



# SCIENTIFIC RESEARCH OF THE SCO COUNTRIES: SYNERGY AND INTEGRATION

上合组织国家的科学研究：协同和一体化

Materials of the  
International Conference

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上合组织国家的科学研究：协同和一体化  
国际会议

参与者的英文报告

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“Scientific research of the SCO  
countries: synergy and integration”

Part 1: Participants' reports in English

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这些会议文结合了会议的材料 – 研究论文和科学工作者的论文报告。它考察了职业化人格的技术和社会学问题。一些文章涉及人格职业化研究问题的理论和方法论方法和原则。

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## Foreword

*We thank all participants of our conference "Scientific research of the SCO countries: synergy and integration" for the interest shown, for your speeches and reports. Such a wide range of participants, representing all the countries that are members of the Shanghai Cooperation Organization, speaks about the necessity and importance of this event. The reports of the participants cover a wide range of topical scientific problems and our joint interaction will contribute to the further development of both theoretical and applied modern scientific research by scientists from different countries. The result of the conference was the participation of 69 authors from 7 countries (China, Russia, Uzbekistan, Kazakhstan, Azerbaijan, Tajikistan, Kyrgyzstan).*

*This conference was a result of the serious interest of the world academic community, the state authorities of China and the Chinese Communist Party to preserve and strengthen international cooperation in the field of science. We also thank our Russian partner Infinity Publishing House for assistance in organizing the conference, preparing and publishing the conference proceedings in Chinese Part and English Part.*

*I hope that the collection of this conference will be useful to a wide range of readers. It will help to consider issues, that would interest the public, under a new point of view. It will also allow to find contacts among scientists of common interests.*

**Fan Fukuan,**

*Chairman of the organizing committee of the conference*

*"Scientific research of the SCO countries: synergy and integration"*

*Full Professor, Doctor of Economic Sciences*

## 前言

我们感谢所有参加本次会议的“上海合作组织国家的科学研究：协同作用和整合”，感谢您的演讲和报告。代表所有上海合作组织成员国的广泛参与者都谈到此次活动的必要性和重要性。参与者的报告涵盖了广泛的主题性科学问题，我们的联合互动将有助于不同国家的科学家进一步发展理论和应用的现代科学研究。会议结果是来自7个国家（中国，俄罗斯，乌兹别克斯坦，哈萨克斯坦，阿塞拜疆，塔吉克斯坦，吉尔吉斯斯坦）的83位作者的参与。

这次会议的召开，是学术界，中国国家权力机关和中国共产党对维护和加强科学领域国际合作的高度重视的结果。我们还要感谢我们的俄罗斯合作伙伴无限出版社协助组织会议，准备和发布中英文会议文集。

我希望会议的收集对广大读者有用，将有助于在新的观点下为读者提供有趣的问题，并且还将允许在共同利益的科学家中寻找联系。

范福宽，

教授，经济科学博士，中国科学院院士，会议组委会主席“上合组织国家科学研究：协同与融合”



从传统经济到可持续发展经济：支持还是反对？！

**FROM THE TRADITIONAL ECONOMY TO THE ECONOMY  
OF SUSTAINABLE DEVELOPMENT: FOR OR AGAINST?!**

**Chibisov Oleg Valeryevich**

*Candidate of Economic Sciences, Associate Professor  
Russian State Academy of Intellectual Property (RGAIS)*

**Chibisova Elena Ivanovna**

*Candidate of Economic Sciences, Associate Professor  
Moscow Automobile and Road Construction State Technical University  
(MADI)*

*Associate Professor*

*Russian State Academy of Intellectual Property (RGAIS)*

抽象。 在全球自然资源和资源限制的重要性背景下，传统经济体制与可持续发展经济相关；传统本身就是人类财富的主要形式。 我们认为，只有平衡市场和政府监管，才能实现可持续发展。 市场并非始终处于平衡和有效运作中，并不总是能够确保社会可接受的利益分配，因此今天的公共干预必须被视为稳定和纠正市场负面影响的必然缓冲工具。。

关键词：经济发展，经济，法律支持，可持续发展，代际可接受性，资源退化。

**Abstract.** *In the context of the importance of global natural and resource constraints, the institutions of the traditional economy are relevant for the economy of sustainable development; the traditions themselves are the main form of human wealth. In our view, sustainable development can be achieved solely by balancing the market and government regulation. The market is not always in balance and functions effectively, it is not always possible to ensure a socially acceptable distribution of benefits, so public intervention today must be seen as an inevitable, necessary buffer- tool to stabilize and correct the negative effects of the market.*

**Keywords:** *economic development, economy, legal support, sustainable development, generational acceptability, degradation of resources.*

The economy of sustainable development takes its roots from the traditional system, the difference is that sustainable development provides for rapid economic growth and technological progress, in contrast to the traditional economy, whose field of activity in subsistence farming is that the sustainable development economy affects all areas of activity with minimal environmental damage.

Sustainable economy is a harmonious development, a process of change in which the use of natural resources, attracting investments, personality development and institutional changes are coordinated with each other, strengthen the existing and future potential to meet the needs of the population. Many actions are aimed at improving people's living standards.

The main stages of sustainable economic development go through 3 main concepts:

1. The concept of sustainable development of the 1970s - this period was marked by a transition to the ecologization of socio-economic development and scientific knowledge, and many scientific works were devoted to the problems of environmental pollution and limited natural resources. As a result of such concern, a number of international organizations were created: the Club of Rome, the International Federation of Advanced Research Institutes, the All-Union Institute for System Research, etc.

2. The concept of "sustainable development" of the 70-80s - the opinion of the Soviet and Russian philosopher, a specialist in political psychology, cultural anthropology and the methodology of interdisciplinary synthesis, Doctor of Philosophy A.P. Nazaretyan rather reminded the researchers of this field of medical advice about how to prolong the agony of a doomed patient, as well as many similar concepts that were built on reducing the population of the Earth.

One of the most significant stages of development was the UN Conference in Stockholm - 1972. on environmental issues. As a result, a special program was developed that consolidated the solution of environmental problems at the state level. Departments and ministries on environmental issues began to be created, environmental policy and diplomacy developed.<sup>1</sup>

In the 1980s and to this day: they began and continue to talk about the sustainable development of ecological systems. In fairness, it must be said that not only they say, but much has been done, environmental literacy and awareness in society have increased, not without the participation of state programs. The 1980 World Conservation Strategy for the first time refers to the term "sustainable economy." When we talk about sustainable development, we are not talking about stopping economic growth, but stopping the irrational use of natural environmental resources. In the face of growing competition, the race for higher profits and profitability of production, this approach seems rather complicated.

The formation of a sustainable economy was based on the use of information technology, intellectual property, which led to the "dematerialization" of the manufacturing sector. Today, the volume of financial transactions significantly exceeds the volume of trade in natural resources and tangible goods by 7 times. The main stimuli for the new economy were a shortage of material resources and an abundance of knowledge and information resources.

<sup>1</sup>Koptyug V. A. United Nations Conference on Environment and Development (Rio de Janeiro, 1992) // Information review. - Novosibirsk: SB RAS, 1992.

