry] // *Aleya nauki.* – V. 5. – № 4 (20). – Pp. 161-165. – [Online]. Available at: https://www.elibrary.ru/othzef. (Accessed: 09.10.2024). (in Russian)

4. Spotify website. – [Online]. Available at: https://www.spotify.com/int/why-not-available. (Accessed 03.10.2024).

5. VK Music website. – [Online]. Available at: https://music.vk.com. (Accessed 03.10.2024).

SECTION 5
CHEMICAL AND BIOLOGICAL SCIENCES

UDK 615.1, 615.4

DIE VERWENDUNG VON NIFEDIPIN ALS REKTALE ZUBEREITUNG

Romanzowa Alina Alexandrowna,
Aspirantin des Instituts für Pharmazie, Chemie und Biologie,
Belgoroder Staatliche Nationale Forschungsuniversität, Belgorod, Russland,
E-mail: orexova.alina@mail.ru
Taranowa Elena Nikolayewna,
Kandidatin der philologischen Wissenschaften,
Professorin des Lehrstuhls für Fremdsprachen
und berufliche Kommunikation,
Belgoroder Staatliche Nationale Forschungsuniversität, Belgorod, Russland,
E-mail: taranova_e@bsuedu.ru

Annotation: *Jedes Jahr bleibt die Dynamik der Inzidenz von Hämorrhoiden unverändert, was eine moderne Behandlung erfordert. Der Pharmamarkt bietet verschiedene Gruppen von Medikamenten zur Behandlung von Hämorrhoiden und Analfissuren. Pharmazeutische Substanz – Nifedipin wird auch verwendet, um sie zu behandeln, aber seine Verwendung auf dem modernen Markt ist begrenzt. Die Hauptanwendung von Nifedipin ist arterielle Hypertonie, Angina pectoris. Die Entwicklung heimischer Arzneimittel mit Nifedipin zur rektalen und äußerlichen Anwendung ist heute ein aktuelles Problem der pharmazeutischen Industrie.*

Schlagwörter: *das Nifedipin, die Hämorrhoide, die Behandlung von Hämorrhoiden, das Relifipin, die rektale und äußerliche Anwendung von Nifedipin, die Lokalanästhetika.*

Am Anfang des Artikels klären wir einige Begriffe, die grundlegend in unserer wissenschaftlichen Arbeit sind. Laut der Definition ist Hämorrhoide „eine Erkrankung, die mit Thrombose, Entzündung, pathologischer Ausdehnung und Kräuselung der Hämorrhoidalvenen des distalen Rektums einhergeht“ [Sowetskaja Enziklopedia, 1969-1978]. Die Analfissur ist ein spontan auftretender linearer oder ellipsenförmiger Längsriss der Schleimhaut des menschlichen Anus, gekennzeichnet durch starke Schmerzen während und nach dem Stuhlgang, sporadisch spärliche Blutverunreinigungen im Stuhl [Offizialnyi sait gosudarstvennogo nauchnogo zentra kolonoskopii, 2019].

Nach den offiziellen Angaben des Gesundheitsministeriums leiden weltweit etwa 10% der Menschen an Hämorrhoiden. Die Prävalenz von Hämorrhoiden in Russland erreicht etwa 130-145 Fälle pro 1000 Einwohner. Jedes Jahr nimmt die Dynamik der Morbidität nicht ab, was die Behandlung dieser Krankheit dringend erfordert.

Der moderne Pharmamarkt für die Behandlung von Hämorrhoiden und Analfissuren bietet verschiedene Gruppen von Medikamenten: Antikoagulanzien, Lokalanästhetika, Venotonikamittel, Hämostatika, nichtsteroidale entzündungshemmende Medikamente, Glukokortikosteroide, krampflösende Mittel, unspezifische Medikamente, die antiseptisch, adstringierend und trocknend wirken [Mediko-fanrazevticheskiy zurnal Puls, 2022].

Der Hauptanteil der im Inland hergestellten Arzneimittel sind Lokalanästhetika (Lidocain, Benzocain) sowie auch die Antikoagulanzien (Heparin-Natrium). Der Wirkungsmechanismus dieser Gruppen von Medikamenten erklärt also ihre Wahl. Er zielt sich darauf ab, die Entzündungen zu reduzieren, antithrombotische und analgetische Wirkungen zu machen. Das Heparin als direkt wirkendes Antikoagulans verhindert die Bildung von Blutgerinnseln und fördert die Regeneration des Bindegewebes. Lidocain und Benzocain sind Lokalanästhetika, die wiederum selektiv die empfindlichen Nervenenden beeinflussen und dadurch eine analgetische Wirkung haben.

Es sein erwähnt werden, dass bei Hämorrhoiden und Analfissuren das Vorhandensein eines Hypertonus des inneren Analsphinkters charakteristisch ist. Das Nifedipin kann verwendet werden, um den Hypertonus des Sphinkters des Anus zu beseitigen.

So ist das Nifedipin ein Blocker langsamer Kalziumkanäle. Aufgrund der Hemmung der Aufnahme von Kalzium in die Kardiomyozyten und Zellen der glatten Gefäßmuskulatur hat es antianginöse und blutdrucksenkende Aktivität und verbessert den koronaren Blutfluss und reduziert auch den Tonus der glatten Gefäßmuskulatur. Angesichts des Wirkungsmechanismus von Nifedipin wird es in der modernen pharmazeutischen Industrie hauptsächlich zur Herstellung von Arzneimitteln verwendet, die zur internen Anwendung und Behandlung von Angina pectoris, arterieller Hypertonie und Raynaud-Krankheit verwendet werden.

Trotz der Prävalenz von Nifedipin als blutdrucksenkendes Medikament ermöglicht der Wirkmechanismus seine Verwendung auch zur äußerlichen Anwendung und Behandlung von Hämorrhoiden und Analfissuren. Der Wirkungsmechanismus von Nifedipin bei rektaler Anwendung ist mit einer Abnahme des extrazellulären Calciumstroms in den glatten Muskelzellen des Anus-Schließmuskels verbunden. Durch die Beseitigung des Sphinkterospasmus wird die Schwere der Schmerzen bei Patienten mit Hämorrhoiden und Analfissur deutlich reduziert. Mit einer Abnahme des Tonus des Schließmuskels des Anus verbessert sich die Blutversorgung der ischämischen Zonen der Schleimhaut des Analkanals und ihres Funktionszustands. Die pharmakologische Aktivität von Nifedipin führt zu einer Abnahme der Intensität der Entzündungsreaktion und hat eine modulierende Wirkung auf die Mikrozirkulation [Spravochnik Vidal, 2020].

Auf dem modernen Pharmamarkt gibt es eine kleine Anzahl von Arzneimitteln mit Nifedipin, von denen der Großteil durch Tabletten zur Behandlung der arteriellen Hypertonie dargestellt wird.

Tabelle 1

Die Arzneimittel mit Wirkstoff – Nifedipin

Name der Arzneimittel	**Wirkstoff**	**Arzneiform**	**Hersteller (Herstellungsland)**
Kalcigard Rethar	Nifedipin	Tabletten	Indien
Cordaflex	Nifedipin	Tabletten	Ungarn
Cordaflex RD	Nifedipin	Tabletten	die Schweiz
Cordipin Retard	Nifedipin	Tabletten	Slowenien
Cordipin HL	Nifedipin	Tabletten	Malta
Corinfar	Nifedipin	Tabletten	Kroatien
Corinfar Retard	Nifedipin	Tabletten	Kroatien

Окончание табл. 1

Nifedipin	Nifedipin	Tabletten	Russland
Nifekard HL	Nifedipin	Tabletten	Slowenien
Phenigidin	Nifedipin	Tabletten	die Ukraine
Relifipin	Nifedipin, Lidacoin	Gel	Deutschland

Das einzige Medikament auf dem russischen Pharmamarkt zur Behandlung von Analfissuren und akuten Hämorrhoiden mit dem Wirkstoff Nifedipin ist das Gel „Relifepin". Dieses Medikament wurde im Jahre 2021 registriert und ist in Form einer weichen Darreichungsform präsentiert, die durch ihre Verwendung gerechtfertigt ist. Es wird für den rektalen und externen Gebrauch verwendet. Dieses Medikament wird in Deutschland hergestellt. Es ist kombiniert und zusätzlich zu 0,3% Nifedipin enthält es ein Lokalanästhetikum – 2,0% Lidocain. Der Wirkungsmechanismus beruht sich auf einer Verletzung der funktionellen Aktivität der Natriumkanäle, die die Erzeugung von Schmerzimpulsen in den Enden der empfindlichen Nerven und die Leitung von Schmerzimpulsen durch die Nervenfasern verhindert.

In einer randomisierten Studie aus dem Jahre 2017 zeigte diese feste Form von Nifedipin und Lidocain im Vergleich zu Relief Advance Salbe, die Benzocain enthält, höhere Heilungsraten, hauptsächlich akute Analrisse, vor dem Hintergrund von Hämorrhoiden. In diesem Fall hatte das Kombinationspräparat keine systemische Wirkung auf das Herz-Kreislauf-System oder andere Systeme und Körperfunktionen [Koloproktologia, 2017].

Fazit: Nach der Untersuchung der pharmakologischen Aktivität des Wirkstoffs Nifedipin wurde die Möglichkeit seiner Verwendung als Medikament zur Behandlung von Hämorrhoiden und Analfissuren identifiziert. Nach der Analyse des modernen Pharmamarktes wurde eine Schlussfolgerung über eine begrenzte Anzahl von im Inland hergestellten Arzneimitteln mit dem Wirkstoff Nifedipin und das Fehlen einer Auswahl an Arzneimitteln für den externen und rektalen Gebrauch gezogen.

Diese Problematik der Anwendung des Medikaments Nifedipin erfordert heutzutage eine moderne Lösung, nämlich die Entwicklung von Arzneimitteln mit Nifedipin für den rektalen und externen Gebrauch.

Literaturliste

1. Anal'naya treshchina. Informaciya o zabolevanii [Analfissur. Die Informationen über die Krankheit]. – [Elektronische Ressource]. Zugriffsmodus: https://gnck.ru/?ref=xranks. (Datum der Behandlung: 19.02.2025). (in Russisch)

2. Anurowa, M.N., Zharkowa, M.D., Lenskaya, M.G., Margaryan, A.H., Speranskaya, W.W. (2022). Perspektivy razrabotki novoj lekarstvennoj formy dlya lecheniya anal'nyh treshchin [Die Perspektiven für die Entwicklung einer neuen Darreichungsform zur Behandlung von Analfissuren] // *Mediko-farmacevticheskij zhurnal "Pul's*". – №1 (T.24). – S. 5-7. (in Russisch)

3. Seliwerstow, D.W., Get'man, M.A., Manuilow, D.M., Hubezow, D.A., Kuznetsow, A.W., Yudin, W.A. (2017). Effektivnost' i bezopasnost' klinicheskogo primeneniya novogo preparata Fissario dlya naruzhnogo lecheniya ostroj anal'noj treshchiny na fone hronicheskoj gemorroidal'noj bolezni [Die Wirksamkeit und Sicherheit der klinischen Anwendung des neuen Arzneimittels Fissario zur äußerlichen Behandlung akuter Analfissuren vor dem Hintergrund chronischer Hämorrhoidenerkrankungen] // *Nauchno-prakticheskij medicinskij zhurnal obshcherossijskoj obshchestvennoj organizacii „Associaciya koloproktologov Rossii"* – №1. – S. 45-51. (in Russisch)

4. Spravochnik Vidal', 2020. Lekarstvennye preparaty v Rossii. [Die Medikamente in Russland]. – M.: AstraFarmServis. – 173 S. (in Russisch)

UDK 615.1

POLOXAMERE ALS HILFSSTOFFE IN DER PHARMAINDUSTRIE

Romanzowa Alina Alexandrowna,
Aspirantin des Instituts für Pharmazie, Chemie und Biologie,
Belgoroder Staatliche Nationale Forschungsuniversität, Belgorod, Russland,
E-mail: orexova.alina@mail.ru
Taranowa Elena Nikolayewna,
Kandidatin der philologischen Wissenschaften,
Professorin des Lehrstuhls für Fremdsprachen
und berufliche Kommunikation,
Belgoroder Staatliche Nationale Forschungsuniversität, Belgorod, Russland,
E-mail: taranova_e@bsuedu.ru

Annotation: *Poloxamere sind eine Klasse von Polymeren, die in der Pharmaindustrie weit verwendet werden. Das staatliche Arzneibuch stellt fünf Arten von Poloxameren vor. Sie werden sowohl als Hilfsstoffe als auch Lösungsvermittler, Emulgatoren, Geliermittel und Weichmacher eingesetzt. Ihre Untersuchung ist ein wichtiges Ziel im Bereich der Pharmazie. In diesem Artikel wird die Frage der Typen der Poloxamere, ihrer Beschreibung und Löslichkeit und ihrer Anwendung bei der Herstellung von Arzneimittel und Kosmetikprodukten behandelt.*

Schlagwörter: *die Arzneimittelproduktion, die Hilfsstoffe, die Poloxamere, die Polymere, die Tenside, die Geliermittel.*

Die Polyxamere sind eine wichtige Polymerklasse, die in der Pharma- und Kosmetikindustrie häufig zur Herstellung hochwertiger Kosmetikprodukte als Hilfsmittel verwendet werden. Das Ziel ihrer Anwendung ist die Verbesserung von Leistung und Stabilität der Wirkstoffe. Es ist bekannt, dass die Polyoxymethylen auch in hochwertigen Transportsystemen für den Transport der Wirkstoffe zu den Organen-Auffänger benutzt werden.

Poloxamere sind synthetische Block-Copolymere aus Ethylenoxid und Propylenoxid. Es existieren verschiedene flüssige und halbfeste Typen, die in Wasser löslich bis sehr leicht löslich sind. Es handelt sich um schaumarme und schaumdämpfende nichtionische Tenside, die zur Dispergierung und Emulgierung in der chemisch-technischen Industrie Anwendung finden.

Poloxamere sind amphiphil und werden als pharmazeutische Hilfsstoffe unter anderem als Emulgatoren, Lösungsvermittler, Gelbildner und Schmiermittel eingesetzt. Poloxamere sind als Hilfsstoffe in vielen Arzneimitteln enthalten, zum Beispiel in Tabletten, Granulaten, Cremen, Suspensionen und Injektionslösungen.

Selbst stellen die Polyoxymethylen ein bifunktionelles Polymer dar, deren Moleküle aus zwei hydrophilen Enden und einem hydrophoben Mittelteil bestehen. Das Staatliche Arzneibuch der Russischen Föderation der 14. Herausgabe bietet eine Definition für Polyoxymethylene, aus der folgt, dass es sich um synthetische Blockcopolymere aus Ethylenoxid und Propylenoxid handelt [Farmakopeya, 2018].

Die Untersuchung von Polyoxymethylenen ist heute ein relevantes und aktuelles Thema, weil sie in der modernen Arzneimittelproduktion häufig als Wirkstoffe benutzt werden. Da die Polyoxymethylene nichtionische oberflächlich-aktive Substanzen sind, können sie bei der Herstellung von duroplastischen Gelen verwendet werden.

Abhängig von der Anzahl der Ethylenoxid- und Propylenoxid-Einheiten werden die Poloxamere in fünf Typen unterteilt. Ihre Beschreibung und Löslichkeit sind in der Tabelle 1 in Anlehnung an das staatliche Arzneibuch dargestellt.

Tabelle 1

Beschreibung und Löslichkeit von Poloxameren

Typ der Poloxamer-	**Beschreibung**	**Löslichkeit**
124	farblose oder fast farblose Flüssigkeit	sehr gut löslich in Wasser und Ethanol 96%
188	weißes oder fast weißes wachsartiges Pulver, Mikropartikel oder Flocken	löslich in Wasser und Ethanol 96%
237	weißes oder fast weißes wachsartiges Pulver, Mikropartikel oder Flocken	sehr gut löslich in Wasser und Ethanol 96%
338	weißes oder fast weißes wachsartiges Pulver, Mikropartikel oder Flocken	sehr gut löslich in Wasser und Ethanol 96%
407	weißes oder fast weißes wachsartiges Pulver, Mikropartikel oder Flocken	sehr gut löslich in Wasser und Ethanol 96%

Die Poloxamere der Typen 188, 237, 338 und 407 sind feste Substanzen ohne Geschmack und Geruch. 10%-ige Poloxamerlösungen haben einen pH-Wert im Bereich von 5,0–7,5 [European Pharmacopoeia, 2014]. Die Poloxamerlösungen sind bei der Anwesenheit von Säuren, Alkali und Metallionen stabil. Diese Eigenschaft spielt bei der Verwendung von Poloxameren in der pharmazeutischen Industrie eine wichtige Rolle. Das Molekulargewicht von Poloxameren ist ein entscheidender Faktor für die Gelbildung – die Polymere mit höherem Molekulargewicht haben bei niedrigeren Konzentrationen einen mehr ausgeprägten Geleffekt [Pharmaceutical Chemistry Journal, 2015].

In wässrigen Lösungen bilden die Poloxamere bei steigender Temperatur die Mizellen mit dem Ziel, die freie Energie der Lösung zu verringern. Bei höheren Temperaturen kommt es bei einigen Poloxamerlösungen zur thermoreversiblen Gelierung, d.h. zur Desaggregation der Mizellen [ZHurnal nauchnyh statej zdorov'e i obrazovanie v XXI veke, 2018].

Poloxamer 407 ist als „inaktiver“ Bestandteil in einer ganzen Reihe von Arzneimitteln enthalten. Diese Arzneien werden oral, als Aerosol, topisch, ophthalmologisch genommen. Wässrige Lösungen dieses Poloxamers in einer Konzentration von 20–30 % bilden bei erhöhten Temperaturen die Gele, aber bei niedrigeren Temperaturen verwandeln sie sich wieder in flüssige Lösungen. Diese Eigenschaft wird als „Thermoreversibilität“ genannt. Dank der geringen Toxizität von Poloxamer und seiner Thermoreversibilität gilt es als ein häufig verwendetes Polymer für die Arzneimittelverabreichung [Journal of colloid and interface science, 1997].

Poloxamer 188 wird am häufigsten bei der Herstellung von Arzneimitteln verwendet, da seine Sicherheit am besten untersucht ist. Es wird als Lösungsvermittler, Weichmacher und Emulgator verwendet (beispielsweise bei der Herstellung von Perftoran). Es hat einen thermoreversiblen Geleffekt und kann als Feuchtigkeitsmittel in Gelen verwendet werden.

In Kosmetikprodukten, die zur Hautkorrektur bestimmt sind, wird die Verwendung nichtionischer Tenside empfohlen, da diese am wenigsten toxisch und

allergen sind. Zum Beispiel wird Poloxamer 188 in der professionellen Kosmetik Perflör als Hautdurchlässigkeitsverstärker in einer Gelmaske verwendet [Internet-zhurnal "Kommercheskaya biotekhnologiya", 2017].

Poloxamere werden auch bei der Herstellung von Proteinmedikamenten verwendet. Dank der Eigenschaft von Poloxameren, die Hydrogele zu bilden, bewirken sie eine Verlängerung der Wirkung von Arzneistoffen, wodurch die Nebenwirkungen minimiert und die Pharmakotherapie verbessert werden. Dies ist für diese Medikamente sehr wichtig, da die Proteine bei parenteraler Verabreichung schnell aus dem Körper ausgeschieden werden, was zu einer geringen Bioverfügbarkeit des Medikaments führt.

Größter Produzent von Poloxameren ist der deutsche Konzern BASF. Er produziert die Produkte wie Lutrol F 127 – der Handelsname von Poloxamer 407 – und Lutrol F 68 – der Handelsname von Poloxamer 188. Sie werden in verschiedenen Darreichungsformen verwendet: Gele, Cremes, Suspensionen. Sie werden als Verdickungs- und Geliermittel, Stabilisatoren, Co-Emulgatoren und Konsistenzgeber in Salben verwendet. Lutrol F 68 wird als Dispergier- und Netzmittel zur oralen, lokalen und parenteralen Verabreichung von Arzneimitteln verwendet. Die Arzneibücher bestätigen die wichtige Rolle von Poloxameren als Hilfsstoffe für die Herstellung wirksamer und sicherer Arzneimittel.

Fazit: Die weitere Erforschung und Entwicklung von Arzneimitteln auf Basis von Poloxameren ist und bleibt ein wichtiges Ziel der modernen Pharmazie. Die Aussicht auf die Entwicklung neuer auf ihnen basierender Arzneimittel verbessert die Wirksamkeit der Therapie und die Lebensqualität der Patienten.

Die thermoreversiblen Eigenschaften von Poloxameren eröffnen die Möglichkeit, gezielte Verabreichungsformulierungen zu entwickeln, die optimale biopharmazeutische Eigenschaften und eine einfache Handhabung aufweisen, was wiederum zu einer höheren Neigung der Patienten zur Heilung beiträgt.

Literaturliste

1. Anurova, M.N., Bakhrushina, E.O., Demina, N.B. (2015). Review of Contemporary Gel-Forming Agents in the Technology of Dosage Forms // *Pharmaceutical Chemistry Journal*. – V. 49, 9. – Pp. 627-634.

2. Bahrushina, E.O., Nikiforova, D.A., Demina N.B. (2018). Osnovnye aspekty razrabotki termoreversivnyh polikompleksov poloksamerov [Die wichtigsten Aspekte der Entwicklung von Thermoversions-Polykomplexen von Polokameren] // *ZHurnal nauchnyh statej zdorov'e i obrazovanie v XXI veke*. – №5. – S. 103-106. (in Russisch)

3. Cabana, A., AiF-Kadi A., Juhasz, J. (1997). Study of the Gelation Process of Polyethylene Oxidea–Polypropylene Oxideb–Polyethylene Oxidea Copolymer (Poloxamer 407) Aqueous Solutions //*Journal of colloid and interface science*. – № 190. – Pp. 307–312.

4. Farmakopeya 14: Gosudarstvennaya farmakopeya Rossijskoj Federacii [Staatliches Arzneibuch der Russischen Föderation], 14 izdanie, 2018. (in Russisch)

5. European Pharmacopoeia 8.0, Strasbourg. 2014. – [Elektronische Ressource]. Zugriffsmodus: http://www.fptl.ru/biblioteka/farmakopei/ evropeyskaya_farmakopeya_8_vol-1.pdf. (Datum der Behandlung: 06.03.2025).

6. Puschkin, S.YU. (2017). PFO-korrekciya – novyj podhod k resheniyu problem, svyazannyh s vypadeniem volos [PFO-Korrektur – ein neuer Ansatz zur Lösung von Problemen im Zusammenhang mit Haarausfall] // *Internet-zhurnal "Kommercheskaya biotekhnologiya*". – [Elektronische Ressource]. Zugriffsmodus: https://laboratoriyapushkina.ru/pfo-correction/. (Datum der Behandlung: 06.03.2025). (in Russisch)

UDK 631.147

BIOTECHNOLOGICAL PRODUCTION OF α-AMYLASE BY MICROMYCETES OF THE ASPERGILLUS GENUS

Morkel Angelina Ruslanovna,
Student of the Institute of Pharmacy, Chemistry and Biology,
Belgorod State National Research University, Belgorod, Russia,
E-mail: morkelangelina94@gmail.com
Andrievskaya Arina Vladimirovna,
Student of the Institute of Pharmacy, Chemistry and Biology,
Belgorod State National Research University, Belgorod, Russia,
E-mail: arickbbba@gmail.com
Mariasova Elena Anatolyevna,
Ph.D. in Philosophy,
Associate Professor of the Department of Foreign Languages and Professional Communication,
Belgorod State National Research University, Belgorod, Russia,
E-mail: mariasova@bsuedu.ru

Abstract: *In recent decades, the biotechnological production of enzymes such as α-amylase has become an important area of industrial biotechnology. Micromycetes of the genus Aspergillus, due to their ability for high enzyme production and adaptability to different environmental conditions, are becoming the main targets for the biotechnological production of α-amylase. This work focuses on the study of methods for the production of α-amylase using Aspergillus strains, including the optimization of cultivation conditions such as temperature, pH and nutrient medium composition. The biochemical characterization of the obtained α-amylase and its potential applications in various industries are also discussed.*

Keywords: *α-amylase, enzymes, biotechnology, micromycetes, Aspergillus.*

In recent years, the biotechnological production of α-amylase using micromycetes of the genus Aspergillus has become increasingly relevant due to the industry's desire for environmentally friendly and cost-effective methods. The main amylolytic enzyme producers are the fungi Aspergillus awamori, Aspergillus oryzae and Aspergillus niger, especially the latter two, due to their high enzyme secretion capacity.

α-Amylase plays a key role in starch hydrolysis and finds wide applications in various industries including food (alcohol, starch, brewing), textiles and pharmaceuticals. This creates a high demand for α-amylase production and determines its promising potential [Rao, 2007].

Thus, studying the features of biotechnological production of α-amylase using micro-mycetes of the genus Aspergillus is a promising area of research work.

The aim of this work is to study the aspects of biotechnological production of α-amylase using Aspergillus micromycetes.

The following tasks are aimed at the realization of this goal:

1. to study the general characterization of strains of fungi of the genus Aspergillus producing α-amylase.

2. to study the general characterization of α-amylase enzyme.

3. To consider the role of α-amylase in modern industry.

The object of the study was various strains of fungi of the genus Aspergillus.

The subject of the study – features of biotechnological production of α-amylase with the help of micromycetes of the genus Aspergillus. garden and art garden.

Strains of fungi of the genus Aspergillus producing α-amylase are important in biotechnology. Let us consider the main ones.

Aspergillus oryzae 740-A2 is an active producer of α-amylase with an enzyme activity of 200 units/g dry weight. However, it suffers from instability of activity in industrial production and high susceptibility to infections.

Aspergillus oryzae HPB-169 also produces α-amylase using potato and corn starch as carbohydrate sources. Its amylolytic activity is 40-55 units/mg, but its low amylase activity limits its use.

Aspergillus awamori M-2002 (VKM F-3771D) is cultured in depth on cereal flour hydrolysate and synthesizes glucoamylases. By changing the pH of the medium to 5.9-6.4 with the addition of CaCO3 and MgSO4 salts, the synthesis of acidic α-amylase could be increased. Nevertheless, the amylolytic activity of this strain remains low, 60-80 units/mL of culture fluid per 192 h of growth.

Aspergillus niger is one of the most common species for the production of α-amylase and glucoamylase. For example, Aspergillus niger strain 33-19 NMN FD 02A, derived from the original strain 33 by exposure to gamma rays, shows increased activity of extracellular amylases – 1.7-2.1 times higher than in the original strain. Thus, different Aspergillus strains have unique characteristics and advantages, but also face certain limitations in α-amylase production [Nikitina, 2013].

Most of the enzymes that break down starch belong to the α-amylase family (1,3-glycosylhydrolase family). They act on α-glycosidic bonds, causing hydrolysis and forming α-isomers of mono- and oligosaccharides. These enzymes have barrel-shaped structures with a catalytic center and contain regions that form active sites.

α-Amylase (1,4-α-D-glucan hydrolase) hydrolyzes α-1,4-glucoside bonds in starch and glycogen to form monomers (dextrins, maltose). Its structure contains a calcium atom that activates the enzyme and protects it from proteinases.

Classification of amylases:

1. According to the temperature of reaction:

– Mesophilic amylase: active at 30-70 °C, used in food industry.

– Thermophilic amylase: active at 90-105 °C, used in high temperature industries.

2. By hydrolysis site:

– α-amylase: breaks 1,4-glycosidic bonds at random sites in starch to form short chains of sugars.

– β-amylase: hydrolyzes 1,4-glycosidic bonds at the ends of starch molecules, forming maltose.

– γ-amylase (glucoamylase): breaks 1,4- and 1,6-glycosidic bonds to form glucose.

– Isoamylase: breaks 1,6-glycosidic bonds in branched starch molecules such as amylopectin.

These enzymes play a key role in starch processing and the production of sugars. The mechanism of action of α-amylase involves several stages. The first stage, the hydrolysis of amylose, proceeds with the formation of maltose, maltotriose and other oligosaccharides [Novikov, 2018].

Then, in the second stage, their hydrolysis occurs with the formation of low-molecular-weight dextrins. The degradation of maltotriose is noticeably slower, because this substrate is less specific for the enzyme α-amylase. Amylopectin is then hydrolyzed, which leads to an increase in the concentration of low molecular weight α-dextrins in the reaction mixture. α-Dextrins contain 4 or more glycosidic residues, which are connected by α-1,6-bonds, as well as glucose and maltose compounds. In the second stage, the enzyme cleaves the maltotrioses and there is a slow hydrolysis of the specific bonds of the terminal α-dextrins, at their branching points.

Aspergillus niger is a major source of α-amylase and two main methods are used for its cultivation: submerged fermentation (SmF) and solid phase fermentation (SSF).

SmF (Submerged Fermentation) is a method of deep seeding into liquid media. It provides better process control and easy extraction of extracellular enzymes, but is more suitable for bacteria.

SSF (Solid-State Fermentation) is a method in which the culture is grown on solid nutrient medium with low free water content. This method is more convenient for fungi and allows the use of agro-industrial wastes such as wheat bran and straw. SSF is a cost-effective tool for industrial enzyme production and starch hydrolysis.

The ammonium sulfate fractionation method is used to purify α-amylases and includes conventional methods such as ion exchange chromatography and gel filtration. In the study by E. V. Avdiuk et al. ammonium sulfate was added to the supernatant of Aspergillus flavus var. oryzae fungi, increasing the concentration from 0% to 90%. At 30% concentration, a partial decrease in amylase activity was observed, but on further salting out, the activity increased 3-fold. The precipitate was centrifuged and dissolved in 3M ammonium sulfate [Avdiyuk, 2012].

Gel filtration was performed on a Toyopearl HW-50 TSK-gel column stabilized with Tris-HCl-buffer (pH 6.5). After dialysis and concentration on polyethylene glycol (PEG), the sample was eluted using Tris-HCl-buffer. Ion-exchange chromatography was then performed on a DEAE-Toyopearl 650M column with a NaCl gradient to combine the active fractions.

According to the results of the performed gel filtration of the dialysate of salinization, the authors identified three fractions (Figure 1). α-Amylase activity was observed only in fraction I and was increased 1.5-fold. The other fractions, proteolytic and fractions with glycosidase activity, had reduced α-amylase activity by a factor of 30 and 2, respectively.

The obtained fraction I by ion-exchange chromatography performed on DEAE-Toyopearl 650M gel using NaCl gradient (0-1.0 M) (Figure 2) has 9-fold increased α-amylase activity of A. flavus var. oryzae strain compared to the gel filtration results. Another advantage of this purification method is that it allows purification of the resulting enzyme from associated proteins

The method of affinity sorption of α-amylase on starch by E. V. Avdiuk and coworkers included the following steps: 200 mg of insoluble potato starch was washed

with 0.01 M phosphate buffer (pH 6.5) and centrifuged at 5000 g for 10 min to remove soluble particles. The starch was then incubated with the cooled dialysate for 1 h on an ice bath and centrifuged again. The precipitated starch was washed with buffer at 60°C [Avdiyuk, 2012].

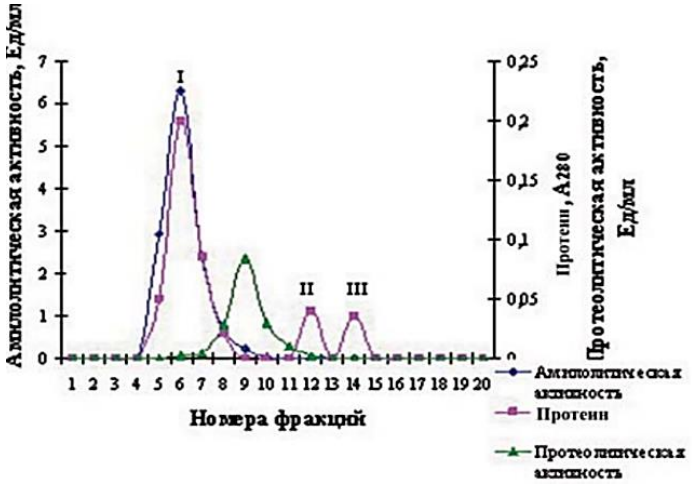


Figure 1. Elution profile of α-amylase preparation of A. flavus ver. oryzae Toyopearl HW-50

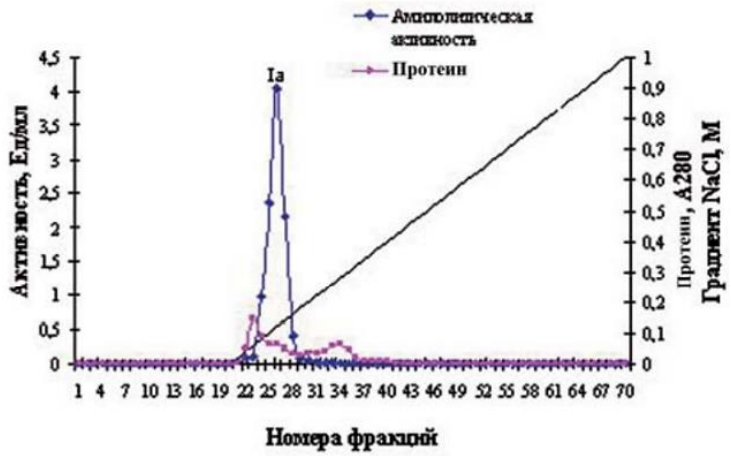


Figure 2. Elution profile of A. flavus ver. oryzae α-amylase preparation on DEAE-Toyopearl 650 M.

However, the results of affinity sorption did not meet expectations: a 3-fold decrease in the specific activity of the enzyme was observed, which indicates the ineffectiveness of this method for purification of α-amylase obtained from A. flavus var. oryzae.

Biotechnological production of α-amylase using Aspergillus micromycetes is becoming increasingly important due to the growing need for environmentally safe and cost-effective methods. The major α-amylase producers are Aspergillus oryzae, Aspergillus niger and Aspergillus awamori. Promising strains include:

– Aspergillus oryzae UV27R-14 – a mutant strain obtained by genetic selection [Nikitina, 2013].

– Aspergillus awamori M-2002 – producer of glucoamylase and acidic α-amylase under changing environmental conditions.

– Aspergillus niger 33-19 NMN FD 02A is a gamma-irradiated strain producing α-amylase and glucoamylase.

α-Amylases find applications in the food, medical and pharmaceutical industries. For example, they are used in the production of soy sauce, starch, acetic acid, alcohol and beer. In pharmaceuticals, α-amylase-based preparations such as Oraza and Wobenzyme are known.

The best method for producing amylases is the SSF method (growth on solid medium with low free water). Optimal methods of enzyme purification include gel filtration and ion exchange chromatography [Gérard, 2001].

References

1. Avdiyuk, E.V., Varbanec, L.D., Safronova, L.A., Harkevich, E.S. (2013). Ochistka α-amilaz Aspergillus flavus var. oryzae i Bacillus subtilis i ih svojstva [Purification of α-amylase from Aspergillus flavus var. oryzae and Bacillus subtilis and their properties] // *Biotechnologia Acta*. – T. 6. – № 3. – Pp. 91-99. (in Russian).

2. Gérard, C., et al. (2001). A multi-stages biosynthetic pathway in starch granules revealed by the ultrastructure of maize mutant starches // *Journal of Cereal Science*. – T. 34. – № 1. – Pp. 61-71.

3. Nikitina, E.V., Reshetnik, O.A., Gubajdullin, R.A. (2013). Biotekhnologicheskie aspekty primeneniya amiloliticheskih fermentov v pishchevoj promyshlennosti [Biotechnological aspects of the application of amylolytic enzymes in the food industry] // *Vestnik Kazanskogo tekhnologicheskogo universiteta*. – T. 15. – № 13. – Pp. 148-153. (in Russian).

4. Novikov, D.A. (2018). Farmacevticheskaya biotechnologia: Uchebnoe posobie [Pharmaceutical biotechnology: A textbook] – [online]. Available at: https://elib.bsu.by/handle/123456789/259539. (in Russian).

5. Rao, D.M., Swamy, A.V.N., Siva Rama Krishna, G. (2007). Bioprocess technology strategies, production and purification of amylases: An overview // *Internet Journal of Genomics and Proteomics*. – T. 2. – № 2. – Pp. 30-34.

UDK 606

LABORATORY DIAGNOSIS OF INFECTIOUS DISEASES

Gordienko Alina Nikolaevna,
Student of the Institute of Pharmacy, Chemistry and Biology,
Belgorod State National Research University,
Belgorod, Russia,
E-mail: gordienkoalinka809@gmail.com
Garkavaya Anastasia Andreevna,
Student of the Institute of Pharmacy, Chemistry and Biology,
Belgorod State National Research University,
Belgorod, Russia,
E-mail: nastiona.garkavaya@yandex.ru
Mariasova Elena Anatolyevna,
Ph.D. in Philosophy,
Associate Professor of the Department of Foreign Languages and Professional Communication,
Belgorod State National Research University,
Belgorod, Russia,
E-mail: mariasova@bsuedu.ru

Abstract: *This article explores the role of laboratory diagnostics in the detection and presumptive identification of microorganisms. Sampling by various methods is reviewed. The critical*

nature of the microbiology laboratory in the diagnosis of infectious diseases requires a close, positive working relationship between the physician and advanced health care provider and the microbiologists who contribute immensely to the medical team.

Keywords: *clinical microbiology, disease diagnosis, epidemiology, common microorganisms, specimen interpretation.*

Clinical microbiology is a science of interpretive judgment that is becoming more complex, not less. Even with the advent of laboratory automation and the integration of genomics and proteomics into microbiology, interpretation of results still depends on the quality of the samples obtained for analysis, whether prokaryotes or eukaryotes are suspected as the etiologic agent. Microbes generally have unique abilities to adapt to environmental conditions where antibiotic and host response pressures favor their survival. Laboratory instrumentation may or may not detect these mutations, which can present a challenge for clinical interpretation.

The goal of new diagnostic methods is to improve human health, but technological advances alone will not achieve this goal. Diagnosis of infectious diseases is best achieved by applying in-depth knowledge of both medical and laboratory science along with principles of epidemiology and antibiotic pharmacokinetics, and by integrating a strategic approach to host-parasite interactions.

Purpose of the work: to analyze the diagnosis of infectious diseases, focusing on the detection and identification of common microorganisms in different cytological specimens.

Objectives of the work:

1. Consider the role of rapid interpretation and sorting of samples;
2. To analyze the methods of sampling;
3. Evaluate the pitfalls in diagnosis and the usefulness of auxiliary techniques.

The originality of this research stems from integrating theoretical advancements with real-world implementations, potentially yielding substantial advancements in diagnosing infectious diseases.

Tuberculosis is an infectious disease caused by the Mycobacterium tuberculosis complex group of mycobacteria, Mycobacterium tuberculosis complex, which affects humans and animals. The main etiologic agent causing this infection in humans is Mvcobacterium tuberculosis. or the human species.

Plague is an acute infectious disease that is transmitted from animals to humans. It disrupts the functioning of various body systems. It is characterized by a high degree of toxicity, fever, skin, lymph nodes and lungs, as well as the ability to become septic. Given the extreme danger of this disease, plague is a quarantine infection [SanPIN 3.3686-21, 2022].

Anthrax is an acute infectious disease that belongs to the group of zoonoses. It is a dangerous disease that occurs within a few hours to 6 days after infection, with an average incubation period of about 2-4 days. In the primary inhalational form, the incubation period is shorter, while in vector-borne infection it may be longer.

Bacteria called Brucella cause brucellosis. This disease is characterized by a chronic course and recurrent fever, as well as the formation of specific granulomas in lymph nodes and internal organs.

Salmonellosis is an infection that is capable of epidemic spread. It is manifested by intoxication, diarrheal syndrome, abdominal pain and general weakness [SanPIN 3.3686-21, 2022].