Specific consumption of economic activity is decreasing, but at the same time, total energy consumption continues to increase. According to the professor, doctor of physical and mathematical sciences, the author of the theory (concept) about the determining influence of natural ecosystems (biota) on maintaining environmental parameters within the limits that allow life on planet Earth V.G. Gorshkov: "Earth is a system in which life itself helps to control its own condition. Biological processes interact strongly with physical and chemical processes in the formation of environmental properties, but biology plays a much more important role in maintaining the environmental habitability limits than previously assumed." The realization that the most rational interaction of nature and man is becoming ever more distinct.

The development of the concept of "society-nature" as an interaction and development of environmental and economic forms is currently a reflection of the fact that society has come close to the need to manage the socio-economic development of regions, cities, states, to move from dealing with the consequences of irrational economic activities to build a system of environmental management. In most cases, sustainable development is considered from the perspective of an environmentally balanced solution of socio-economic problems, in which the growth of human well-being does not cause environmental degradation and natural resource degradation, but becomes crucial in the sustainable development of the environmental factor.<sup>2</sup>

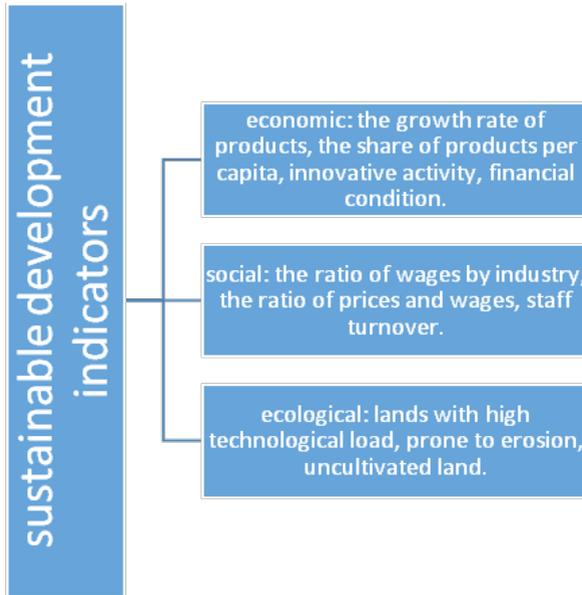
A sustainable ecological and economic system should strive to preserve natural capital (biodiversity, the ozone layer, etc.), renew natural resources that can be renewed (for example, biological species), or replace them with artificial substitutes, and strive to achieve fair relations (narrowing the gap between poor and rich, equality by gender, nationality).

Most of the international organizations that are members of the UN have included a significant environmental component in their activities, which is focused on the transition to sustainable development. According to many experts, World-wide and Sustainable Development is a process of managing a set of assets that are aimed at preserving and expanding human capabilities. This choice is the paradigm of sustainable development.

The concept of sustainable development, developed by the joint efforts of the world community, is an ideology of balancing the interests of generations and is directly related to the question of whether there is a future for humanity. The concept of sustainable development arises as a new paradigm of the global social life of a person, capable of becoming a guiding vector of the global transition of civilization to new formats of development.

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<sup>2</sup>Golubev G.N., Danilov-Danilyan V.I. Once again on the basis of sustainable development of nature and society // Bulletin of the Russian Academy of Sciences. - 2014. - V. 65. - № 6. P. 516-519.



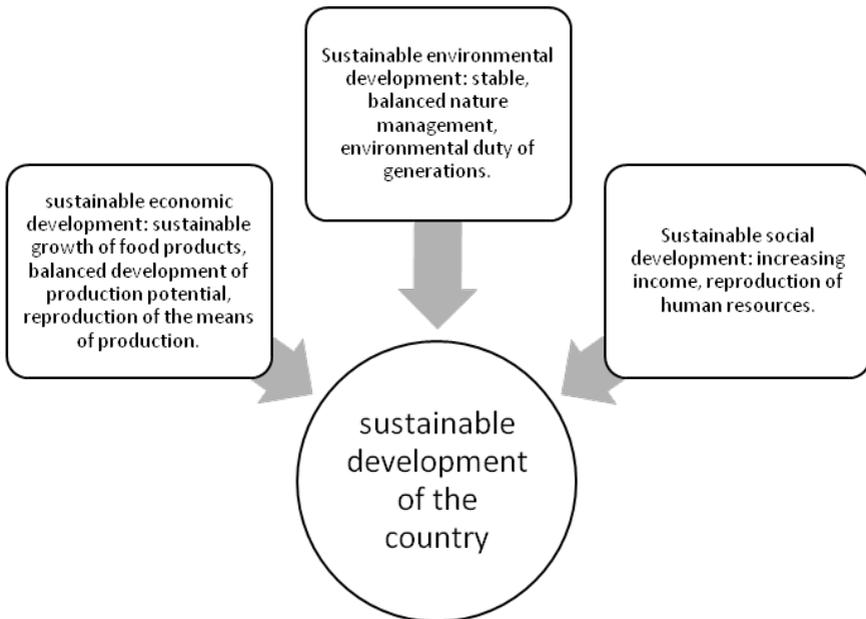
*Fig. 1. Sustainable Development Indicators*

In the above, so-called theory-defining assets - is not only physical capital, but also human and natural capital. Sustainable development requires growth or, at a minimum, it is necessary to apply by restraining the reduction of these assets. In the management of the economy of the country adhere to the same concept as in the management of private property. According to the World Bank, the main indicators of sustainability are both “true rates of investment in the country” and “true rates of savings”. Thus, we can say that the sustainable development of the Russian economy is not possible without observing the requirements of world communities.<sup>3</sup>

The triune concept of sustainable development. This concept arose as a result of combining three points of view: economic, social and environmental. Thus, the economic approach to sustainable development is based on the theory of the maximum total income stream, the author of which is a well-known Swedish economist, a representative of the Stockholm school of economic science, creator of the Lindahl model Hicks-Lindahl, which says “This stream can be produced only if the total capital has been preserved, with the help of which this income is received.” The essence of this concept is the optimal use of limited resources, environmental, material, energy-saving technologies, the creation of environmentally friendly products, cost reduction, active destruction and recycling.

<sup>3</sup>Andrianova V.D. The evolution of the basic concepts of economic regulation from the theory of mercantilism to the theory of self-regulation. // *Economy*, 2008. P. 326.

Sustainability of development includes the social component, which is focused on the individual and on maintaining the stability of cultural and social systems, reducing destructive conflicts between citizens. An important aspect of this component is the fair sharing of existing goods. It is also desirable to preserve cultural capital, to use the practice of sustainable development that exists in non-dominant cultures. In order to create a model of sustainable development, modern society must pursue a policy of effective solutions that takes into account the historical experience of the state. It is imperative to achieve intergenerational justice. Within the framework of this concept, a person is a subject of development, and not its object. Sustainable economic development measures are aimed at expanding human participation in the processes that create their life, contribute to decision-making, monitor its implementation.



*Fig 2. Characteristics of sustainable economic, social and environmental development*

On the environmental side of the issue, sustainable development should ensure the integrity of physical and biological natural systems. The work of ecosystems is of the greatest importance - the global stability of our entire biosphere depends on this. Degradation of natural systems, environmental pollution, loss of biological diversity reduce the ability of ecological systems to self-repair. Combining different points of view into one concept is a task of enormous complexity. All considered elements of sustainable development should be analyzed in a balanced manner. The transition to sustainable development involves the gradual restoration of natural ecosystems to a level that guarantees environmental stability - in our opinion this can be achieved through the efforts of all mankind, but each country should begin to move towards this goal on its own.

The traditional economy is quite specific, because the practice of using resources is determined by traditions and customs. It is characterized by the influence of religion and the state on the economy, low labor productivity and the traditional structure of society, but at the same time, the sustainable development economy takes its roots and ideas from the traditional system. The difference lies in the fact that sustainable development provides for rapid economic growth and technological progress, and, unlike the traditional economy, whose field of activity is subsistence farming, a sustainable economy affects all areas of activity with minimal environmental damage.

However, the transition to sustainable development is impossible to carry out, while maintaining the current stereotypes of thinking that neglect the capabilities of the biosphere and generate an irresponsible attitude of citizens both towards the environment and environmental safety in general.

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一种提高企业管理质量的综合机制  
**AN INTEGRATED MECHANISM FOR IMPROVING THE QUALITY  
OF ENTERPRISE MANAGEMENT**

**Nikitina Natalya Vladislavovna.**

*Candidate of Economic Sciences, Associate Professor  
Samara State University of Economics  
Department of Economics, Organization and Strategy  
for Enterprise Development*

抽象。所研究问题的相关性是由于与企业规划和管理的新过程相关的问题。当前的企业管理实践迫切需要开发新方法来提高其竞争力，效率和管理质量。改革和重组企业管理过程是当前经济改革发展的重要内容。绝大多数国内企业不符合现代条件和竞争环境的要求，其有效性取决于最优管理机制的形成。由于需要企业的战略发展，重点在于解决面对不确定性而提高管理质量的问题以及使管理系统适应外部环境变化的需要。

关键词：企业，质量管理，机制，创新，创新发展

**Abstract.** *The relevance of the problem under study is due to issues of problems associated with new processes of enterprise planning and management. The current practice of enterprise management urgently requires the development of new approaches to increase their competitiveness, efficiency and quality of management. Reforming and restructuring the enterprise management process is currently an important element in the development of economic reforms. The vast majority of domestic enterprises do not meet modern conditions and the requirements of the competitive environment, and their effectiveness depends on the formation of an optimal management mechanism. The emphasis is placed on solving the problem of improving the quality of management in the face of uncertainty and the need to adapt the management system to changes in the external environment, due to the need for strategic development of enterprises.*

**Keywords:** *enterprise, quality management, mechanism, innovation, innovative development*

In conditions of dynamically developing and significantly changing in various aspects of economic and social systems, appropriate methodological foundations of forming a management system in them become necessary.

A characteristic and essential feature of the implementation of control in these conditions is the need to take into account significant qualitative changes in the behavior and characteristics of the system that arise in the processes and control systems. At the same time, it is necessary to make equally significant changes in the management system up to the transition to another management organization.

To implement such profound changes, it is necessary to build an enterprise management system capable of development, efficiency, competitiveness and sustainability [1].

Currently, it is possible to implement an effective enterprise management system on the basis of successes achieved in the field of information technology and informatization. At the same time, specialized subsystems can be created as part of the enterprise management system that provide real-time monitoring of the status of management processes, their analysis, and the identification of qualitative changes.

Production, organizational and innovative, informational, intellectual subsystems of enterprises interact with each other and directly or indirectly with subsystems - consumers and the competitive environment.

Moreover, the subsystems allocated as part of the control system perform the following functions.

The information subsystem of the enterprise provides the collection and streamlining of primary information about the system, in addition, the data are ranked, their impact, usefulness and value are assessed for the enterprise. This subsystem is basic, as it provides all other subsystems and processes with the necessary data.

Organizational and innovative subsystem reflects the structure of the interaction of system elements, communication links, governing bodies, a delegation of authority using network information technologies, innovative projects, and research activities of companies.

The intelligent subsystem is a combination of professional knowledge and experience of the enterprise personnel. It is this system based on its intellectual properties that is crucial in assessing the quality of management processes, identifying signs of qualitative changes in the system in order to overcome the negative factors that led to a decrease in the quality level of the enterprise management system.

All subsystems are mutually connected, the restructuring of one subsystem requires a change in others.

Under these conditions, it is important to keep in mind that the highest quality management is achieved when all subsystems and the relationships between them are coordinated.

When changing in any element of the enterprise management system, it is necessary to look for a new combination with other elements, changing their settings.

According to A.A. Belov, the highest quality of management obtained under these conditions will differ from the initial level in one direction or another.

The magnitude of the change in quality under the condition of a harmonious combination of subsystems may be a sign of significant qualitative changes in the activities of the enterprise. If the change occurs in the direction of deterioration of the quality of management and exceeds a certain acceptable threshold, then the properties of the control system have changed fundamentally and the control system must be changed [2].

An important role in the formation of such a system should play a mechanism to improve the quality of enterprise management.

Management quality is a top priority in market conditions where genuine upheavals have taken place in this area. It is with the help of modern methods to improve the quality of management that leading foreign companies have achieved leading positions in various markets. There is a direct link between quality and management effectiveness. Improving management quality improves management efficiency, leading to lower costs and increased market share.

The regulation of enterprises in order to increase their effectiveness is carried out in various ways and methods, using various tools.

The most important of these methods are organizational and economic methods of regulation, which are implemented through a variety of management tools.

The administrative mechanism for regulating the activities of enterprises in order to increase their efficiency is a methodological, organizational, technological, economic, legal methods and quality management in the development and enhancement of competitiveness.

Improving the efficiency and quality of enterprise management is associated with the development of integrated automated management systems that can solve the problems of advanced management:

- coordinated management of aggregates and units (for example, in pressure maintenance systems, etc.);
- software control (for example: switching on / off units, routing program for pumping in tank farms, etc.);
- optimization of plant operating modes (for example, dosing of reagents, selection of temperature conditions, etc.);
- diagnostics of prediction of malfunctions and protection from their consequences;
- modeling of processes, calculation of technical and economic indicators of production efficiency down to a single process or unit for the purposes of operational management, cost optimization and environmental safety.

Investment planning serves as the basis for organizing the project structure for accounting for the enterprise's funds, prioritizing financing and strict cost accounting in several areas of production activity at once (by divisions, business areas, projects).

State support for large, systemic innovations in industry should be carried out primarily through the implementation of targeted innovation programs that are organically linked to medium-term prospects for the development of the real sector and socio-economic forecasts.

One of the most important directions of state policy to improve managerial mechanisms to increase industry efficiency should be the organization and financing of research and development work.

Modernization in the management system means the creation of such an innovative potential and implementation mechanism that, when systemic inconsistencies are found in management and in the economy, this potential allows the company to launch processes and mechanisms for improving the economy, taking into account the current emphasis on modernization.

This technological mechanism allows for the implementation of a new level of management quality, processes of reproduction and regulation of the economy of the enterprise [3].