Bacteriologic testing is used to diagnose the above diseases. It is based on the following principles:

1. When selecting material for the study, it is necessary to take into account the nature and location of the pathological process, the pathogenesis of the disease and its stage for clinical samples, as well as the possible importance of environmental objects as pathways and factors of transmission of microorganisms- causing infections;

2. To ensure adequate volume of material for examination, proper sample selection and timely delivery are necessary to preserve the viability of the causative microorganisms;

3. The optimal set of nutrient media for primary inoculation and pathogen accumulation should be selected taking into account the nature of the material, the properties of the microorganism sought and the inoculum doses.

4. Classical principles must be followed to scrutinize crops;

5. When studying isolated pure cultures, special attention should be paid to their phenotypic characteristics, primanly biochemical properties, while standardizing the conditions for their determination at the highest possible level;

6. In accordance with the objectives of the study, it is necessary to determine the taxonomic position of the isolated culture according to classification tables, taking into account its genus, species and intraspecific affiliation [Vasiliev, 2003].

To accomplish the work, the following steps must be followed in sequence:

1. Preparation of nutrient media;

2. Determination of ideal acidity (pH);

3. Selection and performance of sterilization of nutrient media;

4. Isolation of pure microbial cultures (cultivation methods, sowing and crossing);

5. Study of culture properties of microorganisms on dense and liquid nutrient media;

6. Analysis of biochemical properties of microbes such as proteolytic, saccharolytic, hemolytic and others;

7. Study of microbial motility in "hanging" and "crushed" drop preparations prepared from pure cultures of isolated microbes;

8. Recognizing the sensitivity of microorganisms to antibiotics [Gosmanov, 2022].

For accurate results, the material to be tested should be collected aseptically, placed in sterile containers and transported to the laboratory as soon as possible. If necessary, samples should be stored in a refrigerator. The technique of sample collection depends on the characteristics of the object, the nature of the disease and the properties of microorganisms.

To take a swab from the pharynx, a sterile probe should be used on an empty stomach. The swab is taken from the inflamed areas, and in the presence of plaque from their edges. It is also necessary to take a smear from the depth of the crypts of the tonsils, the back wall of the pharynx, the pharynx and tongue. The obtained material is placed in a tube with transport medium.

To swab the nose and ear, you should also use a sterile probe and place the material in a tube with transport medium. A sterile probe should be used to collect material from the wound and the upper sections should be avoided as they may contain saprophytic microflora. It is worth cleaning the wound of dead tissue beforehand and extracting a sample from the deeper parts. The material obtained is placed in a tube with transport medium.

To take a swab from the conjunctiva of the eye, you need to go to an ophthalmologist, who in turn uses a special eye spatula. After taking the material, it is placed in a tube with a transport medium.

In men, the material is taken with a sterile probe, which is inserted into the urethra to a depth of 3-4 cm and scraped. The swab is placed in a tube with transport medium. In women, the probe is inserted to a depth of 1.5-2 cm. The obtained material is also placed in a tube with transport medium. The collected sample is sent for laboratory examination in special containers with Ames or Stewart media and stored at room temperature for no more than 1-2 days [Makarova, 2018].

Special sowing techniques are used to grow the microorganisms on nutrient dense media. Colonies of individual bacteria are then sieved to obtain a pure culture of the pathogen. To isolate specific microbial species, selective media are used, which contain substances that stimulate the growth of pathogenic bacteria but do not encourage the growth of other microorganisms. Microbes cultured on nutrient media are identified to determine their species or type identity.

To this day, infectious diseases remain one of the most dangerous diseases for humans. Therefore, accurate and rapid diagnosis is essential for successful treatment and prevention of infection. For bacteriological examination, various materials are used, which require a special approach during collection and transportation to the laboratory. They are also identified and sensitized to antibiotics.

Bacteriological methods of laboratory diagnostics make it possible to identify the infectious agent, detect new strains of bacteria and monitor their spread. Through monitoring, effective control methods and prevention strategies against dangerous microorganisms are developed.

References

1. Gosmanov, R.G., Ravilov, R.H. (2022). Laboratornaya diagnostika infektsionnykh bolezney: uchebnik dlya vuzov [Laboratory diagnosis of infectious diseases: textbook for universities]. – [online]. – Available at: https://e.lanbook.com/book/215735. (Accessed: 27.03.2025). (in Russian)

2. Makarova, A.E., Svistunov, V.V. (2018). Biopsi-sektsionnyy kurs [Biopsy-sectional course]. – [online]. – Available at: https://e.lanbook.com/book/158762. (Accessed: 19.03.2025). (in Russian)

3. SanPiN 3.3686-21 "Sanitarnye i epidemiologicheskie trebovaniya k predotvrashcheniyu infektsionnykh bolezney" (vmeste s "SanPIN 3.3686-21. Sanitarnye pravila i normy") [Sanitary and epidemiological requirements for the prevention of infectious diseases] (2022). – M.: CENTRMAG. – Pp. 161-162. (in Russian)

4. Vasiliev, D.A., Zolotukhin, S.N., Nikishina, N.M. (2003). Metody obshchey bakteriology [Methods of general bacteriology]. – Ulyanovsk: UIGSA. – 130 p. (in Russian)

UDK 606

MICROBIOLOGICAL PROCESSING OF ORGANIC WASTE

Saltevskaya Anastasiya Evgenievna,
Student of the Institute of Pharmacy, Chemistry and Biology,
Belgorod State National Research University, Belgorod, Russia,
E-mail: nsaltevskaya@bk.ru
Malinovsky Nikita Sergeevich,
Student of the Institute of Pharmacy, Chemistry and Biology,
Belgorod State National Research University, Belgorod, Russia,
E-mail:1640854@bsu.edu.ru
Mariasova Elena Anatolyevna,
Ph.D. in Philosophy,
Associate Professor of the Department of Foreign Languages
and Professional Communication,
Belgorod State National Research University, Belgorod, Russia,
E-mail: mariasova@bsuedu.ru

Abstract: *Microbiological recycling of organic waste is a disposal method based on the use of microorganisms to decompose organic matter. The process involves such technologies that contribute to the production of nutritious fertilizers and renewable energy. The adoption of such recycling methods contributes to sustainable resource management and reduces the negative impact on the environment.*

Keywords: *waste, utilization, organic waste, microbiological processing, composting, fermentation.*

In the modern world the problem of waste management is becoming more and more acute. Population growth, increased production leads to the accumulation of huge amounts of organic waste, which, if improperly disposed of, can have a detrimental effect on the environment, which creates not only an unpleasant odor, but also contributes to the spread of pests that can have a negative impact on human and animal health. Microbiological waste recycling is the use of microorganisms to decompose organics, which contributes to a rational approach to solving environmental problems.

In the process of executing the work, the following tasks were set:

1. Consider the general characterization of organic waste.
2. To study the methods of microbiological transformation of organic wastes.
3. Analyze the development of approaches to microbiological treatment of organic waste.

The objects of the study were various microorganisms capable of processing organic waste.

Organic waste refers to all types of waste that have been created by nature and decompose naturally. There are two types of waste – biodegradable waste and non-biodegradable waste. Waste can also be divided into: solid, liquid and gaseous. Solid wastes are substances that society discards as unwanted. These include industrial, agricultural, biomedical, urban and radioactive wastes. Liquid wastes, are generated during industrial washing or manufacturing process. Gaseous wastes, wastes that are

emitted as gases from factories, automobiles or when fossil fuels such as oil are burned. They sometimes lead to phenomena such as acid rain and smog because they combine with other gases in the atmosphere.

Microbiological recycling of organic waste is an efficient and environmentally friendly process in which microorganisms, mainly bacteria, fungi and actinomycetes are used to decompose organic materials. Examples of bacteria that are involved in organic waste recycling are *Bacillus subtilis, Bacillus licheniformis*, they are in demand due to the fact that they form spores, which allows them to survive in unfavorable conditions. Also, anaerobic bacteria *Clostridium acetobutylicum, Clostridium butyricum*, capable of decomposing complex carbohydrates and cellulose. They are mainly used for bioenergy production. Temperature is important for their growth. Optimal temperatures vary. From 30-37°C for mesophilic bacteria to 50-60°C for thermophilic bacteria, which are active in thermal processing. ost bacteria prefer a neutral or slightly acidic pH= 6-7. An example of waste-processing fungi is the fungus *Pleurotus*, which actively degrades cellulose and lignin. *Fusarium oxysporum* is used for antibiotic production in biotechnology. Sabouraud's nutrient medium, which includes glucose, peptone, yeast extract, and agar, is used to cultivate the fungi. Incubation of crops in aerobic conditions occurs at a temperature of 20-37°C, pH 6.0-6.5. *Actinomycetes* are a unique group of Gram-positive bacteria of the order *Actinomycetales*, which combines the properties of both bacteria and fungi. In the cells of some actinomycetes, specific dark-colored compounds are formed, the molecules of which, when interacting with each other, form humus substances [Molchanov, 2022].

Microbiological formation methods include: anaerobic digestion, fermentation, and composting. The anaerobic digestion process involves four main steps in which organic matter such as glucose is broken down by microorganisms into carbon dioxide and methane:

$$C_6H_{12}O_6 \rightarrow 3CO_2 + 3CH_4$$

The first step is hydrolysis, during which large organic polymers are broken down into monomers (e.g. sugars). In the second stage, acidogenesis, acidogenic bacteria *Further* break down the remaining components to form fatty acids, ammonia, carbon dioxide and hydrogen sulfide. The third stage, acetogenesis, involves further cleavage of simple molecules to form acetic acid, carbon dioxide, and hydrogen. In the last stage of methanogenesis, methanogens utilize intermediates to form methane, carbon dioxide, and water [Kokieva, 2020].

Fermentation is a biochemical processing using enzymes, Fermentation involves several stages. First, the substrate is prepared. Organic waste is shredded or treated. Then microorganisms are selected for inoculation, which can be natural microflora or specially selected strains. In the decomposition step, the microorganisms break down the organic matter by releasing enzymes and metabolites. This process can take anywhere from a few days to weeks. Alcohols, acids and gases are eventually produced. Fermentation is used for wastewater treatment, degradation of toxic waste, and in agriculture and food processing.

The composting process consists of natural biological decomposition, the decomposition of organic matter in the presence of oxygen. The end product of composting is a humus-like substance that can be used as fertilizer. The composting method is used to treat sewage sludge. Sewage sludge is filtered, mixed with wood chips

to improve aeration and placed in piles. After 6-8 weeks, humus is produced, ready for use in fields, and the woodchips can be reused [Kirienko, 2013].

Microbiological recycling of organic waste is a promising approach to solving the problems of utilization of various wastes. By using active cultures of microorganisms it is possible not only to reduce waste volumes, but also to restore the natural balance, which makes recycling an important element of sustainable development of environmental safety. With global climate change and growing volumes of organic waste, the importance of such technologies will only increase.

Research and introduction of new microorganism strains will further improve the efficiency of recycling, as well as create cleaner technologies for waste utilization. Microbiological waste treatment technologies open new ways to create closed cycles in agronomy and other industries, contributing to the improvement of the environmental situation.

References

1. Kirienko, O.A., Ganin, G.N. (2013). Ispol'zovanie fototrofnыx bakteriy dlya podgotovki komposta iz stochnykh ilov [Use of phototrophic bacteria for the preparation of compost from sewage sludge] // *Vestnik Dal'nevostochnogo otdeleniya Rossiyskoy akademii nauk*. – № 5 (171). – Pp. 122-126. (in Russian)

2. Kokieva, G.E., Shaposhnikov, Y.A., Dondokov, M.Y. (2020). Proizvodstvo biogaza pri anaerobnom razlozhenii otkhodov skotovodcheskikh ferm [Biogas production by anaerobic digestion of livestock farm wastes] // *Vestnik Altaiyskogo GAU*. – № 9 (191). – Pp. 140-144. (in Russian)

3. Molchanov, V.P., [et al.] (2022). Integrirovannaya pererabotka organicheskikh otkhodov s proizvodstvom biologicheski aktivnykh veshchestv i sel'skokhozyaystvennykh produktov [Integrated processing of organic waste with the production of biologically active substances and agricultural products] // *Aktual'naya biotekhnologiya*. – № 1. – Pp. 40-44. (in Russian)

UDK 606

MODERN METHODS OF BIOREMEDIATION OF OIL-CONTAMINATED SOILS

Burakova Anastasia Alexandrovna,
Student of the Institute of Pharmacy, Chemistry and Biology,
Belgorod State National Research University, Belgorod, Russia,
E-mail: burakova4nastacia@yandex.ru
Efimova Alisa Olegovna,
Student of the Institute of Pharmacy, Chemistry and Biology,
Belgorod State National Research University, Belgorod, Russia,
E-mail: 1640960@bsuedu.ru
Mariasova Elena Anatolyevna,
Ph.D. in Philosophy,
Associate Professor of the Department of Foreign Languages and Professional Communication,
Belgorod State National Research University, Belgorod, Russia,
E-mail: mariasova@bsuedu.ru

Abstract: *This article reveals the problem of oil pollution of soils. Current approaches to the restoration of soils contaminated with oil and petroleum products are being investigated and*

analyzed. Modern bioremediation methods based on the use of various microorganisms capable of eliminating or neutralizing hydrocarbon compounds are considered.
***Keywords**: bioremediation, petroleum products, soil, hydrocarbon-oxidizing microorganisms, oil pollution.*

Firstly, it must be said, there is a significant intensification of oil production, as well as the production of various petroleum products. Besides, petroleum products are widely used both in various branches of heavy industry and in everyday human life. Large-scale oil production and its widespread use lead to the fact that petroleum products accumulate in large quantities in the environment. This leads to various environmental problems, for example, to a decrease in soil fertility, which, in turn, is an essential natural resource.

Various physical, chemical, and physico-chemical methods are used to clean oil-contaminated soils, which, although very effective, also have some disadvantages. Therefore, it will be more effective to use biological methods, namely bioremediation, which, in turn, is not only more environmentally friendly, but also less resource-intensive.

As for modern methods of bioremediation of oil-contaminated soils, most of them use various microorganisms. Actually, a search is underway for new strains of bacteria capable of decomposing hydrocarbons. In the future, these strains are directly used in practice. When searching for new strains, some factors are taken into account.

One of the important things that is being given a lot of attention when developing new bioremediation methods is the distribution of hydrocarbons over the soil substrate. This factor is given great attention as when selecting a microbe or a consortium of microbes for bioremediation, it is crucial to know how far hydrocarbons can penetrate into the given soil substrate. This is because not all microbes have normal metabolic activity at great depths due to insufficient aeration or lack of nutrients.

The distribution of hydrocarbons over the soil substrate is influenced by two factors – a factor that contributes to the accumulation of hydrocarbons in the soil, and a factor that enhances movement along the profile. The difference in the intensity of these processes controls the migration of hydrocarbons in the soil.

During initial contamination, the pollutant seeps mechanically into the soil, but as it progresses, hydrocarbons gradually dissolve in water. Therefore, the shallower the contaminated layer, the higher the sorptive capacity of the substrate for that particular pollutant [Anchugova, 2010]. Sorption and screening barriers lead to the fixation of hydrocarbons in the soil, the main barriers are humus and organogenic horizons of soils [Burlaka, 2003].

The differences in the migration behavior of oil and oil sludge hydrocarbons are due to their differing hydrocarbon compositions. For instance, a clay substrate, with its high sorptive properties, serves as a good geochemical barrier for oil. However, raw oil can easily pass-through sand due to its permeability and low sorptive capacity. Conversely, peat shows better hydrocarbon binding capacity due to its porosity. Consequently, hydrocarbons closest in composition to raw oil migrate best through the substrate [Anchugova, 2010]. The sorptive capacities of substrates for raw oil decrease in the order of clay – peat – sand, while for oil sludge, they decrease in the order of sand – peat – clay (Figure 1).

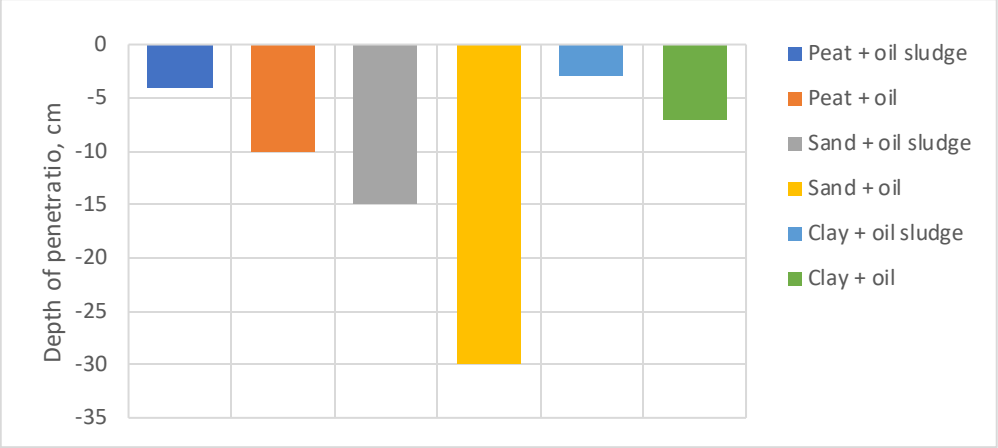


Figure 1. The depth of penetration of hydrocarbon pollution in different soil substrates

Also, when selecting microorganisms for bioremediation of a particular soil substrate, the following factors are taken into account:

- soil type,
- climatic conditions (temperature and humidity),
- type of oil products,
- presence of other microorganisms in the soil.

The most important factor in this list is the climatic factor, as biopreparations are often developed for use in a specific climate, as the destructive activity towards petroleum products depends on the humidity-temperature characteristics when using microbiological bioremediation [Sozina, 2023]. Given the factors mentioned above, biological preparations containing hydrocarbon-oxidizing microorganisms are developed. When creating such preparations, particular attention is paid to the following aspects: microbiological composition, selection of sorbent-carrier and auxiliary nutrients [Sozina, 2023]. An overview of some of them will be presented next.

Most biopreparations are created using consortia of microorganisms. These preparations have higher efficiency than those created using monocultures, as different types of microorganisms have biodegradation activity towards various classes of organic compounds [Sozina, 2023]. As well as, in the conducted studies, when some strains were removed from the consortium, the effectiveness of the mixed culture was significantly reduced. This fact also indicates that each member in the microbial community of a particular biological product plays a significant role and may have to depend on the presence of other species or strains so that they can survive when the energy source and complex carbon atoms are limited [Cherepanova, 2018]. The biopreparation "Ecoyl" uses several different aerobic oil-degrading bacteria belonging to the *Mycobacterium*, *Rhodococcus*, and *Acinetobacter* genera. It also contains sucrose, polyethylene glycol, oil, and water in its composition [Sozina, 2023].

Another bacterial preparation with a similar composition, consisting of a consortium of bacterial strains of the genera *Bacillus*, *Atherobacter*, *Rhodococcus* and *Pseudomonas*, is "Bak-Verad". This product is intended for biological purification of soil, sand, oil sludge, harmful objects and other non-aggressive media from oil and petroleum products pollution. The bacteria that are part of this biological product are natural non-toxic, non-pathogenic, improved microorganisms, specially selected

according to the criterion of efficiency of metabolism of complex hydrocarbon compounds. The efficiency of "Bak-Verad" in land reclamation and oil sludge processing at high and low degrees of pollution ranges from 1% to 80%. This drug is effective in the pH range of 5-9, the application temperature is from +10 °C to +40 °C. Besides bacteria, other hydrocarbon-oxidizing microorganisms may also be present in biological products. For example, the drug "Devoroil" contains five types of oil-oxidizing bacteria and yeast [Sozina, 2023].

Another to the mentioned bacterial preparations, there are also highly effective ones such as "Biorestorer AV (BIORAV)" and "MicroBak". "BIORAV" contains the following active microbial cultures – *Azotobacter chroococcum*, *Bacillus megaterium*, *Pseudomonas fluorescens*. In addition to these, the preparation includes humic acids, carboxylic acids, amino acids, polysaccharides, and vitamins of group B. These substances enhance the metabolic activity of the bacteria in the preparation [Kuritsyn, 2011]. One more biopreparation "MicroBak" is designed for soil bioremediation with oil content up to 15% and consists of a consortium of bacteria of the *Rhodococcus* and *Pseudomonas* genera [Fomicheva, 2020]. The above-mentioned preparations are most frequently used in soil bioremediation for the purpose of oil.

When analyzing various literature sources, it was also concluded that many modern bioremediation methods are used in combination with chemical remediation methods. Thus, before biological preparations containing a consortium of microorganisms are added to the soil, the soil is treated with chemical reagents for preliminary oxidation. Additionally, various organic or mineral fertilizers can be added to the soil to restore the carbon-to-nitrogen balance that is disrupted by raw oil on contaminated sites. For effective bacterial growth, the carbon-to-nitrogen ratio should be approximately 60-100:1 [Seredin, 1998]. Moreover, the soil can be treated with nitrogen-phosphorus fertilizers for the normal development and vital activity of bacteria.

In conclusion, it should be admitted that bioremediation is a promising approach to combating soil pollution by oil and petroleum products. The methods of soil remediation discussed in the article, such as Ecoil, Bak-Verad, BioRav and MicroBak, are effective and environmentally friendly. These methods make it possible to restore soil fertility and prevent further pollution. However, to achieve optimal results, it is important to choose the right biologics and apply the technology.

References

1. Anchugova, E. M. (2010). Osobennosti vertikal'nogo raspredeleniya uglevodorodov v pochvennyh substratah [Features of vertical distribution of carbohydrates in soil substrates] // *Izvestiya Samarskogo nauchnogo centra RAN*. –№1-5. – Pp. 1203-1207. (in Russian)

2. Burlaka, V. A. (2003). Sposob vosstanovleniya plodorodiya zemel', zagryaznennyh neft'yu [A way to restore the fertility of oil-polluted lands] // *Ekologiya i promyshlennost' Rossii*. – № 3. – Pp. 41-44. (in Russian)

3. Cherepanova, A. E. (2018). Biodegradaciya syroj nefti bakteriyami, vydelennymi iz zagryaznennoj syroj neft'yu pochvy [Biodegradation of crude oil by bacteria isolated from soil contaminated with crude oil] // *Vestnik nauki i obrazovaniya*. – №7. – Pp. 18-22. (in Russian)

4. Fomicheva, N. V. (2020). Novye biosredstva dlya remediacii neftezagryaznyonnoj pochvy [New biological means for remediation of oil-contaminated soil] // *Izvestiya Irkutskogo gosudarstvennogo universiteta. Seriya: Biologiya. Ekologiya*. – № 31. – Pp. 19-29. (in Russian)

5. Kuritsyn, A.V. (2011). Bioremediaciya neftezagryaznennyh gruntov na tekhnologicheskih ploshchadkah [Bioremediation of oil contaminated at technological sites] // *Izvestiya Samarskogo nauchnogo centra RAN*. – № 1-5. – Pp. 1271-1273. (in Russian)

6. Seredin, V.V. (1998). Cenka geoekologicheskih uslovij sanacii territorij, zagryaznennyh neft'yu i nefteproduktami [Assessment of the geoecological conditions for the rehabilitation of territories contaminated with oil and petroleum products]. – Perm': Perm. gos. tekhn. – 153p. (in Russian)

7. Sozina, I. D. (2023). Mikrobiologicheskaya remediaciya neftezagryaznennyh pochv [Microbiological remediation of oil-contaminated soils] // *Zapiski Gornogo instituta*. – №260. – Pp. 297-312. (in Russian)

UDK 579.66

ISOLATION OF SOIL ACTINOMYCETES AND THEIR STUDY MORPHOLOGICAL AND PHYSIOLOGICAL PROPERTIES

Kireev Sergey Alexandrovich,
Student of the Institute of Pharmacy Chemistry and Biology,
Belgorod State National Research University, Belgorod, Russia,
E-mail: kireevser461@mail.ru
Prilutsky Leonid Yurievich,
Student of the Institute of Pharmacy Chemistry and Biology,
Belgorod State National Research University, Belgorod, Russia,
E-mail: 1471212@bsuedu.ru
Mariasova Elena Anatolyevna,
Ph.D. in Philosophy,
Associate Professor of the Department of Foreign Languages and Professional Communication,
Belgorod State National Research University, Belgorod, Russia,
E-mail: mariasova@bsuedu.ru

Abstract: *This article describes the prospects for the use of actinomycetes in various industrial applications. Morphological and physiological properties of isolated actinomycetes strains are considered. It is also proposed to familiarize with the parameters of actinomycetes strains isolated from soils of the Belgorod region.*

Keywords: *actinomycetes, soils of the Belgorod region, morphological and physiological properties actinomycetes, antibiotics, enzymes.*

Actinomycetes occupy many ecological niches, mostly related to the decomposition of organic matter or symbiotic relationships. This is largely due to the fact that they are capable of forming mycelium at certain stages of the life cycle, as well as producing antibiotics and enzymes. Their secretory functions allow actinomycetes to be used in many high-tech activities. Many actinomycete species are already being utilized by humans, but more are to be utilized in the future. For this purpose, the isolation of actinomycetes and subsequent study of their properties are utilized.

The purpose of the work is the isolation, determination of physiological and morphological properties of soil actinomycetes distributed in the territory of Belgorod region.

In the process of work performance, the following ***tasks*** were set:

1) To study the methods of isolation of actinomycetes;

2) To isolate actinomycetes from soils of Belgorod region;

The object of this work is actinomycetes.

The subject is: ecology, systematics, morphology, physical and morphological properties of actinomycetes.

Regardless of the chosen method of preparation of the nutrient medium, the first stage of cultivation of microorganisms is the preparation of dishes and materials. In most cases, surface seeding on Petri dishes is performed to study and record soil microorganisms. At the same time, it is possible to use one method to study different groups of microorganisms – bacteria, actinomycetes, yeast fungi.

For sowing, it is necessary to prepare for each soil sample as the following:

1) a flask of sterile water and a measuring cylinder. An average of 25 ml is needed for each Petri dish.

2) test tubes or other glass vessels for the preparation and dilution of soil suspension;

3) sterile pipettes or dispensers with sterile tips. Both pipettes and tips must be the same size.

4) sterile spatulas;

5) sterile petri dishes;

6) flask with a pre-prepared medium.

There are many media suitable for the cultivation of actinomycetes. Since representatives of this order are ubiquitous in the soil and are an integral part of its biota, other soil microorganisms will also appear on any specialized media. These will usually be bacteria, archaea, or molds, but despite the fact that actinomycete colonies have easily detectable antagonistic activity, microscopy and other methods for determining actinobacteria will always be relevant, since some mold species can secrete mycotoxinsthat have the same negative effect on surrounding colonies.

Media suitable for isolation of actinomycetes include:

1) Oat agar (in g/l of distilled water): Oat flour (or flakes) – 20; agar – 25; $FeSO_4$ – 0.1; $MnCl_2$ – 0.1; $ZnSO_4$ – 0.1. To prepare the medium, boil oat flour (or flakes) in 1 liter of water for 20 minutes, filter and bring the volume to 1 liter.

2) Krasilnikov's medium № 1 (in g/l of distilled water): glucose – 20; KNO_3 – 1; K_2HPO_4 – 0.5; $MgSO_4*7H_20$ – 0.5; NaCl – 0.5; $CaCO_3$ – 1; $FeSO_4*7H_2O$ – 0.1.

3) Krasilnikov's medium № 6 (in g/l of distilled water): soluble starch – 10; corn extract – 10; $(NH_4)_2SO_4$ – 3; NaCl – 3; $CaCO_3$ – 3.

4) Krasilnikov's medium № 71 (in g/l of distilled water): soluble starch – 15; corn extract – 10; $(NH_4)_2SO_4$ – 4; K_2HPO_4 – 2; $CaCO_3$ – 3.

5) Gauze medium № 1 (in g/l of distilled water): soluble starch – 20; KNO_3 – 1; K_2HPO_4 – 0.5; $MgSO_4*7H_20$ – 0.5; NaCl – 0.5; $FeSO_4*7H_2O$ – 0.1.

6) Waxman's medium (in g/l of distilled water): glycerol – 3; K_3HPO_4 – 1; $NaNO_3$, – 2; $MgSO_4*7H_2O$ – 0.5; KCI – 0.5; $FeSO_4*7H_2O$ – 0.01.

After cooking, any medium must be sterilized in an autoclave. At the same time, if glucose or other low -resistant substances are present in the composition, it is necessary to reduce the temperature of the autoclave to 112°C, otherwise the media will be damaged [Netrusov, 2005].

To carry out the work, it was necessary to determine the materials that would be required for the study. We decided on the number of Petri dishes for each soil sample – 3 pieces. This made it possible to increase the probability of detecting actinomycetes in the samples and made it possible not to lose the sample if unforeseen circumstances occurred with one of the cups.

A 250 ml flask for preparing the medium, a 250 ml measuring cylinder, bacteriological loops for sampling, a glass spatula, an alcohol lamp, a lighter, cover and slide glasses, a test tube with a dye – safranin, a dispenser with sterile replaceable nozzles, flasks for preparing the suspension, a package of medical cotton wool, a supply of distilled water and alcohol were prepared. Due to the fact that the study was stretched over time, the instruments were periodically replaced or re-prepared.

For the study, the methodological manual "Methods of soil microbiology and biochemistry" by D. G. Zvyagincev was chosen as one of the most comprehensive manuals that deals with the isolation of soil microorganisms, including actinomycetes. From the media presented in the book, the most suitable starch-ammonia medium was chosen, since it was recommended for actinomycetes, did not contain low-resistant substances in its composition, and also because the institute had all the necessary reagents in its warehouse. It required: $(NH_4)_2SO_4$ – 2 grams per liter, K_2HPO_4 – 1 gram per liter, $MgSO_4$ gram per liter, $MgSO_4$ – 1 gram per liter, NaCl – gram per liter, NaCl – 1 gram per liter $CaCO_3$ – 3 grams per liter, 10 grams per liter of soluble starch and 20 grams agar-agar per liter.

It was decided to take two soil samples, so the mass of reagents should be calculated for 6 Petri dishes, that is, for 150 milliliters. That is, to maintain the ratio of substances, you need to use for each cooking medium: 0.3 grams of $(NH_4)_2SO_4$, 0,15 grams of K_2HPO_4, 0.15 grams of $MgSO_4$, 0.15 grams of NaCl, 0.45 grams of $CaCO_3$, 1.5 grams of soluble starch and 3 grams of agar-agar. Using a laboratory scale, the required mass of each reagent was measured and poured into a common flask, after allowing the starch to dissolve in a smaller volume of water. After that, the medium was sent to the autoclave for sterilization and then poured into 6 bottles. Petri dishes, approximately 25 grams each.

From the samples, suspensions were prepared in flasks in a mass ratio of 1: 2 and left to settle the solid fraction for a while. 100 ml of each resulting suspension was collected with a dispenser and injected into the intended cups, after which the liquid was evenly distributed over the medium with a sterile spatula. Petri dishes were placed in a thermostat at 25 degrees and left in it for a week, waiting for the appearance of colonies.

After a week of being in the thermostat, the Petri dishes developed colonies that were clearly visible to the naked eye (Figure 1).



Figure 1. Petri dishes with sample 1 (left) and sample 2 (right), bottom view

In total, there were three types of colonies that looked like actinomycetes. White with a pink tint from sample 2, brown with a developed substrate mycelium from sample 1, and white with a green developed aerial mycelium from sample 1. To help identify possible actinomycete species, we turned to the Gause Determinant and found that brown and green colonies fit the description of Streptomyces capuensis and Streptomyces glaucus, respectively.

Thus, in the course of our work, we studied methods for isolating actinomycetes, as well as isolated them from the soils of the Belgorod region.

The study of actinomycetes is always relevant, since antibiotics and the hormones they produce are necessary for medicine, since harmful microorganisms can develop resistance to known types of drugs. The isolation process performed showed that actinomycetes grow well in starch-ammonia medium and are contained in the most common soil. It follows from this that producers of antibiotics and hormones are quite easy to obtain in the laboratory, which means that various studies can be conducted with them.

References

1. Gauze, G. F., Preobrazhenskaya, T. P., Sveshnikova M. A. (1983). Opredelitel` aktinomicetov. Rody` *Streptomyces, Streptoverticillium, Chainia* [The determinant of actinomycetes. Genera *Streptomyces, Streptoverticillium, Chainia*]. – M.: Nauka. – 248 p. (in Russian)

2. Netrusov, A. I., Egorova, M. A., Zaxarchuk, L. M. (2005). Praktikum po mikrobiologii: Uchebnoe posobie dlya studentov vy`sshix uchebny`x zavedenij [Microbiology Workshop: A textbook for university students]. – M.: Izdatel`skij centr „Akademiya". – 172 p. (in Russian)

3. Zvyagincev, D. G. (1991). Metody` pochvennoj mikrobiologii i bioximii: Uchebnoe posobie [Methods of soil microbiology and biochemistry: A textbook]. – M.: Izdatel'stvo MGU. – 304 p. (in Russian)

UDK 635.112:631.522./524:577.2

GENETISCHE MARKER. MIKROSATELLITEN-LOCI

Potapowa Olga Petrowna,
Masterstudentin des Instituts für Pharmazie, Chemie und Biologie,
Belgoroder Staatliche Nationale Forschungsuniversität, Belgorod, Russland,
E-mail: polga9153@gmail.com
Taranowa Elena Nikolayewna,
Kandidatin der philologischen Wissenschaften,
Professorin des Lehrstuhls für Fremdsprachen und berufliche Kommunikation,
Belgoroder Staatliche Nationale Forschungsuniversität, Belgorod, Russland,
E-mail: taranova_e@bsuedu.ru

Annotation: *Mikrosatelliten-Loci sind ein wichtiges Instrument in der genetischen Forschung, da sie die Analyse der genetischen Variabilität und der Populationsstruktur ermöglichen. Im Artikel werden die Merkmale dieser Marker, ihre Rolle bei der Erforschung der Landweichtierart Chondrula tridens und der Einfluss anthropogener Faktoren auf ihre Populationen untersucht und beschrieben. Die durchgeführten Forschungen zeigen, dass die Fragmentierung des Lebensraums und die Umweltbedingungen die genetische Vielfalt dieser Art erheblich beeinflussen. Der Einsatz von Mikrosatellitenmarkern hilft nicht nur, die Anpassungsmechanismen von Chondrula tridens zu*

identifizieren, sondern auch die Auswirkungen des Klimawandels und der Urbanisierung auf die Bevölkerung einzuschätzen. Die Ergebnisse der Studie können für die Entwicklung von Strategien zum Erhalt der Biodiversität und zum Ökosystemmanagement genutzt werden.

Schlagwörter: *die Genetik, genetische Marker, die Mikrosatelliten, die Populationsgenetik, Chondrula tridens, die Biodiversität, die Ökologie, anthropogene Auswirkungen, die Naturschutzbiologie.*

Genetische Marker spielen in der modernen Biologie eine Schlüsselrolle und bieten einzigartige Möglichkeiten zur Untersuchung der genetischen Struktur von Populationen, Evolutionsprozessen und Anpassungsmechanismen von Organismen an veränderte Umweltbedingungen. Unter den vielen Arten genetischer Marker nehmen Mikrosatelliten-Loci (oder STR – Short Tandem Repeats) einen besonderen Platz ein. Diese kurzen wiederholenden DNA-Sequenzen sind hochgradig polymorph und werden häufig zur Analyse der genetischen Vielfalt, Beziehungen und Populationsdynamik verwendet.

Eines der interessanten Objekte für mehrere wissenschaftliche Studien mit Mikrosatelliten-Loci ist die Landweichtierart Chondrula tridens, eine in verschiedenen Ökosystemen Eurasiens verbreitete Art. Diese Weichtiere sind ein wichtiges Glied in der Nahrungskette und spielen eine bedeutende Rolle bei Ökosystemprozessen wie der Zersetzung organischer Stoffe und der Erhaltung der Bodenfruchtbarkeit.

Der Einfluss anthropogener Faktoren des Klimawandels und der Fragmentierung des Lebensraums stellen für die Wissenschaftler jedoch eine Herausforderung dar, wenn es darum geht, die genetische Variabilität und Stabilität der Chondrula tridens-Populationen zu bewerten. Aufgrund ihres hohen Informationsgehalts ermöglichen Mikrosatelliten-Loci ein detailliertes Bild der genetischen Struktur dieser Art zu erhalten und die Schlüsselfaktoren zu identifizieren, die ihre Evolution prägen.

Mikrosatelliten-Loci zeichnen sich durch einen hohen Grad an Variabilität aus, was sie für die Untersuchung der genetischen Struktur von Populationen besonders wertvoll macht. Ihr Polymorphismus wird durch Mutationen verursacht, die als Folge von DNA-Replikationsfehlern auftreten. Diese Fehler führen zu einer Erhöhung oder Verringerung der Anzahl wiederholender Einheiten an einem Locus [Zhivotovsky, 2006]. Aufgrund dieses Mechanismus weisen Mikrosatelliten eine hohe allelische Diversität auf, wodurch sie zur genauen Beurteilung genetischer Unterschiede auch zwischen eng verwandten Individuen verwendet werden können.

Einer der wichtigen Aspekte von Mikrosatelliten-Loci ist ihre Neutralität in Bezug auf die natürliche Selektion. Da sie sich normalerweise in nicht-kodierenden Regionen des Genoms befinden, hat ihre Variabilität keinen Einfluss auf die phänotypischen Eigenschaften des Organismus [Goncharenko, 2016]. Dies macht sie zu einem idealen Werkzeug für die Analyse der neutralen Evolution und die Bewertung der genetischen Drift in Populationen. Bei der Untersuchung von Chondrula tridens können die Mikrosatelliten beispielsweise dabei helfen, historische Ereignisse wie Populationsaufspaltungen oder Migrationen zu identifizieren, die die aktuelle genetische Struktur der Art beeinflusst haben könnten.

Ein weiterer Vorteil von Mikrosatelliten ist ihre relativ einfache Analysemethode. Moderne Technologien wie die PCR (Polymerase-Kettenreaktion) ermöglichen eine schnelle und genaue Bestimmung der Allelzusammensetzung von

Mikrosatelliten-Loci bei einer großen Anzahl von Individuen. Dies ist besonders wichtig für Arten wie Chondrula tridens, die oft in schwer zugänglichen oder fragmentierten Lebensräumen vorkommen. Die Mikrosatelliten können auch zur Analyse von Beziehungen innerhalb von Populationen verwendet werden, was zum Verständnis der Mechanismen der Fortpflanzung und Verbreitung einer Art beiträgt.

Die Landweichtierart Chondrula tridens ist ein geeignetes Modellobjekt zur Untersuchung des Einflusses anthropogener Faktoren und Umweltveränderungen auf die genetische Struktur von Populationen. Diese Art ist in Eurasien weit verbreitet. Ihr Verbreitungsgebiet ist jedoch oft fragmentiert, was einzigartige Bedingungen für die Analyse der genetischen Variabilität schafft. Aufgrund ihrer hohen Auflösung ermöglichen die Mikrosatelliten-Loci die Erkennung selbst geringfügiger Unterschiede zwischen Populationen, die unter unterschiedlichen Umweltbedingungen leben.

Die modernen Studien zeigen, dass die Variabilität in den Populationen der Chondrula tridens mit den Eigenschaften ihres Lebensraums zusammenhängen kann. Zum Beispiel, die Populationen der Chondrula tridens in Tieflandgebieten zeigen eine höhere genetische Vielfalt im Vergleich mit den Bergpopulationen. Dies kann mit höherer Individuendichte und dem aktiveren Austausch des genetischen Materials in Tieflandökosystemen verbunden sein. Gleichzeitig kommt es häufig zu einer Isolierung der Bergpopulationen, was zu einer verringerten genetischen Vielfalt und einem erhöhten Inzuchtrisiko führt.

Ein weiterer wichtiger Aspekt ist die Verwendung von Mikrosatelliten zur Einschätzung des Anpassungspotenzials von Chondrula tridens. Da diese Art eine wichtige Rolle in Ökosystemen spielt und an den Prozessen der Zersetzung organischer Stoffe beteiligt ist und die Bodenfruchtbarkeit erhält, ist ihre Widerstandsfähigkeit gegenüber äußeren Einflüssen von entscheidender Bedeutung. Mikrosatellitenmarker können dabei helfen, genetische Mechanismen zu identifizieren, die es Weichtieren ermöglichen, sich an veränderte Umweltbedingungen wie Dürre, Bodenverschmutzung oder Temperaturschwankungen anzupassen [Sychew, 2017].

Die von den Menschen verursachte Belastungen, darunter sind die Urbanisierung, die Landwirtschaft und die Umweltverschmutzung zu nennen, haben erhebliche Auswirkungen auf die Artenvielfalt terrestrischer Weichtiere wie Chondrula tridens. Die Mikrosatelliten-Loci ermöglichen es das Ausmaß dieses Einflusses auf genetischer Ebene zu bewerten. Die Studien zeigen, dass die Populationen, die in der Nähe von landwirtschaftlichen Flächen oder Industriegebieten leben, häufig eine geringere genetische Vielfalt aufweisen als die Populationen aus weniger gestörten Ökosystemen [Snegin, 2014]. Diese Tatsache kann mit der Verringerung der Individuenzahl und der zunehmenden Isolation zwischen den Populationen verbunden sein.

Einer der wichtigsten Aspekte beim Einsatz von Mikrosatelliten ist ihre Fähigkeit, den Flaschenhalseffekt zu erkennen, der dann auftritt, wenn die Populationsgröße stark zurückgeht. In solchen Fällen wird die genetische Vielfalt erheblich reduziert, was zu einer Verringerung des Anpassungspotenzials der Art führen kann. Für Chondrula tridens ist dies besonders wichtig, da die Art häufig in fragmentierten Landschaften vorkommt, in denen anthropogene Faktoren die Isolation der Population verstärken können [Zhiwotowsky, 2006].

Darüber hinaus ermöglichen es die Mikrosatelliten den Grad der genetischen Differenzierung zwischen den Populationen zu beurteilen. Wenn zum Beispiel zwei Populationen von Chondrula tridens. Wenn Chondrula tridens durch eine Straße, ein landwirtschaftliches Feld oder eine andere künstliche Barriere getrennt werden, so kann die Mikrosatellitenanalyse zeigen, wie stark diese Barrieren den Austausch des genetischen Materials einwirken können. Solche Daten können zur Entwicklung von Schutzstrategien für die Art genutzt werden, einschließlich der Schaffung ökologischer Korridore, die es den einzelnen Tieren ermöglichen werden, sich frei zwischen isolierten Gebieten zu bewegen [Nesterow, 2015].

Der hohe Informationsgehalt der Mikrosatelliten-Loci ermöglicht es, selbst die geringfügigen Unterschiede zwischen Populationen zu erkennen, was besonders für die Arten wichtig ist, die in fragmentierten Landschaften leben. Darüber hinaus bieten die Mikrosatelliten eine einzigartige Möglichkeit, den Einfluss anthropogener Faktoren und Umweltveränderungen auf die genetische Vielfalt einer Art zu analysieren [Zhiwotowsky, 2006].

Weitere Studien zur Mikrosatellitenvariation bei Chondrula tridens können durch die Integration genomischer und transkriptomischer Daten erweitert werden. Dieser Ansatz wird nicht nur das Verständnis der genetischen Grundlagen der Anpassung vertiefen, sondern auch ermöglicht, die Schlüsselgene zu identifizieren, die für das Überleben einer Art in einer sich verändernden Umwelt verantwortlich sind. Darüber hinaus wird die weitere Erforschung der Rolle von Mikrosatelliten bei der Gestaltung des Anpassungspotenzials von Populationen ein wichtiger Schritt zur Entwicklung wirksamer Maßnahmen zum Schutz der Artenvielfalt dieser Art sein.

Fazit: Mikrosatelliten-Loci eröffnen neue Perspektiven für die Untersuchung evolutionärer Prozesse bei Chondrula tridens. Diese Markierungen ermöglichen es, die Geschichte der Entstehung moderner Populationen zurückzuverfolgen, einschließlich der Ereignisse der Artbildung und der adaptiven Radiation. Die Analyse der Mikrosatellitenvariation kann dabei helfen, in zukünftigen Studien aufdecken, wie sich die Klimaänderungen auf die Verbreitung und genetische Struktur einer Art ausgewirkt haben.

Literaturliste

1. Goncharenko, G. G. (2016). DNK-markeri w geneticheskoi daktiloskopii osobei Felis catus i rodstvennih vidov semeistva Kachachi [Die Mikrosatelliten-DNA-Marker im genetischen Fingerabdruck von Individuen der Art Felis catus und die verwandten Arten der Familie Felidae] // *Izvestiya Gomel'skogo gosudarstvennogo universiteta imeni F.Skorina. Seriya: Estestvennie nauki [Nachrichten der Gomel Staatlichen Universität, benannt nach F. Skorina. Serie: Naturwissenschaften]*. – Nr. 3 (96). – S. 21-25. (in Russisch)

2. Nesterow, M. A., Afonnikow, D. A., Sergeewa, E. M., Miroshnichenko A. A., Bragina, M. K., Bragin, A. O., Vasiliev G. W., Salina, E. A. (2015). Identifikaziya mikrosatellitnih lokusov po dannim sekvenirovanij VAS- klonov i ih fizicheskoe kartirovanie na hromosomu 5 B mjgkoi pchenizi [Identifizierung von Mikrosatelliten-Loci basierend auf Sequenzierungsdaten von BAC-Klonen und ihrer physischen Zuordnung zum Chromosom 5B von Weichweizen] // *Vavilovskii zhurnal genetiki i selekcii.* – №19(6):707-714 S. (in Russisch)

3. Snegin, E. A. (2014). Osobennosti Mikroevilyzionnih prozessov, protekaychih v uslovijn fragmentirovannogo lanchafta lesostepi [Die Besonderheiten mikroevolutionärer Prozesse, die unter den Bedingungen einer fragmentierten Waldsteppenlandschaft auftreten] // *Materialy II mezdunarodnoi konferencii 11-14 marta 2014 goda, Moskwa*. – M.: GDM. – 448 S. (in Russisch)

4. Sychew, A. A. (2017). Nazemnie molluski kal'zefitnih soobshestv yuga Srednerusskoi vozvichennosti (biologia, ekologia, genetika, populzacij) [Terrestrische Weichtiere von Calciphytengemeinschaften im Süden des Zentralrussischen Hochlandes (Biologie, Ökologie und Genetik von Populationen)] // *Dissertaciya na soiskanie uchenoi stepeni kandidata biologicheskich nauk [Dissertation für die Erlangung des wissenschaftlichen Grades des Kandidaten der Biowissenschaften].* – Belgorod. – 348 S. (in Russisch)

5. Zhiwotowsky, L. A. (2006). Mikrosatellitnaj izmenchivost' v populjzijh cheloweka i metodi ee izuchenij [Die Mikrosatellitenvariabilität in menschlichen Populationen und die Methoden ihrer Untersuchung] // *Vestnik VOGiS.* – V. 10. – Nr. 1. – S. 74-96. (in Russisch)

UDK 574:631.4: 665.6**.**

MIKROBIOLOGISCHE ÖLZERSTÖRUNG: MODERNE ERRUNGENSCHAFTEN UND PERSPEKTIVEN DER BIOREMEDIATION

Sechkarewa Ekaterina Nikolajewna,
Masterstudentin des Instituts für Pharmazie, Chemie und Biologie,
Belgoroder Staatliche Nationale Forschungsuniversität, Belgorod, Russland,
E-mail: schetinina.katia2016@yandex.ru
Taranowa Elena Nikolayewna,
Kandidatin der philologischen Wissenschaften,
Professorin des Lehrstuhls für Fremdsprachen und berufliche Kommunikation,
Belgoroder Staatliche Nationale Forschungsuniversität, Belgorod, Russland,
E-mail: taranova_e@bsuedu.ru

Annotation: *Dieser Artikel gibt einen Überblick der aktuellen Forschungen auf dem Gebiet des mikrobiologischen Abbaus von Erdöl und Erdölprodukten. Die vorliegende Arbeit betrachtet die letzten modernen Fortschritte beim Verständnis der Mechanismen des Kohlenwasserstoffabbaus, die Vielfalt der mikrobiellen Abbauprodukte sowie die Faktoren, die die Effizienz der Bioremediation beeinflussen. Besondere Aufmerksamkeit wird der Anwendung moderner molekularbiologischer Methoden zur Untersuchung mikrobieller Gemeinschaften und zur Optimierung von biologischen Abbauprozessen gewidmet. Man betrachtet im Artikel die Optimierung von biologischen Abbauprozessen. Vielversprechende Forschungsrichtungen, einschließlich der Entwicklung gentechnisch veränderter Mikroorganismen und der Anwendung der Nanotechnologie, werden ebenfalls von den Autoren des Artikels erörtert.*

Schlagwörter*: mikrobiologische Zerstörung, die Bioremediation, die Kohlenwasserstoffe, die Mikroorganismen, die Metagenomik, die Nanotechnologie, genetisch veränderte Mikroorganismen, die Bioremediationseffizienz.*

Die Umweltverschmutzung durch Erdöl und Erdölprodukte ist nach wie vor eines der dringendsten Umweltprobleme unserer Zeit. Traditionelle übliche Sanierungsmethoden wie die physikalische Entfernung und die chemische Behandlung sind oft unwirksam und teuer, und können negative Auswirkungen auf die Umwelt haben. In diesem Zusammenhang gewinnt der mikrobiologische Abbau von Öl, der auf der Fähigkeit von Mikroorganismen zum Abbau von Kohlenwasserstoffen beruht, als umweltfreundliche und kostengünstige Bioremediationsmethode zunehmend an Bedeutung.

In dieser Studie werden die letzten Fortschritte auf diesem Gebiet untersucht, wobei der Schwerpunkt auf neuartigen Abbaumechanismen, mikrobieller Vielfalt, die Faktoren, die die Effizienz beeinflussen, und vielversprechenden Forschungsrichtungen liegt.

Es sei erwähnt, dass die aktuellen modernen Erkenntnisse über die Mechanismen des mikrobiologischen Abbaus von Öl das Verständnis dafür ganz besonders erweitert haben. Neben den klassischen aeroben Abbauprozessen werden auch anaerobe Prozesse des Kohlenwasserstoffabbaus durch spezialisierte Mikroorganismen unter Sauerstoffmangel aktiv untersucht und probiert. Besondere Aufmerksamkeit wird der Rolle der extrazellulären Enzyme und Biotenside gewidmet, die die Auflösung und den Transport von Kohlenwasserstoffen zu mikrobiellen Zellen erleichtern könnten. Durch metagenomische Studien werden neue Gene und Enzymsysteme identifiziert, die am Abbau komplexer Kohlenwasserstoffe beteiligt sind [Jones, 2022].

Es wurde traditionell gemeint, dass die Zersetzung von Öl hauptsächlich von den Bakterien der Gattungen Pseudomonas, Alcanivorax, Marinobacter durchgeführt wird. Aber moderne metagenomische und kulturelle Studien haben jedoch eine viel größere Vielfalt an Mikroorganismen aufgedeckt, die an diesem Prozess beteiligt sind, einschließlich Archaeen, Pilze und Mikroalgen. Von besonderem Interesse sind extreme Mikroorganismen, die Öl unter extremen Bedingungen (niedrige oder hohe Temperaturen, hoher Salzgehalt, hoher Druck) effektiv zersetzen können [Brown, 2021].

Die Wirksamkeit der mikrobiologischen Zerstörung von Öl wird durch viele Faktoren bestimmt, einschließlich die Art und Konzentration von Kohlenwasserstoffen, Temperatur, pH-Wert, Verfügbarkeit von Nährstoffen (Stickstoff, Phosphor), Verfügbarkeit von Sauerstoff, Salzgehalt usw. Die Studien haben gezeigt, dass die Optimierung dieser Faktoren sowie die Zugabe von Biosurfaktanten und anderen biostimulierenden Substanzen die Geschwindigkeit und Vollständigkeit der Zersetzung von Öl erheblich verbessern können [Garcia, 2023].

Die Untersuchung von mikrobiellen Gemeinschaften spielt eine Schlüsselrolle beim Verständnis und der Optimierung von Bioremediationsprozessen, die darauf abgezielt werden, die Umwelt von verschiedenen Schadstoffen zu befreien. Traditionelle Methoden zur Kultivierung von Mikroorganismen erlauben oft kein vollständiges Bild der Zusammensetzung und Aktivität von mikrobiellen Gemeinschaften, da ein großer Teil der Mikroorganismen unter Laborbedingungen nicht kultiviert werden kann. In den letzten Jahren sind molekularbiologische Methoden zu einem leistungsfähigen Werkzeug geworden, um mikrobielle Gemeinschaften zu untersuchen, die an der Bioremediation beteiligt sind und detaillierte Informationen über ihre Zusammensetzung, Struktur, Funktionen und Wechselwirkungen liefern.

Die basierenden auf DNA-Analysen Methoden sind:

- *Metagenomik*. Die Metagenomik oder die DNA-Sequenzierung der gesamten mikrobiellen Gemeinschaft ermöglicht es, die Informationen über das genetische Potenzial aller Mikroorganismen in der zu untersuchende Probe zu erhalten. Bei der Bioremediation ermöglicht die Metagenomanalyse, die Gene zu identifizieren, die für die am Abbau von Schadstoffen beteiligten Enzyme kodieren, und die Vielfalt der für Mikroorganismen verfügbaren Stoffwechselwege zu bewerten. Das wissenschaftliche Team unter Leitung von Y. Zhou hat in 2020 die mikrobiellen Gemeinschaften, die am Abbau von Öl in kontaminierten Meeresablagerungen beteiligt sind, mit Metagenomik untersucht und neue Gene identifiziert, die für Enzyme kodieren, die am Stoffwechsel von Alkanen und aromatischen Kohlenwasserstoffen teilnehmen.

Noch anderes Team der Wissenschaftler mit K. Wu als Leiter der Studie hat in 2022 die Metagenomik angewendet, um die mikrobielle Gemeinschaft zu erforschen, die am Abbau von Mikroplastik beteiligt ist, und potenzielle Polyethylen-Abbaustoffe zu identifizieren.

- *Amplicon-Sequenzierung*: Die Amplicon-Sequenzierung, am häufigsten das 16S-rRNA-Gen für Bakterien und Archaeen oder das ITS-Gen für Pilze, ermöglicht es, die taxonomische Zusammensetzung einer mikrobiellen Gemeinschaft zu bestimmen und ihre Vielfalt zu bewerten. Diese Methode wird häufig verwendet, um die Veränderungen in der Struktur mikrobieller Gemeinschaften während des Bioremediationsprozesses zu überwachen. Zum Beispiel die Wissenschaftler mit J. Chen als Hauptleiter haben in 2017 eine verstärkte Sequenzierung verwendet, um die Auswirkungen der Biostimulation auf die Struktur der mikrobiellen Gemeinschaft in Böden zu untersuchen, die mit polyzyklischen aromatischen Kohlenwasserstoffen (PAK) kontaminiert sind, und diese Forschung zeigte, dass die Zugabe von Nährstoffen zu einer erhöhten Anzahl von Bakterien führt, die zum Abbau von PAK fähig sind.
- *Quantitative PCR (qPCR):* Mit qPCR kann man die Anzahl bestimmter Mikroorganismen oder Gene in der zu untersuchender Probe quantifizieren. Bei der Bioremediation wird qPCR verwendet, um die Anzahl von Mikroorganismen zu überwachen, die zum Abbau von Schadstoffen fähig sind, und um die Wirksamkeit von Bioremediationsaktivitäten zu bewerten. Zum Beispiel J. Zhang und seine Studiengruppe haben qPCR verwendet, um die Anzahl der Benzol-Abbaustoffe im Grundwasser nach der Verabreichung des biologischen Mittels zu überwachen. Diese Untersuchung hat gezeigt, dass die Verabreichung des biologischen Mittels zu einer signifikanten Zunahme der Anzahl dieser Mikroorganismen führt [Bell, 2018].

Die RNA-basierende Methoden sind:

- *Metatranskriptomik* (Sequenzierung von Gemeinschafts-RNA): Die Metatranskriptomik oder RNA-Sequenzierung der gesamten mikrobiellen Gemeinschaft liefert Informationen über die Gene, die zu einem bestimmten Zeitpunkt aktiv exprimiert werden. Mit dieser Methode lässt sich die Stoffwechselaktivität der mikrobiellen Gemeinschaft bewerten und die für den Bioremediationsprozess wichtigsten Gene ermitteln.

So untersuchten T. H. E. Bell und sein wissenschaftliches Team mit Metatranskriptomik mikrobielle Gemeinschaften, die am Ölabbau in arktischen Meeressedimenten beteiligt sind, und sie identifizierten die Gene, die bei niedrigen Temperaturen aktiv exprimiert werden und für Enzyme kodieren, die ihrerseits am Stoffwechsel von Alkanen beteiligt sind [Bell, 2018].

- *Reverse Transkriptase qPCR (RT-qPCR)*: RT-qPCR ermöglicht die quantitative Bewertung der Expressionsstärke bestimmter Gene in einer Probe zu machen. Bei der Bioremediation wird RT-qPCR eingesetzt, um die Expression von Genen zu überwachen, die für Enzyme kodieren, die am Schadstoffabbau beteiligt sind, und um die Aktivität von Mikroorganismen zu bewerten, die am Bioremediationsprozess beteiligt sind. Zum Beispiel verwendeten Y. Li und sein Wissenschaftsteam die Auswirkungen verschiedener Faktoren auf die Expression von Genen für den Abbau von Trichlorethylen (TCE) in Mikroorganismen und zeigten, dass die Zugabe bestimmter Co-Substrate zu einer Steigerung der Expression dieser Gene führt [Li, 2021].

In diesem Artikel zeigen wir auch die vielversprechenden Forschungsrichtungen, die für die Genwissenschaft sehr wichtig sind. Darunter sind folgende:

– *Genetisch veränderte Mikroorganismen (GVM):* Die Entwicklung von GVM mit verbesserter Ölabbaubarkeit, Resistenz gegen toxische Ölbestandteile und der Fähigkeit, unter extremen Bedingungen zu überleben, ist ein vielversprechender Bereich zur Verbesserung der Effizienz der Bioremediation.

– *Die Nanotechnologie*: Der Einsatz von Nanopartikeln zur Zuführung von Nährstoffen und Mikroorganismen in die kontaminierte Umgebung und zur Verbesserung der Löslichkeit von Kohlenwasserstoffen kann den biologischen Abbauprozess erheblich verbessern [Kim, 2024].

– *Die Verwendung von kombinierten Methoden*: Die Kombination von mikrobiologischem Abbau mit anderen Reinigungsmethoden (physikalisch, chemisch) kann bessere Ergebnisse bei der Entfernung von Ölverschmutzungen erzielen [Wang, 2023].

– *Künstliche Intelligenz und maschinelles Lernen*: Der Einsatz von Algorithmen des maschinellen Lernens zur Analyse großer Datensätze mikrobieller Gemeinschaften und zur Optimierung von Bioremediationsparametern wird auch in der Zukunft benutzt.

Fazit: Der mikrobiologische Abbau von Öl ist eine vielversprechende und umweltverträgliche Methode der Bioremediation. Die moderne Forschung ermöglicht ein besseres Verständnis der Abbaumechanismen, der mikrobiellen Vielfalt und der Faktoren, die die Effizienz des Prozesses beeinflussen. Die Anwendung moderner molekularbiologischer Methoden, die Entwicklung von GVM und der Einsatz der Nanotechnologie eröffnen neue Möglichkeiten zur Verbesserung der Effizienz der Bioremediation von Ölverschmutzungen.

Weitere Forschungsarbeiten in diesem Bereich sowie die Integration interdisziplinärer Ansätze werden die Entwicklung wirksamerer und nachhaltigerer Methoden zur Lösung dieses globalen Umweltproblems ermöglichen.

Literaturliste

1. Bell, T. H. E., Ergo, D. A., Li, K. W., White, L. G., & Greer, C. W. (2018). Metatranscriptomic analysis of microbial communities in oil-contaminated Arctic soils reveals differential expression of alkane degradation genes // *Applied and Environmental Microbiology*, *84*(15), e00714-18.

2. Brown, A., et al. (2021). Novel extremophilic microorganisms for oil degradation in harsh environments // *Extremophiles*, *25*(2). – Pp. 221-235.

3. Garcia, M., et al. (2023). Biostimulation strategies for enhancing oil degradation in contaminated soils // *Journal of Environmental Management*, *330*, 117125.

4. Jones, L., et al. (2022). Identification of novel genes and enzymes involved in anaerobic oil degradation using metagenomics // *Environmental Microbiology*, *24*(5). – Pp. 2211-2225.

5. Kim, S., et al. (2024). Nanotechnological bioremediation for oil spills: a review of recent advances // *Environmental Science: Nano*, *11*(3). – Pp. 456-470.

6. Li, Y., Zhao, Y., Wu, D., Li, S., Zhang, J., & Wang, X. (2021). Enhanced trichloroethylene degradation and expression of functional genes by Burkholderia cepacia strain WJ-1 with addition of different co-substrates // *Bioresource Technology*, *320*, 124377.

7. Wang, K., et al. (2023). Integrated approaches for oil spill response: combining physical, chemical, and biological methods // *Science of the Total Environment*, *864*, 161002.

UDK 631.61

BIOREMEDIATION OF SOILS CONTAMINATED WITH HEAVY METAL COMPOUNDS BY MICROORGANISMS

Bachurina Sofya Maksimovna,
Student of the Institute of Pharmacy, Chemistry and Biology,
Belgorod State National Research University, Belgorod, Russia,
E-mail: 1640830@bsuedu.ru
Buglova Maria Viktorovna,
Student of the Institute of Pharmacy, Chemistry and Biology,
Belgorod State National Research University, Belgorod, Russia,
E-mail: 1665130@bsuedu.ru
Mariasova Elena Anatolyevna,
Ph.D. in Philosophy,
Associate Professor of the Department of Foreign Languages
and Professional Communication,
Belgorod State National Research University, Belgorod, Russia,
E-mail: mariasova@bsuedu.ru

Abstact: *This article raises the ecological problem of soil pollution by heavy metals. The negative impact of these compounds on the whole biosphere is considered. It also considers bioremediation as one of the most effective and safe ways of cleaning substrates from toxicants.*

Keywords: *heavy metals, bioremediation, soil, microorganisms, ecology, purification, detoxification.*

In our modern world, the issue of environmental pollution is acute, due to rapidly developing industrial enterprises. Many of these processes can be accompanied by the release of a variety of harmful substances, which in turn cause great harm to the environment on our earth. Therefore, it is very important to prevent contamination processes or minimize them using waste-free production technologies, but if a pollutant leak does occur, it is necessary to be able to deal with them quickly and effectively. Then bioremediation methods come to the rescue, which are very good at detoxifying contaminated substrates.

Heavy metals are one of the most common pollutants in the ecosystem. Heavy metals are chemical compounds that have a molecular weight of 50 or higher. These include lead, copper, zinc, nickel, cadmium, cobalt, chromium, and mercury. They are classified as critical pollutants that require monitoring in various environmental systems. Their accumulation in the environment is often associated with geochemical processes, but the main source is anthropogenic emissions, especially from metallurgical plants and car exhaust gases. Their role in biochemical cycles is significant because they are components of various enzymatic systems and may be necessary in small quantities for plants and living organisms. But at the same time, even a minimal excess of their permissible concentration can have a toxic effect on the human body and cause diseases.

Heavy metals accumulate in the soil and contribute to changes in its chemical composition, gradually disrupting the vital functions of plants and living organisms. Heavy metals can be transmitted from soil substrates to animals and humans, causing harmful effects [Miftahutdinov, 2022].

The biosphere has never encountered such a large number of heavy metals on the Earth's surface before. Environmental pollution by these elements is not limited to their direct presence. Heavy metals are also distributed as a result of industrial processes related to the extraction and processing of iron and aluminum, the burning of fuels and the handling of chemical materials.

The toxicity of heavy metals is mainly based on their interaction with biologically active proteins, similar to the action of metals that are necessary for the body. The essence of this effect is the attack of heavy metal ions on molecular targets:

1) heme-containing proteins and enzymes;

2) mechanisms of oxidative stress;

3) enzymes of electron transport and ATP synthesis;

4) proteins of cell membranes and ion channels of membranes.

The negative effects of toxic metal ions on biological macromolecules are expressed through the following mechanisms:

– displacement of necessary metals from their active binding sites by toxic metal;

– by binding a part of the macromolecule necessary for the normal functioning of the body;

– by crosslinking to form biological aggregates harmful to the body;

– depolymerization of biologically important macromolecules;

– incorrect pairing of nucleotide bases and errors in protein synthesis [Muhutdinova, 2013].

Restoration of the properties of natural environments while eliminating the effects of pollution or reducing the impact on the environment is called remediation. It includes physical, chemical and biological methods [Okolelova, 2022]. The most effective method of detoxification of heavy metals is bioremediation, a method of purifying the environment with the help of living organisms [Korotchenko, 2020].

Purification of the polluted environment by bioremediation occurs due to natural biological processes that develop in mild physico-chemical conditions, while maintaining the integrity of the soil and its basic properties. Therefore, it is environmentally friendly for the environment [Korotchenko, 2020].

The advantage of bioremediation technologies is the widest range of possibilities to accumulate and biodegrade various organic toxicants, including heavy metals. Bioremediation is also economically advantageous due to lower equipment costs and high efficiency of the method.

However, there are disadvantages to this purification method: the problem of survival of microbial cultures in an open ecosystem and the low rate of biodegradation of toxicants.

The purpose of bioremediation is to convert organic pollutants into carbon dioxide and water. This method of environmental purification is based on the enhancement of natural biodegradation processes occurring in nature. The effective implementation of bioremediation in polluted areas depends on the specifics of each specific territory. Limiting factors affecting the rate of biodegradation include soil characteristics, the properties of the contaminant, its availability for biodegradation, and the number of microorganisms [Okolelova, 2022].

Some microorganisms, such as bacteria and yeast, are capable of accumulating heavy metals, radioisotopes and transuranic elements in excessive amounts. Metal ions and organic compounds can be absorbed and concentrated by various colloids, such as iron (III) hydroxides, as well as precipitated as a result of the activity of these microorganisms. In case of contamination, substances not only accumulate in the tissues of organisms, but also undergo irreversible processes of immobilization on surfaces, adsorption to soil materials as a result of exposure to living creatures or subsidence in areas where they are actively functioning [Korotchenko, 2020].

Therefore, microorganisms are used for bioremediation of soils contaminated with heavy metal compounds. The bacteria of childbirth cope with this role most effectively *Bacillus, Rhodococcus, Enterobacter, Arthrobacter* [Faskhutdinova, 2021]. It's also worth noting that the removal, degradation and neutralisation of heavy metals is much better with a consortium of these bacteria.

As noted above, heavy metals present a serious threat to the environment and human health. Their widespread use leads to soil, water and air pollution, disruption of ecosystems and negative effects on living organisms. At the same time, traditional methods of removing heavy metals are often expensive and not always environmentally safe.

In this context, bioremediation is a promising and environmentally safe way to solve the problem of heavy metal pollution. The use of microorganisms makes it possible to clean up polluted environments without introducing additional pollutants. Despite existing limitations related to microbial engraftment, process speed and environmental factors, modern bioremediation methods such as bioaugmentation, biostimulation and the use of microbial consortia can significantly improve the efficiency of remediation.

Further research into bioremediation, aimed at identifying and selecting new strains of micro-organisms, optimising the remediation process and developing new technologies, can make a huge contribution to reducing heavy metal pollution. Bioremediation is also aimed at creating a safer ecological environment. It is necessary to take into account the specificity of each pollution and develop unique purification technologies for more efficient degradation of pollutants [Korotchenko, 2020].

References

1. Faskhutdinova, E.R. (2021). Perspektivy ispol'zovaniya mikrobioma pochv ugol'nyh otvalov s cel'yu remediacii antropogenno narushennyh sistem [Prospects of using the soil microbiome of coal dumps for the purpose of remediation of anthropogenically disturbed systems // *Tekhnika i tekhnologiya pishchevyh proizvodstv [Technics and technology of food production]*. – № 4. – Pp. 883-904. (in Russian)

2. Korotchenko, I.S. (2020). Bioremediaciya: uchebnoe posobie [Bioremediation]. – Krasnoyarsk: KrasGAU. – 246 p. (in Russian)

3. Miftahutdinov, A.V. (2022). Toksikologicheskaya ekologiya: uchebnik 2–e izd., ster. [Toxicological ecology]. – Sankt–Peterburg: Lan'. – 193 p. (in Russian)

4. Muhutdinova, T.Z. (2013). Ekonomika prirodopol'zovaniya: kurs lekcij: uchebnoe posobie [Economics of nature management]. – Kazan': KNITU. – 135 p. (in Russian)

5. Okolelova, A.A. (2022). Degradaciya, remediaciya i bioindikaciya pochv: uchebnoe posobie [Degradation, remediation and bioindication of soils]. – Volgograd: Volgogradskij GAU. – 144 p. (in Russian)

UDK 574

ISOLATION OF NITROGEN-FIXING MICROORGANISMS FROM MOSSES GROWING ON TREES

Firsova Irina Andreevna,
Student of the Institute of Pharmacy, Chemistry, and Biology,
Belgorod State National Research University, Belgorod, Russia,
E-mail: firsova_irina@mail.ru
Kuzemkina Vladislava Alekseevna,
Student of the Institute of Pharmacy, Chemistry, and Biology,
Belgorod State National Research University, Belgorod, Russia,
E-mail: vladislava_korshunova2018@mail.ru
Gusakova Natalya Leonidovna,
Ph.D. in Psychology,
Associate Professor of the Department of Foreign Languages
and Professional Communication,
Belgorod State National Research University, Belgorod, Russia,
E-mail: gusakova_n@bsu.edu.ru

Abstract: *The article observes the isolation of nitrogen-fixing microorganisms from mosses that grow on trees, which can later be used in biotechnology as various fertilizers that improve the growth and development of agricultural and indoor plants. A nitrogen-fixer is a plant that has the ability to accumulate nitrogen in root nodules. Nitrogen-fixing microorganisms play a key role in ecosystems by providing plants with access to nitrogen, which is an essential element for their growth. Mosses, as part of terrestrial ecosystems, may serve as a potential source of such microorganisms.*

Keywords: *microbiology, bacteria, nitrogen, microorganisms, mosses.*

Nitrogen constitutes 75-80% of the atmosphere and enters the biosphere through nitrogen-fixing bacteria. These bacteria assimilate nitrogen and convert it into a chemical compound that plants can utilize. Subsequently, nitrogen is transferred through food chains and returns to the atmosphere in its free form. The nitrogen cycle, involving nodule-forming and nitrifying bacteria, is an important biochemical process occurring in the biosphere [Netrusov, 2005].

The main objective of this study is to isolate microorganisms capable of nitrogen fixation from mosses growing on trees. For the research, samples were collected in the forest area around the Seversky Donets River. Approximately 6 grams of material were collected from the surfaces of the trees, and then 10 ml of distilled water was added to the biomass. The samples were placed in a thermostat for incubation at a temperature of 30 °C for 24 hours. The isolation of a culture of nitrogen-fixing microorganisms was carried out using a selective Ashby medium. This medium does not contain nitrogen sources, so only those bacteria that capture nitrogen from the air can grow on it. A microbiological loop was used to inoculate the surface of the Ashby medium with microorganisms, followed by the isolation of a pure culture.

Nitrogen-fixing bacteria are classified as chemotrophic bacteria based on their nutritional type. Their main function is to facilitate the assimilation of atmospheric nitrogen by oxidizing it into biologically available forms. The process of nitrogen fixation, known as microbiological fixation of atmospheric nitrogen, involves

microorganisms in the soil absorbing atmospheric nitrogen and converting it into organic and mineral compounds. This process occurs in several stages: 1) ammonification (resulting in ammonia); 2) nitrification.

There are groups of nitrogen-fixing bacteria: symbiotic (bacteria of the genera *Rhizobium, Actinomyces, Azospirillum*), free-living or non-symbiotic (bacteria of the genera *Azotobacter, Beijerinckia,* and *Clostridium*), and associative (nitrogen-fixing bacteria of the genera *Enterobacter*, *Klebsiella*, *Escherichia*, *Erwinia*, and *Citrobacter*). An interesting fact is that the same bacterial species can perform two opposing processes, such as nitrogen fixation and denitrification [Netrusov, 2005].

One of the most studied groups of nitrogen-fixing bacteria is the nodule bacteria. This group belongs to the family *Rhizobiaceae* and includes the genera *Rhizobium, Bradyrhizobium, Sinorhizobium, Azorhizobium*, and *Mesorhizobium*. The species name of nodule bacteria usually corresponds to the Latin name of the plant from which the bacteria were isolated. Nodule bacteria form a symbiotic relationship with leguminous plants, providing mutual benefits: the bacteria assimilate nitrogen from the atmosphere and convert it into compounds that can be used by the plants, while the plants supply the bacteria with carbon-containing substances.

Cyanobacteria are rod-shaped, gram-negative bacteria that possess the ability to photosynthesize, releasing oxygen in the process. These bacteria often form clusters in the shape of balls or other formations. Cyanobacteria represent a morphologically varied group of gram-negative prokaryotes, which can be found in unicellular, colonial, and multicellular forms. Their cells may be spherical, rod-like, or curved in shape. These organisms have the ability to fix atmospheric nitrogen. In heterocysts, nitrogenase is shielded from the detrimental effects of molecular oxygen by additional surface membranes. Cyanobacteria inhabit the surfaces of sphagnum twigs, in leaf axils, and in the intercellular spaces [Petrova, 2023].

The symbionts of mosses are nitrogen-fixing bacteria of the genera *Nostoc* and *Anabaena*. Cyanobacteria penetrate the mucilage-filled cavities on the leaves and settle there. In the studied forest area, eight species of diazotrophic cyanobacteria were noted in association with sphagnum mosses. Common species include *Microchaete tenera*, *Nostoc paludosum*, and N. *punctiforme*. Nitrogen fixed by cyanobacteria accumulates in sphagnum mosses, promoting their growth and increasing biomass. This, in turn, affects the accumulation of organic matter and the dynamics of carbon in wetland ecosystems.

Several factors influence nitrogen fixation, including moss moisture (high moisture accelerates the fixation process), temperature, light intensity, and the availability of nitrogen (fixation occurs exclusively in areas with low nitrogen content) [Sytnikov, 2012].

Nitrogen-Fixing Cyanobacteria Associated with Mosses:

1) *Nostoc paludosum*. This species forms gelatinous colonies with a blue-green hue. The colonies consist of filamentous cells that can form heterocysts –specialized cells for nitrogen fixation. Besides mosses, they are found in water bodies. Their function is to fix atmospheric nitrogen, which then becomes available for mosses and other plants.

2) *Microchaete tenera*. This cyanobacterium is found in associations with sphagnum mosses. It forms long, thin filaments that can be green or yellow.

Microchaete tenera effectively fixes nitrogen, helping mosses obtain necessary nutrients and contributing to their resilience against adverse conditions.

3) *Anabaena verrucosa*. This filamentous cyanobacterium is often found in water bodies and on moist substrates, including mosses. It forms heterocysts, specialized cells that protect nitrogenase from oxygen, allowing for effective nitrogen fixation even in oxygen-rich conditions. *Anabaena verrucosa* fixes atmospheric nitrogen, enabling mosses and other plants to obtain essential elements for growth [Gusev, 2010].

4) *Hapalosiphon pumilus*. It forms long filaments and can create colonies that appear as green masses on mosses. It forms a symbiosis with mosses, enriching them with nutrients. This bacterium fixes atmospheric nitrogen, improving conditions for the growth of mosses and other plants. It can also protect mosses from drying out and other adverse conditions [Sytnikov, 2012].

Nitrogen-fixing bacteria, such as *Nostoc paludosum*, *Microchaete tenera*, *Anabaena verrucosa*, and *Hapalosiphon pumilus*, play a crucial role in moss ecosystems. They not only enrich the soil with accessible nitrogen but also contribute to the resilience of mosses against unfavorable conditions, making them indispensable for maintaining ecosystem health [Netrusov, 2005].

A mixed culture of nitrogen-fixing microorganisms was obtained using a selective Ashby agar medium composed of the following components: sucrose (6.0 g), K2HP04 (0.06 g), MgS04·7H20 (0.06 g), NaCl (0.06 g), FeSO4 (0.03 g), CaCO3 (1.5 g), agar (2%), and distilled water (300 ml). The inoculation was performed in Petri dishes containing the prepared medium. For this purpose, 100 µl of biomaterial, which consisted of a mixture of moss microorganisms suspended in sterile water, was used. The pure culture was isolated by using a microbiological loop to streak the Ashby medium with microorganisms, employing the depletion stroke technique [Gusev, 2010].

In the course of the research, microorganisms were isolated that, based on their tintorial and physicochemical properties, resemble the community of nitrogen-fixing bacteria belonging to the family Azotobacter. Eight strains of microorganisms were discovered. Some were isolated from mosses collected from coniferous trees (strain Pine); others were isolated from moss collected from an apple tree (YAB1, YAB2, YAB3, YAB4, YAB5) and from mosses that settled on a felled tree (BR1, BR2).

Subsequently, a microscopic analysis was conducted, revealing that the bacteria are motile, do not have spores, and are capable of forming capsules. Gram staining resulted in both Gram-negative and Gram-positive cultures: YAB1 – Gram-negative; YAB2 – Gram-positive; YAB3 – Gram-positive; YAB4 – Gram-negative; YAB5 – Gram-positive; Pine – Gram-positive; BR1 – Gram-negative; BR2 – Gram-negative.

The research suggests that the isolated microorganisms have significant potential for use in biotechnology as various fertilizers that enhance the growth and development of agricultural and houseplants.

As a result of the study on the isolation of nitrogen-fixing bacteria from mosses growing on trees, it was found that these microorganisms play an important role in ecosystems by contributing to the biological enrichment of the soil and improving conditions for plant growth.

Nitrogen-fixing bacteria living in symbiosis with mosses are capable of effectively assimilating atmospheric nitrogen, making them valuable for agriculture

and ecological restoration. The isolated strains demonstrate various physiological and biochemical characteristics, which opens up prospects for their use in agronomy, especially in conditions of limited access to chemical fertilizers. These findings highlight the need for further research in this area, aimed at studying the diversity and functional capabilities of nitrogen-fixing bacteria, which could lead to the development of new approaches to sustainable ecosystem management and increased productivity.