But for the stable functioning of such a mechanism within the socio-economic system, it is necessary to form a certain new level of managerial culture and the competence of management and management specialists in business.

The level of managerial culture and competence, like human skills, is based on a different model of thinking, activity and management, and a different model of change, with a new position of responsibility not only for activity, but also for interaction.

The integrated mechanism for improving the quality of management involves the organization of diagnostics of the state of management, business evaluation, marketing, production management, personnel management and motivation, financial management, business planning and investment.

The integrated approach to the mechanism for improving the quality of management is determined by the following provisions:

- objectivity of the economic management mechanism, its functioning on the basis of real economic processes to improve the quality of management;
- informational nature of the mechanism for improving the quality of management;
- formation and functioning on the basis of stable direct and feedback;
- applicability with respect to the mechanism for improving the quality of management of the main methods of system analysis;
- hierarchy;
- additivity, that is, inclusion in the control mechanism of a high level as elements of mechanisms of a lower level;
- the ability to achieve a specific result of improving the quality of management based on goals;

- optimization of economic processes based on control actions to ensure the quality of management.

The objective nature of the mechanism for improving the quality of management is determined by its formation on the basis of processes taking place in the economic environment and reflecting fundamental long-term patterns and trends in its development. These patterns and trends are taking into account the subjective actions of business entities.

The informational nature of the mechanism is determined by the nature of the relationship between economic phenomena and processes, as well as decisions taken by business entities. These links are provided by the flows of information reflected in the dynamics of economic indicators. The dynamics of indicators also serves as the basis for certain actions of economic entities.

The presence in the economic system of both direct links and feedback makes it possible to adjust the management decisions. This ensures the inter-adaptability of specific economic processes.

The interconnection of the concepts of “mechanism” and “system” is obvious. Both of these concepts reflect the object, structure, as well as the dependence of the elements and their interaction on the basis of direct links and feedback. But the mechanism includes the most stable, long-term connections of the system, which can be used by the subject of control for regulatory influences on the system as a whole.

The mechanism is distinguished by the subject from the interconnections of the system for controlling it and ensuring its evolution in the direction chosen by the subject. The managing entity does not create a mechanism, but selects it, determining by methods of analysis the most stable connections in the system for their use in order to transmit an information signal and to change specific elements of the system.

The hierarchy of the mechanism means that it and its subgroups play different roles in the functioning of the economic system. This is determined by the degree of stability of the relationships on which the action of a particular mechanism is based.

Additivity of the mechanism is based on the properties of system elements. Based on the additivity property, stable bonds are combined into a mechanism. For example, sustainable communication in management processes is a mechanism of companies' competitiveness.

Both of these mechanisms constitute a single policy mechanism - the competitiveness of companies, which plays a decisive role in ensuring the strong position of the national economy in world markets.

The objectivity of the mechanism and their informational nature open up wide opportunities for their use in order to manage the economic system.

For example, identifying sustainable links between policies and companies' competitiveness should be seen as an important reserve for economic development.

From the perspective of the integrated approach, it is possible to determine the mechanism for improving the quality of management as a combination of direct links and feedback elements of the system used by the subject to ensure the functioning, evolution and optimization of the economic system. Thus, the integrated approach developed in the study to the mechanism for improving the quality of management consists in recognizing the objectivity of the economic mechanism, its informational nature, forming and functioning on the basis of stable direct and feedback connections, applying system analysis methods, hierarchy, additivity, and the possibility of using in order to improve the quality of management and its optimization [4].

Thus, we propose to consider the mechanism for improving the quality of company management as the organization of interaction between market participants, company structures and departments, internal business processes, as well as the methods and mechanisms for ensuring this interaction, which determine the possibility of creating the proper conditions for the effective functioning, development and competitiveness of the enterprise by selecting, integrating and combining means of influencing certain factors of the internal and external environment.

Effects of improving the quality of management - improving management efficiency, improving interconnections and communications, increasing the effectiveness of decisions, organizing systematic control, developing innovative potential, ensuring sustainable economic growth.

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俄罗斯联邦和后苏联国家为国家提供医疗保健和社会支持的法律框架  
**LEGAL FRAMEWORK FOR STATE FINANCING OF HEALTH CARE  
AND SOCIAL SUPPORT FOR MOTHERHOOD IN THE RUSSIAN  
FEDERATION AND POST-SOVIET COUNTRIES**

**Artymuk Vladimir Anatolevich**

*NO Bar Association № 4 of the Rudnichny District of Kemerovo,  
Kemerovo, Russia*

研究目的 – 评估俄罗斯联邦保护公共卫生，母亲和儿童的监管框架的状况。

材料和方法。对俄罗斯联邦的现代科学文献进行了分析，并对保护公共卫生和对母亲的社会支持进行了监管。对前苏联国家卫生系统和母亲社会保障的有效性进行了比较评估。已经表明，在俄罗斯保护母亲和童年的措施很复杂，但存在许多问题。2018年采用的医疗保健行业计划的实施非常有希望。制定医疗保健行业的战略规划应基于表征医疗保健作为活动产业特征的基本原则。

结论。目前，国际条约，俄罗斯联邦宪法，联邦法律，俄罗斯联邦组成实体法和其他监管法律法规都提出了医疗保健的宪法原则，基础和保障。俄罗斯怀孕，分娩和育儿期间的妇女可以依靠社会保护，这通常高于许多欧洲国家。

关键词：医疗保健，融资，宪法原则，对母性的社会支持。

**Purpose of the study** – to assess the state of the regulatory framework for the protection of public health, motherhood and childhood in the Russian Federation.

**Materials and methods.** The analysis of modern scientific literature, as well as regulatory on the protection of public health and social support of motherhood in the Russian Federation was carried out. A comparative assessment of the effectiveness of health systems and social security of motherhood in the countries of the former Soviet Union is carried out. It has been shown that measures to protect motherhood and childhood in Russia are complex, but have a number of problems. The implementation of the Healthcare sector program adopted in 2018 is very promising. The development of a strategic planning in the healthcare sector should be based on the basic principles characterizing the characteristics of healthcare as an industry of activities.

**Conclusion.** Currently, the constitutional principles, foundations and guarantees in healthcare are presented in international treaties, the Constitution of the Russian Federation, Federal laws, laws of constituent entities of the Russian Federation and other regulatory legal acts. Women during pregnancy, child-birth and childcare in Russia can count on social protection, which is often higher than in many European countries.

**Keywords:** *healthcare, financing, constitutional principles, social support for motherhood.*

The prospect of the existence of the state directly depends on how effectively it takes care of preserving the health of citizens, creating favorable conditions that determine the quality and duration of life in the country. In this regard, health is a strategic factor in ensuring the national welfare and security of the state, the key to its strength and development [1].

The Constitution of the Russian Federation guarantees the right of citizens to unhindered access to medical and healthcare services [2].

Art. 2 recognizes the rights and freedoms of citizens as the highest value and calls their observance the duty of the state [2].

Art. 7. defines the Russian Federation as a social state, the policy of which, inter alia, is aimed at protecting the health of citizens [2].

According to Art. 41 part 1., Everyone has the right to protection of health and medical care. Medical assistance in state and municipal healthcare institutions is provided to citizens free of charge from the corresponding budget, insurance contributions, and other incomes [2].