References

1. Gusev, M.V., Mineeva, L.A. (2010). Mikrobiologiya [Microbiology]. – M.: Izdatelskiy Zentr "Akademiya". – 464 p. (in Russian)

2. Netrusov, A.I., Egorova, M.A., Zakharchuk, L.M. (2005). Praktikum po mikrobiologii [Practicum on microbiology]. – M.: Izdatelskiy Zentr "Akademiya". – 608 p. (pp. 75-81). (in Russian)

3. Petrova, O.A. (2023). Rol mirgoorganismov v formirovanii chemicheskogo sostava pochvy [The Role of Microorganisms in the Formation of Soil Chemical Composition]. – [Electronic resource]. Access mode: https://infourok.ru/nauchnaya-rabota-rol-mikroorganizmov-v-formirovanii-himicheskogo-sostava-pochv-5683198.html. (Date of access: 01.04.2023). (in Russian)

4. Sytnikov, D.M. (2012). Biotekhnologiya azotfiksiruyushchikh mikroorganizmov i perspektivy ispol'zovaniya lekarstvennykh preparatov na ikh osnove [Biotechnology of nitrogen-fixing microorganisms and prospects for the use of drugs based on them]. – M.: Biotechnol. acta. – [Electronic resource]. Access mode: https://cyberleninka.ru/article/n/biotehnologiya-mikroorganizmov-azotfiksatorov-i-perspektivy-primeneniya-preparatov-na-ih-osnove. (Date of access: 10.04.2023). (in Russian)

UDK 579.2

EVALUATION OF THE ANTAGONISTIC ACTIVITY OF BACILLUS SUBTILLIS ISOLATED FROM THE INTESTINES OF POULTRY AGAINST CERTAIN MICROORGANISMS

Zhidkikh Tatiana Denisovna,
Student of the Institute of Pharmacy, Chemistry and Biology,
Belgorod State National Research University, Belgorod, Russia
E-mail: tanyazhidki82@gmail.com
Gusakova Natalya Leonidovna,
Ph.D. in Psychology,
Associate Professor of the Department of Foreign Languages and Professional Communication,
Belgorod State National Research University, Belgorod, Russia,
E-mail: gusakova_n@bsuedu.ru

Abstract: *The study evaluates the antagonistic activity of Bacillus subtilis, isolated from the intestines of poultry, against pathogenic fungi such as Pythium vexans, Bipolaris sorokiniana, Alternaria brassicicola, and Aspergillus unguis. The strain was identified using 16S rRNA analysis and showed significant potential in inhibiting fungal growth. These findings suggest that Bacillus subtilis could be a promising candidate for developing biopreparations and probiotics in agriculture.*

Keywords: *Bacillus subtilis, antagonistic activity, poultry microbiota, mycotoxins, probiotics.*

The aim of the study is to evaluate the antagonistic potential of bacterium 10.2 isolated from the intestine of day-old chick with the purpose of its practical application in agriculture.

In the course of this work the bacterium Bacillus subtilis was studied. This bacterium is not dangerous for humans and is widely distributed in the environment. The absence of pathogenicity in this strain allows us to consider them more promising as a basis for probiotics.

One of the most important biochemical properties of Bacillus subtilis is its ability to acidify the environment as well as produce antibiotics. It is due to these properties that Bacillus subtilis is able to reduce the impact of various opportunistic as well as pathogenic microorganisms. Bacillus subtilis is regarded as an antagonist for yeast fungi, salmonella, proteus, streptococci, and staphylococci. This property of the bacteria has received practical application in veterinary medicine by using them as probiotics.

In the process of executing the work, the following tasks were set:

1. To study the morphological properties of the isolated bacterium.

2. To study antagonistic activity of bacterium 10.2 isolated from the intestines of chickens to other pathogenic microorganisms.

3. Select a growth substrate for the most favorable cultivation of this microorganism.

The gut microbiota of poultry can form a protective barrier by attaching to the epithelial walls of the enterocyte (mucus-producing cells of the animal intestinal mucosa epithelium) and thus reduce the possibility of colonization by pathogenic bacteria [Markova, 2022].

According to the UN food organization, up to 30% of food and feed crops are contaminated with mycotoxins [Popov, 2018]. This type of toxin is capable of affecting various species of cereal plants, thereby causing a decrease in the field germination of the crop, as well as causing mycotoxicoses when ingested in the gastrointestinal tract of poultry. One of the species of pathogenic bacteria is Aspergillus unguis and Bipolaris sorokiniana, species of mold fungi capable of producing mycotoxins [Serdyuk, 2011].

Morphological and tinctorial properties of bacterium 10.2 were carried out in the course of the work (Figure 1). Gram reaction and spore formation ability were evaluated by the standard method [Netrusov, 2005]. Gram staining was performed with the colorants gencyanine, methyl violet. Spores were detected by negative staining. Methylene blue or fuchsin was applied for 3-5 minutes or 1-3 minutes, after which the preparation was carefully air-dried.

bacterial shape	coccobacillus
Gram staining	gram-positive
colony color	white
bacterial spores	spore-forming
bacterial colony shape	round with an edge roll
optimum growth temperature	30 **℃**

Figure 1. – Results of morphological and tinctorial properties of the bacterium 10.2

Based on 16S RNA analysis, the strain was identified as Bacillus subtilis. To determine the evaluation of the growth substrate it is necessary to add 9 ml of liquid mineral medium into a test tube, then add 1 ml of 1% solution of growth substrate into the test tube with mineral medium. At the end, we put the growth of bacterium 10.2 with medium in the thermostat for 24 h at 30°C. Composition of the mineral medium g/l; KNO3 (potassium nitrate) – 0.4; KH2PO4 (monokaliy phosphate) – 0.06; Na2HPO4 (sodium hydrophosphate) – 0.14; MgSO4 (magnesium sulfate) – 0.08.

As a result of growth substrate selection, the highest growth of bacterium 10.2 occurred with four chlorobenzoic acid. When evaluating the possibility of using other growth substrates, high growth of the bacterium relative to the control was not observed (Figure 2).

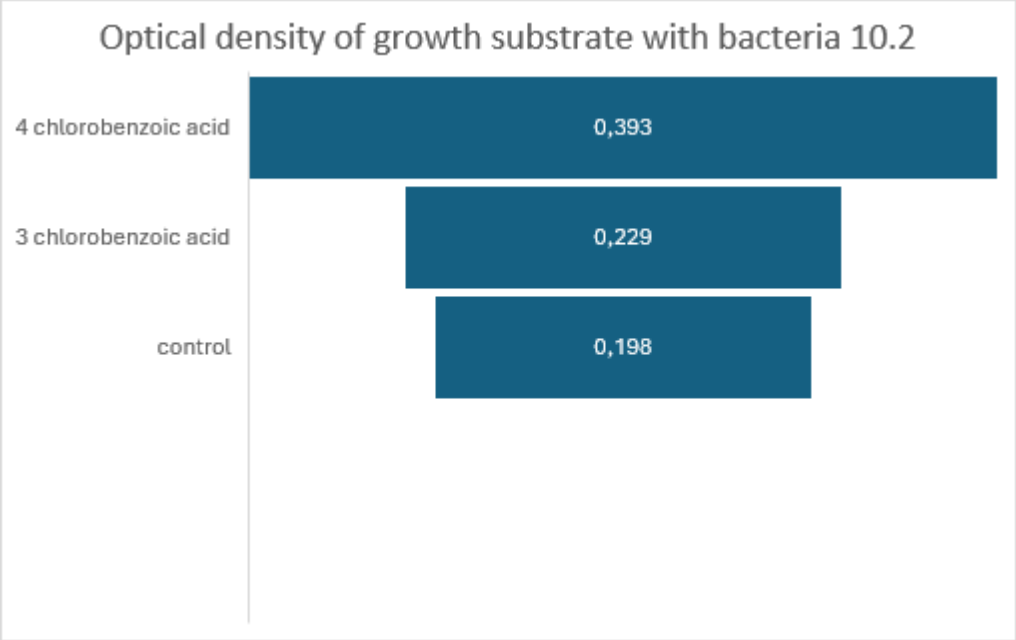


Figure 2. – Optical density of growth substrate using hydrocarbon compounds

Sabouraud medium (composition (g/l): peptone – 10.0, D-glucose – 40.0, yeast extract – 5, microbiological agar – 20.0) was used to determine the antagonistic activity of Bacillus subtilis culture to other mold fungi. The following pathogen species were used as antagonists: Pythium vexans, Bipolaris sorokiniana, Alternaria brassicicola, Aspergillus unguis, Rhizoctonia solani. Seeding on the medium was done by perpendicular stroke on Petri dishes followed by culturing for 24 h at 30 C [Irkitova, 2017].

According to the results of antagonistic activity evaluation, growth suppression was observed against Pythium vexans, Bipolaris sorokiniana, Alternaria brassicicola, Aspergillus unguis (Figure 3).

Thus, a strain of Gram-positive spore-forming bacterium identified as Bacillus subtilis was isolated from the intestine of farm poultry. During the evaluation of individual properties of the culture, its antagonistic activity against: Pythium vexans, Bipolaris sorokiniana, Alternaria brassicicola, Aspergillus unguis was revealed. Thus, the isolated bacterium has potential and requires in-depth study of the prospects for biotechnology in connection with the widespread use of Bacillus subtilis for the production of biopreparations and probiotics.

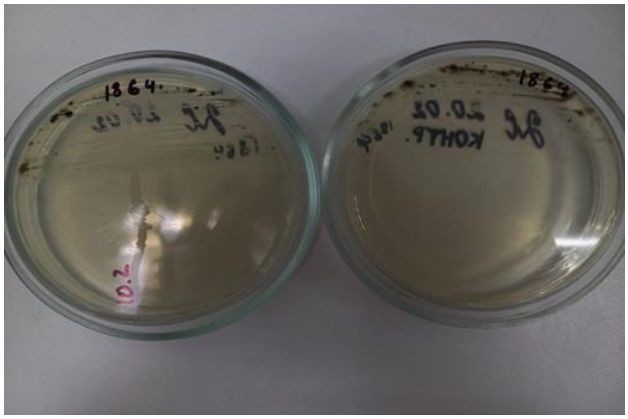


Figure 3. Perpendicular stroke seeding of the bacterium Bacillus subtilis in relation to Alternaria brassicicola

References

1. Irkitova, A.N., Yatsenko, E.S. (2017). Optimizatsiya metoda opredeleniya antagonisticheskoy aktivnosti probioticheskikh bakteriy [Optimization of the method for determining the antagonistic activity of probiotic bacteria] // *Tekhnologii pishchevoy i pererabatyvayushchey promyshlennosti APK-produkty zdorovogo pitaniya*. – Pp. 113-117. (in Russian)

2. Laptev, G. Yu., Dunyashev, T. P., Yildirim, E. A., Ilyina, L. A., Tyurina, D. G., Novikova, N.I., Melikidi, V.Kh. (2021). Biotekhnologicheskiy potentsial shtamma bacillus subtilis na osnove dannykh polnogenomnogo sekvenirovaniya [Biotekhnologicheskiy potentsial shtamma bacillus subtilis na osnove dannykh polnogenomnogo sekvenirovaniya]. – M.: AgroEkoInzheneriya. – Pp. 1-6. (in Russian)

3. Netrusov, A.I., Egorova, M.A., Zakharchuk, L.M. (2005). Praktikum po mikrobiologii [Microbiology practical]. – M.: Izdatel'skiy tsentr „Akademiya". – Pp. 75-81. (in Russian)

4. Popov, V.S., Samburov, N.V., Vorob'yeva, N.V. (2018). Problemy mikotoksikozov v sovremennykh usloviyakh i printsipy profilakticheskikh resheniy [Problems of mycotoxicoses in modem conditions and principles of preventive solutions] // *Monografiya*. – Kursk. – Pp. 101-105 (in Russian)

5. Serdyuk, O.A. (2011). Izuchenie skrytoy formy alternarioza semyan maslichnykh kul'tur semeystva kapustnykh [Study of the latent form of Alternaria alternaria of seeds of oilseed crops of the cabbage family] // *Nauchno-tekhnicheskiy byulleten' Vserossiyskogo nauchno-issledovatel'skogo instituta maslichnykh kul'tur.* – Pp. 146-147. (in Russian)

UDK 615.012:620.3

DIE ANWENDUNG VON NANOTECHNOLOGIEN BEI DER ENTWICKLUNG VON ARZNEIFORMEN: AKTUELLE TRENDS UND PERSPEKTIVEN

Grigoryewa Olesya Walentinowna,
Studentin des Instituts für Pharmazie, Chemie und Biologie,
Belgoroder Staatliche Nationale Forschungsuniversität, Belgorod, Russland,
E-mail: olesag908@gmail.com
Taranowa Elena Nikolayewna,
Kandidatin der philologischen Wissenschaften,
Professorin des Lehrstuhls für Fremdsprachen
und berufliche Kommunikation,
Belgoroder Staatliche Nationale Forschungsuniversität, Belgorod, Russland,
E-mail: taranova_e@bsuedu.ru

Annotation: *In diesem Artikel werden die aktuellen Trends und Perspektiven der Anwendung von Nanotechnologien in der Entwicklung von Arzneiformen untersucht. Es werden die wichtigsten*

Typen von Nanoträgersystemen, ihre Eigenschaften und die Vorteile für den Einsatz in der pharmazeutischen Industrie analysiert. Aktuelle Probleme bei der Einführung von Nanotechnologien in die Arzneimittelproduktion werden dargestellt und vielversprechende Entwicklungsrichtungen für dieses Gebiet bestimmt.

Schlagwörter: *die Nanotechnologien in der Pharmazie, die Nanoträgersysteme für Arzneimittel, die pharmazeutische Entwicklung, die zielgerichtete Arzneimittelabgabe, die innovativen Arzneiformen, pharmazeutische Industrie, moderne Pharmazie.*

In der modernen Welt steht die pharmazeutische Industrie an der Schwelle zu revolutionären Veränderungen, die mit der Einführung von Nanotechnologien in die Entwicklung und Produktion von Arzneiformen verbunden sind. Dieses Gebiet eröffnet beispiellose Möglichkeiten zur Schaffung wirksamerer und sichererer Medikamente, die gezielt auf pathologische Prozesse im Körper einwirken können.

Die Relevanz dieser Forschung wird durch die rasante Entwicklung des nanotechnologischen Sektors in der pharmazeutischen Industrie und den wachsenden Bedarf an innovativen Lösungen für die Behandlung verschiedener Krankheiten bestimmt. Der Einsatz von nanotechnologischen Verfahren ermöglicht es, traditionelle Einschränkungen bei der Wirkstoffverabreichung zu überwinden, die Bioverfügbarkeit zu erhöhen und Nebenwirkungen zu minimieren.

Die modernen Trends im Bereich der pharmazeutischen Nanotechnologien sind auf die Entwicklung intelligenter Wirkstoffträgersysteme ausgerichtet, die auf Veränderungen der inneren Umgebung des Körpers reagieren und den Wirkstoff unter bestimmten Bedingungen freisetzen können. Dies eröffnet neue Perspektiven in der Behandlung von onkologischen, kardiovaskulären und neurodegenerativen Erkrankungen.

In den letzten Jahren haben nanotechnologische Entwicklungen in der pharmazeutischen Industrie einen rasanten Fortschritt gezeigt und neue Horizonte für die Schaffung innovativer Arzneiformen eröffnet. Die modernen Errungenschaften im Bereich der Nanotechnologien ermöglichen es eine deutliche Steigerung der Wirksamkeit von Arzneimitteln und die Reduzierung ihrer Nebenwirkungen. Aktiv entwickeln sich die Technologien zur Herstellung von Nanoträgern, die eine gezielte Wirkstofffreisetzung gewährleisten können [Kitaew, 2024].

Besonderes Augenmerk gilt der Entwicklung von Systemen für den gezielten Transport von Arzneistoffen, die verschiedene Arten von Nanopartikeln verwenden. Der Einsatz nanotechnologischer Ansätze macht es möglich, zentrale Probleme der modernen Pharmazie zu lösen, wie etwa die geringe Bioverfügbarkeit von Arzneimitteln und deren unzureichende Selektivität der Wirkung. Die zahlreichen Studien zeigen, dass der Einsatz von Nanoträgern die therapeutische Wirksamkeit von Medikamenten um das Zwei- bis Dreifache steigern kann [Koschewenko, 2024].

Erhebliche Fortschritte wurden im Bereich der Entwicklung "intelligenter" Arzneistofftransportsysteme erzielt, die auf Veränderungen physiologischer Parameter im Körper reagieren und den Wirkstoff unter genau bestimmten Bedingungen freisetzen können. Moderne nanotechnologische Plattformen ermöglichen dabei die Schaffung multifunktionaler Systeme, die sowohl diagnostische als auch therapeutische Funktionen vereinen [Eschnasarowa, 2024].

Die Entwicklung der Nanotechnologie in der pharmazeutischen Industrie geht einher mit der Verbesserung der Methoden zur Charakterisierung und Standardisierung nanoskaliger Arzneiformen. Neue analytische Methoden und Ansätze zur Qualitätsbewertung von Nanopräparaten werden eingeführt, was zur Erhöhung ihrer Sicherheit und Wirksamkeit beiträgt. Gleichzeitig werden regulatorische Anforderungen für die Erforschung und Zulassung von Arzneimitteln, die unter Einsatz von Nanotechnologien entwickelt wurden, aktiv erarbeitet [Antonenkow, 2024].

Der aktuelle Stand der Entwicklung nanotechnologischer Ansätze ist auch durch den aktiven Einsatz von Methoden der Computermodellierung und künstlichen Intelligenz zur Optimierung der Entwicklung neuer Arzneiformen gekennzeichnet. Dies verursacht eine erhebliche Reduzierung des Zeit- und Ressourcenaufwands bei der Entwicklung effizienter nanoskaliger Arzneistofftransportsysteme.

In der modernen pharmazeutischen Entwicklung wird eine breite Palette von Nanoträgern verwendet, von denen jeder über einzigartige Eigenschaften und Merkmale verfügt. Polymere Nanopartikel stellen eine der vielversprechendsten Plattformen für den Arzneistofftransport dar, da sie eine kontrollierte Freisetzung ermöglichen und die aktiven Bestandteile vor vorzeitiger Zersetzung schützen [Eschnasarowa, 2024].

Liposomale Transportsysteme, die aus einer Phospholipid-Doppelschicht bestehen, zeigen eine hohe Biokompatibilität und die Fähigkeit, sowohl hydrophile als auch hydrophobe Arzneistoffe zu verkapseln. Dendrimere zeichnen sich wiederum durch ihre einzigartige baumartige Struktur aus, die eine präzise Kontrolle über Größe und Funktionalität des Nanoträgers ermöglicht [Kitajew, 2024].

Tabelle 1

Klassifizierung von Nanoträgern und ihre Eigenschaften

Typ des Nanoträgers	**Größenbereich (nm)**	**Hauptvorteile**	**Anwendungsbereich**
Polymer-Nanopartikel	10-200	Biologisch abbaubar, kontrollierte Freisetzung	Tumortherapie
Liposomen	50-400	Biokompatibilität, Vielseitigkeit	Kardiologie, Onkologie
Dendrimere	1-15	Monodispersität, Funktionalität	Zielgerichtete Wirkstofffreisetzung
Nanoemulsionen	20-200	Stabilität, hohe Bioverfügbarkeit	Ophthalmologie
Quantenpunkte	2-10	Fluoreszierende Eigenschaften	Diagnostik

Metallische Nanopartikel, einschließlich Gold- und Silberpartikeln, finden aufgrund ihrer einzigartigen optischen und physikalischen Eigenschaften die Anwendung in therapeutischen und diagnostischen Bereichen. Besonderes Interesse gilt hybriden Nanoträgern, die die Vorteile verschiedener Typen von Nanomaterialien kombinieren [Koschewenko, 2024].

Erhebliche Fortschritte wurden in der Entwicklung „intelligenter“ Nanoträger erzielt, die auf Veränderungen physiologischer Parameter wie pH-Wert, Temperatur

oder das Vorhandensein bestimmter Enzyme reagieren können. Dies eröffnet neue Möglichkeiten für die Entwicklung von zielgerichteten Wirkstoffträgersystemen mit kontrollierter Freisetzung [Antonenkow, 2024].

Der Einsatz von Nanotechnologien in der pharmazeutischen Entwicklung bietet eine breite Palette an Vorteilen, die den Ansatz zur Herstellung von Arzneiformen grundlegend verändern. Die Verwendung von Nanoträgern trägt zu einer signifikanten Erhöhung der Bioverfügbarkeit von Wirkstoffen, insbesondere mit geringer Wasserlöslichkeit. Durch die einzigartigen Eigenschaften von Nanomaterialien wird eine kontrollierte Freisetzung der aktiven Komponenten erreicht, was zur Aufrechterhaltung einer optimalen therapeutischen Wirkstoffkonzentration über einen längeren Zeitraum beiträgt [Kitaew, 2024].

Einer der wichtigsten Erfolge besteht in der Fähigkeit biologische Barrieren, einschließlich der Blut-Hirn-Schranke, zu überwinden, was neue Perspektiven für die Behandlung neurologischer Erkrankungen eröffnet. Nanotechnologische Plattformen schützen Wirkstoffe vor vorzeitiger Degradation im Körper, was ihre Stabilität und Wirksamkeit erheblich erhöht [Koschewenko, 2024].

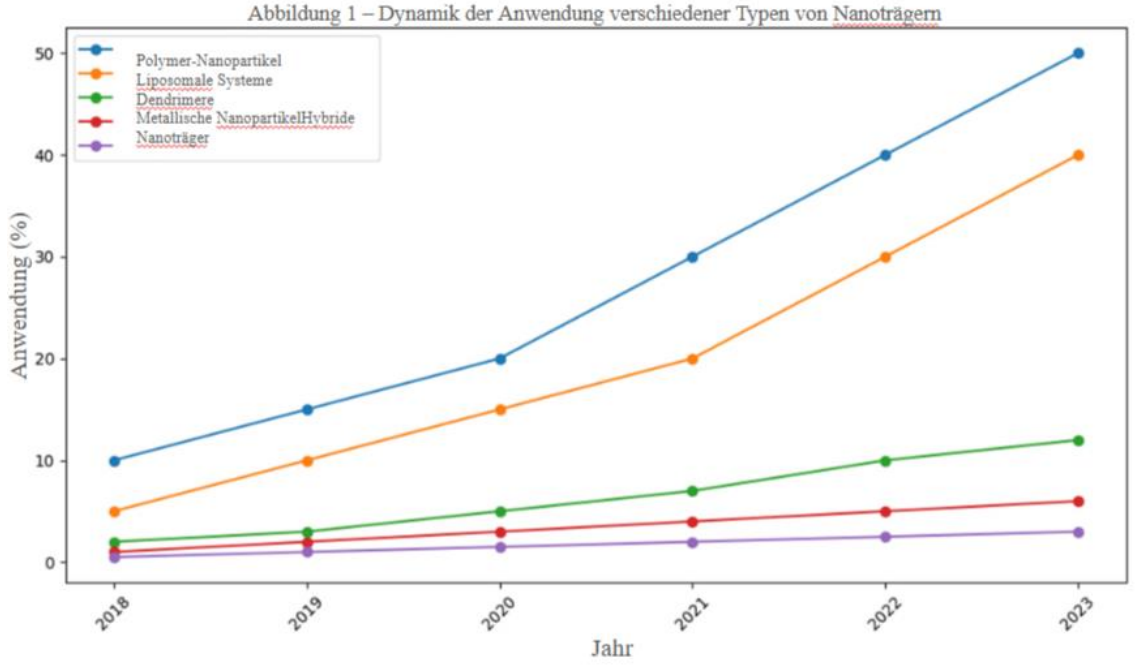


Abbildung 1. Dynamik des Wachstums des Einsatzes verschiedener Typen von Nanoträgersystemen

Die Analyse der vorgelegten Daten zeigt ein stetiges Wachstum des Einsatzes aller Typen von Nanoträgersystemen mit einer besonders auffälligen Zunahme der Verwendung von polymeren Nanopartikeln und liposomalen Systemen. Dies deutet auf eine zunehmende Anerkennung der Vorteile nanotechnologischer Ansätze in der pharmazeutischen Entwicklung hin [Eschnasarowa, 2024].

Ein bedeutender Vorteil ist die Möglichkeit multifunktionale Zustellsysteme zu schaffen, die therapeutische und diagnostische Funktionen in sich kombinieren. Solche Systeme ermöglichen es nicht nur, den Wirkstoff zum Ziel zu transportieren, sondern auch seine Verteilung im Körper zu überwachen, was neue Möglichkeiten für die personalisierte Medizin eröffnet [Antonenkow, 2024].

In der heutigen Entwicklung der Nanotechnologien in der pharmazeutischen Branche gibt es eine Reihe von bedeutenden Problemen, die einer systematischen Lösung bedürfen. Ein zentrales und wichtiges Problem bleibt die Schwierigkeit, die Produktion von nanogroßen Arzneiformen im großen Maßstab aufrechtzuerhalten, während ihre qualitativen Eigenschaften bewahrt bleiben. Besonderes Augenmerk gilt den Fragen der Standardisierung und Validierung von Methoden zur Qualitätskontrolle von Nanomedikamenten [Kitaew, 2024].

Tabelle 2

Hauptprobleme bei der Anwendung von Nanotechnologien und Lösungsansätze

Problem	**Charakteristik**	**Mögliche Lösungen**	**Erwartetes Ergebnis**
Skalierung der Produktion	Schwierigkeit, Parameter beizubehalten	Entwicklung neuer technologischer Plattformen	Verbesserung der Reproduzierbarkeit
Standardisierung	Fehlen einheitlicher Anforderungen	Harmonisierung der Normenbasis	Verbesserung der Qualitätskontrolle
Toxikologische Risiken	Mangel an Daten	Erweiterung präklinischer Studien	Erhöhung der Sicherheit

So sieht man vielversprechende Entwicklungsrichtungen die Schaffung von "intelligenten" Nanosystemen mit kontrollierter Freisetzung von Arzneistoffen und die Entwicklung personalisierter Präparate auf Basis von Nanotechnologien. Es werden aktiv Ansätze zur Nutzung von Künstlicher Intelligenz zur Optimierung des Designs von Nanoträgersystemen entwickelt [Eschnasarowa, 2024].

Ein wichtiger Aspekt der weiteren Entwicklung ist die Verbesserung der Methoden zur Bewertung der Sicherheit von nanoskaligen Arzneiformen, einschließlich der Untersuchung ihrer langfristigen Auswirkungen auf den Körper. Besonderes Augenmerk wird auf die Entwicklung umweltfreundlicher Technologien für die Herstellung von Nanomedikamenten und die Schaffung biologisch abbaubarer Nanoträgersysteme gelegt [Koschenenko, 2024].

Literaturliste

1. Antonenkow, W.S., Delvig-Kamenskaya, T.Y. (2024). PESTEL–analiz orfannogo segmenta rynka lekarstvennykh preparatov Rossiyskoy Federatsii [PESTEL-Analyse des Orphan-Segments des Arzneimittelmarktes der Russischen Föderation] // *Studencheskiy forum*. – N. 30. – S. 30–35. (in Russisch)

2. Eschnazarowa, G.P., Khamraewa, D.T., Norowa, G.U., Sattorowa, M.A. (2024). Osnovnye ponyatiya biotekhnologicheskogo polucheniya lekarstv [Grundlegende Konzepte der biotechnologischen Arzneimittelproduktion] // *Byulleten studentov novogo Uzbekistana*. – V. 2. – N. 2. – S. 11–15. (in Russisch)

3. Kitaew, F.F. (2024). Biotekhnologiya v razrabotke lekarstv: innovatsii i dostizheniya [Biotechnologie in der Arzneimittelentwicklung: Innovationen und Errungenschaften] // *Vestnik nauki*. – V. 3. – N. 2. – S. 647–650. (in Russisch)

4. Koschewenko, A.S., Romanow, B.K., Olefir, Y.V., Merkulow, W.A., Bunyatyan, N.D. (2024). Rol otdel'nykh institutov v realizatsii dostizheniya farmatsevticheskogo suvereniteta na primere Tsentra transfera meditsinskikh tekhnologiy FGBU „NCESMP“ Minzdrava Rossii [Die Rolle der einzelnen Institutionen bei der Verwirklichung der pharmazeutischen Souveränität am Beispiel des Zentrums für den Transfer medizinischer Technologien FGBU „NCESMP“ des

Gesundheitsministeriums Russlands] // *Vedomosti Natsional'nogo tsentra ekspertizy sredstv meditsinskogo primeneniya*. – V. 14. – N. 5. – S. 505–512. (in Russisch)

5. Wdowina, E.W., Semerozubowa, L.P. (2024). Primenenie innovatsionnykh tekhnologiy v sisteme obucheniya i vospitaniya studentov meditsinskogo kolledzha [Die Anwendung innovativer Technologien im System der Ausbildung und Erziehung von Medizinstudenten] // *Innovatsionnye tekhnologii v obrazovanii.* – №1. – Nabereshnye Tschelny. – S. 68–72. (in Russisch)

UDK 615.322.015.035(075.8)

DIE ROLLE VON PHYTOPRÄPARATEN BEI NIEREN- UND HARNSYSTEMERKRANKUNGEN

Schemelinina Ksenia Alexandrowna,
Studentin des Instituts für Pharmazie, Chemie und Biologie,
Belgoroder Staatliche Nationale Forschungsuniversität, Belgorod, Russland,
E-mail: kschemelinina@mail.ru
Taranowa Elena Nikolayewna,
Kandidatin der philologischen Wissenschaften,
Professorin des Lehrstuhls für Fremdsprachen
und berufliche Kommunikation,
Belgoroder Staatliche Nationale Forschungsuniversität, Belgorod, Russland,
E-mail: taranova_e@bsuedu.ru

Annotation: *In der modernen Welt sind Phytopräparate aufgrund der geringen Anzahl von Nebenwirkungen und einer Vielzahl von medizinischen Eigenschaften sehr nachgefragt. Pflanzliche Arzneimittel spielen eine wichtige Rolle bei der Behandlung verschiedener Pathologien. Darunter sind Herz- und Gefäßerkrankungen, verschiedene Störungen des Verdauungstraktes und Entzündungsprozesse in Organen und Systemen des menschlichen Körpers. Ihre Phyto-Komponenten werden auf antioxidative und immunstimulierende Eigenschaften untersucht. Das ist ein neuer Schritt in der Entwicklung der modernen Medizin.*

Schlagwörter: *die Phytopräparate, medizinische Eigenschaften der Phytopräparate, pflanzliche Arzneimittel, die Phytokomponenten, die Anwendung von Phytopräparaten in der Urologie, Diuretika des pflanzlichen Ursprungs.*

Phytopräparate sind Präparate, die aus pflanzlichen Rohstoffen hergestellt werden. In der Medizin werden sie bei der Behandlung vieler Krankheiten als vielversprechende Richtung angesehen. Biologisch aktive Pflanzenstoffe haben starke pharmakologische Eigenschaften. Die moderne Wissenschaft befasst sich mit der Klärung von Phytopräparaten und deren Standardisierung, ohne die es unmöglich ist, sie zu verwenden.

Die umfangreiche Anwendung von Phytopräparaten in der Urologie nimmt bei der komplexen Behandlung einen besonderen Platz ein. Mit Phytopräparaten kann man die Funktion des Harnsystems wiederherstellen, den Entzündungsprozess lindern und die Diurese verstärken. Sie können auch bei den chronischen Nierenerkrankungen als Vorbeugung eingesetzt werden [Nazionalnaya medizinskaya bibliotheka, 2008: 227-244].

Bei entzündlichen Nierenerkrankungen der Harnwege verschreiben die Therapeuten die Medikamente, die eine harntreibende Wirkung haben. Aber viele Medikamente haben ihre Nebenwirkungen, die mit einer Verschlimmerung der Störung

der tubulären Transportsysteme verbunden sind. Diuretika des pflanzlichen Ursprungs sind eine gute Alternative, da ihre Wirksamkeit klinisch erfolgreich nachgewiesen ist. Pflanzliche Präparate haben sich hervorragend zur Vorbeugung von Patienten mit Nierensteinbildung bewährt, da sie das Gleichgewicht zwischen Kolloiden und salzbildenden Strukturen im Urin normalisieren [Wrachebnoe soslovie, 2004: 4-9].

Die Phytokomponente sind antiviral. Darunter sind Rhizom von Kalmus, Birken-, Kiefer-, Kiefer-, junge Tannen-, Ringelblumen-, Himbeer-, Wacholder-, Melissen-, Thymian-, Salbei-, Eukalyptus-, Knoblauch. Sie sind antibakteriell, zum Beispiel, Osot im Garten, Rhizom von Kalmus, Alant, Labaznik, Birkenknospen, Johanniskraut, Tausendsassa, Melisse, Zitronenmelisse, Thymian, Erdbeerblätter, Blüten der Blumen, Salbeiblätter, Eukalyptus, Knoblauch, Kamille). Diese Phytokomponente erhöhen die Wirksamkeit der Behandlung von Infektionen der Harnwege. In der modernen Welt gibt es keine Medikamente, um die Nierensteine aufzulösen, aber einige pflanzliche Präparate besitzen diese Eigenschaft.

Tabelle 1

Bestandteile der pathogenetischen Wirkung von Phytopräparaten bei Erkrankungen der Nieren und der Harnwege

Krankheit	**Richtung der Kräutermedizin**	**Arten der Wirkung von medizinischen pflanzlichen Rohstoffen**
Pyelonephritis	Aktivierung der Diurese	die Birkenknospen, die Birkenblätter, die Preiselbeerblätter, die Kornblumenblüten, das Johanniskraut, der Wacholder, die Saudistel
Nephrolithiasis	Vermeidung von Salzabfällen	Kolloidale Wiederherstellung die Strukturen des Urins: das Brennnesselkraut, das Honigtaugras, das Schachtelhalmgras, die Klettenwurzeln, die Saudistel
Nierenschäden bei arterieller Hypertonie	Senkung des Blutdrucks durch Gefäßerweiterung Senkung des Blutdrucks durch Verringerung der Herzfrequenz und der Herzfrequenz Senkung des Blutdrucks durch erhöhte Diurese	der Kalmuswurzelstock, die Früchte der Eberesche, das Gras von stinkendem Basilikum, das Helmgras, das Gras von Astragalus Wolligblüten die Arnikablüten, das Mistelgras, das Ledumgras die Birkenknospen, die Birkenblätter, das Kraut von Nierentee, die Bärentraubenblätter

Die komplexe Anwendung von Arzneimitteln und Phytopräparaten hat sich bei der Behandlung von Infektionen der Nieren und der Harnwege wie Urethritis, Pyelonephritis, Blasenentzündung und bakterieller Prostatitis effektiv erwiesen. Gleichzeitig reduziert sich eine große Anzahl von Phytopräparaten die Nebenwirkung von Medikamenten und erhöht sich die therapeutische Wirkung [Rukowodstwo po urologii, 1998].

Tabelle 2

Möglichkeiten der kombinierten Anwendung von Pharmako- und Kräutermedizin für die Verbesserung der Wirksamkeit und Sicherheit der Behandlung von Nieren- und Harnwegserkrankungen

Arzneimittelgruppe	**Arten von medizinisch-pflanzlichen Rohstoffen**	**Ergebnisse der gemeinsamen Anwendung**
Antibiotika und antimykotische Medikamente	der Kalmuswurzelstock, die Birkenknospen, die Kiefernknospen, die Ringelblumenblüten, die Lavendelblüten, die Himbeerfrüchte, das Eukalyptusblätter	Stärkung der antimikrobiellen Eigenschaften von Antibiotika, Prävention von Dysbiose, Superinfektionen
Kalziumantagonist	die Birkenknospen, die Birkenblätter, das Johanniskraut die Cranberryfrüchte, die Saudistel	erhöhte blutdrucksenkende Wirkung
Nephrotoxische Präparate	die Birkenknospen, die Birkenblätter die Kornblumenblüten, der Maisnarben, die Saudistel	Vorbeugung und Beseitigung von Nierenerkrankungen
Beta-Adrenoblocker	der Zitronengras, die Minzblätter, die Erdbeerblätter, die Erdbeerfrüchte, die Cranberryfrüchte, die Kümmelfrüchte, die Fenchelfrüchte	erhöhte blutdrucksenkende Wirkung
Saluretika	die Birkenknospen, die Birkenblätter, der Zitronengras, das Petersiliegras, das Selleriegras, die Dillfrüchte, die Saudistel	erhöhte diuretische Aktivität, die Möglichkeit, die Diuretikumdosis zu reduzieren
Analgetika	die Baldrianwurzel, die Pfingstrosenwurzel, die Herzgespannwurzel, die Minzblätter	Verbesserung der Wirksamkeit von Analgetika, die Möglichkeit, kleinere Dosen zu verwenden, Vorbeugung von Komplikationen

Viele pflanzliche Präparate beeinflussen gleichzeitig die Pathogenese von Pyelonephritis und Urolithiasis, einschließlich ihrer Exazerbationen und Rückfälle. Aufgrund der Mehrkomponentenzusammensetzung und des Wirkmechanismus erhöhen sie die metabolischen Indikatoren für die Ableitung von kleinen Steinen und Salzen im Urin. Gegenwärtig werden die Formen der Freisetzung von Phytopräparaten, die in der Urologie verwendet werden, immer größer und vielfältiger.

Auf der Grundlage der Pathogenetik wurde die Wirksamkeit von Phytopräparaten nachgewiesen. Einige von ihnen haben mehrere Komponenten, die eine therapeutische Wirkung haben.

Die Phytopräparation, die bei der Behandlung von Erkrankungen des infektiösen und entzündlichen Harnsystems weit verbreitet ist, ist eine Aufmerksamkeit wert. Das sind die Prolit Super-Septo-Kapseln. Es hat sich gut bei der komplexen Behandlung von Pyelonephritis, Urolithiasis, Blasenentzündung und Urethritis gezeigt. Die Wirkung des Abscheidens des Konkrements ist bewiesen, unabhängig von seiner Lokalisation im Harnsystem.

Tabelle 3

Charakterisierung der pathogenetischen Wirkung von pflanzlichen Arzneimitteln, die zur Vorbeugung und Behandlung von Erkrankungen des Harnsystems eingesetzt werden

pathogenetische Komponente des Effekts	**Arzneipflanzen**
antiallergische Wirkung	zweihäusig Brennnessel, die große Klette, der große Wegerich, das Süßholz, der Schachtelhalm, gemeiner Hopfen
entzündungshemmende Wirkung	die Gartensalbei, gemeiner Hopfen, die Schafgarbe die Weißtanne, die Pfefferminze, die Ringelrose, echte Kamille), zweihäusige Brennnessel, der Nierentee
Nephroprotektive Wirkung	die schwarze Johannisbeere, die Erdbeere, die Heidelbeere, die Himbeere, zweihäusige Brennnessel, die Primel, die Baummelone
Harntreibende Wirkung	die Birke, die Kornblume, das Hartheu, der Wacholder, der Nierentee, wilde Möhre, die Erdbeere, die Bärentraube
Antibakterielle und antimikrobielle Wirkung	die Birke, die Preiselbeere, der Wacholder, die Bärentraube die Weißtanne, das Hartheu, die Pfefferminze, die Moosbeere, gemeiner Hopfen, die Linde, die Saudistel die Baummelone, der große Wegerich, echter Kalmus
Immunmodulierende Wirkung	zweihäusige Brennnessel, die Melisse, das Veilchen, die Birke, die große Klette, die Schafgarbe, die Baummelone
Antioxidative Wirkung	die Birke, die Ringelrose, zweihäusige Brennnessel, die Linde, die Melisse, der Nierentee, die Hauhechel, das Veilchen

Dieses Präparat hat eine harntreibende Eigenschaft und wirkt sich positiv auf die Stoffwechselparameter aus. Es hilft bei längerer Anwendung, die Ausscheidung von Kalzium durch die Nieren zu reduzieren. Aus diesem Grund wird es in Calcium–Oxalat– und Calcium-Phosphat-Nephrolithiasis-Schemata verwendet. Die Prolit Super-Septo-Kapseln haben eine antibakterielle Wirkung und werden bei fast allen infektiösen und entzündlichen Erkrankungen des Harnsystems angewendet [Urologiya, 2004: 38-44].

Fazit: Die Phytopräparate in der modernen Medizin sind eine wertvolle Ergänzung zur Grundbehandlung von Erkrankungen des Harnsystems. Aufgrund der natürlichen Zusammensetzung und des Fehlens von Nebenwirkungen in therapeutischen Dosen ist die wichtige Rolle ihrer Anwendung bereits bewiesen. Die Verwendung von Phytopräparaten sollte streng mit dem behandelnden Arzt abgestimmt sein, da die kombinierte Anwendung mit einigen Medikamenten eine unerwünschte Wirkung haben kann. Die unabhängige Verwendung von Phytopräparaten ist inakzeptabel. Für jeden Patienten wird ein individueller Ansatz bei der Behandlung ausgewählt, der nur von einem qualifizierten Spezialisten bestimmt werden kann. Eine weitere Untersuchung von Phytopräparaten ist notwendig, wenn neue Wirkmechanismen für ein breiteres Spektrum von Krankheiten untersucht werden.

Literaturliste

1. Alyew, Y.G., Rapoport, L.M., Rudenko, W.I. (2004). Mochekamennaya bolezn. Aktualnie woprosy diagnostiki i lecheniy [Urolithiasis. Aktuelle Fragen der Diagnostik und Behandlung] // *Wrachebnoe soslovie*. – №4. – S. 4-9. (in Russisch)

2. Borisow, W.W., Koptew, W.W., Enaleewa, S.K. (2004). Prolit w lechenii i profilaktike nefrolitiaza [Prolit in der Behandlung und Prävention von Nephrolithiasis] // *Urologiya*. – № 2. – S. 38-44. (in Russisch)

3. Hed, K.A. (2008). Estestwennye podhody k profilaktike i lecheniy infekziy nizhnih mochewiwodayschix putey [Natürliche Ansätze zur Vorbeugung und Behandlung von Infektionen der unteren Harnwege] // *PubMed*. – №13. – S. 227-244. (in Russisch)

4. Lopatkin, N.A. (1998). Rukowodstwo po urologii [Die Leitfaden für die Urologie]. – M.: GEOTAR-Media. – S. 398-466. (in Russisch)

UDK 591.11:612.11:636.5

EXAMINATION OF HEMATOLOGICAL PARAMETERS OF COTURNIX JAPONICA

Popova Anastasia Borisovna,
Student of the Institute of Pharmacy, Chemistry and Biology,
Belgorod State National Research University, Belgorod, Russia,
E-mail: 1641318@bsuedu.ru
Semenova Sophia Valerievna,
Student of the Institute of Pharmacy, Chemistry and Biology,
Belgorod State National Research University, Belgorod, Russia,
E-mail: 1555141@bsuedu.ru
Gusakova Natalya Leonidovna,
Ph.D. in Psychology,
Associate Professor of the Department of Foreign Languages and Professional Communication,
Belgorod State National Research University, Belgorod, Russia,
E-mail: gusakova_n@bsuedu.ru

Abstract: *The article presents research materials by various authors on the morphological composition and biochemical parameters of the blood of Japanese quails. Hematological blood analysis includes determination of the concentration of hemoglobin, erythrocytes, leukocytes, platelets, calculation of the leukocyte formula, calculation of the color index, determination of the erythrocyte sedimentation rate. Some of the indicators are described in the age aspect. The study of this issue has a number of perspectives.*

Keywords: *Japanese quail, blood, leukocytes, erythrocytes, biochemical parameters of blood.*

Currently, quail farming is widespread both in our country and abroad. Quail farming has a number of advantages, as this bird grows and develops almost five times more intensively than other types of poultry. Quails begin to lay eggs at five to six weeks. Moreover, quail eggs are three to four times richer than chicken eggs in the content of a number of vitamins, including B1 and B2, ions, and amino acids [Guschin, 2003].

The ***purpose of this work*** is to analyze and summarize scientific data on hematological blood parameters (morphological composition and biochemical parameters) of the Japanese quail (*Coturnix japonica*).

In the process of completing the work, the following tasks were set:

1. Study of information sources on the blood composition of the Japanese quail;
2. Conducting a comparative analysis;
3. Generalization of scientific data on hematological parameters.

The object of the study is the Japanese quail (*Coturnix japonica*), ***the subject of the study*** is the blood of the Japanese quail.

Blood testing is one of the normative and informative diagnostic procedures in practical poultry farming. Due to the fact that blood is a connecting link between organs and their systems, as well as the body with the external environment and performs a transport function, its indicators can be used to assess the physiological state and health of birds: the state of metabolism and body systems, the immune system, the presence of latent infections, and preclinical and early clinical stages of the disease. An important property of blood is its rapid response to extreme internal and external influences by changing its morphological and biochemical composition.

Hematological blood test is a complete analysis, including determination of the concentration of hemoglobin, erythrocytes, leukocytes, platelets, calculation of the leukocyte formula, calculation of the color index, determination of the erythrocyte sedimentation rate. These indicators have a fixed range of values in healthy individuals, whereas they vary in many diseases [Okolelova, 2023; Savchuk, 2018].

The shaped elements of blood are standard, but the morphological composition of white blood cells and the parameters of red blood cells have a number of features. Erythrocytes are the most numerous blood cells, the duration of their life cycle is 25–45 days. Synthesis occurs in the yolk sac and bone marrow. The shape of the erythrocyte is oblong-oval, biconvex disc, and the nucleus is elongated. The dimensions are 11–12 x 6–8 micrometrs [Okolelova, 2023; Savchuk, 2018].

Other shaped elements of the blood are leukocytes, which are involved in non-specific immunity. The proportion of white blood cells in the blood depends on various factors: infectious diseases or blood diseases and other processes accompanied by inflammation.

The leukocytes of birds, and quails in particular, are represented by eosinophils, basophils, pseudoeosinophils related to granulocytes, and lymphocytes and monocytes, which are agranulocytes. The leukocyte profile is formed by the fourth week.

Eosinophils are large (9 – 12 micrometrs) rounded cells. Their core is segmented, consisting of two large segments, between which there is a narrow bridge. The cytoplasm is pale blue in color and contains red spherical granules located in all areas of the cell's internal environment. The granules give the cell a crimson color. The proportion of eosinophils in the blood of birds is 3 – 4%. As the Japanese quail grows and develops, the percentage of cells remains unchanged, but the number of cells increases [Turitsyna, 2014; Savchuk, 2018].

Basophils are relatively large (8–11,5 micrometrs) round cells, the smallest (1–4,5%) and the largest. They contain a rounded-oval, rod-shaped, or segmented core. Cherry-purple rounded granules of various sizes are located in their protoplasm. When studying age dynamics, the number and proportion of basophils is increasing [Turitsyna, 2014].

Pseudoeosinophils are rounded, relatively large (7–13 micrometrs) cells, usually with a segmented nucleus. The cytoplasm of pseudoeosinophils is almost colorless, filled with granules of various sizes, shapes and colors. When considering the age-related dynamics of blood parameters, the proportion of pseudoeosinophils decreases. When making blood smears, they are often destroyed [Turitsyna, 2014].

Lymphocytes are the most numerous white blood cells (> 50%); rounded cells, but pseudopodia can also be observed, with a large rounded or slightly bean-shaped nucleus of red-purple color. The cytoplasm is blue or blue in the form of a narrow rim around the nucleus. Based on the variety of sizes of lymphocytes, three types of lymphocytes are distinguished: large (d = 11–18 micrometrs), medium (6–9 micrometrs) and small (4 – 8 micrometrs). Moreover, small and medium-sized forms predominate in the lymphocyte population, but with age the proportion of large forms increases, small forms decrease, but the predominance of medium forms [Turitsyna, 2014; Savchuk, 2018].

Monocytes are the largest white blood cells (10–20 micrometrs) with a large oval, kidney- or horseshoe-shaped nucleus. They are stained basophilically. Quails have about 4 – 10% of them. They are synthesized mainly in the spleen and liver [Turitsyna, 2014; Savchuk, 2018].

It is also worth mentioning about platelets, which in quails are slightly smaller than red blood cells (5,5 x 5,5 – 4,6 x 12,9 micrometrs) and the shape of an irregular ellipse. They are formed in the bone marrow. The nucleus is rounded-oval in shape and is located more often in the middle of the cell. Platelets are involved in blood clotting processes [Okolelova, 2023; Savchuk, 2018].

Important biochemical blood parameters include hematocrit, which shows the volume ratio of red blood cells to blood plasma. The characteristic range for adult birds ranges from 37 – 50%, but younger birds have lower values. The hemoglobin content in red blood cells in relation to the norm expresses a color indicator [Okolelova, 2023].

The rate of erythrocyte sedimentation (ESR) increases in pathology, since under normal conditions erythrocytes with a negative electric charge, repelling each other, are suspended in plasma and settle relatively slowly. In pathology, some of the negative ions are neutralized, which leads to the adhesion of red blood cells to each other and the settling of the formed aggregates [Okolelova, 2023]. Adult quails have a hemoglobin content of 128–157 g /l. The concentration of hemoglobin in red blood cells determines the oxygen capacity of the blood.

The level of proteins in the blood is to a certain extent an indicator of the level of protein metabolism in the body of a bird. The total protein content in the blood serum increases during growth, reaching a maximum by the beginning of egg production [Lisunova, 2005].

Uric acid is the main product of the metabolism of nitrogenous compounds in birds, the synthesis of which occurs in the liver. Its content in the blood increases with delayed excretion by the kidneys [Lisunova, 2005].

After reviewing the studies of hematological parameters, we come to the conclusion that studies of both morphological and cytometric parameters of blood cells and biochemical parameters of Japanese quail blood have been conducted and are being conducted, and consideration of this issue in an intact state, as well as under the influence of various factors (feeding, infections, the use of medications).

This topic has a number of prospects for studying the influence of previously unexplored factors, conducting comprehensive studies of hematological parameters of the blood of Japanese quails to increase the efficiency of quail farming and reduce the risks of this type of poultry farming, namely in order to prevent the development of a

large number of diseases or detect them at the initial stage and maintain the stability of the considered indicators, and other indicators of homeostasis.

References

1. Gushchin, V. V., Croic, L. (2003) Perepelovodstvo doljno razvivatsa [Quail farming should develop] // *Ptitcevodstvo*. – № 6. – Sergiev Posad: OOO „Avian". – Pp. 22–23. (in Russian)

2. Lisunova, L. I. et al. (2005) Sravnenie bioximicheskih pocazatelei crovi vozrastnih grup perepelov [Comparison of biochemical blood parameters of quail age groups] // *Izvestiya Orenburgskogo gosudarstvennogo agrarnogo universiteta*. – № 4(8). – Orenburg: Orenburgskij gosudarstvennyj agrarnyj universitet. – Pp. 114 – 115. (in Russian)

3. Okolelova, T. M., Engashev, S. V., Egorov, I. A., Egorova, T. A. (2023) Otcenka fiziologichescogo sostoyania ptitci po pocazateliam crovi [Assessment of the physiological state of the bird by blood parameters] // *Ptitsevodstvo*. – № 1. – Sergiev Posad: OOO „Avian". – Pp. 22 – 23. (in Russian)

4. Savchuk, S. V., Sergeyenkova, N. A. (2018) K voprosu o sostave crovi yaponskih perepelov [To the question of composition of blood of the Japanese quails] // *Vestnik Tuvinskogo gosudarstvennogo universiteta*. – №2. – Kyzyl: Tuvinskij gosudarstvennyj universitet. – Pp.45–49. (in Russian)

5. Turitsyna, E. G., Klimova, E. A. (2014) Morfologichescaya i citometrichescaya haracteristica leicocitov crovi perepelov v vozrastnom aspecte [The morphological and cytometric characteristic of the quail blood leukocytes in the age aspect] // *Vestnik Krasnoyarskogo gosudarstvennogo agrarnogo universiteta.* – № 9. – Krasnoyarsk: Krasnoyarskij gosudarstvennyj agrarnyj universitet. – Pp. 157 – 160. (in Russian)

UDK 539.199, 539.2, 577.32, 577.29

POLYSACCHARIDE ALS EINE WERTVOLLE KLASSE NATÜRLICHER VERBINDUNGEN IN DER MEDIZIN

Tregubowa Marina Wladimirowna,
Studentin des Instituts für Pharmazie, Chemie und Biologie,
Belgoroder Staatliche Nationale Forschungsuniversität, Belgorod, Russland,
E-mail: tregubova.m2024@mail.ru
Taranowa Elena Nikolayewna,
Kandidatin der philologischen Wissenschaften,
Professorin des Lehrstuhls für Fremdsprachen
und berufliche Kommunikation,
Belgoroder Staatliche Nationale Forschungsuniversität, Belgorod, Russland,
E-mail: taranova_e@bsuedu.ru

Annotation: *Polysaccharide sind die wichtigsten Klassen bioorganischer Verbindungen, die praktische Anwendungen in verschiedenen Bereichen der Wissenschaft und Technik finden. Die Untersuchung dieser Klasse von Verbindungen ermöglicht es nicht nur, das Verständnis ihrer biologischen Funktionen zu vertiefen, sondern auch die Möglichkeiten ihrer praktischen Anwendungen in verschiedenen Branchen zu erweitern, wodurch die Entwicklung neuer Technologien und die Verbesserung der Lebensqualität gefördert werden.*

Schlagwörter: *die Polysaccharide, die Monosaccharide, die Homopolysaccharide, die Heteropolysaccharide, praktische Anwendungen von Polysacchariden.*

Am Anfang des Artikels ist es für uns wichtig, die Definition der Polysaccharide zu geben, die in dieser wissenschaftlichen Arbeit fadenleitend wird. Laut der Definition

aus der Sowjetischen Enzyklopädie sind Polysaccharide „hochmalmolekulare Verbindungen aus der Klasse der Kohlenhydrate; sie bestehen aus Rückständen von Monosacchariden, die durch glykosidische Bindungen verbunden sind“ [Sowetskaya enziklopedia, 1969-1978].

Es ist bekannt, dass die Polysaccharide sehr wesentliche Rolle im Stoffwechsel der Pflanzen und Tieren spielen. Sie sind wichtig für die Ernährung des Menschen und werden in vielen Bereichen der Volkswirtschaft, einschließlich der Pharmazie weit verbreitet [Muravjowa, Samylina, Jakowlew, 2002: 100].

Die Polysaccharide bestehen aus vielen Monosacchariden und deren Derivaten. Den Forschungen zufolge wurden in der Zusammensetzung von Polysacchariden über 20 verschiedene Arten von Monosacchariden nachgewiesen. Die am häufigsten vorkommende Monosaccharide lassen sich wie folgt klassifizieren:

– *die Polysaccharide aus Hexosen*: D-Glucose, D-Galactose, L-Fructose, D-Mannose;

– *die Polysaccharide aus Pentosen*: D-Xylose, L-Arabinose;

– *die Polysaccharide aus Desoxyzuckern:* L-Rhamnose, D-Fucose;

– *die Polysaccharide aus Reduktionsprodukten von D-Mannose:* Mannitol;

– *die Polysaccharide aus Oxidationsprodukten von Monosacchariden*: D-Glucuronsäure, D-Mannuronsäure, D-Galacturonsäure, D-Guluronsäure [Zhokhowa, et all, 2012: 53].

Polysaccharide werden nach ihrem Aufbau in Homo- und Heteropolysaccharide unterteilt. Die Homopolysaccharide sind Polymere, die aus Monosaccharideinheiten desselben Typs bestehen (z.B. Stärke, Cellulose). Die Heteropolysaccharide setzen sich hingegen aus verschiedenen Monosaccharidresten und deren Derivaten zusammen (z.B. Inulin, Hemicellulosen, Pektin, Schleime, Gummen) [Mirowitsch, Priwalowa, 2018: 5].

Zusätzlich können die Polysaccharide nach ihrer funktionalen Bestimmung (Reservestoffe, Strukturstoffe, Schutzstoffe), Herkunft (Phytopolysaccharide, Zoopolysaccharide, Polysaccharide von Mikroorganismen), Säuregehalt (neutrale und saure) und Art der Struktur der Hauptkette (lineare und verzweigte) klassifiziert werden [Zhokhowa, Goncharow, Powydysh, Derenchuk, 2012: 53].

Das Stärkemehl ist das wichtigste Reservekohlenhydrat in Pflanzen. Die Polysaccharide des Stärkemehls setzen sich aus Amylose (17-24 %) und Amylopektin (76-83 %) zusammen. Das Stärkemehl findet seine breite Anwendung in der Medizin. Es wird in verschiedenen Pudern und Salben verwendet. Als Schleimmittel wird das Stärkemehl oral und in Form von Abkochungen für Einläufe verabreicht. Außerdem wird es zur Herstellung von Tabletten eingesetzt. [Muravjowa, Samylina, Jakowlew, 2002: 101-102].

Das Stärkemehl unterliegt sowohl enzymatischer als auch saurer Hydrolyse. Bei schwacher Säureeinwirkung entsteht das sogenannte lösliche Stärkemehl, die häufig in der Laborpraxis für jodometrische Bestimmungen verwendet wird. Als Zwischenprodukte bei der Stärkemehlhydrolyse entstehen die Polysaccharide unterschiedlicher Molekulargewichte – sogenannte Dextrine. Mit der Bildung von Dextrinen werden nach und nach die Aldehydgruppen freigesetzt und eine reduzierende Fähigkeit entwickelt, die beim Stärkemehl fehlt [Kadagidse, Tschertkowa, Slawina, 2009: 270].

Schleimhaltige Pflanzen stellen eine einzigartige Gruppe der Flora dar, die zahlreiche wertvolle Eigenschaften besitzt. Die von diesen Pflanzen produzierten Schleimstoffe bestehen aus Polysacchariden, die den Schutz, die Befeuchtung und die Ernährung lebenswichtiger Gewebe gewährleisten. Diese pflanzlichen Schleime finden ihre Anwendung in der Medizin, der Lebensmittelindustrie sowie in der Kosmetik.

Eine der bekanntesten schleimhaltigen Pflanzen ist die Eibischwurzel (Althaea officinalis). Die Eibischwurzel ist reich an Schleimstoffen, die eine lindernde und entzündungshemmende Wirkung besitzen. Der Tee aus Eibischwurzel wird häufig zur Behandlung von Erkrankungen der oberen Atemwege eingesetzt, da er gereizte Schleimhäute beruhigt.

Auch die Blätter des Breitwegerichs (Plantago major) enthalten die Schleimstoffe, die eine beruhigende und wundheilende Wirkung auf Haut und Schleimhäute haben. Die Abkochungen und Aufgüsse aus Breitwegerich werden häufig zur Behandlung von Wunden, Verbrennungen und anderen Hautverletzungen eingesetzt, da sie den Heilungsprozess beschleunigen und Entzündungen reduzieren können.

Eine weitere wertvolle schleimstoffreiche Pflanze ist die Leinsamen (Linum usitatissimum). Die Leinsamen setzen beim Kontakt mit Wasser Schleim frei und bilden eine gelartige Masse. Diese Eigenschaft macht sie zu einem beliebten Mittel zur Verbesserung der Verdauung und Verhinderung von Verstopfung, sowie zu einer guten Zutat in Diäten zur Gewichtsreduktion. Zusätzlich enthält das Leinsamenöl die Omega-3-Fettsäuren, die für die normale Körperfunktion unerlässlich sind [Sujewa, Lopatina, Rasina, Gurjew, 2010: 10].

Zu den Pflanzen, die Gummi enthalten, gehört der behaarte Astragalus. Der behaarte Astragalus enthält Gummi (Tragacanth), das aus natürlichen Rissen und Schnitten im Stamm gewonnen wird. Der Gummi besteht aus 60% Bassorin und 3-10% Arabin, die zu den Polysacchariden gehören. Außerdem sind das Stärkemehl, Zucker, schleimige Substanzen, Farbstoffe und organische Säuren in diesen Pflanzen enthalten.

Die pharmakologische Untersuchung des Astragalus wurde erstmals von E.W. Popova durchgeführt. Diese Forschungsuntersuchung zeigte, dass der Aufguss der Pflanze sedative und blutdrucksenkende Eigenschaften hat. Darüber hinaus erweitert der Astragalus die koronaren Gefäße und die Nierengefäße und erhöht die Diurese [Zephirow, Kulow, 1994: 65].

Die Anwendung des behaarten Astragalus ist am effektivsten bei der Herzinsuffizienz I – II Grades und bei der Behandlung der akuten Nephritis. Außerdem wird er bei der Hypertonie und der chronischen Herz-Kreislauf-Insuffizienz eingesetzt.

Fazit: Polysaccharide als wertvolle Klasse von natürlichen Verbindungen nehmen einen wichtigen Platz in der Phytochemie ein. In der durchgeführten Untersuchung wurde festgestellt, dass die Polysaccharide nicht nur zentrale biologische Funktionen wie Energiespeicherung und strukturelle Unterstützung von Zellen erfüllen, sondern auch erhebliches Potenzial für die Anwendung als therapeutische Wirkstoffe und funktionelle Zusatzstoffe besitzen. Sie helfen aktuelle Probleme der modernen Welt wissenschaftlich zu lösen, einschließlich gesunder Ernährung, Wiederherstellung von Ökosystemen und Behandlung verschiedener Krankheiten.

In den zukünftigen Forschungen sollte das Verständnis ihrer Eigenschaften und Wirkmechanismen vertieft sowie die Möglichkeiten für die großtechnische Produktion und Anwendung von Polysacchariden in verschiedenen Industrien untersucht werden. Dies wird ermöglichen, ihr Potenzial für das Wohl der Gesellschaft und der Natur maximal zu nutzen.

Literaturliste

1. Kadagidze, Z.G., Chertkowa, A.I., Slawina, E.G. (2009). Regulyatornye T-kletki i ikh rol v protivopukholevom immunnom otvete [Die regulatorischen T-Zellen und ihre Rolle in der antitumoralen Immunantwort] // *Zlokachestvennye opukholi [Die bösartigen Tumoren]*. – N. 3. – M. – S. 269-277. (in Russisch)

2. Mirowich, W.M., Priwalowa, E.G. (2018). Lekarsvennye rasteniya i fitopreparaty, primenyayemye pri zabolevaniyakh organov dykhaniya [Die Arzneipflanzen und phytotherapeutischen Präparate, die bei Erkrankungen der Atemorgane angewendet werden]. – Irkutsk, FGBOU VO IGMU Minzdrava Rossii. – S. 3-47. (in Russisch)

3. Muravjowa D.A., Samylina, I.A., Jakowlew, G.P. (2002). Farmakognosiya. [Die Pharmakognosie]. – M.: Medicina. – S. 100-104. (in Russisch)

4. Zefirow, N.S., Kulow, N.N. (1995). Khimicheskaya entsiklopediya [Die chemische Enzyklopädie]. – M.: Nauchnoe izdatelstvo „Bolshaya Rossiyskaya entsiklopediya“. – S. 641. (in Russisch)

5. Zhokhowa, E.V., Goncharow, M.J., Powydysh, M. N., Derenchuk, S.W. (2012). Farmakognosiya [Die Pharmakognosie]. – M.: Izdatelskaya gruppa „GEOTAR-Media“. – S. 53-55. (in Russisch)

UDK 547.97

COLORANTS NATURELS DANS L'INDUSTRIE ALIMENTAIRE: PARTICULARITÉS DE LA COMPOSITION, DE LA STABILITÉ ET DE L'APPLICATION

Podaneva Alina Evgenyevna,
Etudiante de l'institut de pharmacie, de chimie et de biologie,
Université nationale d'Etat de recherche de Belgorod,
Belgorod, la Russie,
E-mail: 1641257@bsuedu.ru
Koupina Natalya Ivanovna,
Docteur ès lettres,
Professeur associé, Département des langues étrangères
et de la communication professionnelle,
Universite nationale d'Etat de recherche de Belgorod,
Belgorod, la Russie,
E-mail: nkupina@bsuedu.ru

Abstrait: *Cet article analyse les colorants alimentaires naturels, en se concentrant sur les caroténoïdes, les chlorophylles et surtout les anthocyanes. L'étude couvre leur structure chimique, leurs propriétés physicochimiques (y compris la solubilité, la stabilité à la lumière et à la chaleur, et la dépendance au pH), les méthodes d'isolation, et détaille les modifications structurelles des anthocyanes et leur changement de couleur en fonction de l'acidité. Des tableaux et des illustrations contenant les formules structurelles des pigments clés et des données sur les substituants de 11 espèces d'anthocyanures sont présentés pour plus de clarté.*

Mots clés: *colorants alimentaires naturels, caroténoïdes, chlorophylles, anthocyanes, stabilité chimique, dépendance de la couleur par rapport au pH, extraction des pigments, propriétés antioxydantes, industrie alimentaire, flavonoïdes.*

Les colorants alimentaires (additifs colorants) sont des substances qui donnent une certaine teinte aux aliments et aux boissons. Ils sont produits sous différentes formes: liquide, poudre, gel et pâte. Les colorants naturels sont obtenus à partir de sources végétales et animales par extraction de pigments organiques [Smirnov, 2009].

Les principaux groupes sont les suivants:

Les caroténoïdes – hydrocarbures isoprénoïdes ($C_{40}H_{56}$) et leurs dérivés oxygénés, responsables des teintes rouge-jaune. Caractérisés par la présence de doubles liaisons conjuguées, ce qui permet d'obtenir une coloration intense [Colorants alimentaires naturels, 2024]. Résistants aux changements de pH et aux agents réducteurs, mais se dégradent lorsqu'ils sont chauffés à plus de 100°C ou exposés à la lumière. Insolubles dans l'eau mais solubles dans les graisses et les solvants organiques. Un exemple est le bêta-carotène (provitamine A), dont la structure est présentée dans la figure 1 [Carotène, 2024].

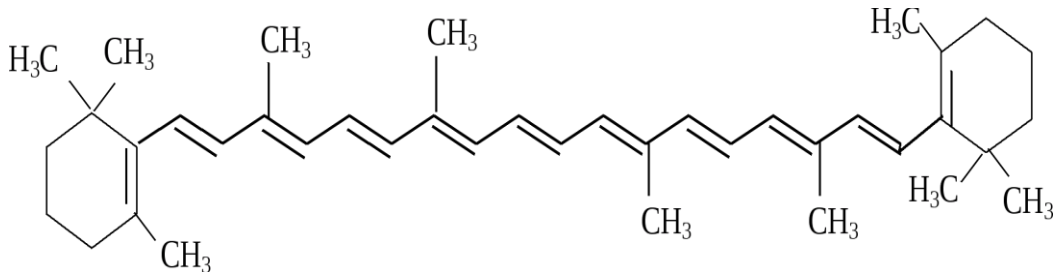


Figure 1. Bêta-carotène

Les chlorophylles sont des pigments verts prédominants dans les aliments végétaux. Elles se composent de chlorophylle-a (bleu-vert) et de chlorophylle-b (jaune-vert) dans un rapport de 3:1. Elles sont extraites à l'aide d'alcool et d'éther de pétrole. Lorsqu'elles sont chauffées en milieu acide, elles perdent leur stabilité : la couleur verte passe à l'olive, puis au brun en raison de la formation de phéophétine (Fig. 2) [Nechaev, 2008].



Figure 2. Formule structurelle de la chlorophylle

Les anthocyanes sont des pigments flavonoïdes à spectre rouge, bleu et violet. Ils sont synthétisés par la voie des phénylpropanoïdes et sont solubles dans l'eau et les solvants polaires. Leur coloration dépend du pH: à pH ≈ 1 – teintes rose-rouge (forme flavine); à pH 3,5-4,5 – forme semi-acétale incolore; en milieu alcalin – teintes bleu-vert (structure quinoïde). La figure 3 présente la structure générale des anthocyanes [Mokronosova, 2019].

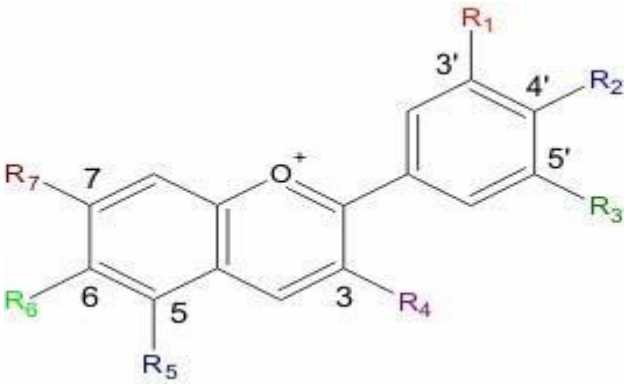


Figure 3. Structure générale des anthocyanes

Le tableau 1 présente la liste des substituants de leurs 11 variétés [Mokronosova, 2019].

Tableau 1

Liste des substituants des anthocyanes

Anthocyanes	R1	R2	R3	R4	R5	R6	R7
Aurantinidine	-H	-OH	-H	-OH	-OH	-OH	-OH
Cyanidine	-OH	-OH	-H	-OH	-OH	-H	-OH
Delphinidine	-OH	-OH	-OH	-OH	-OH	-H	-OH
Europinidine	-OCH3	-OH	-OH	-OH	-OCH3	-H	-OH
Lutéolinidine	-OH	-OH	-H	-H	-OH	-H	-OH
Pélargonidine	-H	-OH	-H	-OH	-OH	-H	-OH
Malvidine	-OCH3	-OH	-OCH3	-OH	-OH	-H	-OH
Péonidine	-OCH3	-OH	-H	-OH	-OH	-H	-OH
Pétunidine	-OH	-OH	-OCH3	-OH	-OH	-H	-OH
Rosinidine	-OCH3	-OH	-H	-OH	-OH	-H	-OCH3

Lors de l'utilisation de colorants naturels, il est essentiel de tenir compte de leur sensibilité aux facteurs externes. La température et la lumière provoquent l'oxydation des caroténoïdes. L'acidité du milieu affecte la stabilité de la couleur des anthocyanes. Les méthodes d'extraction déterminent la pureté et l'efficacité des pigments (par exemple, les solutions acides pour les anthocyanes).

L'analyse des colorants alimentaires est généralement effectuée selon deux méthodes: qualitative et quantitative. L'analyse qualitative est conçue pour déterminer

avec précision la composition en espèces des colorants présents dans les produits alimentaires. Dans le cadre de cette définition, diverses méthodes sont appliquées, qui permettent non seulement d'identifier les substances, mais aussi de distinguer les pigments naturels des pigments artificiels et de détecter d'éventuelles impuretés [Kunze, 1997]:

- Observation visuelle;
- Méthodes chimiques telles que la précipitation et le changement de couleur;
- Spectrophotométrie;
- Chromatographie: chromatographie liquide (HPLC) et chromatographie sur couche mince (TLC);
- Méthodes électrochimiques;
- Spectroscopie infrarouge.

Une fois les espèces de colorants identifiées, elles sont analysées quantitativement pour déterminer leur teneur dans le produit. L'utilisation de méthodes de haute précision permet de contrôler la concentration des additifs et d'éviter les quantités excessives ou insuffisantes. Les approches suivantes peuvent être utilisées pour réaliser les études [Charlo, 1965]:

- Méthodes photométriques;
- Spectrométrie de masse;
- Titrage;
- Méthodes chromatographiques: HPLC, TLC,
- Fluorimétrie:

Les résultats des analyses quantitatives sont reflétés dans la documentation et sur les étiquettes des aliments, garantissant ainsi la qualité pour les acheteurs et les autorités de contrôle.

Ainsi, les colorants naturels, malgré leur instabilité, restent recherchés par l'industrie alimentaire en raison de leur innocuité et de leurs propriétés fonctionnelles, telles que l'action antioxydante des caroténoïdes ou la valeur nutritionnelle des chlorophylles. L'optimisation de leurs conditions d'utilisation, y compris le contrôle du pH et de la température, permet de préserver les caractéristiques esthétiques et qualitatives des produits. L'application intégrée de méthodes qualitatives et quantitatives de détermination des colorants alimentaires fait partie intégrante d'une bonne production, car elles constituent une garantie de qualité.

Littérature

1. Karotin [Carotène]. – [en ligne]. Disponible à l'adresse: https://ru.wikipedia.org/wiki/Karotin. (Date de l'adresse: 14.03.2024). (en Russe)

2. Kunce, U., Shvedt, G. (1997). Osnovy kachestvennogo i kolichestvennogo analiza [Principes fondamentaux de l'analyse qualitative et quantitative]. – M.: Mir. (en Russe)

3. Natural'nye pishchevye krasiteli [Colorants alimentaires naturels]. – [en ligne]. Disponible à l'adresse: https://bstudy.net/619509/estestvoznanie/ naturalnye_pischevye_krasiteli. (Date de l'adresse: 14.03.2024). (en Russe)

4. Nechaev, A. P. et al. (2008). Pishchevye krasiteli: klassifikaciya, svojstva, primenenie [Colorants alimentaires: classification, propriétés, application]. – Sankt-Peterburg: GIORD. – 240 p. (en Russe)

5. Mokronosova, D. M. (2019). Opredelenie krasitelej, ispol'zuemyh dlya prigotovleniya siropov i limonadov metodami elektroforeza i spektrofotometrii [Détermination des colorants utilisés

pour la préparation des sirops et des limonades par électrophorèse et spectrophotométrie]. – Belgorod: BelGU. – 46 p. (en Russe)

6. Sharlo, G. (1965). Metody analiticheskoj himii [Méthodes de chimie analytique]. – M.: "Himiya". – 977 p. (en Russe)

7. Smirnov, E. V. (2009). Pishchevye krasiteli [Colorants alimentaires]. – SPb.: Professiya. – 352 p. (en Russe)

UDK 637.2.07

ASSORTIMENT UND QUALITÄTSBEWERTUNG VON BUTTER IM VERKAUFSNETZ „MAGNIT“

Zybina Ekaterina Wladimirowna,
Studentin des Instituts für Pharmazie, Chemie und Biologie,
Belgoroder Staatliche Nationale Forschungsuniversität, Belgorod, Russland,
E-mail: zybina-2004@mail.ru
Sopowa Irina Walentinowna,
Kandidatin der philologischen Wissenschaften,
Professorin des Lehrstuhls für Fremdsprachen und berufliche Kommunikation,
Belgoroder Staatliche Nationale Forschungsuniversität, Belgorod, Russland,
E-mail: sopova@bsuedu.ru

Annotation: *Dieser Artikel analysiert das Sortiment und die Qualität von Butter, die im Verkaufsnetz „Magnit“ in Belgorod verkauft wird. Es werden die chemische Zusammensetzung, Klassifizierung, Qualitätsanforderungen gemäß GOST-Standards sowie die Ergebnisse einer organoleptischen und physikalisch-chemischen Bewertung von drei Butterproben vorgestellt. Die Studie zeigt, dass das Sortiment breit gefächert ist und alle Proben den festgelegten Normen entsprechen.*

Schlagwörter: *die Butter, die Qualitätsbewertung, die Sortimentsanalyse, GOST-Standard, organoleptische Eigenschaften, das Sortiment und die Qualität von Butter.*

Die Butter ist ein wesentliches Milchprodukt, das weltweit aufgrund seines Nährwerts und seiner kulinarischen Vielseitigkeit geschätzt wird. In Russland bleibt die Nachfrage nach Butter stabil, was auf traditionelle Ernährungsgewohnheiten und die steigende Produktqualität zurückzuführen ist. Dennoch erfordert die Vielfalt des Marktes eine regelmäßige Überprüfung der Sortimentsstruktur und Qualitätssicherung. Butter (Kuh) ist ein in Produkt aus konzentriertem Milchfett mit charakteristischem Geschmack, Geruch und plastischer Konsistenz [Sedykh, 2021: 192-194].

Das Ziel dieser Arbeit ist es, die Sortimentsvielfalt und die Qualität der im Verkaufsnetz „Magnit“ verkauften Butter zu analysieren. Die durchgeführte Studie umfasst die Bewertung der Einhaltung technischer Standards (GOST 32261-2013), die Untersuchung der chemischen Zusammensetzung sowie die Durchführung organoleptischer und physikalisch-chemischer Tests.

Chemische Zusammensetzung und Nährwert

Die Butter besteht zu 72,5–82,5% aus Milchfett, wobei die restlichen Komponenten Wasser (≤16 %), Proteine (0,5–1 %), Kohlenhydrate (0,8–1,4 %) und Mineralstoffe (Kalzium, Magnesium) umfassen [Nikolaeva, 2018: 367]. Butter enthält bis zu 82,5 % Milchfett, Vitamine (A, D, E) und essentielle Fettsäuren wie Palmitin-,

Öl- und Stearinsäure. Diese Komponenten tragen zur Energieversorgung bei und unterstützen physiologische Prozesse. Laut des GOST-Standards muss der Wassergehalt unter 16 % liegen, um eine optimale Haltbarkeit zu gewährleisten [https://docs.cntd.ru/document/1200107359?ysclid=m9sawjimzr967012668].

Die Butter hat einen hohen Kaloriengehalt: 662-748 kkal in berechnet auf 100 g, leicht vom Körper aufgenommen (91%). Charakteristisch ist ein hoher Fettgehalt: 78-82,5%. Die Zusammensetzung des Öls umfasst Proteine (0,6-1 g / 100 g), Kohlenhydrate (0,8-1,4 g / 100 g). Das Produkt enthält β-Carotin (0,17-0,56 mg / 100g), Tocopherole (2-5 mg / 100g), Transfette (bis zu 8 mg / 100g) und Cholesterin [Klimenko, 2018: 34-38].

Klassifizierung und Sortiment

Gemäß des GOST-Standards wird Butter in drei Hauptkategorien unterteilt:

Traditionelle Butter (mindestens 82,5 % Fett);

Lieblingsbutter (mindestens 80 % Fett);

Bauernbutter (mindestens 72,5 % Fett).

Zusätzlich existieren Varianten wie gesalzene, saure Rahmbutter und leichtes Butterprodukt mit reduziertem Fettgehalt [Nikolaeva, 2018: 367].

Sortimentsanalyse im Verkaufsnetz „Magnit“

Das Sortiment umfasst 18 Buttermarken mit Fettgehalten zwischen 72,5 % und 82,5 %. Die Preisspanne reicht von 72,99 Rubel („Syrnaja Dolina“, 100 g) bis 359,99 Rubel („Molochnye Gorki“, 360 g). Die Breite des Sortiments (90 %) und die Aktualisierungsrate (44 %) weisen auf eine hohe Verbraucherorientierung hin.

Qualitätsbewertung

Drei Proben („Wkusnoteewo“, „Brest-Litowsk“, „Korowka is Korenowki“) wurden gemäß GOST 32261-2013 untersucht:

Organoleptische Bewertung:

− Geschmack und Geruch**:** Alle Proben wiesen einen reinen, buttrigen Geschmack ohne Fremdnoten auf.

−Konsistenz**:** Dichte und plastische Textur, geringe Krümeligkeit.

−arbe: Gleichmäßig gelb.

Die organoleptische Bewertung der Indikatoren für die Butter, ihre Verpackung und ihre Etikettierung werden auf einer 20-Punkte-Skala bewertet. Die Skala für die Bewertung der organoleptischen Indikatoren, der Verpackung und der Etikettierung ist in der Tabelle 1 dargestellt.

Tabelle 1

Bewertungsskala für organoleptische Indikatoren, Verpackung, Etikettierung

Name des Indikators	Ergebnis
Geschmack und Geruch	10
Konsistenz und Aussehen	5
Farbe	2
Verpackung und Etikettierung	3
Insgesamt	*20*

Die Ergebnisse der organoleptischen Bewertung von Butter sind in der Tabelle 2 dargestellt.

Tabelle 2

Organoleptische Bewertung von Proben

Probe	Geschmack/Geruch	Konsistenz	Farbe	Gesamtpunktzahl
Wkusnoteewo	9/10	4/5	2/2	18
Brest-Litowsk	8/10	4/5	2/2	17
Korowka is Korenowki	9/10	3/5	2/2	18

Die untersuchten Butterproben gehören zur höchsten Klasse, da die Gesamtpunktzahl mehr als 17 Punkte beträgt. Dies zeigt eine hohe Produktqualität und Akzeptanz für die Implementierung an.

Bei der Untersuchung der Qualität der Butter haben wir eine physikalisch-chemische Untersuchung durchgeführt.