Art. 41 Part. 2. establishes that in the Russian Federation federal programs for the protection and promotion of public health are financed, measures are taken to develop state, municipal, private health systems, activities that contribute to improving human health, the development of physical culture and sports, and environmental and sanitary-epidemiological well-being are encouraged [2].

Art. 41 Part. 3. determines that the concealment by officials of facts and circumstances that pose a threat to the life and health of people entails liability in accordance with federal law [2].

The commentary to article 41 of the Constitution of the Russian Federation states that health is one of the highest benefits of a person, without which many other benefits, the ability to use other rights (choice of profession, freedom of movement, etc.) can lose value [2].

The Federal Law "On the Basics of Protecting the Health of Citizens in the Russian Federation" dated November 21, 2011 N 323-FL defines healthcare as a system of political, economic, legal, social, scientific, medical measures, including sanitary and anti-epidemic (preventive) nature, implemented by state authorities of the Russian Federation, state authorities of the constituent entities of the Russian Federation, local governments, organizations, their officials and other persons, citizens with the aim of preventing diseases, preserving and strengthening the physical and mental health of each person, maintaining his long active life, providing him with medical care, and are given in [3].

This normative legal act defines healthcare as the social function of the state, which is called upon and obligated to its implementation by the Constitution of the Russian Federation [2].

Some researchers, for example, Glushchenko A.N. (2012), consider healthcare as an integral element of the structure of the social sphere of society, the primary goal of which is the preservation and strengthening of public health [1].

According to Zudin A.B. (2018), the healthcare system ensures the national security of the state, since without healthy citizens it is impossible to achieve production growth and ensure defense capability [4]. Some researchers, in particular, Vasiliev V.P. (2017) interpret healthcare as the basis for the formation of both social and human capital of a society [5].

According to Bogma (2016), the principles of the state healthcare system should include: state character; Free and public; preventive focus; the unity of science and practice, treatment and prevention; continuity in the provision of medical care; social character; internationalism. The healthcare system in the Russian Federation is one of the elements of the totality of social institutions and is fundamental from the point of view of the physical development of society and, as a consequence, of the state. Moreover, society is a complex system of interconnected social institutions [6].

In accordance with the Constitution of the Russian Federation, universally recognized principles and norms of international law, international treaties of the Russian Federation, recognizing the fundamental role of protecting the health of citizens as an inalienable condition of society and confirming the responsibility of the state for maintaining and strengthening the health of citizens of the Russian Federation, striving to improve legal regulation and consolidating priority of the rights and freedoms of man and citizen in the field of health protection, these Fundamentals establish legal, organizational and economic principles in the field of public health [2].

According to the 323 FL, the basic principles of health care are: respect for the rights of citizens in the field of health care and ensuring state guarantees related to these rights; priority of patient interests in providing medical care and protecting children's health; social protection of citizens in case of loss of health; responsibility of state authorities and local government bodies, officials of organizations for ensuring the rights of citizens in the field of health protection; accessibility and quality, as well as the inadmissibility of refusal to provide health care; priority of prevention in the health sector; the medical confidentiality [3].

On the protection of motherhood and childhood in Russia, the main document is the Constitution of the Russian Federation, the foundations of support are enshrined in Part 1 of Art. 38. There are also measures to promote fertility, support the institution of the family, protect the interests of children, which are enshrined in the family, administrative, labor codes [2].

The main objectives of the state policy in the Russian Federation regarding maternity and childhood are as follows: increasing the number of marriages and reducing the number of divorces; reducing the rates of child, maternal and infant mortality; creating an effective system of care for orphans; reducing the number of street children and children from dysfunctional families.

This social policy entails significant budget expenditures in the following areas: the formation of a wage fund for women in budget sectors, such as healthcare, culture, science, education; unemployment benefits and child benefits; maternity benefits and childcare benefits; benefits at birth, or when transferring a child to a family, pensions for children with disabilities, payment of maternity capital, etc. [7].

By the Decree of the President of the Russian Federation, the new Law on Children's Benefits № 418-FL from January 1, 2018 introduced a whole range of measures aimed at supporting the family in which the younger generation is brought up. New benefits for caring for children under 1.5 are already paid from January 2018. The size is calculated based on the cost of living of the region. The average amount will be 10-10.5 thousand rubles. It is issued for the first child from the budget [8].

However, according to some authors, in particular, Grek N.V. (2012) in his work indicates that modern legislation in the field of social policy embodies gender imbalance. All the benefits associated with childbearing and childcare are shifting towards maternal payments, but are useless without the presence of an active male breadwinner, the main source of family finances [9].

The Birth certificate as an example of innovative social practice also continues to show some imperfections. This is partly related to the behavior of women who ignored the timely receipt of this document, and partly the problems are attributed to the obstetric aid system itself. Informal payments in the field of medicine, low awareness of the principle of operation of birth certificates hinder the successful implementation of the above social program [9].

Social protection by the state is manifested, inter alia, in the provision of paid leave during pregnancy and childcare. Thus, the Malolychenko E.V. (2018) study presents an analysis of postpartum leave for childcare, including in countries of the "post-Soviet space": Belarus, Latvia, Lithuania, Moldova Ukraine, Russia, Estonia. The largest vacation duration is 20 months with 100% coverage registered in Russia and Estonia. In other "post-Soviet" countries, vacation time is 16-18 months [10].

In Western Europe, the duration of parental leave is, on average, 16–20 months: Sweden (14 months), Switzerland (14 months), France (16 months), Finland (18 months), Slovenia (15 months), Romania (18 months), Netherlands (16 months), Malta (18 months), Germany (14 months), Belgium (15 months). The largest va-

ation duration was recorded in Croatia - 58 months with 100% coverage, the shortest - in Iceland - 13 months. Despite the fact that the Russian Federation has approved Convention № 183 [11], social protection of mothers is carried out according to international standards. In terms of payment and duration of maternity leave, the Russian Federation surpasses many European countries. In addition, Russia has a long paid leave to care for a child. Long paid holidays take place only in Austria, Belarus, Hungary, Poland, Slovakia, the Czech Republic and Sweden [12]. However, a sufficiently long vacation cannot be contrasted with the amount of benefits during this period in other European countries. Statistics show that the higher the amount of the childcare allowance, the shorter the duration of the leave [10].

Thus, we can conclude that at present, the modern social policy of Russia is pronatalistic in nature, which is expressed in intensive stimulation of reproductive behavior, including social measures to financially support motherhood [9].

The ranking of countries around the world on the effectiveness of health systems was compiled by analysts at Bloomberg based on data from the World Health Organization, the United Nations and the World Bank (*The Most Efficient Health Care*). The rating includes 56 countries. The criterion for assessing the effectiveness of the health care system was the life expectancy at birth, in addition, the relative health care costs as a percentage of GDP, as well as the absolute cost per capita per year, were estimated. That is, the health care system that allowed to achieve the greatest life expectancy at the lowest cost was considered the most effective [13].