Die thermische Stabilität von Butter wird durch die Kontrolle ihrer Formbeständigkeit bei Raumtemperatur (28-30 °C) bestimmt. Wenn Butter diese Fähigkeit besitzt, verformt sie sich nicht unter der Einwirkung ihres eigenen Gewichts.

Die Proben 1 und 3 haben eine gute Thermo-Stabilität, da der Wert größer als 0,86% ist. Die Stichprobe № 2 hat jedoch eine zufriedenstellende Eigenschaft für diesen Indikator, einen Wert von 0,81%.

Der Massenanteil des Butterfetts wird mit speziellen Butterfettmessgeräten oder durch Berechnung ermittelt.

Der Massenanteil der Butterfeuchtigkeit wird durch Trocknen einer Probe des Erzeugnisses bei konstanter Temperatur bestimmt.

Alle Proben entsprechen dem Fett- und Feuchtigkeitsgehalt von GOST 32261-2013 [https://docs.cntd.ru/document/1200107359?ysclid=m9sawjimzr 967012668].

Bewertung physikalisch-chemischer Indikatoren: die Ölproben sind in der Tabelle 3 aufgeführt.

Tabelle 3

Physikalisch-chemische Parameter von Butterproben

Indikator	Metrik-Wert von GOST 32261-2013	Beispiel-Nummer		
		№1	№2	№3
Temperaturbeständigkeit	0,70-1,00	0,87	0,81	0,86
Massenanteil an Fett, %	50-82,5	82,96	82,67	82,86
Massenanteil an Feuchtigkeit, %	bis 16,0	15,4	15,8	16,2

Nach der Analyse der organoleptischen und physikalisch-chemischen Indikatoren, der Struktur des im Geschäft „Magnit“ verkauften Buttersortiments können wir feststellen, dass das Geschäft „Magnit“ eine breite Palette von Butter anbietet. Die untersuchten Proben des Produkts haben die Qualitätsprüfung auf Übereinstimmung mit den Anforderungen der Norm bestanden.

Die Untersuchung ergab, dass bei den Proben keine Verstöße festgestellt wurden. Die Produkte gehören zur höchsten Qualitätsstufe und sind für den Verkauf zugelassen.

Literaturliste

1. GOST 32261-2013. Mezhgosudarstvennyy standart “Maslo slivochnoe. Tekhnicheskie usloviya“ [Internationaler Standard „*Butter. Technische Bedingungen*“]. −[Elektronische Ressource]. Zugriffsmodus: https://docs.cntd.ru/document/1200107359?ysclid=m9sawjimzr967012668. (Datum der Behandlung: 25.03.2025). (in Russisch)

2. Klimenko, O.W. (2018). Pishchevaya cennost' i veterinarno-sanitarnaya ekspertiza slivochnogo masla [Nährwert und veterinärmedizinische Untersuchung von Butter] // *Molodeyh i nauka*. No. 4. −Ekaterinburg: Uralskiy gosudarsvennyi agrarnyi universitet. – S. 34-38. (in Russisch)

3. Nikolaeva, M.A. (2018). Teoreticheskie osnovy tovarovedeniya i ekspertizy tovarov: uchebnik: v 2 ch. Ch. 2. Tovarnaya ekspertiza [Theoretische Grundlagen der Rohstoffkunde und der Prüfung von Waren. Lehrbuch. Teil 2. Produktprüfung]. − M.: Norma. − 367 S. (in Russisch)

4. Sedykh, E.S., Kulikova, G.A. (2021). Veterinarno-sanitarnaya ekspertiza slivochnogo masla. Opredelenie organolepticheskikh pokazatelei [Veterinar-sanitare Expertise von Butter. Bestimmung der organoleptischen Parameter] // *Nauchnyi elektronnyi zhurnal "Meridian"*. – No. 1. ─ Jakutsk: IP Osenina. – S. 192-194. −[Elektronische Ressource]. Zugriffsmodus: https://www.elibrary.ru/ item.asp?id=44602678. (Datum der Behandlung: 10.03.2025). (in Russisch)

UDK 577.12

BIOCHEMICAL STUDY OF GRAPE JUICE OBTAINED FROM RED GRAPE BERRIES GROWN IN THE CENTRAL BLACK EARTH REGION

Stoyanova Natalya Georgievna,
Postgraduate Student of the Medical Institute,
Belgorod State National Research University, Belgorod, Russia,
e-mail: stoyanova@bsuedu.ru
Platoshina Victoria Vladimirovna,
Ph.D. in Philosophy,
Associate Professor of the Department of Foreign Languages and Professional Communication,
Belgorod State National Research University, Belgorod, Russia,
e-mail: platoshina@bsuedu.ru

Abstract: *The aim of the article is to study the biochemical parameters of grape juice from red grape berries grown in the Belgorod region to determine the prospects of its use in comparison with grape juice obtained from technical red grape varieties of the Krasnodar region. This article deals with the research of several grape varieties, which are planted in the Botanical Garden of Belgorod State National Research University. These grape varieties are interspecific hybrids, they are resistant to many vine diseases, including frost resistance.*

Keywords: *grape variety, grape juice, interspecific hybrids trans-resveratrol, malolactic fermentation, winemaking conditions.*

Stress during the growing season of grapes, caused by natural-climatic conditions of the Central Black Earth region, leads to changes in the balance of biochemical and physicochemical indicators in red grapes berries. The material of biochemical research is grapes, 2023 year of harvest, interspecific hybrids of technical red varieties: Marquette,

Rubin Golodrigi, Saperavi northern, Saperavi southern planted in the Botanical Garden of Belgorod State National Research University of Belgorod region.

As control variants for biochemical study were used grapes of 2023 harvest-technical varieties of red grapes Cabernet Sauvignon and Krasnostop Zolotovsky, grown in Kransodar region. The grapes were analysed according to the „Method of evaluation of grape varieties by physico-chemical and biochemical indicators" (RD 0033483.042-2005). Under micro winemaking conditions, table wine materials were prepared from grapes by the red method, according to the current normative documentation [Valuyko, 1985:12].

Biochemical studies were carried out to determine the content of biologically active substances in the wine material (trans-resveratrol, mg/l), conducted in the laboratory of Belgorod Research Institute of Pharmacology of Living Systems (Belgorod) by HPLC method (Ultimate 3000 RS liquid chromatograph with diode array detector PDA (Thermo Fisher Scientific) with a chromatographic column – ZORBAX SB C18, 4.6 x 250 mm, gradient system: 95% B at 0 min, 90% B at 3.5 min, 80% B at 7.0 min, 60% B at 25 min, 60% B at 26 min, 5% B at 27 min, 5% B at 29 min, 95% B at 30 min, 95% B at 35 min. Acetonitrile (solvent A) and 0.1% solution of perchloric acid in water (solvent B) were used as solvents. Flow rate was 1.0 ml/min; Wavelength of detection of resveratrol was 307 nm (Table №1) [Ulyanova, 2010].

In the accredited testing laboratory of grape processing Federal State Budgetary Scientific Institution "North Caucasian Federal Scientific Centre of Horticulture, Viticulture, Winemaking Krasnodar were conducted physicochemical studies according to GOSTs: volume fraction of ethyl alcohol, % (GOST 32095-2013), mass concentration of sugars in g/dm3 (GOST 13192-73), mass concentration of titratable acids in terms of tartaric acid, g/dm3 (GOST 32114-2013), mass concentration of volatile acids in terms of acetic acid, g/dm3 (GOST 32001-2012), mass concentration of citric acid in g/dm3 (GOST 32113-2013), mass concentration of reduced extract g/dm3 (GOST 32000-2012), mass concentration of total sulphur dioxide in mg/dm3 (GOST 32115-2013), mass concentration of lead mg/kg (GOST 30178-96), mass concentration of arsenic, mg/kg) (GOST R 51823-2001), mass concentration of cadmium, mg/kg (GOST 30178-96), mass concentration of mercury, mg/kg (GOST R 51823-2001), qualitative and quantitative composition of organic acids: mass concentration of malic acid, g/dm3, mass concentration of tartaric acid, g/dm3, mass concentration of lactic acid, g/dm3 by capillary electrophoresis method using the Kapel-105M capillary electrophoresis system device.

It was noted that the mass concentration of tartaric acid in wine materials from interspecific hybrid technical red varieties: Marquette, Rubin Golodrigi, Saperavi Northern, Saperavi Southern was within 1.67-3.14 g/dm3, and in technical red varieties Cabernet Sauvignon and Krasnostop Zolotovsky – within 1.63-2.16 g/dm3.

The highest indicator of mass concentration of lactic acid was determined in the wine material from the interspecific hybrid of the technical red grape variety Marquette and was 0.57 g/dm3, and the lowest concentration in the wine material from Rubin Golodrigi grape variety was 0.11 g/dm3. In terms of malic acid mass concentration: the highest concentration in the Rubin Golodrigi wine material is 2.88 g/dm3, and the lowest concentration in the Marquette wine material is 1.43 g/dm3.

One of the important indicators of quality of wine materials from interspecific hybrid technical varieties of red grapes is the indicator of mass concentration of the reduced extract in terms of g/dm3. Thus, in the wine material from the studied interspecific hybrids of Marquette grape variety the mass concentration of the reduced extract is 32.5 g/dm3, Saperavi Severny 24.5 g/dm3, Rubin Golodrigi 25.3 g/dm3 [Ntuli, 2021].

The reduced extract in wine materials serves as an indicator of control of the fermentation technological process. In the absence of this control, the experience leads to obtaining liquid, devoid of varietal and characteristic type features of high-quality wines.

Table 1

Investigated quantitative index of trans-resveratrol determination in 7 samples of obtained wine materials

Method of quantitative determination of trans-resveratrol in wine materials			
Indicators that need to be analyzed	Analysis results		
	Indicators	Wine Material	Fact
		Saperavi severny	2,0
		Saperavi yuzhny	1,07
		Krasnostop Zolotovsky	1,19
		Rubin Golodrigi	0,93
		Rubin Golodrigi &Saperavi severny	1,25
		Markett	1,44
		Cabernet	1,34
	Conclusion: Seven samples of wine materials obtained on the basis of the National Research University "BelSU" were analyzed according to the indicator "Quantitative content of trans-resveratrol" and contained significant concentrations of the analyzed substance from 0.93 mg/l to 2.0 mg/l, depending on the grape variety		

Thus, on the basis of the conducted research it was shown that all produced wine materials from interspecific hybrids of technical varieties of red grapes meet the requirements of normative documents GOST 32030-2013 "Table wines and table wine materials. General technical conditions p 4.1.3.1-4.1.3.7, as well as meet the safety indicators according to TR TS 021/2011 "Technical Regulations of the Customs Union on safety of food products and on the basis of test reports".

According to the totality of conducted researches it is possible to conclude that wine materials received from interspecific hybrids of red technical grape varieties Marquette, Saperavi Severny, Rubin Golodrigi, grown on terroir of Belgorod region are of interest for production of high-quality wines, and also for use as a natural biomaterial for carrying out preclinical researches in pharmacology.

References

1. Ntuli, R.G., Saltman, Y., Ponangi, R., Jeffery, D.W., Bindon, K., Wilkinson, K.L. (2021). Impact of fermentation temperature and grape solids content on the chemical composition and sensory profiles of Cabernet Sauvignon wines made from flash détente treated must fermented off-skins. – [online]. Available at: https://pubmed.ncbi.nlm.nih.gov/34469835/. (Accessed: 07.03.2025).

2. Valuyko, G.G. (1985). Spravochnik po vinodeliyu [Guide to winemaking]. – M.: Agropromizdat. – 475 p. (in Russian)

3. Ulyanova, E.V. (2010). Visokoeffektivhaya hromotographiya v issledovanii antioksidantnih svoist vin [High-performance chromatography in the study of antioxidant properties of wines] // *Sorbitsionnie i hromatographicheskiye protsessi* [*Sorption and chromatographic processes*]. – V. 10. – No. 4. – Voronezh: VGU. – Pp. 522-532. (in Russian)

UDK 544.4

KINETIK DER VERESTERUNGSREAKTION VON INDOL-5-YL CARBONSÄURE

Zawatskiy Daniil Wadimovich,
Student des Instituts für Pharmazie, Chemie und Biologie,
Belgoroder Staatliche Nationale Forschungsuniversität, Belgorod, Russland,
E-mail: zawackiidaniil21@yandex.ru
Sopowa Irina Walentinowna,
Kandidatin der philologischen Wissenschaften,
Professorin des Lehrstuhls für Fremdsprachen
und berufliche Kommunikation,
Belgoroder Staatliche Nationale Forschungsuniversität, Belgorod, Russland,
E-mail: sopova@bsuedu.ru

Annotation*: Die Untersuchung konzentriert sich auf die Kinetik der Reaktion der 2,3-Dimethylindol-5-ylcarbonsäureeutherisierung. Während der Arbeit werden die Reihenfolge der Reaktion, ihre Geschwindigkeit und Faktoren, die den Prozess beeinflussen, bestimmt. Es wurden Wege gefunden, die Synthese zu optimieren, um die Ausgangsgröße des Zielproduktes zu erhöhen. Die Studie ist von Interesse für den Bereich der organischen Synthese und pharmazeutische Industrie.*

Schlagwörter: *kinetische Kurve, die Veresterung, die Geschwindigkeit der chemischen Reaktion, organische Synthese, Indol, Ester, chemische Industrie*

Derzeit studieren die Wissenschaftler der organischen Chemie weiterhin die heterocyclischen Verbindungen, auf deren Grundlage sie pharmazeutische Substanzen, Beschichtungen, Farbstoffe, Stabilisatoren, Katalysatoren und Inhibitoren, Lösungsmittel herstellen. Breites Interesse wird durch restriktive Maßnahmen (Sanktionen) und Versuche, wirtschaftlich vorteilhafte Wege der Synthese hervorgerufen, um die notwendigen Komponenten zur Aufrechterhaltung der Stabilität der chemischen Industrie in der Russischen Föderation zu erhalten.

Auf der modernen Materialbasis stellen Indole und ihre Derivate aufgrund ihrer Prävalenz in der Natur eine vielversprechende Richtung in der Wissenschaft dar. In den meisten Fällen sind sie in Kohlenteer vorhanden, der durch die Verkokung von Naturkohle in Fabriken, ätherischen Ölen von Pflanzen (Kalk und Jasminöl) und Phytohormonen (Heteroauxin) hergestellt wird [Traven', 2023: 267].

Das Indolmolekül wird durch einen konjugierten Benzol- und Pyrrolkern in den Positionen 2.3 dargestellt, wie in Abbildung 1 gezeigt wird.

Manchmal sind die Bestimmungen 2, 3 mit den Buchstaben des griechischen Alphabets α bzw. β gekennzeichnet, das sich auf die Regeln der Nomenklatur organischer Verbindungen nach IUPAC bezieht. Es ist planar und hat ein

hochkonjugiertes 10-π-Elektronensystem, das von zwei Elektronen aus dem Stickstoffatom und acht aus Kohlenstoffatomen gebildet wird, was die heteroaromatische Natur der Verbindung bestätigt. Indole hat mehr elektrophilen Substitutionsreaktionen als nukleophile. Freie radikale Transformationen gehen unterschiedlich, bilden Mischungen aus Ersatzprodukten im Benzolkern [Unnikova u.a., 2017: 57].

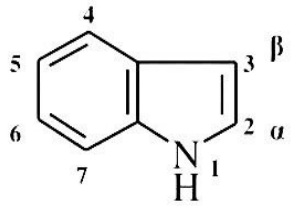


Abbildung 1. Indol-Struktur

Arbeitsziel. Verfolgen der Kinetik der Eutrophierung der iso5-Ylcarbonsäure in Gegenwart von sauren Agenzien und identifizieren Wege zur Optimierung des Prozesses.

Experimenteller Teil. Für die Untersuchung wurde mehrstufig synthetisierte 2,3-Dimethylindol-5-carbonsäure verwendet. Der Prozess umfasste die Synthese von p-Carboxyphenylhydrazinhydrochlorid aus p-Aminobenzoesäure, gefolgt von der Cyclisierung zu 2,3-Dimethyl-5-carbethoxyindol und dessen anschließender Hydrolyse [Vul'fson, 1959: 788]. Das Syntheseschema ist in der Abbildung 2 dargestellt.

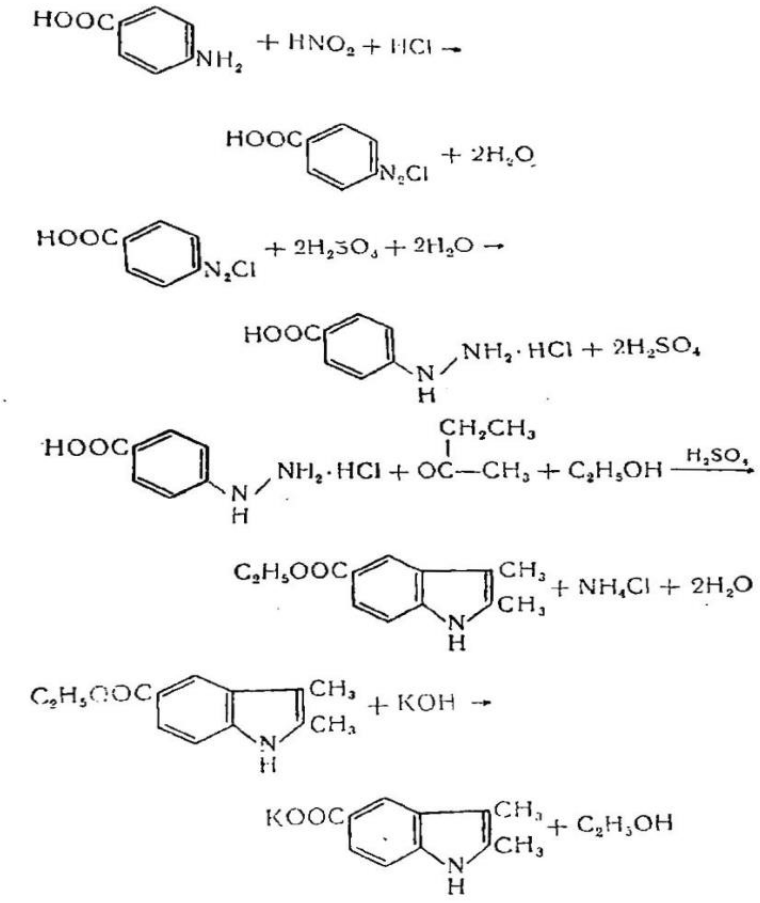


Abbildung 2. Syntheseverfahren von 2,3-Dimethylindol-5-carbonsäure

Diskussion. Ein Ethylether von 2,3 Dimethylindol-5-yl Carbonsäure wurde schließlich erhalten. Während des Experiments wurden die folgenden Daten in Tabelle 1 erhalten.

Tabelle 1

Wassermenge in einer bestimmten Zeitspanne

Zeit, min	Wasservolumen, ml
5	2,5
10	3,25
15	5,1
20	7,3
25	10,7
30	13,4
35	16,1
40	18,4
45	21,2
50	24,0
55	27,5
60	29,0

Basierend auf den tabellarischen Ergebnissen wurde ein Diagramm erstellt, das die Abhängigkeit des freigesetzten Wassers von der Zeit zeigt.

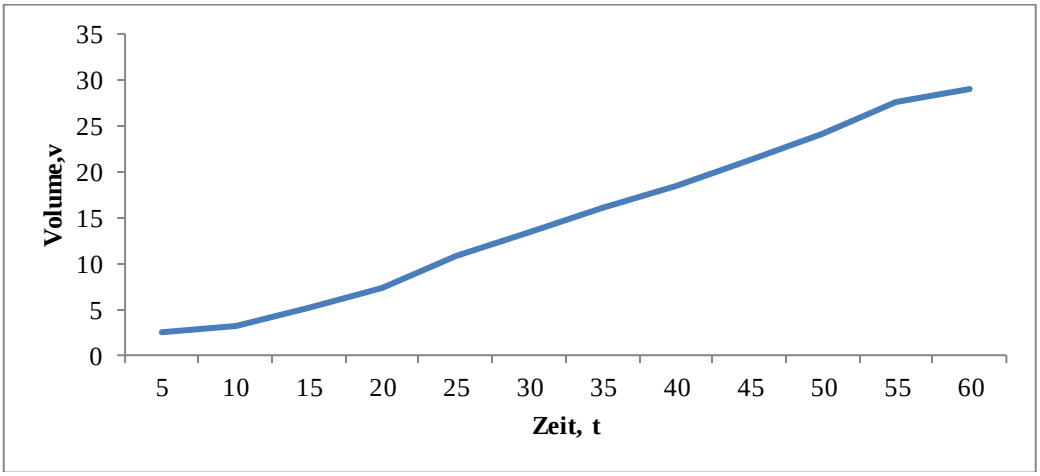


Diagramm 1. Abhängigkeit des Wasservolumens in einer bestimmten Zeitspanne

Aus den erhaltenen Daten wurde die Konzentration des Äthers berechnet. Carbonsäure und Alkohol reagieren in einem Molverhältnis von 1: 1, entsprechend ist die Menge an freigesetztem Wasser gleich der Menge an Ester, dann können Sie die Formel verwenden:

$$C = \frac{n}{V}$$

wo:

C- Konzentration der Substanz (Mol /L)

n ist die Menge der Substanz (Mol)

V-Volumen (L)

Nachdem die Berechnungen durchgeführt wurden, wurden die folgenden Werte in Tabelle 2 angezeigt.

Tabelle 2

Abhängigkeit der Ester-Konzentration von der Zeit

Zeit, min	Ester-Konzentration, Mol /l
5	0,138889
10	0,180556
15	0,283333
20	0,405556
25	0,594444
30	0,744444
35	0,894444
40	1,022222
45	1,177778
50	1,333333
55	1,527778
60	1,611111

Basierend auf den tabellarischen Ergebnissen wurde ein Diagramm der Abhängigkeit der Ester-Konzentration von der Zeit erstellt, um die Reihenfolge der Reaktion zu bestimmen.

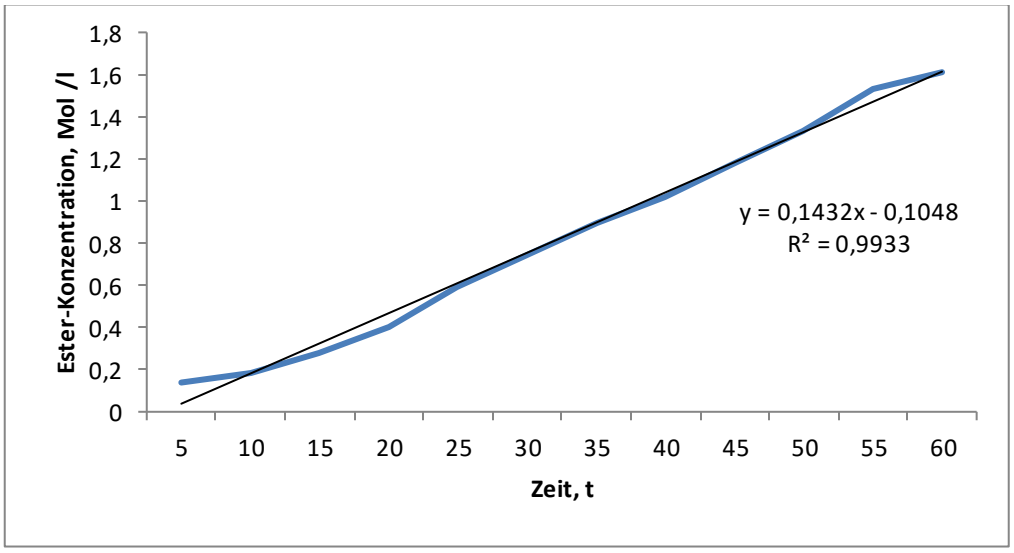


Diagramm 2. Abhängigkeit der Ester-Konzentration von der Zeit

Basierend auf Zeitplan 2 können die folgenden Merkmale des Prozesses beachtet werden. Die Kurve des Diagramms entspricht der Kurve Null, da eine lineare Abhängigkeit auftritt. Auf der Trendlinie wurde die Reaktionsgeschwindigkeit berechnet, die 0,143 mol / l × min entspricht.

Fazit: Im Experiment wurde eine Reaktion nullter Ordnung mit einer Geschwindigkeit von 0,143 mol/l×min bestimmt. Zur Optimierung des Prozesses sollten aromatische Carbonsäuren als Katalysator verwendet und die azeotrope Destillation durch hochporöse, wasserbindende Zeolithe ersetzt werden.

Literaturliste

1. Sajks, P. (1999). Mekhanizmy reakcij v organicheskoj himii [Reaktionsmechanismen in der organischen Chemie]. – M.: Himiya. – 323 S. (in Russisch)

2. Traven', V.F. (2023). Organicheskaya himiya [Organische Chemie]. – M.: Laboratoriya znanij. – 1272 S. (in Russisch)

3. Unnikova, L.P. et all. (2017). Organicheskij sintez [Organische Synthese]. – Perm': Himiya. – 128 S. (in Russisch)

4. Vejgand-Hil'getag, A. (1968). Metody eksperimenta v organicheskoj himii [Experimentelle Methoden in der organischen Chemie]. – M.: Himiya. – 562 S. (in Russisch)

5. Vul'fson, N.S. (1959). Preparativnaya organicheskaya himiya [Präparative organische Chemie]. – M.: Gosudarstvennoe nauchno-tekhnicheskoe izdatel'stvo himicheskoj literatury. – 892 S. (in Russisch)

UDK 577.112.3

ACIDES AMINÉS NON PROTÉINOGÈNES: RÉGULATEURS IMPERCEPTIBLES DES PROCESSUS PHYSIOLOGIQUES

Podaneva Alina Evgenyevna,
Etudiante de l'institut de pharmacie, de chimie et de biologie,
Université nationale d'Etat de recherche de Belgorod, Belgorod, la Russie,
E-mail: 1641257@bsuedu.ru
Koupina Natalya Ivanovna,
Docteur ès lettres,
Professeur associé, Département des langues étrangères
et de la communication professionnelle,
Universite nationale d'Etat de recherche de Belgorod, Belgorod, la Russie,
E-mail: *nkupina@bsuedu.ru*

***Abstrait*:** *Cet article explore les acides aminés non protéinogènes: leurs fonctions dans l'organisme, leur impact sur la santé et leur rôle dans le développement des maladies. Il analyse leur implication dans le métabolisme, la régulation des processus physiologiques et la réponse de l'organisme au stress. Une attention particulière est accordée aux conséquences de leur déséquilibre, incluant diverses pathologies (cardiovasculaires, neurologiques, métaboliques) et la toxicité. L'article examine également les perspectives d'application des acides aminés non protéinogènes en médecine, notamment dans la neuroprotection, le traitement du diabète, la rééducation et la nutrition sportive. En conclusion, il souligne la nécessité d'une approche personnalisée pour contrôler le niveau de ces acides aminés et ajuster l'alimentation afin de prévenir les maladies et d'améliorer la qualité de vie.*

Mots clés*: acides aminés non protéinogènes; métabolisme; biosynthèse des acides aminés; régulation enzymatique; conditions de stress; adaptation de l'organisme; application médicale; déséquilibre des acides aminés.*

Les acides aminés sont des composés organiques combinant des groupes carboxyle et amine. Leur structure de base comprend du carbone, de l'hydrogène, de l'oxygène et de l'azote, bien que les radicaux de certains puissent inclure d'autres éléments. Parmi plus de 200 acides aminés naturels connus, seuls 20 participent à la synthèse des protéines et sont qualifiés de protéinogènes. Les autres, appelés non protéinogènes, ne font pas partie des protéines mais jouent un rôle clé dans les processus biochimiques [Souleïmanova, 2023].

Les acides aminés protéinogènes servent de base à la construction des protéines et se divisent en remplaçables (synthétisés par l'organisme) et essentiels (apportés par l'alimentation). Contrairement à eux, les acides aminés non protéinogènes interviennent dans les voies métaboliques, la régulation des fonctions physiologiques et l'adaptation aux stress. Leur biosynthèse est un processus complexe et multistade, fondamental pour le maintien de la vie [Okonenko, 2022]. Les substrats de leur synthèse proviennent non seulement de métabolites, mais aussi de composés intermédiaires empruntés à d'autres voies biochimiques, comme le cycle de l'acide citrique ou la glycolyse.

La régulation de ce processus repose sur des enzymes dont l'activité est contrôlée par rétroaction – par exemple, les produits finaux peuvent inhiber des enzymes clés, évitant une accumulation excessive. Une caractéristique essentielle de la biosynthèse est la stéréospécificité des enzymes: elles catalysent sélectivement la transformation d'isomères spécifiques des substrats, garantissant la production de formes biologiquement actives. Ces enzymes participent ainsi à la synthèse de neurotransmetteurs, d'hormones, de nucléotides et de coenzymes, ou s'intègrent dans le cycle de l'acide citrique et la gluconéogenèse. Des études montrent que leurs niveaux varient lors d'hypoxie, de carences nutritionnelles ou d'autres stress, soulignant leur importance adaptative [Netyoukhaïlo, 2012].

Exemples d'acides aminés non protéinogènes importants:

• Ornithine – Un acide α-aminé non incorporé dans les protéines (formule sur la figure 1). Il participe au cycle de l'urée, neutralisant et éliminant l'ammoniac toxique. Il sert d'intermédiaire dans la synthèse de l'arginine, qui régule le tonus vasculaire, stimule l'anabolisme, inhibe le catabolisme et renforce l'immunité. L'ornithine est synthétisée par l'organisme humain [Korotkova, 2011].

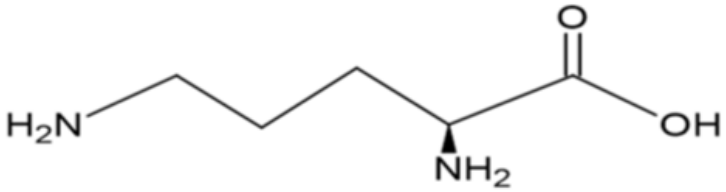


Figure 1. Formule structurale de l'ornithine

• Citrulline (formule sur la figure 2). Un acide aminé non impliqué dans la formation des protéines. Découvert initialement dans les pastèques, il est synthétisé à partir de la L-arginine par traitement alcalin. Essentiel pour le cycle de l'urée, il améliore la circulation sanguine, maintient l'équilibre azoté (en stimulant la croissance musculaire), normalise le métabolisme et renforce l'immunité. La citrulline favorise la saturation des muscles en nutriments, élimine l'acide lactique et l'ammoniac, accélérant la récupération après l'effort. On le trouve dans les pastèques, le poisson, le lait, les œufs, la viande, le soja, les arachides, l'oignon et l'ail [L-Citrullin, 2025].

• Taurine (formule sur la figure 3). Une sulfonamide dérivée de la cystéine. En raison d'une synthèse limitée dans l'organisme, ses principales sources sont les produits animaux, notamment les fruits de mer. Elle participe à l'osmorégulation, stabilise les membranes cellulaires, régule le métabolisme des lipides et des vitamines

liposolubles. Dotée de propriétés antioxydantes et détoxifiantes, elle module les réponses inflammatoires et soutient la santé cardiaque et visuelle. Des compléments alimentaires sont utilisés pour corriger les carences [Zarkhina, 2013].

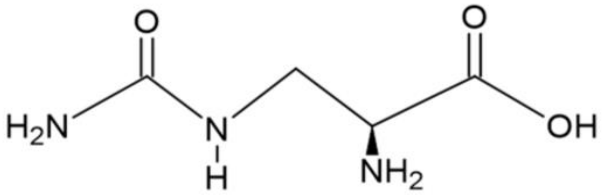


Figure 2. Formule structurale de la citrulline

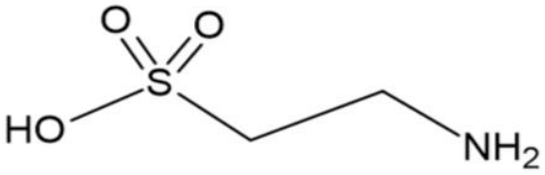


Figure 3. Formule structurale de la taurine

• GABA (acide γ-aminobutyrique) (formule sur la figure 4). Un neurotransmetteur du système nerveux central, synthétisé à partir de l'acide glutamique. Il exerce un effet sédatif, réduit l'excitabilité neuronale et régule la transmission des influx nerveux. Utilisé dans le traitement des convulsions, des pathologies vasculaires cérébrales et des traumatismes crâniens. Principalement présent dans le cambium des arbres [Ovechkin, 2010].

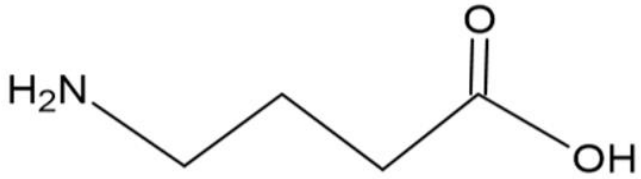


Figure 4. Formule structurale du GABA (acide γ-aminobutyrique)

•β-Alanine (formule sur la figure 5). Isomère de l'alanine avec un groupe amine en position β. Peut être synthétisé par l'organisme ou apporté par l'alimentation. Augmente le niveau de carnosine, réduisant la fatigue et améliorant l'endurance. Participe à la synthèse de l'insuline, des enzymes et du GABA, tout en soutenant la santé globale [Tsikalov, 2018].

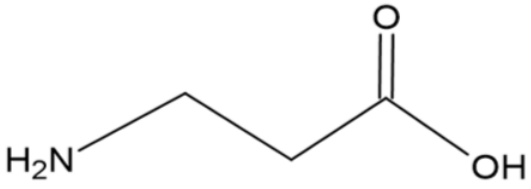


Figure 5. Formule structurale de la β-Alanine

Les acides aminés non protéinogènes sont activement impliqués dans divers processus biochimiques, servant de précurseurs à la création de composés biologiquement significatifs. Ils jouent un rôle clé dans la formation des structures cellulaires et la régulation de leurs fonctions, participant au maintien de l'homéostasie et aux mécanismes d'adaptation. Outre leur importance fondamentale dans le métabolisme, ces acides aminés trouvent des applications pratiques étendues. Ils sont utilisés dans le développement de médicaments, la fabrication de compléments sportifs pour améliorer l'endurance, l'enrichissement d'aliments fonctionnels, l'élaboration de formules cosmétiques, ainsi que dans l'industrie pharmaceutique pour la synthèse de nouvelles molécules thérapeutiques.

Un déséquilibre des acides aminés non protéinogènes peut entraîner des pathologies graves. Un déficit en taurine est associé à des troubles cardiovasculaires, à la schizophrénie et à l'autisme, tandis qu'un manque de GABA est lié à l'anxiété, à la dépression et à l'épilepsie. À l'inverse, leur excès peut provoquer des effets toxiques, comme l'accumulation d'ammoniac en cas de dysfonctionnement du métabolisme de l'ornithine. Cependant, leur utilisation ciblée ouvre des perspectives médicales prometteuses: la taurine améliore la fonction cardiaque et protège le foie, la citrulline stimule la circulation sanguine et l'endurance, et la bêta-alanine réduit la fatigue musculaire. Leur application thérapeutique fait l'objet de recherches actives, notamment dans la neuroprotection, le traitement du diabète, le soutien immunitaire et la rééducation post-traumatique [Koudriacheva, 2004]. Une approche personnalisée est cruciale: surveiller leurs niveaux et ajuster l'alimentation (suppléments, poisson, noix, produits laitiers), en particulier pour les personnes âgées ou atteintes de maladies chroniques, chez qui l'équilibre des acides aminés est critique.

Par conséquent, les acides aminés non protéinogènes, bien que restant dans l'ombre de leurs homologues protéinogènes, sont des régulateurs essentiels de la santé. Leur étude ouvre la voie à de nouvelles méthodes de traitement et de prévention des maladies, en faisant un axe central de la recherche médicale et biologique moderne.

Littérature

1. Cikalov, V. V., Cikalova, V. N. (2018). Sintez i prognoziruemaya biologicheskaya aktivnost' proizvodnyh β-alanina [Synthèse et activité biologique prévue des dérivés de la β-alanine] // *Nauchnye zapiski Krymskogo federal'nogo universiteta im. V. I. Vernadskogo. 26 Biologiya. Himiya [Notes scientifiques de l'Université fédérale de Crimée V. I. Vernadsky. 26 Biologie. Chimie]*. – № 2. – 214–220 p. (en russe)

2. Korotkova, E. I., Dorozhko, E. V. (2011). Issledovanie antioksidantnyh svojstv nekotoryh aminokislot metodom vol'tamperometrii [Etude des propriétés antioxydantes de certains acides aminés par la méthode de voltampérométrie] // *Sibirskij medicinskij zhurnal [Journal médical sibérien]*. – № 2-2. – Pp. 62–65. –Tomsk. (en russe)

3. Kudryasheva, A. A., Presnyakova, O. P. (2004). Mediko-biologicheskie osobennosti natural'nyh pishchevyh aminokislot [Caractéristiques biomédicales des acides aminés alimentaires naturels] // *Pishchevaya promyshlennost' [Industrie alimentaire]*. – № 3. – Pp. 68–73. (en russe)

4. L-Citrullin [L-Citrulline]. – [en ligne]. Disponible à l'adresse: https://www.chemspider.com/Chemical-Structure.9367.html. (Date de l'adresse: 10.01.2025). (en russe)

5. Netyuhajlo, L. G. (2012). Metabolizm aminokislot, specificheskie puti prevrashchenij aminokislot, nadsledstvennye enziomopatii [Métabolisme des acides aminés, voies spécifiques de transformation des acides aminés, voies enzymatiques étudiées] // *Byulleten' problem biologii i mediciny [Bulletin de la biologie et de la médecine des problèmes]*. – № 2(92). – Pp. 11–13 p. (en russe)

6. Okonenko, T. I. et al. (2022). Fiziologicheskie mekhanizmy zamenimyh proteinogennyh aminokislot i ih znachenie dlya nevrologii [Mécanismes physiologiques des acides aminés protéinogènes interchangeables et leur pertinence pour les neurosciences] // *Vestnik Novgorodskogo gosudarstvennogo universiteta [Bulletin de l'université d'État de Novgorod]*. – № 4(129). – Pp. 61–65. (en russe)

7. Ovechkin, A. M., Efremenko, I. V. (2010). Est' li mesto antikonvul'santam v skhemah lecheniya ostroj posleoperacionnoj boli? (analiticheskij obzor) [Les anticonvulsivants ont-ils leur place dans la prise en charge de la douleur postopératoire aiguë (revue analytique)?] // *Regionarnaya anesteziya i lechenie ostroj boli [Anesthésie régionale et gestion de la douleur aiguë]*. – № 2. – Pp. 5–12. (en russe)

8. Sulejmanova, E.I. (2023). Primenenie metoda spektrofotometrii dlya opredeleniya aminokislot [Application de la méthode spectrophotométrique pour l'analyse des acides aminés] // *Byulleten' Bashkirskogo universiteta [Bulletin de l'université de Bashkir]*. – № 1. – Pp. 100–103. (en russe)

9. Zarhina, T. S. (2013). Ingibirovanie processov termookislitel'noj destrukcii polietilenoksida [Inhibition des processus de destruction thermique par oxydation de l'oxyde de polyéthylène] // *Tekhnicheskie nauki [Sciences techniques]*. – № 8(145). – Pp. 14–17. (en russe)

UDK 632.15

LES PRODUITS PÉTROLIERS COMME SOURCES DE POLLUTION DES SOLS

Semenova Daria Sergeevna,
Etudiante de l'institut de pharmacie, de chimie et de biologie,
Université nationale d'Etat de recherche de Belgorod, Belgorod, Russie
E-Mail: 1640946@bsuedu.ru
Koupina Natalia Ivanovna,
Docteur ès lettres,
Professeur associé, Département des langues étrangères
et de la communication professionnelle,
Universite nationale d'Etat de recherche de Belgorod, Belgorod, Russie
E-mail: nkupina@bsuedu.ru

Abstrait: *L'article traite des sources de pollution de l'environnement par les produits pétroliers, ainsi que des conséquences de leur impact sur l'écologie et la biosphère, en particulier sur les sols. Il est nécessaire de prendre conscience de l'ampleur du problème et de développer des mesures efficaces pour le combattre. Le pétrole est une ressource précieuse, c'est aussi une ressource dangereuse. La pollution par le pétrole se produit non seulement à la suite de déversements et d'accidents, mais aussi lors de son utilisation et de son transport quotidiens.*

Mots-clés: *pétrole, polluants technogènes, environnement, produits pétroliers, déchets, biosphère.*

À l'heure actuelle, le pétrole et ses dérivés sont l'un des polluants environnementaux d'origine humaine les plus répandus, et la pollution de divers environnements naturels par des produits pétroliers est de plus en plus répandue. Bien que le pétrole soit une ressource importante et précieuse, c'est aussi l'un des polluants anthropiques les plus dangereux, qui cause d'énormes dégâts à l'environnement.