The most effective healthcare in the world is Hong Kong, which is estimated at 87.3 points on the Bloomberg scale with an estimated life expectancy of 84.3 years and costs, respectively, of 5.7% of GDP and \$ 2222 per capita. It should be noted that in this rating in 2018 there were only 4 countries from the former “post-Soviet space”: Kazakhstan, Belarus, Russia and Azerbaijan [13].

Kazakhstan takes 44th place in the ranking with 39.2 points in health care, 72 years of life expectancy, 3.9% of GDP and \$ 379 in absolute costs per capita. Belarus takes 49th place with 35.3 points in efficiency, and GDP 6.1% and an absolute cost of \$ 352. Azerbaijan occupies 54th place with an efficiency of 29.6 points, costs of GDP of 6.7% and absolute costs of \$ 368 [13].

Russia ranks 53rd in the rating; over the past 5 years, it has managed to rise up 2 points (from 55th place). At the same time, the effectiveness of healthcare in Russia is estimated at 31.3 points on the Bloomberg scale with an estimated life expectancy of 71.2 years and a cost of 5.6% of GDP and \$ 524 in absolute terms per capita [13].

Thus, in 2018, the health system in the Republic of Kazakhstan was recognized as the most effective of the post-Soviet countries. Moreover, the highest life

expectancy among the countries of the "post-Soviet space" was in the Republic of Belarus - 73.6 years. The highest relative costs for healthcare in 2018 were in the Republic of Azerbaijan - 6.7%, and absolute costs - in Russia - \$ 524 [13, 14].

The most expensive healthcare is in the USA, however, its effectiveness is estimated at only 29.6 points. This country ranks 54th in Bloomberg's ranking on healthcare performance. Costs of 16.8% of GDP and \$ 9,536 in absolute terms allow the US to achieve an expected life span of 78.7 years [13].

The deterioration of all indicators of public health in Russia since the 1990s has given them the status of threats to national security. For many decades, the following problems have been observed: dysfunctional infant mortality rates, high growth rates of social diseases (tuberculosis, AIDS, drug addiction), low life expectancy in comparison with Western countries, high gap in life expectancy of men and women (13 years), "super-mortality of men of working age [15].

According to Zudin A.B. (2018), Russian healthcare in the last ten years has been intensively reorganized and modernized [3]. But despite a number of organizational and economic reforms and consolidation of socially approved principles in the legislation, the healthcare sector stays in a difficult situation: mortality does not decrease, a significant part of the population is not satisfied with the quality of medicine, and there is always a lack of funding [16].

At present, Decree of the President of the Russian Federation dated 07.05.2018 No. 204 "On National Goals and Strategic Tasks of the Development of the Russian Federation for the Period until 2024" defines the main development strategies: ensuring sustainable natural growth in the population of the Russian Federation, increasing life expectancy to 78 years (by 2030 year - up to 80 years), a decrease in mortality of the working-age population (up to 350 thousand per 100 thousand people), a decrease in mortality from diseases of the circulatory system (up to 450 per 100 thousand) and mortality from neoplasms (up to 185 cases per 100 thousand), and infant mortality rate (up to 4.5 cases per 1 thousand), elimination of personnel shortages in medical organizations providing primary health care, ensuring that all citizens are covered with preventive medical examinations at least once a year, ensuring optimal accessibility for the population (including for residents of settlements located in remote areas) of medical organizations that provide primary health care; reduce waiting time in line for citizens Kie organization, simplification of entry procedures to the doctor, the increase in export of medical services not less than four times compared to 2017 year (up to \$ 1 billion per year). [17]

Pursuant to this Decree, the Ministry of Health of Russia has developed a passport of the Healthcare national project, which includes eight federal projects. An important task of the project is to create mechanisms for the interaction of medical organizations based on a unified state information system in the field of healthcare. It is planned that the budget of the national project as a whole will amount

to 1725.8 billion rubles. Sources will be: the federal budget - 1366.7 billion rub., State off-budget funds - 94.0 billion rub., Off-budget sources - 265.0 billion rub. budgets of the constituent entities of the Russian Federation - 0.1 billion rubles [18]. According to some researchers, a new approach to the development of strategic planning in the healthcare sector at present should be based on the basic principles characterizing the particularities of healthcare as an industry [4].

Thus, at present, the constitutional principles, foundations and guarantees in healthcare are presented in international treaties, the Constitution of the Russian Federation, Federal laws, laws of constituent entities of the Russian Federation, and other regulatory legal acts. Great prospects are presented by the implementation of the Healthcare industry program adopted in 2018. Measures to protect motherhood and childhood in Russia are comprehensive, but have a number of problems. Women during pregnancy, childbirth and childcare in Russia can count on social protection, which is often higher than in many European countries.

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将法律制度纳入全球化背景下的立法政策工具

**INTEGRATION OF LEGAL SYSTEMS AS AN INSTRUMENT  
OF LAW-MAKING POLICY IN THE CONTEXT OF GLOBALIZATION**

**Diachenko Olga Viktorovna**

*Candidate of Juridical Sciences*

*Associate Professor at the Department*

*of Constitutional and Administrative Law of the Faculty of Law*

*at The North Caucasus Federal University*

**Mazurenko Andrey Petrovich**

*Doctor of Juridical Sciences*

*Professor at the Department of legal support for the activities*

*of authorities at The North Caucasian Institute*

*of The Russian Presidential Academy*

*of National Economy and Public Administration*

抽象。这项工作致力于整合作为全球化背景下立法政策的一种手段。关于法律国际化进程和新千年伊始法律制度趋同的各种观点进行了审查。强调了这些进程的积极和消极方面，得出了关于现代现实中国家立法政策目标的结论。

关键词：整合，立法政策，全球化，统一，国际化，法律制度

**Abstract.** *The work is devoted to the analysis of integration as a means of law-making policy in the context of globalization. Various points of view are examined regarding the processes of internationalization of law and the convergence of legal systems at the beginning of the new millennium. The positive and negative sides of these processes are highlighted, conclusions are drawn regarding the goals of the national law-making policy in modern realities.*

**Keywords:** *integration, law-making policy, globalization, unification, internationalization, legal systems*

The legislative policy of modern states is developing under the influence of a whole set of internal and external factors of social reality. Perhaps one of the most important factors in this influence is globalization. The problems associated with it have for many years been in the center of attention of discussions of scientists, politicians, businessmen, artists, journalists, and religious figures. This is due to the fact that at the turn of the millennium global problems faced humanity to the utmost, on the successful solution of which our fate depends. This trend is espe-

cially pronounced during periods of global financial and economic crises, which are becoming more frequent, clearly demonstrating the interdependence of various states on global processes.

At its core, the phenomenon of globalization is not new to the global community. So, we can agree with N. Bindyukov that globalization in the broad sense is a historically long process that has gone through a number of stages in its development. The idea of a common destiny of people, their special tribal identity, the unity of human existence on Earth has existed for centuries, it was born when a person realized himself as a thinking (*Homo sapiens*) and social (*Homo politicus*) creature. This is evidenced by ancient myths, poetic traditions, religious scriptures, testaments of sages, prophets and philosophers from the time of Antiquity<sup>1</sup>. Many researchers of globalization believe that this process from an ideological point of view began to develop actively since the establishment of the Club of Rome, an international non-governmental organization that put forward a program to study global problems affecting the fundamentals of human existence in the late 60s of the 20th century: the arms race, environmental disasters, depletion of natural resources, poverty alleviation, etc.