Le pétrole est par nature un produit naturel qui pénètre naturellement dans l'environnement naturel. Cependant, le pétrole se répand dans la biosphère par d'autres moyens. Ainsi, sa distribution se produit au cours de la production de pétrole, ainsi que lors du raffinage du pétrole pour obtenir du carburant et de nombreux produits pétroliers, dont les déchets se retrouvent à leur tour dans divers environnements naturels – air, sol, eau [Galkin, 2011].

Il existe plusieurs sources majeures de pollution par le pétrole et les produits pétroliers. De nombreux suggèrent que est la principale source de pollution par le pétrole et les produits pétroliers. Les déversements d'hydrocarbures dans les installations de production ou de stockage de pétrole constituent une source majeure de pollution pétrolière, mais c'est loin d'être le cas. Certes, les dommages causés aux oléoducs ou les accidents dans les installations de stockage de pétrole, les raffineries et les usines pétrochimiques constituent une source importante de pollution, mais ce n'est pas la seule. Par exemple, la pollution par les hydrocarbures peut survenir lors de l'utilisation domestique de produits pétroliers, auquel cas la source de pollution par les hydrocarbures est constituée par les carburants et les diverses huiles lubrifiantes utilisées pour le fonctionnement de divers véhicules. Par exemple, pour une station-service moyenne de 500 à 600 postes de remplissage, les émissions d'dans l'environnement provenant des réservoirs des voitures peuvent atteindre 3 % par jour de la quantité totale de produits pétroliers stockés.

Le pétrole et ses dérivés peuvent également être rejetés dans l'environnement en cas de fuite lors de la production ou de déversement lors du transport. Ainsi, les pertes lors du transfert de pétrole dans les wagons-citernes peuvent atteindre environ 0,04 % du volume total du produit rempli, et les pertes de pétrole lors des déplacements – en moyenne 0,08 % du volume total du produit transporté. Si l'on prend un chiffre plus général, les pertes de pétrole et de ses différents produits pendant le transport et le stockage représentent environ 2 % du volume total de pétrole produit [Davydova, 2004]. D'autres sources peuvent être diverses entreprises de l'industrie chimique qui utilisent le pétrole dans leurs activités. Dans ce cas, la pollution de l'environnement se produit par le biais des eaux usées ou des émissions atmosphériques.

Après avoir analysé et comparé tous les faits susmentionnés, nous pouvons conclure qu'une grande variété de produits pétroliers pénètrent dans le sol et qu'en raison de leurs diverses propriétés chimiques et physiques, ils auront toutes sortes d'effets négatifs sur le sol.

L'huile est un liquide naturellement inflammable, huileux, gras et doté d'une odeur spécifique. La couleur du pétrole dépend généralement des résines qui y sont dissoutes et peut varier de presque noir à brun-vert. Le pétrole brut a une composition très complexe à base d'hydrocarbures de structures très diverses. Outre les hydrocarbures, le pétrole contient également des composants autres que les hydrocarbures, à savoir des composés d'azote, de soufre et d'oxygène. Si l'on considère la teneur en pourcentage des éléments chimiques, le pétrole aura la forme suivante : carbone 82-87% ; hydrogène 11-14% ; soufre 0,1-7% ; azote – 0,001-1,8%; oxygène – 0,05-1,0% [Chukharova, 2010]. Ces paramètres peuvent varier en fonction de certains facteurs, tels que l'âge ou l'origine de l'huile.

Comme nous l'avons déjà mentionné, le pétrole a une grande variété de composés hydrocarbonés dans sa composition. Il s'agit principalement d'hydrocarbures aliphatiques, mais dans certains cas, il peut également contenir des hydrocarbures alicycliques et aromatiques. Le pourcentage d'hydrocarbures aromatiques peut atteindre 55 %.Il existe trois types de composition chimique du pétrole: fractionnée, chimique de groupe, élémentaire. L'huile peut également être divisée en deux groupes, ou plus précisément en deux catégories – A et B.

La particularité des huiles de catégorie A est que leurs chromatogrammes présentent des pics d'alcanes normaux et isoprénoïdes, c'est-à-dire qu'il y a une forte concentration de ces substances dans leur composition. Les huiles de cette catégorie sont également divisées en deux types: A1 – huile à teneur relativement faible en résine, dans laquelle on enregistre une teneur élevée en fractions d'essence; A2 – huile dans la composition de laquelle les alcanes isoprénoïdes (1 - 6%) l'emportent sur les alcanes normaux (0,5-5%) [Davydova, 2004].

La particularité des huiles de catégorie B, contraire, est que leurs chromatogrammes ne contiennent pas de pics d'alcanes normaux et isoprénoïdes, c'est-à-dire que la composition de cette catégorie d'huile contiendra plus de cycloalcanes (de 60% à 75%). Les huiles de la catégorie B sont également de plusieurs types: B1 – huile dans laquelle les alcanes normaux et isoprénoïdes sont totalement absents et dans laquelle les fractions légères sont contenues en petites quantités; B2 – huile dont la composition est naphténique et paraffinonaphténique et qui se distingue par une teneur élevée en cycloalcanes [Ezelev, 2015].

En ce qui concerne les produits dérivés du pétrole brut, les principaux types de produits pétroliers liquides sont des fractions d'hydrocarbures obtenues à partir du pétrole brut lors de la distillation ou du raffinage secondaire. Ces produits comprennent: les essences (C4-C12), la paraffine (C12-C16), les carburants diesel (C16-C20), les combustibles pour chaudières, les huiles à usages divers, les huiles combustibles.

Outre les hydrocarbures, les produits pétroliers peuvent également contenir des composés d'azote et d'oxygène. En outre, les composants constants des produits pétroliers commerciaux sont divers additifs qui améliorent leurs propriétés opérationnelles, tels que des inhibiteurs de corrosion et des antidétonateurs [Galkin, 2011].

Comme on l'a déjà appris, le pétrole et les produits pétroliers introduisent dans le sol toute une série de composés chimiques. Et c'est justement cette variété qui est à l'origine d'un grand nombre de changements divers dans le sol provoqués par la pollution pétrolière [Davydova, 2004].

Le pétrole et les produits pétroliers qui pénètrent dans le sol ont un impact négatif sur son état et provoquent divers processus chimiques et physico-chimiques irréversibles, qui, à leur tour, provoquent la salinité du sol et affectent négativement la composition de l'humus, entraînant une perte partielle ou totale de la fertilité du sol. En outre, la porosité et la densité du sol peuvent être perturbées, ce qui peut entraîner des changements dans les régimes d'aération, d'eau et de température du sol.

Les différents composés d'hydrocarbures du pétrole ont des effets toxiques différents sur le sol et la microflore du sol. Par exemple, les alcanes à haut poids

moléculaire perturbent les processus d'échange d'air et d'eau du sol avec l'environnement. Les résines contenant des asphaltènes ont des effets similaires [Chukhareva, 2010]. Un autre exemple est celui des fractions légères du pétrole, ainsi que des composés soufrés, qui ont un effet toxique sur divers micro-organismes et plantes, et peuvent être utilisés comme exemple de ce qui suit inhibent leur croissance. Les composés les plus toxiques qui ont un effet dramatiquement négatif sur le sol sont les arènes.

Si nous parlons des caractéristiques générales des changements dans l'état du sol en cas de pollution par les hydrocarbures, nous pouvons distinguer les principaux processus suivants qui se produisent lorsque les hydrocarbures et les produits pétroliers pénètrent dans le sol:

– Perturbation de l'équilibre des micro-organismes du sol, changement des micro-organismes dominants. Ainsi, par exemple, les représentants des Fibrobacterales, Thermoanaerobacterales, Enterobacteriales, Thermotogales sont très sensibles à la pollution pétrolière et sont absents du sol à de faibles concentrations de pétrole (0,5-2,5 %), tandis que les bactéries Flavobacteriales, Pseudomonadales, Rhizobiales, Sphingomonadales seront les bactéries dominantes dans le sol contaminé par le pétrole et les produits pétroliers.

– Perturbation de l'activité photosynthétique des organismes végétaux et entrave à l'apport de nutriments;

– Ralentissement et détérioration des processus d'auto-épuration du sol.

Afin d'évaluer le niveau d'impact du pétrole et des produits pétroliers sur l'état du sol, deux paramètres sont utilisés:

1. Seuil inférieur de concentration admissible – concentrations de polluants auxquelles le sol est capable de s'auto-épurer [Chukhareva, 2010].

2. Seuil supérieur de concentration admissible – concentrations de polluants à partir desquelles le rythme des processus d'auto-épuration du sol ralentit et sa dégradation progressive se produit [Ezelev, 2015].

Bien que le sol soit capable de s'auto-purifier par la dégradation microbienne des hydrocarbures, ce processus est très long et peut durer de 35 à 45 ans, de sorte que pour améliorer la qualité du sol en vue d'une utilisation ultérieure, d'autres méthodes plus efficaces de purification sont nécessaires.

Littérature

1. Chuxareva, N.V., Rudachenko, A.V., Polyakov, V.A. (2010). Opredelenie kolichestvenny`x xarakteristik nefti i gaza v sisteme magistral`ny`x truboprovodov [Quantification du pétrole et du gaz dans le réseau de canalisations principales]. – Tomsk: TPU. – 311 p. (en russe)

2. Davy`dova, S.L., Tagasov, V.I. (2004). Neft` i nefteprodukty` v okruzhayushhej srede [Pétrole et produits pétroliers dans l'environnement]. – M.: Izdatel`stvo RUDN. – 163 p. (en russe)

3. Ezhelev Z. S. (2015). Svojstva i rezhimy` rekul`tivirovannyx posle razlivov nefti pochv Usinskogo rajona respubliki Komi: Kandidata biologicheskix nauk [Propriétés et régimes des sols récupérés après des déversements de pétrole dans le district d'Usinsky de la République de Komi: Candidat en sciences biologiques]. – M.: MGU. – 142 p. (en russe)

4. Galkin, V.I., Kochneva, V.I. (2011). Geologiya nefti i gaza [Géologie du pétrole et du gaz]. – Perm: PNIPU. – 113 p. (en russe)

5. Vernigorova, V.N. (2005). Ximiya zagryaznyayushhix veshhestv i e`kologiya [Chimie des contaminants et écologie]. – M.: Izdatel`stvo "Paleotip". – 240 p. (en russe)

UDK 575.22; 502.4

BIOLOGISCHE UND ÖKOLOGISCHE ASPEKTE DER LANDSCHNECKEN-POPULATIONEN VON HONDRUIA TRIDENS

Potapowa Olga Petrowna,
Masterstudentin des Instituts für Pharmazie, Chemie und Biologie,
Belgoroder Staatliche Nationale Forschungsuniversität, Belgorod, Russland,
E-mail: polga9153@gmail.com
Taranowa Elena Nikolayewna,
Kandidatin der philologischen Wissenschaften,
Professorin des Lehrstuhls für Fremdsprachen
und berufliche Kommunikation,
Belgoroder Staatliche Nationale Forschungsuniversität, Belgorod, Russland,
E-mail: taranova_e@bsuedu.ru

Annotation: *In diesem Artikel werden die biologischen und ökologischen Aspekte der Art Chondrula tridens untersucht, einschließlich ihrer genetischen Struktur, Anpassung an Umweltbedingungen, Wechselwirkungen mit dem Ökosystem und aktuellen Bedrohungen für den Populationserhalt. Die Studie unterstreicht die Bedeutung einer hohen genetischen Variabilität und ökologischen Plastizität für das Überleben der Arten angesichts anthropogener Einflüsse und des Klimawandels. Besonderes Augenmerk wird auf die Rolle von Chondrula tridens bei der Aufrechterhaltung des Ökosystemgleichgewichts und die Notwendigkeit der Entwicklung von Maßnahmen zum Schutz seiner Lebensräume gelegt. Die Ergebnisse der Studie können für die weitere Erforschung der Anpassungsmechanismen von Weichtieren und die Entwicklung von Strategien zum Erhalt der Biodiversität genutzt werden.*

Schlagwörter: *Chondrula tridens, genetische Variabilität, die Landschecken, die Genetik, genetische Struktur von Chondrula tridens.*

Die Genetik als Wissenschaft untersucht die Mechanismen der Vererbung, Variabilität und Evolution lebender Organismen, was ein tieferes Verständnis ihrer Anpassung an die Umwelt ermöglicht. Von besonderem Interesse sind Weichtiere, insbesondere Vertreter der Familie Enidae, zu der auch die Art Chondrula tridens gehört. Diese Landschneckenart ist in verschiedenen Ökosystemen Europas weit verbreitet und erregt aufgrund ihrer einzigartigen Fähigkeit, sich an unterschiedliche Lebensräume anzupassen, die Aufmerksamkeit der Forscher.

Chondrula tridens ist eine kleine Landschnecke, die aufgrund ihrer Aktivität bei der Zersetzung organischer Stoffe und der Aufrechterhaltung des Gleichgewichts der Bodenmikroflora eine wichtige Rolle in Ökosystemen spielt. Durch die Untersuchung ihrer Biologie und Ökologie kann man nicht nur das Wissen über die Überlebensmechanismen dieser Art vertiefen, sondern auch die Beziehung zwischen genetischen Merkmalen und Umweltfaktoren erkennen. So wurde beispielsweise festgestellt, dass die Schalenform und -größe von Chondrula tridens je nach lokalen Umweltbedingungen wie Topografie, Luftfeuchtigkeit und Temperatur erheblich variieren kann.

Darüber hinaus ist diese Art in verschiedenen Programmen zum Schutz der Artenvielfalt enthalten, was ihre ökologische Bedeutung unterstreicht. Die Untersuchungen zeigen, dass anthropogene Einflüsse, darunter die Urbanisierung und

die Bodenverschmutzung, die Häufigkeit und genetische Vielfalt der Chondrula tridens-Populationen erheblich beeinträchtigen können, sodass weitere Forschungen zur Entwicklung von Schutzmaßnahmen erforderlich sind.

Die genetische Struktur von Chondrula tridens ist ein wichtiges Studienobjekt zum Verständnis der evolutionären Prozesse und Mechanismen der Anpassung dieser Art an unterschiedliche Umweltbedingungen. Die wissenschaftlichen Studien zeigen, dass Chondrula tridens eine hohe genetische Variabilität aufweist, was auf sein breites Lebensraumspektrum und seine Fähigkeit, eine Vielzahl ökologischer Nischen zu besiedeln, zurückzuführen sein könnte [Snegin, 2011]. Diese Variabilität spielt eine Schlüsselrolle für das Überleben einer Art, insbesondere angesichts anthropogener Einflüsse oder des Klimawandels.

Besonderes Augenmerk wird in der Studie auf die Analyse der Schalenmorphologie gelegt, die sowohl die genetischen Merkmale der Populationen als auch den Einfluss der Umwelt widerspiegelt. So haben etwa in städtischen Gebieten durchgeführte Studien erhebliche Unterschiede in der Größe und Form der Panzer zwischen Populationen ergeben, was auf eine Variabilität innerhalb der Population hindeutet.

Diese Daten stützen die Hypothese, dass Chondrula tridens über eine Plastizität verfügt, die es ihm ermöglicht, sich an veränderte Umweltbedingungen anzupassen. Darüber hinaus können solche Veränderungen sowohl das Ergebnis genetischer Faktoren als auch des Einflusses äußerer Bedingungen wie Temperatur, Feuchtigkeit und Gelände sein [Malaschchenko, 2014].

Genetische Analysen von Chondrula tridens-Populationen in verschiedenen Regionen, beispielsweise Zhiguli, zeigten, dass es aufgrund von Isolation und Umweltfaktoren zu Divergenzen kommt. Dies weist auf die komplexe Struktur der Verbreitung der Art und ihre Fähigkeit zur lokalen Anpassung hin. So lassen sich zum Beispiel in Bergregionen oder Schluchten, wo die Lebensraumbedingungen sich deutlich von denen im Flachland unterscheiden, auffällige Veränderungen der Schalenmorphologie beobachten, die mit einer höheren Luftfeuchtigkeit und dem Humifizierungsgrad des Bodens in Zusammenhang stehen könnten [Malaschchenko, 2014].

Um die genetischen Mechanismen, die der Anpassung von Chondrula tridens zugrunde liegen, besser zu verstehen, sind weitere Studien zur Beziehung zwischen genetischen Markern und Umweltfaktoren erforderlich [Komarowa, 2015]. Dadurch ist es möglich nicht nur Schlüsselaspekte der Evolution der Art zu identifizieren, sondern auch die Strategien für ihren Schutz angesichts der anthropogenen Einflüsse entwickeln [Snegin, 2011].

Die genetischen Studien unterstreichen auch, wie wichtig die Erhaltung der genetischen Vielfalt für das langfristige Überleben einer Art in einer sich verändernden Umwelt ist. Eine geringe genetische Vielfalt kann zu einer verringerten Anpassungsfähigkeit und einem erhöhten Risiko des Aussterbens einer Population führen, insbesondere unter Bedingungen der Lebensraumfragmentierung oder Umweltverschmutzung.

Die Anpassung von Chondrula tridens an unterschiedliche Umweltbedingungen ist das Ergebnis eines langen Evolutionsprozesses, bei dem die genetische Variabilität eine Schlüsselrolle spielt. Diese Art kommt sowohl in offenen Biotopen als auch in

Waldökosystemen in Westeuropa vor, beispielsweise im Morava-Tal, wo die Lebensraumbedingungen erheblich variieren können. Diese ökologische Plastizität macht Chondrula tridens zu einem einzigartigen Objekt für die Untersuchung von Anpassungsmechanismen.

Einer der Hauptfaktoren für eine erfolgreiche Anpassung ist die Fähigkeit der Schnecken, ihre Aktivität je nach Luftfeuchtigkeit und Temperatur der Umgebung zu regulieren. Unter trockenen Bedingungen können sie in einen Zustand der Scheintod geraten, der es ihnen ermöglicht, ungünstige Perioden zu überleben [Komarowa, 2016]. Solcherweise erfüllen ihre Schalen eine Schutzfunktion, indem sie den Feuchtigkeitsverlust verhindern und den Körper vor Fressfeinden schützen. Dies ist besonders wichtig in trockenen und heißen Regionen, in denen der Zugang zu Wasser begrenzt ist.

Die Forschung zeigt auch, dass Chondrula tridens in der Lage ist, sich an anthropogene Einflüsse, einschließlich der Urbanisierung, anzupassen. Allerdings führen solche Bedingungen häufig zu einer verringerten genetischen Vielfalt, was sich negativ auf die langfristige Überlebensfähigkeit von Populationen auswirken kann. In Städten beispielsweise, in denen die Boden- und Luftverschmutzung höher ist, können sich die physikalischen Eigenschaften der Muscheln verändern. Sie werden dicker oder sehen weniger dekorativ aus, um die Stressfaktoren standzuhalten.

Ein weiterer wichtiger Aspekt der Anpassung ist die Fähigkeit von Chondrula tridens, unterschiedliche Bodentypen zu besiedeln. Die Schnecken bevorzugen humusreiche Böden mit hohem Feuchtigkeitsgehalt, können aber auch unter trockeneren Bedingungen überleben, wenn sie den Zugang zu Pflanzenresten als Nahrung haben [Komarowa, 2016]. Dies verdeutlichten im Grunde ihre ökologische Plastizität und ihre Fähigkeit, die begrenzten Ressourcen zu nutzen.

In Waldökosystemen mit nahezu optimalen Bedingungen kann die Anzahl von Chondrula tridens hohe Werte erreichen, was auf eine erfolgreiche Anpassung hindeutet. In gestörten oder verschmutzten Ökosystemen kann ihre Rolle jedoch eingeschränkt sein, sodass weitere Forschungen zur Beurteilung der Auswirkungen anthropogener Einflüsse erforderlich sind. In Gebieten mit intensiver Landwirtschaft kann der Einsatz von Pestiziden beispielsweise toxische Auswirkungen auf Schnecken haben, wodurch ihre Zahl sinkt und ihre Fähigkeit, Ökosystemfunktionen zu erfüllen, eingeschränkt wird.

Chondrula tridens spielt eine wichtige Rolle in Ökosystemen, da sie an der Zersetzung organischer Stoffe beteiligt ist und das Gleichgewicht der Bodenmikroflora aufrechterhält. Ihre ernährungsphysiologische Aktivität fördert die Verarbeitung von Pflanzenresten, was sie zu wichtigen Teilnehmern am Stoffkreislauf der Natur macht [Adamowa, 2019]. Dies ist insbesondere in den Waldökosystemen bemerkenswert, wo die Schneckenzahlen aufgrund günstiger Lebensbedingungen hohe Werte erreichen können.

Daraus folgt, dass diese Schnecken verschiedenen Raubtieren (Vögeln und kleinen Säugetieren) als Nahrung dienen und sind somit ein wichtiges Glied in der Nahrungskette. In Tieflandwäldern oder Tälern des Flusses Morava dient Chondrula tridens häufig als wichtige Nahrungsquelle für die lokale Fauna, was seine ökologische Bedeutung unterstreicht. Auch die Interaktion mit anderen Weichtierarten beeinflusst

ihre Verbreitung und Häufigkeit. Zum Beispiel kann der Wettbewerb um Ressourcen deren Verteilung in einigen Regionen einschränken, insbesondere unter anthropogenen Einflüssen [Adamowa, 2019].

Die Interaktion von Chondrula tridens mit dem Ökosystem ist jedoch nicht auf positive Aspekte beschränkt. In einigen Fällen kann die vom Menschen verursachte Verbreitung dieser Art zu unvorhersehbaren Folgen für die lokale Flora und Fauna führen. In gestörten Ökosystemen kann ihre Aktivität beispielsweise das Gleichgewicht zwischen verschiedenen Organismengruppen stören. Um die langfristigen Auswirkungen zu verstehen, sind weitere Untersuchungen erforderlich [Sychew, 2019].

Es ist wichtig zu beachten, dass die Rolle von Chondrula tridens in den Ökosystemen direkt vom Zustand der Umwelt abhängt. Unter Bedingungen der Bodenverschmutzung oder des Klimawandels kann ihre Fähigkeit, Ökosystemfunktionen zu erfüllen, eingeschränkt sein. So kann etwa der Einsatz von Pestiziden in der Landwirtschaft eine toxische Wirkung auf Schnecken haben, wodurch ihre Zahl sinkt und ihre Fähigkeit, sich an der Zersetzung organischer Stoffe zu beteiligen, eingeschränkt wird.

Trotz der relativen Häufigkeit von Chondrula tridens ist diese Art einer Reihe von Bedrohungen durch Umweltveränderungen ausgesetzt. Eines der Hauptprobleme ist die Urbanisierung, die zur Fragmentierung von Lebensräumen und einer Verringerung der genetischen Vielfalt der Populationen führt. Durch die Fragmentierung des Lebensraums werden die Möglichkeiten zur Verbreitung und zum Austausch genetischen Materials zwischen Populationen eingeschränkt, was zu einem erhöhten Risiko des Aussterbens lokaler Gruppen führen kann.

Eine weitere erhebliche Bedrohung ist der Klimawandel, der die Ressourcenverfügbarkeit und die Lebensraumbedingungen erheblich beeinträchtigen kann. So können häufigere Dürreperioden die Aktivität der Schnecken einschränken und zu einer Verringerung ihrer Zahl führen. Bei hohen Temperaturen und unzureichender Luftfeuchtigkeit sind Chondrula tridens den Stress ausgesetzt, der ihre Fortpflanzungs- und Überlebensfähigkeit beeinträchtigt.

Darüber hinaus wirken sich die Bodenverschmutzung und der Einsatz von Pestiziden in der Landwirtschaft negativ auf die Populationen von Chondrula tridens aus. Im Körper der Schnecken können sich giftige Substanzen ansammeln, die ihre Lebensfähigkeit und ihre Fähigkeit, Ökosystemfunktionen zu erfüllen, beeinträchtigen. Dies ist besonders in Gebieten mit intensiver Landwirtschaft spürbar, wo chemische Düngemittel und Herbizide das Gleichgewicht des Ökosystems stören, einschließlich der Bodenmikroflora, die eine wichtige Rolle bei der Ernährung von Schalentieren spielt.

Um diese Art zu erhalten, müssen die Überwachungs- und Schutzprogramme umgesetzt werden, einschließlich der Schaffung geschützter Gebiete und der Wiederherstellung beschädigter Ökosysteme. Besondere Aufmerksamkeit muss auf die Erhaltung der genetischen Vielfalt gelegt werden, die die Grundlage für die Anpassungsfähigkeit der Arten bildet. So hat etwa die Forschung in der Region Zhiguli gezeigt, dass die Erhaltung der genetischen Vielfalt von Chondrula tridens direkt mit ihrer Fähigkeit zusammenhängt, Umweltveränderungen und anthropogenen Einflüssen standzuhalten.

Daraus folgt, dass die aktuellen Bedrohungen für den Schutz der Chondrula tridens-Populationen einen umfassenden Ansatz erfordern, der sowohl wissenschaftliche Forschung als auch praktische Maßnahmen zum Schutz ihrer Lebensräume umfasst. Nur die gemeinsamen Anstrengungen und Bemühungen von Wissenschaftlern, Umweltschützern und verschiedenen Behörden können das langfristige Überleben dieser einzigartigen Weichtierart sichern, die eine wichtige Rolle bei der Erhaltung der Artenvielfalt und des Gleichgewichts der Ökosysteme spielt.

Fazit: Die durchgeführte Studie zeigt wichtige Aspekte der Biologie und Ökologie von Chondrula tridens. Darunter sind genetische Variabilität, die Anpassung an unterschiedliche Umweltbedingungen, die Rolle in Ökosystemen und der Einfluss anthropogener Faktoren. Die hohe Plastizität der Art ermöglicht ihr die erfolgreiche Entwicklung einer Vielzahl von Lebensräumen, von Wäldern bis hin zu städtischen Gebieten. Moderne Bedrohungen wie Klimawandel, Bodenverschmutzung und Lebensraumfragmentierung beeinträchtigen jedoch die Größe und genetische Vielfalt der Populationen erheblich.

Chondrula tridens spielt eine wichtige Rolle bei der Aufrechterhaltung des Gleichgewichts des Ökosystems, indem sie an den Zersetzungsprozessen organischer Stoffe beteiligt ist und ein Bindeglied in der Nahrungskette darstellt. Um die Art zu erhalten, müssen Maßnahmen zum Schutz ihrer Lebensräume und zur Erhaltung der genetischen Vielfalt ergriffen werden, die ihr Überleben in einer sich verändernden Umwelt sicherstellen.

Literaturliste

1. Adamowa, W. W. (2019). Osobennosti adaptazii populjazii adwentiwnih widow molluskow w uslowijah yga Srednerusskoi wozwischennosti “Ekologija (biologicheskie nauki)” [Die Besonderheiten der Anpassung von Populationen adventiver Arten terrestrischer Weichtiere an die Bedingungen im Süden des Zentralrussischen Hochlandes "Ökologie (Biowissenschaften)"] // *Dissertaciya na soiskanie uchenoi stepeni kandidata biologicheskich nauk [Dissertation für die Erlangung des wissenschaftlichen Grades des Kandidaten der Biowissenschaften].* – Belgorod: Belgorodskiy Gosudarstwennyi Universitet. – 287 S. (in Russisch)

2. Komarowa, E. W., Stoyko, T. G., Titow, S. W. (2015). Geneticheskaja i morfologicheskaj struktura populajzii nazemnogo mollyska Chondrula tridens na territorii Srednego Powolch’ja [Genetische und morphologische Struktur der Populationen der Landweichtierart Chondrula tridens im Gebiet der mittleren Wolgaregion] // *Nauchnye wedomosti [Wissenschaftliche Nachrichten].* – Nr. 3 (200). – S. 67-73. (in Russisch)

3. Komarowa, E. W. (2016). Populjacionnaja ekologija i rasprostpanenie nazemnogo molluska Chondrula tridens (Müller, 1774) w lesostepi Priwolchskoi wozwischennosti [Die Populationsökologie und Verbreitung der Landweichtier Chondrula tridens (Müller, 1774) in der Waldsteppe des Wolga-Hochlandes] *// Dissertaciya kandidata biologicheskich nauk [Dissertation Kandidatin der Biowissenschaften].* – Penza. – 157 S. (in Russisch)

4. Malashchenko, T. A., Komarowa, E. W., Stoyko, T. G. (2014). Wlijanie rel’efa na izmenchiwost’ rakowini Condrulia tridens (pulmonata, enidae) [Der Einfluss des Reliefs auf die Variabilität der Schale von Condrulia tridens (pulmonata, enidae)] // *Izwestiya vysschych uchebnych zavedeniy [Nachrichten von Hochschulen].* – Estestvennye nauki. – Nr. 4 (8). – S. 29-35. (in Russisch)

5. Snegin, E. A. (2011). Geneticheskaja struktura populjazii modelnih widow nazemnih mollyskow w uslowijah urbanisirowannogo landschafta na primere Chondrula tridens Müll (Gastropoda, Pulmonata) [Genetische Struktur von Populationen von Modellarten terrestrischer Weichtiere in urbanisierten Landschaften am Beispiel von Chondrula tridens Müll (Gastropoda, Pulmonata)] // *Ekologicheskaya genetika [Ökologische Genetik].* – V. 9. – Nr. 2. – S. 54-64. (in Russisch)

6. Sychew, A. A., Snegin, E. A., Schapowalow, A. S., Ponomarenko E. W., Chendew, Yu. G. (2019). K woprosu o structure fauni nazemnih molluskow zapowednogo uchastka "Jamskaja step'" w pozdnem golozene [Zur Frage der Struktur der Fauna der Landmollusken des Naturschutzgebiets Jamskaja-Steppe im späten Holozän] // *Westnik gosudarstwennogo Tomskogo universiteta [Bulletin der Staatlichen Universität Tomsk]*. – Biologie. – Nr. 2(30). – S. 146-164. (in Russisch)

UDK 543.243

TITRIMETRIC METHODS FOR QUANTITATIVE DETERMINATION OF TABLE SALT

Voloshina Irina Evgenievna,
Studentof the Institute of Pharmacy, Chemistry and Biology,
Belgorod State National Research University, Belgorod, Russia,
E-mail: 1641202@bsuedu.ru
Miroshnichenko Natalia Sergeevna,
Ph.D. in Philology,
Associate Professor of the Department of Foreign Languages
and Professional Communication,
Belgorod State National Research University, Belgorod, Russia,
E-mail: miroshnichenko_n@bsuedu.ru

Abstract: *The article is devoted to the most frequently used analytical methods of quantitative determination of table salt which are titrimetric ones. Nowadays table salt is a very popular food additive. That is the reason why its chemical composition must be strictly controlled. The article deals with such titrimetric methods as Mohr, Volhard, Fajansmethods, mercurometry and complexometry.*

Keywords: *table salt, analytical chemistry, quantitative analysis, titrimetry, mercurometry, argentometry, Mohr method, Volhard method, Fajans method.*

Table salt is one of the most common food additives. When quality control of this product is held, special attention is paid to checking the content of its main component – sodium chloride. In such cases, titrimetric methods of analysis are often used due to the fact that they are based on titration of the analyzed solution by a titrant with a certain precise concentration.

Moreover, quality control of table salt includes checking the salt composition for compliance with state standards for the content of all kinds of impurities. Thus, table salt can often contain such cationic impurities as calcium and magnesium. The same titrimetric analysis that is used to calculate the mass fraction of sodium chloride in a salt sample makes it possible to determinate their content in the food additive.

Titrimetric methods can be used to quantitatively determine sodium chloride NaCl and various impurities in table salt. Among them, argentometry and mercurometry are the basis for determining the content of the main component of table salt of any type.

The first mentioned section of precipitation titration is characterized by the use of silver salts as a titrant. Depending on the indicator used, there are 3 argentometry methods: the Mohr method, the Fajans method and the Volhard method.

Argentometric methods are based on the use of the precipitation properties of a standard silver nitrate solution $AgNO_3$. These include the Mohr method, in which titrating the analyzed solution with halogen anions in the presence of potassium

chromate K_2CrO_4 as an indicator takes place. Due to the difference in solubility of the precipitates of halides and silver chromate Ag_2CrO_4, during the titration process silver ions are primarily bound to form a precipitate with halogen anions, and after their precipitation, an excess drop of titrant forms silver chromate Ag_2CrO_4 with the indicator, which is a brick-red precipitate.

The condition for performing this method is maintaining a neutral or slightly alkaline pH (from 7 to 10). There are several reasons for the limitations of the pH: firstly, in an alkaline environment, the silver nitrate $AgNO_3$solution decomposes into a precipitate of silver oxide Ag_2O, secondly, in an acidic environment, the silver chromate precipitate dissolves.

The next condition for titration by the Mohr method is the absence of interfering ions in the analyzed solution. These include anions that form a precipitate when interacting with Ag^+ (for example, carbonate ions CO_3^{2-}, orthophosphate ions PO_4^{3-}, arsenate ions AsO_4^{3-}), and cations that react with CrO_4^{2-} to form insoluble chromates (Ba^{2+}, Pb^{2+} and Hg_2^{2+}, etc.) [Koltgrof, 1961: 224].

The Volhard method is used to determine chloride ions by reverse titration. Thus, an excess of a standard silver nitrate solution $AgNO_3$ is added to the analyzed solution with Cl^- ions, resulting in the formation of a curdled precipitate of silver chloride AgCl. The remaining silver nitrate is titrated with a solution of ammonium thiocyanate NH_4SCN, leading to the formation of a precipitate of silver thiocyanate AgSCN.

The Fe^{3+} ion is used as an indicator in the Volhard method, which forms a red complex – iron thiocyanate $[Fe(SCN)_3]$, when interacting with an excess drop of titrant. Before titration, iron ions are added to the solution in the form of ferric ammonium alum $NH_4Fe(SO_4)_2*12H_2O$ [Belyavskaya, 1986: 159].

However, when determining chlorides is carried out using the Volhard method, an error occurs due to the greater solubility of AgCl compared to silver thiocyanate. This error is eliminated by adding organic compounds that help to isolate silver chloride from thiocyanate ions. Examples of such organic solvents are benzene and carbon tetrachloride.

The titrant of the method is prepared as a secondary standard, since ammonium thiocyanate NH_4SCN is a hygroscopic salt. Standardization is carried out by using a standard solution of silver nitrate $AgNO_3$.

For titration using this method, the solution must not contain ions that form complexes with trivalent iron (e.g. PO_4^{3-}, F^-), mercury (I) and (II) compounds, since its ions form insoluble salts with titrant ions, as well as oxidizers that affect the content of thiocyanate ions (these include permanganates, chlorates, and other compounds). To prevent hydrolysis of the indicator, it is necessary to maintain an acidic pH [Kreshkov, 1982: 312].

The advantages of the method include the possibility of titration in an acidic environment and the absence of an effect on the results of ions that interfere with the determination of chlorides using the Mohr method.

Fajans method is based on adsorption indicators, in the presence of which direct titration with a silver nitrate solution $AgNO_3$ is carried out.

When titrating the analyzed solution containing chloride ions with silver nitrate is performed, a precipitate appears – silver chloride AgCl. Excess ions of the solution

accumulate on its surface: at the beginning of the titration, negatively charged chloride ions Cl^- dominate, then neutralization occurs, and an excess drop of titrant promotes the absorption of the silver cation Ag^+ by the precipitate surface, which in turn attracts the indicator anion as a counterion. The colored ions of the indicator adsorbed on silver chloride change the color of the precipitate and indicate that the end point of titration has been reached [Vasiliev, 2007: 366].

Depending on the adsorption indicator, the requirements for titration according to the method change. Representatives of this group of indicators are weak organic acids. Some of them are suitable for titration in strictly defined pH ranges where their ionization is not suppressed (for example, the use of fluorescein requires a pH from 7 to 10), while others can be used even in acidic environments, such as eosin [Lurye, 1989: 447].

The basis of the determination by the mercurometry method is the formation of poorly soluble mercury (I) halides during the interaction of the titrant (standard solution of mercury (I) nitrate $Hg_2(NO_3)_2$) with the analyzed solution containing halide ions. The method requires an indicator. A solution of iron (III) thiocyanate [$Fe(CNS)_3$] or an alcoholic solution of diphenylcarbazone are used as indicators. Unlike the first indicator, titration using diphenylcarbazone is possible in strongly acidic conditions. Diphenylcarbazone, which is an adsorption indicator, forms a blue-violet complex with an excess drop of titrant in a strongly acidic condition, and a blue precipitate in a neutral and weakly acidic condition.

Compared to the argentometric method, in mercurometry many cations that interfere with argentometric titration do not interfere with the determination. Moreover, mercury (I) halide precipitates are characterized by lower solubility than similar silver salts, which increases the accuracy of determination.

However, the condition for the mercuriometric method is the absence of the following ions in the solution: SO_4^{2-}, SO_3^{2-}, S^{2-}, Fe^{3+}, MnO^{4-}, $Cr_2O_7^{2-}$. The titrant of the method is prepared as a secondary standard, since mercury nitrate is hygroscopic, contains impurities and is unstable.

The process of preparing the solution includes dissolving a sample of mercury (I) nitrate dihydrate in nitric acid upon heating, reducing mercury (II) ions to mercury (I) as a result of reduction in the presence of metallic mercury. This solution is standardized using chemically pure potassium or sodium chloride. At the beginning of the titration, a precipitate is formed – mercury (I) chloride Hg2Cl2, which is characterized by a light gray color. At the end point of the titration, a change in the color of the solution from pale gray to blue-violet is observed [Bolotov, 2005: 200].

In addition to the main component of table salt, the amount of its impurities also needs to be controlled. The titrimetric method is again suitable for determining the content of some of them. It allows determining the content of many ions in salt, including calcium II and magnesium II ions.

Ca^{2+} and Mg^{2+} ions, which are possible impurities of table salt, are determined by the complexometric method. The essence of this method is titration of the analyzed salt solution with Trilon B, as a result of which the listed ions form strong complexonates in an ammonia buffer condition. In this way, the combined content of Ca^{2+} and Mg^{2+} is determined, after which titration is carried out in a highly alkaline

condition to establish the content of only the Ca^{2+} ion, since Mg^{2+} ions precipitate as magnesium hydroxide $Mg(OH)_2$[GOST 54352-2011, 2011: 11].

To fix the end points of titration during the first and second titrations, the method involves the use of two indicators, respectively – ECHCh-T and murexide. The first indicator forms a wine-red complex with metal ions, which is destroyed during titration with Trilon B. An excess drop of titrant causes the solution to turn blue. When determining Ca^{2+} ions before titration, the solution has a red color of the complex formed by murexide and Ca^{2+}. At the end point of titration, it changes to violet [Vasiliev, 2006: 414].

In conclusion, it is possible to note the variety of titrimetric methods for determining the content of sodium chlorideand many impurities. Their variability allows selecting the necessary method based on the reagents available or the specific requirements of the product to the reaction conditions. For example, when titrating using the Mora method, it is necessary to maintain a slightly alkaline pH, the Volhard method uses a titrant that requires standardization, in the Fajans method the process condition depends on the indicator, and mercury compounds are used in mercurometry. Moreover, in each method specific interfering ions must be considered.

References

1. Belyavskaya, T.A. (1986). Prakticheskoe rukovodstvo po gravimetrii I titrimetrii: Uchebnoe posobie [Practical Guide to Gravimetry and Titrimetry: Study Manual]. – M.: Izdatel'stvo Moskovskogo universiteta. – 159 p. (in Russian)

2. Bolotov, V.V. et al. (2005). Konspekt lekcij po analiticheskoj himii. Kolichestvennyj analiz: Uchebnoe posobie dlya studentov vuzov [Lecture notes on analytical chemistry. Quantitative analysis: A tutorial for university students]. – Kh.: Izdatel'stvo NFAU. –200 p. (in Russian)

3. GOST 54352-2011(2011). National standard of the Russian Federation. Edible table salt. Determination of the mass fraction of magnesium ion and calcium ion by the complexometric method [National standard of the Russian Federation. Edible table salt. Determination of the mass fraction of magnesium ion and calcium ion by the complexometric method]. – M.: Standartinform. – 11 p. (in Russian)

4. Koltgrof, I.M. (1961). Ob"emnyj analiz. Prakticheskaya chast'. Metody nejtralizacii, osazhdeniya I kompleksoobrazovaniya [Volumetric analysis. Practical part. Methods of neutralization, precipitation and complexation]. – T. 2. M.: Goskhimizdat. –224 p. (in Russian)

5. Kreshkov, A.P. (1982). Kurs analiticheskoj himii. Kolichestvennyj analiz. Uchebnoe posobie [Course of analytical chemistry. Quantitative analysis. Studymanual]. – M.: Himiya. – 312 p. (inRussian)

6. Lurye, Y.Y. (1989). Spravochnik po analiticheskoj himii [Handbook of analytical chemistry.]. – M.: Himiya. – 447 p. (in Russian)

7. Vasiliev, V.P. (2006). Analiticheskaya himiya. Laboratornyj praktikum. Uchebnoe posobie dlya vuzov [Analytical Chemistry. Laboratory Workshop. Textbook for Universities]. – M.: Drofa. – 414 p. (in Russian)

8. Vasiliev, V.P. (2007). Analiticheskaya himiya. Kniga 1: Titrimetricheskie I gravimetricheskij metody analiza: uchebnik dlya studentov vuzov, obuchayushchihsya po himiko-tekhnologicheskoj special'nosti [Analytical Chemistry. Book 1: Titrimetric and Gravimetric Methods of Analysis: Textbook for University Students Studying in the Chemical Engineering Specialty]. – M.: Drofa. – 366 p. (in Russian)

UDK [632. 654+632.7]

DER EINFLUSS MODERNER INSEKTIZIDE AUF DIE POPULATIONSDYNAMIK UND PHYSIOLOGIE DER INSEKTEN

Speter Eduard Ewgenyewich,
Masterstudent des Instituts für Pharmazie, Chemie und Biologie,
Belgoroder Staatliche Nationale Forschungsuniversität,
Belgorod, Russland,
E-mail: milrad2018@gmail.com
Taranowa Elena Nikolayewna,
Kandidatin der philologischen Wissenschaften,
Professorin des Lehrstuhls für Fremdsprachen
und berufliche Kommunikation,
Belgoroder Staatliche Nationale Forschungsuniversität,
Belgorod, Russland,
E-mail: taranova_e@bsuedu.ru

Annotation: *Die Insekten sind ein wichtiger Bestandteil der Natur. Die Verwendung von Insektiziden zur Bekämpfung von Insektenschädlingen hat einen signifikanten Einfluss auf die Stabilität von Ökosystemen als Ganzes und schädigt auch nützliche Insekten. Im Artikel werden die Auswirkungen moderner Insektizide auf die Physiologie und Fortpflanzungsfähigkeit von Insekten untersucht und beschrieben. Der bewusste und rationale Ansatz und die Anwendung von Insektiziden spielt eine große Rolle in der Landwirtschaft.*

Schlagwörter: *moderne Insektizide, die Insekten, die Populationsdynamik der Insekten, die Bekämpfung von Pflanzenschädlingen, die Agrarindustrie, die Auswirkungen von Insektiziden auf Ökosysteme.*

Moderne Insektizide spielen eine Schlüsselrolle bei der Bekämpfung von Pflanzenschädlingen und sorgen für hohe Erträge und wirtschaftliche Stabilität in der Agrarindustrie. Ihre Auswirkungen auf Ökosysteme verursachen jedoch erhebliche Bedenken, insbesondere aufgrund ihrer Auswirkungen auf Insekten, die wichtige ökologische Funktionen wie Bestäubung und Schädlingsbekämpfung erfüllen. Angesichts globaler Umweltveränderungen wird es besonders wichtig, die Auswirkungen von Insektiziden zu untersuchen.

Das Ziel dieser Studie ist es, die Auswirkungen moderner Insektizide auf die Populationsdynamik und Physiologie von Insekten zu analysieren. Um dieses Ziel zu erreichen, werden folgende Aufgaben gestellt: die Wirkungsmechanismen von Insektiziden untersuchen, ihre Auswirkungen auf die Reproduktionsleistung und das Überleben von Insekten bewerten und strukturelle Veränderungen in Populationen unter dem Einfluss von Chemikalien analysieren. Die Ergebnisse der Studie werden ermöglichen, die Empfehlungen für die rationale Anwendung von Insektiziden in der Landwirtschaft zu entwickeln.

Moderne Insektizide sind eine breite Palette chemischer Verbindungen, von denen jede einzigartigen Eigenschaften und Wirkmechanismen aufweist. Eine der wichtigsten Gruppen sind Neonicotinoide wie zum Beispiel Imidacloprid. Diese Substanzen nehmen etwa 25% des weltweiten Insektizidmarktes ein, was auf ihre hohe Wirksamkeit und breite Anwendung hindeutet. Neonicotinoide beeinflussen das

Nervensystem von Insekten und bieten eine wirksame Kontrolle über Schädlinge, erfordern jedoch aufgrund möglicher Umweltfolgen eine vorsichtige Verwendung.

Neben den Neonicotinoiden gehören zu den wichtigen chemischen Gruppen von Insektiziden die Pyrethroide, Organophosphate und Carbamate, von denen jede durch ihre eigenen Merkmale in Bezug auf die Anwendung und Wirkung von Insekten auf den Körper gekennzeichnet ist. Daher ist das Verständnis der chemischen Eigenschaften von Insektiziden die Grundlage für ihre effektive und sichere Verwendung in der Landwirtschaft.

Moderne Insektizide wirken auf das Nervensystem von Insekten und stören dabei ihre normale Funktion, was wiederum schwerwiegende Folgen für ihr Verhalten und ihr Überleben hat. Die Hauptmechanismen ihrer Wirkung umfassen die Einwirkung auf Ionenkanäle, Rezeptoren und Enzyme, die die Übertragung von Nervenimpulsen regulieren. Zum Beispiel beeinflussen die Pyrethroide die Natriumkanäle der Membranen von Nervenzellen von Insekten. Dies führt zu einer langen Öffnung, die zu einer permanenten Depolarisation der Membran führt und die normale Signalübertragung stört. Dadurch verlieren die Insekten ihre Fähigkeit, die Bewegungen zu koordinieren, und ihr Nervensystem funktioniert nicht mehr. Neonicotinoide binden an Nikotin-Acetylcholinrezeptoren und verursachen eine ständige Erregung. Dies führt zu Lähmungen von Insekten und schließlich zu ihrem Tod.

Die Insektizide haben auch einen signifikanten Einfluss auf die Fortpflanzungsfähigkeit von Insekten, was sich auf ihre Populationsdynamik auswirkt. Die Störungen im Nervensystem und im Stoffwechsel, die durch die Exposition gegenüber Chemikalien verursacht werden, führen zu einer verminderten Fruchtbarkeit und Vitalität der Nachkommen. Zum Beispiel können die Veränderungen im hormonellen Hintergrund die Fortpflanzungsprozesse stören, was sich darin manifestiert, die Anzahl der abgelagerten Eier zu reduzieren und ihr Überleben zu verringern. Diese Auswirkungen sind für Insektenpopulationen von entscheidender Bedeutung, da sie ihre Fähigkeit zur Wiederherstellung und Anpassung an die Umwelt beeinträchtigen.

Die laufende Forschung zeigt, dass die Exposition gegenüber Insektiziden zu signifikanten Veränderungen in den Fortpflanzungszyklen verschiedener Insektenarten führt. So können die Neonicotinoide die Eikapazität von Bienen um 30% reduzieren, was sich direkt auf ihre Fähigkeit auswirkt, die Populationsgröße aufrechtzuerhalten. Diese Veränderungen sind auf die Auswirkungen von Chemikalien auf das neuroendokrine Insektensystem zurückzuführen, das eine Schlüsselrolle bei der Regulierung von Fortpflanzungsprozessen spielt.

Wichtig ist, dass die Beziehung zwischen den Komponenten des trophischen Systems von Pflanzen–Insekten-Parasiten (Krankheitserregern und Parasitoiden) sich in der Populationsdynamik von Insekten, insbesondere einigen Arten von Waldfollyphagen, widerspiegelt. Ähnliche Störungen werden auch bei anderen Arten beobachtet, was auf einen weitreichenden Einfluss von Insektiziden auf die Fortpflanzungseigenschaften von Insekten hinweist.

Verschiedene Insektenarten zeigen unterschiedliche Reaktionen auf die Exposition gegenüber Insektiziden aufgrund ihrer physiologischen Merkmale und ihrer Resistenz gegen Chemikalien. Die durchgeführte Studie zeigt, dass die Insektizide bei

Drosophila melanogaster aufgrund direkter Auswirkungen auf die Fortpflanzungsorgane und den Hormonhaushalt die Fortpflanzungsfähigkeit um 30% reduzieren können. Gleichzeitig können andere Arten, wie die Apis mellifera, weniger ausgeprägte Veränderungen aufweisen, was auf ihre Anpassungsmechanismen zurückzuführen ist. Diese Unterschiede unterstreichen die Notwendigkeit des individuellen Ansatzes zur Bewertung der Auswirkungen von Insektiziden auf verschiedene Insektenarten. Es ist auch wichtig, „die geografische Farbvariabilität zu untersuchen und zu versuchen, die Populationsstruktur der Ameisenpopulation aufzudecken“, die zusätzlichen Informationen darüber liefern können, wie verschiedene Insektenpopulationen auf Chemikalien reagieren, abhängig von ihrem ökologischen Kontext [Gilew, 2002: 4].

Die Unterschiede in den Reaktionen von Insekten auf Insektizide hängen von einer Vielzahl von Faktoren ab, einschließlich ihrer physiologischen Merkmale, ihrer ökologischen Nische und ihrer Resistenz gegen Chemikalien. Zum Beispiel haben die Insekten, die in den Umgebungen mit hohen Insektizidkonzentrationen leben, oft eine erhöhte Resistenz gegen diese Substanzen, während die Arten, die solchen Bedingungen nicht ausgesetzt sind, empfindlicher sind. Darüber hinaus spielen die Stoffwechselwege und Entgiftungsmechanismen, die jeder Spezies eigen sind, eine Schlüsselrolle bei der Bestimmung ihrer Empfindlichkeit gegenüber Insektiziden. Diese Aspekte müssen bei der Entwicklung von Strategien zur Verwendung von Chemikalien berücksichtigt werden, um ihre negativen Auswirkungen auf die Artenvielfalt zu minimieren.

Moderne Insektizide haben einen signifikanten Einfluss auf die Anzahl der Insektenpopulationen. Die Insektizide können die Fortpflanzungsprozesse stören, die Fruchtbarkeit der Individuen verringern und dadurch die Populationsgröße verringern. Diese Veränderungen sind besonders in den landwirtschaftlichen Gebieten bemerkbar, in denen chemische Behandlungen regelmäßig angewendet werden, was einen konstanten Druck auf die Insektenpopulationen erzeugt.

Die Verringerung der Anzahl von Insekten unter dem Einfluss von Insektiziden führt zu Veränderungen in der Struktur ihrer Populationen. Mehr als 40% der Insektenarten sind nach Angaben der Internationalen Union für den Schutz der Natur vom Aussterben bedroht, was teilweise auf diese Faktoren zurückzuführen ist.

Die Biodiversität von Ökosystemen leidet unter der Anwendung von Insektiziden, was durch zahlreiche Studien bestätigt wird. Zum Beispiel hat der Rückgang der Bestäubungsinsektenpopulationen aufgrund der Verwendung von Neonicotinoiden in den letzten 15 Jahren 30% erreicht. Der Verlust solcher Arten führt zu kaskadierenden Effekten, die viele Ebenen von Ökosystemen betreffen. Der Rückgang der Biodiversität bedroht auch die Nachhaltigkeit von Ökosystemen und macht sie anfälliger für Umweltveränderungen. Dies unterstreicht die Notwendigkeit, die Strategien zur Erhaltung der Artenvielfalt bei der Verwendung von Insektiziden zu entwickeln. Andererseits hat „nach jahrelanger Forschung die kombinierte Verwendung eines Komplexes von Schutzmitteln und Mineraldüngern zur Steigerung des Ertrags und der Qualität von Winterweizenkorn beigetragen“ [Turjanski, Oliwa, 2015: 9]. Daher ist es wichtig, sowohl die positiven als auch die negativen Auswirkungen der Anwendung chemischer Mittel in der Landwirtschaft auf eine nachhaltige Entwicklung zu berücksichtigen.

Die Anwendung von Insektiziden hat trotz ihrer Wirksamkeit bei der Schädlingsbekämpfung einen signifikanten Einfluss auf die Nachhaltigkeit von Ökosystemen. Laut einem FAO (Ernährungs- und Landwirtschaftsorganisation der Vereinten Nationen) Bericht gehen jedes Jahr etwa 40% der Nutzpflanzen durch die Schädlinge verloren, was die weit verbreitete Verwendung von Insektiziden fördert. Die Ansammlung dieser Chemikalien in der Umwelt führt jedoch zur Störung des Gleichgewichts zwischen den verschiedenen Komponenten von Ökosystemen. Zum Beispiel bedroht der Rückgang der Anzahl von Bestäubungsinsekten die natürlichen Bestäubungsprozesse von Pflanzen, was wiederum die Produktivität von Nutzpflanzen beeinträchtigen kann. Daher erfordert die Anwendung von Insektiziden eine sorgfältige Überwachung, um negative Auswirkungen auf die Umweltverträglichkeit zu verhindern.

Der Verlust der Artenvielfalt verringert auch die Fähigkeit von Ökosystemen, sich von äußeren Einflüssen wie dem Klimawandel oder von Menschen verursachten Belastungen zu erholen. Dringende Maßnahmen sind erforderlich, um die Auswirkungen von Insektiziden auf die Artenvielfalt zu minimieren, einschließlich der Entwicklung umweltfreundlicherer Methoden zur Schädlingsbekämpfung.

Die Wahl von Insektiziden für den Einsatz in der Landwirtschaft erfordert die Berücksichtigung vieler Faktoren. Die wichtigsten sind die Wirksamkeit des Mittels gegen gezielte Schädlinge und die minimale Auswirkung auf nicht gezielte Organismen, einschließlich nützlicher Insekten wie Bienen. Im Jahre 2021 verbot die Europäische Union die Verwendung von drei Neonicotinoiden – Clotianidin, Imidacloprid und Thiamethoxam, da die Studien ihre signifikanten Auswirkungen auf den Rückgang der Bienenzahl nachgewiesen haben. Dieser Fall unterstreicht die Notwendigkeit, die Sicherheit von Insektiziden sorgfältig zu bewerten, bevor sie verwendet werden.

Die rechtzeitige und lokale Verwendung von Insektiziden ist ein Ansatz, der darauf abzielt, die Auswirkungen auf die Umwelt und nicht gezielte Arten zu minimieren. Bei dieser Methode werden die Insektizide nur an Stellen mit hoher Schädlingskonzentration angewendet, wodurch die Gesamtmenge der verwendeten Chemikalien erheblich reduziert wird. Die Verwendung spezialisierter Geräte zur Verteilung von Insektiziden wie Drohnen ermöglicht eine genaue Behandlung infizierter Bereiche und vermeidet übermäßiges Sprühen. Dieser Ansatz reduziert nicht nur die Kosten auf Chemische Medikamente, sondern reduziert auch die Wahrscheinlichkeit der Freisetzung in die Ökosysteme, die nicht im Zusammenhang mit der Landwirtschaft.

Biologische Methoden zur Schädlingsbekämpfung werden zu einer wichtigen Alternative zu chemischen Insektiziden und minimieren ihre negativen Auswirkungen auf das Ökosystem. Das integrierte Schädlingsmanagement, das die Verwendung von entomopathogenen Pilzen und Bakterien beinhaltet, ermöglicht laut FAO (Ernährungs- und Landwirtschaftsorganisation der Vereinten Nationen) die Reduzierung des Einsatzes von Chemikalien um 40 bis 50%. Diese biologischen Wirkstoffe wirken spezifisch auf die Schädlinge ein, ohne nützliche Insektenarten zu beeinflussen. Die Studie von 2020 bestätigt die Wirksamkeit entomopathogener Pilze bei der Schädlingsbekämpfung und stellt fest, dass „die effektive Aufnahme von Nährstoffen

es parasitären Pilzen ermöglicht, ihre eigene Masse im Wirt schnell zu erhöhen“ [Kryukowa, Jaroslawtsewa, Glupowa, 2020: 5].

Dieser Ansatz macht biologische Methoden zu einem vielversprechenden Werkzeug für eine nachhaltige Landwirtschaft. Auf der anderen Seite hat auch die Verwendung von chemischen Mitteln wie Neonicotinoiden ihre Vorteile. Dennoch garantieren die unbestreitbaren Vorteile, die Neonicotinoiden innewohnen, ihre Anwendung in Bezug auf eine so nützliche Komponente von Agrobiocenosen, wie bestäubende Insekten sind, nicht völlig sicher. Daher ist es wichtig, einen integrierten Ansatz zur Schädlingsbekämpfung zu berücksichtigen, um die negativen Auswirkungen auf das Ökosystem zu minimieren.

Fazit: Als Ergebnis der durchgeführten Studie wurden die Wirkmechanismen moderner Insektizide und ihre Auswirkungen auf die Physiologie und Populationsdynamik von Insekten untersucht und beschrieben.

Die Analyse zeigte, dass Insektizide erhebliche Auswirkungen auf das Nerven- und Fortpflanzungssystem von Insekten haben, was zu Veränderungen in ihrem Verhalten, Stoffwechsel und Fortpflanzungsfunktionen führt. Dies wiederum beeinflusst die Populationsgröße und -struktur sowie die Nachhaltigkeit von Ökosystemen erheblich.

Die Ergebnisse unterstreichen die Bedeutung eines bewussten Ansatzes für den Einsatz von Insektiziden in der Landwirtschaft. Der Einsatz von Chemikalien erfordert die Berücksichtigung ihrer langfristigen Auswirkungen auf die Artenvielfalt und die Ökosystemdienstleistungen.

Die Entwicklung alternativer Schädlingsbekämpfungsmethoden wie biologische Ansätze kann zu einem vielversprechenden Ziel werden, um die negativen Auswirkungen auf die Umwelt zu reduzieren.

Die Studie hat daher die wichtigsten Aspekte des Einflusses von Insektiziden auf Insekten und Ökosysteme aufgezeigt, indem sie die Notwendigkeit einer verantwortungsvollen Verwendung von Chemikalien hervorhebt und ihre Auswirkungen weiter untersucht. Die Ergebnisse können verwendet werden, um Strategien für eine nachhaltige Landwirtschaft zu entwickeln, die auf die Erhaltung der Artenvielfalt und die Erhaltung des ökologischen Gleichgewichts abzielen.

Literaturliste

1. Dineewich, L. L. (1999). O nablyudenii migracii ptic s pomoshch'yu radiolokacii [Zur Beobachtung der Vogelwanderung mit Hilfe von Radar] // *Scientific Israel – Technological Advantages*. – T. 4. – S. 3-39. (in Russisch)

2. Gilew, A.V. (2002). Ekologomorfologicheskij analiz populyacionnoj struktury i izmenchivosti ryzhih lesnyh murav'ev (Formica S. str.) na srednem Urale [Die ökologisch-morphologische Analyse der Populationsstruktur und der Variabilität von roten Waldameisen im Mittelural] //*Avtoreferat dissertacii na soiskanie uchenoj stepeni kandidata biologicheskih nauk*. – Ekaterinburg. – S. 127-161. (in Russisch)

3. Hodyrew, W.P., Chadinova, A.M., Isin, M.M., Muhamadiew, N.S., Kryukow, V.Yu. (2008). Vspyshki massovogo razmnozheniya i vozbuditeli boleznej osinovoj hohlatki Pbeosia tremula (Clerck) na yuge Zapadnoj Sibiri [Die Ausbrüche von Massenvermehrung und Erregern von Aspen-Cremula-Krankheiten Pheosia tremula (Clerck) im Süden Westsibiriens] // *Evrazijskij entomologicheskij zhurnal.* –7(4). – S. 373-376 (in Russisch)

4. Illarionow, A.I., Derkach, A.A. (2009). Toksicheskoe dejstvie nitro – i cianzameshchennyh neonikotinoidnyh insekticidov na medonosnuyu pchelu. [Toxische Wirkung von nitro- und

zyansubstituierten Neonicotinoid-Insektiziden auf die Honigbiene] // Vestnik. – Teoreticheskij i nauchno-prakticheskij zhurnal Woronezhskogo gosudarstvennogo agrarnogo universiteta. – Vypusk 2 (21). – S. 16-25. (in Russisch)

5. Isachenko, L. I., Fedorowa, I. A. (2015). Vliyanie ryzhih lesnyh murav'ev na chislennost' Ixodes ricinus (Linnaeus, 1758) v landshaftno-rekreacionnyh zonah g. Minska [Der Einfluss der roten Waldameisen auf die Anzahl der Ixodes ricinus (Linnaeus, 1758) in den Landschaft- und Erholungsgebieten von Minsk]. – Minsk: Mezhdunarodnyj gosudarstvennyj ekologicheskij universitet imeni A.D. Saharova. – S. 3-39. (in Russisch)

6. Kryukowa, W. Yu., Yaroslawtsewa, O. N., Glupowa, W. W. (2020). Fiziologo-ekologicheskie aspekty vzaimootnoshenij mezhdu entomopatogennymi gribami (Ascomycota, Hypocreales) i nasekomymi [Physiologisch-ökologische Aspekte der Beziehung zwischen entomopathogenen Pilzen (Ascomycota, Hypocreales) und Insekten] // *Parazitologiya*. – T. 54. – № 6. – S. 443–469. (in Russisch)

7. Markina, T. Yu. (2008). Dinamika strukturnyh parametrov pri optimizacii prostranstvennoj struktury iskusstvennyh populyacij nasekomyh [Die Dynamik der Strukturparameter bei der Optimierung der räumlichen Struktur künstlicher Insektenpopulationen]. – Harkov: Har'kovskij nacional'nyj pedagogicheskij universitet im. G. S. Skovorody. – S. 110-118. (in Russisch)

8. Orlin, N.A., Yakowlewa, E.M. (2012). Sravnitel'nye harakteristiki fosfornych i galogensoderzhashchih insekticidov [Vergleichende Eigenschaften von Phosphor- und halogenhaltigen Insektiziden] // *Advances in Current Natural Sciences*. – № 2. – S. 113–114. (in Russisch)

9. Perewaryuha, A. Yu. (2015). Gibridnaya model' razvitiya lokal'no vzryvoobraznogo populyacionnogo processa nasekomogo [Hybrides Modell für die Entwicklung eines lokal explosiven Populationsprozesses eines Insekts] // *Trudy ISA RAN*. – T. 65. – № 2. – S. 94–95. (in Russisch)

10. Salomowa, H. Zh. (2023). Ocenka opasnosti insekticidov [Die Bewertung der Gefahr von Insektiziden] // *Journal for Innovative Development in Pharmaceutical and Technical Science*. – Special'nyj vypusk*:* Mezhdunarodnaya konferenciya po prikladnym i estestvennym naukam. – S. 260–262. (in Russisch)

11. Schestopalow, N. V., Roslawtsewa, S. A., Alekseew, M. A., Eremina, O. Yu. (2012). Epidemiologicheskoe znachenie postel'nyh klopov i mery bor'by s nimi [Die epidemiologische Bedeutung von Bettwanzen und Maßnahmen zur Bekämpfung von Bettwanzen] // *Informacionnoe pis'mo.* – M.: FBUN NII Dezinfektologii Rospotrebnadzora. – S. 45. (in Russisch)

12. Stankewich, S. W. (2023). Nelinejnaya dinamika populyacij nasekomyh. Rezhimy s obostreniem i vozmozhnosti prognozirovaniya [Nichtlineare Dynamik der Insektenpopulationen. Exazerbationsmodi und Prognosemöglichkeiten]. Harkov: Har'kovskij nacional'nyj agrarnyj universitet im. V. V. Dokuchaeva. – S. 5-19. (in Russisch)

13. Tur'yanskij, A. W., Oliwa, L.W. (2015). Formirovanie i razvitie sistemy gosudarstvennoj podderzhki ekologizacii zemlepol'zovaniya [Bildung und Entwicklung des Systems der staatlichen Unterstützung für die Ökologie der Landnutzung]. Belgorod: Gosudarstwennyi agrarnyi universitet W.I. Gorina. – S. 7-22. (in Russisch)

SECTION 6
PHILOLOGY

UDK 811.161.1

FROM BLESSINGS TO JUSTICE: LINGUOCULTURAL REPRESENTATIONS OF GOD IN ENGLISH AND RUSSIAN PHRASEOLOGISMS AND PAREMIAS

Krivosheev Gleb Sergeevich,
Student of the Department of Russian Language and Russian Literature,
Belgorod State National Research University,
Belgorod, Russia,
E-mail: krivosheev_g@bsuedu.ru
Gusakova Natalya Leonidovna,
Ph.D. in Psychology,
Associate Professor of the Department of Foreign Languages
and Professional Communication,
Belgorod State National Research University,
Belgorod, Russia,
E-mail: gusakova_n@bsuedu.ru

Abstract: *This article deals with the linguocultural concept of «God» in English and Russian phraseological units and paremias. Using a comparative approach, it analyzes idioms and proverbs to reveal the cultural and cognitive views of the divine. The study identifies common and distinct features in how God is conceptualized in both languages.*

Keywords: *linguocultural concept of God, phraseology, paremias, idioms, proverbs, comparative analysis, language functions, cognitive linguistic.*

Language functions as a fundamentally social conception, inseparable from the cultural context of its speakers, and serves as a mirror for their perceptions of the world, moral principles, ethical norms, and religious convictions. N.B. Mechkovskaya points out that, although language and religion lie at opposite ends of the spectrum of social consciousness, both elevate an acute sensitivity to the power of words [Zhukov, 2021]. This bond is not limited to explicitly religious writings, religion's long-standing centrality in human affairs has left an indelible imprint on everyday vocabulary and idiomatic expressions.

The concept of "*God*" permeates everyday language, regardless of personal belief. Even in secular contexts, divine references persist as linguistic habits rooted in cultural tradition. For example, the Russian expression «*спасибо»* (originally derived from "God save you") and the common exclamation «*Слава Богу!»* function alongside English counterparts like «*Bless you!»* or «*Thank God!»*. These phrases, while often used automatically, reveal how deeply embedded the divine remains in the linguistic and cultural consciousness of both Russian and English speakers.

From the perspective of cognitive linguistics, a concept is regarded as a distinct mental formation functioning as a basic unit of human cognition. It is characterized by a structured internal organization and arises through the interaction of individual and collective cognitive experience. Importantly, a concept does not merely store

encyclopedic knowledge about the corresponding object or phenomenon; it also encodes the culturally shaped interpretation, evaluative attitude, and emotional resonance associated with this knowledge within a given linguistic community [Popova, 2001]. In this way, conceptual structures serve as repositories of culturally significant meanings and play a crucial role in mediating between language, thought, and worldview.

The study of concepts attracts the attention of numerous outstanding scholars – both international and Russian – including M. Johnson, G. Lakoff, A. Wierzbicka, D. S. Likhachev, Yu. D. Apresyan, E. S. Kubryakova, Yu. S. Stepanov, N. D. Arutyunova, I. A. Sternin, V. I. Karasik, V. V. Krasnykh, V. A. Maslova and many others. This research offers a linguocultural analysis of the concept of «*God*» as it is embedded in the English and Russian languages through various linguistic layers – including vocabulary, idiomatic expressions, proverbs and sayings, syntactic constructions, and discourse fragments – each of which contributes to shaping a culturally specific image of the divine.

Taking into consideration the fact that the earlier research by L. V. Bazarova, O. K. Kalkova, and O. V. Pashkevich has charted various aspects of how "*God*" is represented in each language, our analysis is confined to a comparative exploration of its phraseological and paroemiological instantiations. As L. V. Bazarova asserts that, a phraseological unit whose core component is connotative directly correlates with cultural concepts [Bazarova, 2016]. Likewise, proverbs and sayings serve as unique vessels of socially significant information, offering deep insight into the structure and content of the corresponding linguocultural concept. Linguists have proposed a series of procedures for concept analysis, broadly outlined by I. A. Sternin and Z. D. Popova [Popova, 2001].

These methods include:

1. Keyword analysis. Selecting the term that denotes the concept and assembling an example file from a variety of texts (e.g., «стыд» or «совесть»), then mapping out all its typical collocations.

2. Dictionary-definition survey. Reviewing as many dictionaries as possible to gather every descriptive facet attributed to the keyword.

3. Diachronic polysemy study. Tracing the historical emergence of new senses of the word in order to uncover the defining features driving its semantic evolution.

4. Analysis of proverbs. Examining those proverbs that include the target term as well as any evaluations of the concept it names.

5. Contrastive equivalence analysis. Comparing words with identical primary meanings across different languages to highlight cultural and semantic divergences.

6. Feature-set description. Characterizing the concept as a bundle of necessary and sufficient attributes for its inclusion within a given logical class.

7. Prototype-based verb-class characterization. Identifying prototypical traits of verb classes through their grammatical markings.

8. Author-specific concept extraction. Revealing individual or stylistic conceptualizations by analyzing their manifestation in literary texts.

Our investigation builds directly on methods 2, 4, and 5, and it further adopts the field-theoretical perspective of concept structure, which distinguishes a central core from

an encompassing periphery. The conceptual core consists of semantic components that are the most tangible, directly linked to sensory perception, and readily available to cognitive processing. In contrast, peripheral elements represent more abstract layers of meaning, often metaphorical or associative in nature, and occupy a more distant position relative to the central, perceptually grounded features. These peripheral zones reflect the expansion of a concept into culturally and contextually shaped interpretations, illustrating its dynamic and multi-layered structure.

When applied to the notion of *"God"* in both English and Russian, this framework reveals a multifaceted, tiered organization: a fundamental base layer that captures the most essential attributes, supported by several additional cognitive layers that enrich and extend the concept's overall structure.

To identify the basic layer of the concept of "God", let's look at the definitions of its key concept in English and Russian. In the Oxford English Dictionary we find the following definition:

GOD 1. (in Christianity and other monotheistic religions) the creator and ruler of the universe and source of all moral authority; the supreme being. 2. (in certain other religions) a superhuman being or spirit worshipped as having power over nature or human fortunes; a deity. 2.1 An image, animal, or other object worshipped as divine or symbolizing a god. 'wooden gods from the Congo' 2.2 Used as a conventional personification of fate. 'he dialled the number and, the gods relenting, got through at once' 3 A greatly admired or influential person. 'he has little time for the fashion victims for whom he is a god' 3.1 A thing accorded the supreme importance appropriate to a god. 'don't make money your god' 4 the gods informal The gallery in a theatre [Oxford Dictionary of Proverbs, 2020].

The dictionary of S.I. Ozhegov contains the following definition: GOD [boh], God, many gods. God, M. 1. In religion: the supreme omnipotent being who rules the world or (in polytheism) one of these beings. Faith in God. Pagan gods. God of Wars (ancient Romans: Mars). To offer prayers to God (the gods). Sacrifice to God(s). Handsome a sa young God. Gods don't burn pots (meaning: you can handle it, you can do it). 2. In Christianity: the triune deity, the Creator, and the universal The universal principle is God the Father, God the Son and God the Holy Spirit. God is one in three persons. Without There is no God to the threshold (God helps in everything). 3. Figurative meaning. The object of worship, adoration. Music is his God.

A close analysis of dictionary definitions allows us to identify the foundational semantic features–or semes–that construct the linguocultural image of "God." In English, this image typically rests on four core notions: God as the creator and sovereign of the universe, as the highest and most perfect being, as the ultimate object of religious devotion, and as an omnipotent force. Russian definitions expand this frame, adding further nuance. Alongside the familiar concepts of a supreme and omnipotent being, creator, and object of worship, Russian sources often emphasize the idea of God as a triune entity (reflecting Orthodox Christian doctrine) and as a metaphysical world principle that underlies all existence. This difference suggests a slightly broader metaphysical and philosophical dimension in the Russian understanding of the divine.

A comparison of these lists shows that the core components largely coincide, underscoring a shared semantic foundation for the concept of *«God»* in both

English- and Russian-speaking cultural frameworks. In addition, we analyze how semes are identified in idioms and proverbs of both English and Russian. Our corpus is based on A.V. Kunin's English-Russian Phraseological Dictionary, A.I. Molotkov's Russian Phraseological Dictionary, V.P. Zhukov's Dictionary of Russian Proverbs and Sayings, as well as the Oxford Dictionary of Proverbs.

In both Russian and English linguistic cultures, the concept of *"God"* is multifaceted and richly represented through idiomatic and proverbial expressions. The core semantic component, that of an almighty being, is reflected in Russian phrases such as «*Бог весть*, *Бог знает*, *Бог прибрал»* and «*одному Богу известно»* [Molotkov, 2020], all of which point to divine omniscience and power. Similarly, the proverb «*Бог не выдаст, свинья не съест»* [Zhukov, 2021] humorously suggests that God protects a person even in trivial matters.

The semantic aspect of creator and ruler of the universe is directly realized in the English proverb "*God made the country, and man made the town"* [Oxford Dictionary of Proverbs, 2020], which emphasizes the greater significance of divine creation compared to human achievements. This concept is echoed in Russian through the idiom «*божий свет»* [Molotkov, 2020], which, along with its derivatives, reaffirms the Christian idea of God as the creator of the world around us.

The object of worship component is less explicitly expressed but still evident in both languages. For instance, the English idiom "*to serve God and Mammon*" (служить Богу и мамоне) [Kunin, 1984] condemns materialism as incompatible with genuine faith and reverence for God. The Russian proverb «*Заставь дурака Богу молиться, он и лоб разобьет»* [Zhukov, 2021] represents excessive zeal and fanaticism, which, when we disconnect it from true understanding of Christian teachings, it is portrayed as misguided.

Another significant semantic component is punishment, which, although is not found in dictionary definitions, it is crucial for understanding the image of God in both traditions. In the English proverb "*whom God would ruin, he first deprives of reason"* (кого Бог захочет погубить, у того он сначала отнимет разум) [Oxford Dictionary of Proverbs, 2020], divine punishment is presented as the deprivation of reason–one of the harshest fates. The Russian idiom «*Богом обиженный»* [Molotkov, 2020] refers to an unfortunate or foolish person, emphasizing divine disfavor.

Contrastingly, the semantic feature of mercy is present in idioms like «*Бог не обидел*, *Бог миловал»* [Molotkov, 2020], and in proverbs such as «*Бог даст день, даст и пищу* and *Бог даст, в окно подаст»* [Zhukov, 2021], which all highlight God's benevolence. In English, the proverb "*God tempers the wind to the shorn lamb"* [Oxford Dictionary of Proverbs, 2020] conveys the same idea: divine mercy is proportionate to human hardship, suggesting compassionate justice.

Several proverbs in both languages stress the idea that human effort is necessary in addition to divine support. English sayings like "*God helps them that help themselves"* [Oxford Dictionary of Proverbs, 2020] and «*God is always on the side of the big battalions»* [Kunin, 1984], as well as Russian ones such as «*Бог-то Бог, да и сам не будь плох»* and «*На Бога надейся, а сам не плошай»* [Zhukov, 2021], reflect a balanced worldview where faith must be complemented by action.

Finally, the binary opposition between God and the Devil as the embodiments of good and evil is a salient element of the concept. English proverbs such as "*Where God builds a church, the Devil will build a chapel"* [Oxford Dictionary of Proverbs, 2020], attributed to Martin Luther, and "*God sends meat, but the Devil sends cooks"* [Oxford Dictionary of Proverbs, 2020], reveal the intrusion of evil even into sacred spaces. The Russian proverb «*Хвалился черт всем миром овладеть, а Бог ему и над свиньей не дал власти»* [Zhukov, 2021] underscores the total superiority of God over dark forces.

Thus, the concept of *"God"* reveals a complex structure composed of semantic components such as almighty being, creator, mercy, punishment, justice, and goodness. Each of these concepts is variously actualized through the idioms and proverbs of the two languages, illustrating the richness and depth of religious representation in both English and Russian linguistic worldviews.

References

1. Bazarova, L.V. (2016). Koncept "bog" vo frazeologicheskikh edinitsakh anglijskogo, russkogo, tatarskogo i turetskogo yazykov [The concept "God" in phraseological units of English, Russian, Tatar, and Turkish]. – Kazan. – 152 p. (in Russian)

2. Frazeologicheskij slovar' russkogo yazyka [Phraseological Dictionary of the Russian Language] / pod red. A.I. Molotkova. – M.: Sovetskaya entsiklopediya, 2020. – 543 p. (in Russian)

3. Kunin, A.V. (1984). Anglo-russkij frazeologicheskij slovar' [English-Russian phraseological dictionary]. – M.: Russkij yazyk. – 944 p. (in Russian)

4. Mechkovskaya, N.B. (1998). Yazyk i religiya: posobie dlya studentov gumanitarnykh vuzov [Language and religion: a textbook for students of humanities]. – M.: Agentstvo "Fair". – 352 p. (in Russian)

5. Oxford Dictionary of Proverbs. – Oxford: Oxford University Press, 2020. – 625 p.

6. Oxford English Dictionary. – [Electronic resource]. Available at: https://en.oxforddictionaries.com (accessed: 18.04.2025).

7. Ozhegov, S.I. Tolkovyj slovar' russkogo yazyka [Explanatory Dictionary of the Russian Language]. – [Online]. – Available at: www.ozhegov.com. (Accessed: 18.04.2025). (in Russian)

8. Popova, Z.D., Sternin, I.A. (2001). Ocherki po kognitivnoj lingvistike: uchebnoe posobie [Essays on cognitive linguistics: a textbook]. – Voronezh: Vikas. – 269 p. (in Russian)

9. Zhukov, V.P. (2021). Slovar' russkikh poslovits i pogovorok [Dictionary of Russian proverbs and sayings]. – M.: Russkij yazyk. – 544 p. (in Russian)

Научное электронное издание
сетевого распространения

WE MAKE THE FUTURE
(МЫ ДЕЛАЕМ БУДУЩЕЕ)

Сборник научных статей
Выпуск XIII

Публикуется в авторской редакции

Выпускающий редактор: В.С. Берегова

Подписано к использованию 02.07.2025.
Гарнитура Times New Roman. Объем издания – 4,7 МБ
Оригинал-макет подготовлен в ЦПП ИД «БелГУ» НИУ «БелГУ»
308015 г. Белгород, ул. Победы, 85. Тел.: 30-14-48