With regard to law, the idea of creating a single legal field is also not new. Back in 1900, E. Lambert, speaking at the International Congress of Comparative Law, held in Paris as part of the World Exhibition, proposed the development of so-called universal law, based on a comparative analysis of national legal systems. Subsequent world wars virtually eliminated this possibility, but in the sphere of globalization processes of the new millennium, E. Lambert's proposal is not so utopian<sup>2</sup>. This is due to the fact that today the process of global change has reached an uncontrolled scale and is moving to its apogee, and therefore, the study of the possibilities of law in streamlining social relations, including globalization trends, is the most relevant<sup>3</sup>.

The foregoing clearly confirms the idea that the law-making policy of each individual national state today depends on global changes in the world, on the timely response of national legal systems to the requirements of worldwide integration. Global problems can only be successfully solved by joint efforts of states. In this regard, the problem of managing globalization is highlighted, which, in turn, enhances the role of such a means of managing global processes in the legal sphere as national and international law-making policies of states.

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<sup>1</sup>See.: Bindyukov N. World. The political component of the era of globalization and Russia. - Kiev: Library of Ukraine (ELIBRARY.COM.UA). Update date: 04/02/2014. URL: <https://elibrary.com.ua/m/articles/view/> (application: 29.08.2019).

<sup>2</sup>See.: Bindyukov N. World. The political component of the era of globalization and Russia. - Kiev: Library of Ukraine (ELIBRARY.COM.UA). Update date: 04/02/2014. URL: <https://elibrary.com.ua/m/articles/view/> (application: 29.08.2019).

<sup>3</sup>On this see.: 2. Kabalkin A., Sannikova L. Globalization of the legal space and novels of Russian civil legislation // Russian Justice. 2007. № 12. P 42.

Today, the rapprochement of legal systems in the world is very intense. This process is especially noticeable in Europe, where a single European legal space is being formed. The problem of harmonization and unification of legal systems is relevant for the Commonwealth of Independent States and the SCO member countries. When carrying out work to bring legislation closer together, states proceed from universally recognized norms of international law, as well as the principles underlying the convergence of the laws of countries with market economies.

However, almost all researchers recognize the fact that globalization is controversial. It has both positive and negative properties. Its processes make changes in the stereotypes of public, including legal consciousness, necessitating the integration of national legal systems, the emergence of new branches and institutions of law and legislation. As a result, the development of supranational international law is proceeding at an accelerated pace. But since law is a cultural-historical phenomenon that takes shape in a specific historical and political situation, contradictions between the tendency of its normative universalization and the peculiarities of embodiment in the real conditions of a particular country are inevitable.

Accordingly, the impact of globalization on the development of national law of states is assessed ambiguously: on the one hand, states borrow experience from each other, look for ways to unify their legal standards, and on the other, the process of constant modernization of national legislation acquires the character of “legal expansion” of economically and politically stronger states<sup>4</sup>. In this regard, questions arise: what are the limits of approximation of legislation? To what extent should state sovereignty be maintained? Is it possible in the long term to form a single world law? In fair opinion of V.I. Blishchenko, borrowing foreign legal experience should not lead to leveling of the features of national legal systems<sup>5</sup>. It is especially important to preserve the national legal identity in multinational states with a rich legal history, which the Russian state undoubtedly belongs to.

Here, there are great opportunities for unlocking the potential of such a phenomenon as national law-making policy, which, in our opinion, has an appropriate system of political and legal means<sup>6</sup> to preserve the national identity of the domestic legal system in the context of global changes and at the same time correctly use the most valuable international experience in this field.

<sup>4</sup>See.: 3. Khvaleev V.A. Transformation of the Russian legal system in the context of globalization // *Philosophy of Law*. 2008. № 4. P. 103-104.

<sup>5</sup>See.: 5. Ayupov V.Sh. Globalization and national law of Russia // *Law and state: theory and practice*. 2008. № 4. P. 146.

<sup>6</sup>See.: 6. Blishchenko V.I. Globalization and international law // "Globalization, state, law, XXI century." Moscow Legal Forum: based on presentations. M., 2004. P. 17.

Just as any integration process is necessarily accompanied by the creation of a system of rules necessary for setting goals and its organization, the integration process between two or more countries is regulated by a set of legal norms that are objectively necessary in modern society. Thus, global integration processes inevitably entail legal integration, which can be defined as the process of forming a new, global system of norms that organize and ensure global interstate interaction and interpenetration in various spheres of life of modern society and the state. The nature of legal integration is determined, on the one hand, by the participation of states in the affairs of the world community, and on the other hand, by the degree to which they perceive certain aspects of the law of other states.

Often, principles tested in other countries are not viable under Russian conditions. Therefore, the legislator, within the framework of the cognitive aspect of lawmaking, should focus not on borrowing foreign standards, but on searching for a model, albeit less perfect, but corresponding to Russian public needs. In the fair opinion of experts, the adopted laws should be socially adequate, in connection with which, the cognitive component of legislative activity requires an objective understanding of new realities, taking into account the national identity, traditions, religions and customs of the Russian peoples. It should be agreed that only such an approach will allow harmonizing, within the framework of the national law-making policy, the interests of various social strata through a system of their own traditional legal values, spiritual and moral guidelines.

In our opinion, the Russian law-making policy should strive not to “bulk” borrowing of foreign versions of legal regulation, but, based on an analysis of its own historical experience and the current national legal system, should more actively use scientifically based procedures for preparing bills, with the involvement of appropriate tools and the participation of various subjects of such a policy (including representatives of civil society), in order to reflect all national interests in domestic law.

In conclusion, we would like to emphasize the idea that the systematic use of law-enforcement policy tools that allow us to quickly respond to the challenges of the time, as well as the study of Russian and foreign experience, are the most important factors in modernizing domestic law-making in the context of integration processes taking place in the world. Moreover, the main vector of such a policy should be aimed, first of all, at improving the domestic system of law, its social characteristics, and, ultimately, at improving the quality of life of the Russian people. Realization of this task should be carried out with a clear understanding that the development of the national law-making policy should be oriented towards the careful preservation of positive domestic legal experience and at the same time on the creative, most balanced use of global achievements in the field of law-making.

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中国古代和日本的国家安全犯罪（比较分析）  
**CRIMES AGAINST STATE SECURITY IN ANCIENT CHINA AND  
JAPAN LAW (COMPARATIVE ANALYSIS)**

**Pivovarov Nikolay Danilovich**

*Managing Partner of "ZAKLICH" Law Firm*

抽象。七世纪至第八世纪成为中日两国建国初期的黄金时期；公共行政，法律，建筑和艺术领域以及公共生活的其他领域都进行了积极的改革。本文系统地介绍了旨在实施国家安全的中日传统刑法规范，揭示了日本和中国传统刑法的法律规范的继承。

关键词：日本古代法，中国古代法，唐代法典，太极拳法典，泰卡改革，唐代。

**Abstract.** *The VII–VIII centuries became the golden period of the dawn of statehood for China and Japan; active reforms were carried out in the field of public administration, law, architecture and art, in other areas of public life. The article provides a systematic presentation of the norms of Chinese and Japanese traditional criminal law aimed at implementing state security, reveals the succession of legal norms of Japanese and Chinese traditional criminal law.*

**Keywords:** *the ancient law of Japan, the ancient law of China, the code of the Tang Dynasty, the code of Taiho Ritsure, Taika reforms, the Tang Dynasty.*

### **Introduction**

This article is based on the *classical system* of Chinese traditional law, which was formed in the era of the Han<sup>1</sup> and Tang<sup>2</sup> dynasties and existed virtually unchanged until the end of the imperial period of Chinese history. The material for the study of the norms of traditional criminal law in China was the Tang dynasty code "*Tan lu shu i*", compiled under the leadership of Emperor Gao-tzu (627-629).

By *traditional Japanese law*, we mean the law that arose in the golden age of the development of the Japanese state and legal system – Taika<sup>3</sup> reforms. In 604, the "Constitution of the Seventeen Articles" fixed on paper the leading role of the emperor in the country - the Heavenly Sovereign *Tenno*.

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<sup>1</sup>Han Empire (Chinese trad. 汉朝, simp. 汉朝, pinyin: Hàn cháo, pall.: Han chao) - 206 BC - 220 AD.

<sup>2</sup>The Tang Era (Li 李 Dynasty) - June 18, 618 - June 4, 907, Chinese, Tanchao. Traditionally, China is considered the period of the highest power of the country.

<sup>3</sup>Reforms of Taika (化化の改新 taika no kaysin, "update of Taika") were carried out in the 7th – 8th centuries.

The first legal act to open the mature stage of Thai government was the “*Taicho Ritsuryo*” Law Code (*Taiho* – is the motto of the first period (701–703) of King Mommu’s reign (697–706), *ritsu* - criminal law, *ryo* - civil law, hence the literal translation - “Criminal and civil laws of [period] Taiho”). Work on the code was completed in 701, during the reign of Emperor Karu Mommu; the code entered into force in 702, this code has been lost, and the text of the code that replaced it in 718 under the name “*Hero Ritsuryo*”, which entered into force only in 757, is currently being used to study it [see: 1].

The legal system, which was developed during the Taika reform period, had the full name of the *Kyakushiki ritsure*, where the *kyaku* - are changes and additions, and the *shiki* - are the law enforcement rules (procedural law).

### Crimes Against State Security in Ancient China

In imperial China, as in Japan and other countries of the Far East, there was a cult of the emperor’s personality. The image of the emperor was described in the following words: “The lord of people by his power of De<sup>4</sup> is like Heaven and Earth, and with his radiance is like the sun and moon. Above, he reverently accepts the Precious Mandate of Heaven, below he looks after the earth and directs it” [2, ju 17].

The emperor was considered a semi-divine person, a protege of heaven on earth, so any crimes directed against him were regarded, firstly, as crimes directed against the state, and secondly, as crimes against Heaven itself. In ancient and medieval Chinese society there was a cult of Heaven. Heaven was seen as a kind of supreme deity. The emperor was considered his chosen one on earth. It was the emperor’s personality and everything connected with it that was the object of the crimes set forth below.

In the classification of crimes in the form of ten atrocities (*shi e*), the first three atrocities were crimes against the state. The object of these crimes was considered the emperor and everything related to his person. This: 1) the intent of the coup or rebellion against

(*moe fan*); 2) the intention of great rebellion or great obstinacy (*moa da ni*); 3) The intent of treason (*moe pan*).

In the famous historical monument of China “*Zuo Zhuang*” regarding the **crime of intent to coup or rebellion against** (*moe fan*) it is said: “When the sky rebels against the (*fan*) cycle of the seasons, natural disasters occur. When people rebel against De, there is confusion. The emperor is extremely revered and receives a mandate from the High Heaven for rule ... he harbors everything and supports everything. He is the father and mother of all people, and they are his children and his subjects, and therefore are obliged to experience only loyalty and filial piety

<sup>4</sup>De (Chinese 德) - manifestation of Tao; in the most general sense, denotes the basic quality that provides the best way of existence for each individual being or thing.

to him. If someone dares to hold back rebellious feelings and intends to give vent to an obstinate heart, he will want to rebel against Heavenly Constancy and go against the principles of human justice (*li*). Therefore, such actions and intentions are the intent of rebellion against" [2, ju 1].

The intention to damage the altar of the Earth and the Grain (*she ji*) was attributed to the same crime<sup>5</sup>. The subject of this crime, taking into account Chinese metaphysics, was not just the emperor as the holder of a heavenly precious mandate to rule, but Heaven itself as the center and creator of the entire universe.

Any crime related to the intent of the coup and the organization of a rebellion against the emperor was considered a crime of the intent of the uprising. In the above article 248 of the Tang Dynasty Code, it was said about the punishment for this crime: "Anyone who has plotted an uprising against him or has committed a fierce obstinacy (*da nie*) is punished with beheading. Their fathers and sons 16 years and older were all punished by hanging, and their sons 15 years and younger, as well as mothers, daughters, wives and concubines, male grandfathers and grandchildren, older and younger sisters, as well as their *butsui*<sup>6</sup>, as well as their property (*Tzu Tsai*), fields and buildings - everything was confiscated to the treasury. Men 80 years old or women 60 years old or *feizi*<sup>7</sup> were free of punishment" [2, ju 17].

As for the objective side of this crime, its public danger was manifested in the creation of unrest and rebellion in the state, coupled with a series of violent acts. The criminal consequence was the establishment of unlawful power in the state.

Could be any person the subject of the crime. Its subjective side is in establishing guilt, even if the criminals did not have time to implement their plan, they were subject to death only for the intent. In this case, the Chinese legislator has in mind direct and indirect intent.

Also, in the code of the Tang Dynasty, article 250 states that anyone who spoke in words about the desire to rebel against, but had no concrete plans, was punished with by an exile by 2000 li. In this case, the offender had an indefinite, unspecified intent, in connection with which the punishment was reduced to exile.

The second atrocity of the ten evils of *shi e* includes **great obstinacy** (*moa da ni*). This crime was understood as the intent of the destruction of the imperial temple of the ancestors, the imperial tomb and the palace. An important element of the object of this crime was the presence of temples of ancestors or tombs with palaces of "imperial" status.

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<sup>5</sup>*She* - is the spirit of the five lands, *ji* - is the ruler of the fields. Through them, the sacred Path of the Earth is made into crops. The ruler is the lord of spirits. Food is Heaven for people. When the emperor is peaceful, the spirits are calm. When the spirits rest, the seasons are plentiful in crops.

<sup>6</sup>*Butsui* - is a category of personally dependent male citizens who belonged to private families. They were considered the youngest members of the family to which they belonged.

<sup>7</sup>*Feiji* - demerital, midgets, dumb, persons deprived of one limb or having a fracture of the spine; the middle (out of three) disability group in Chinese law

As for the objective side of this crime, in this case it could be manifested in any actions aimed at the destruction or damage of the imperial tombs, temples of the ancestors of the emperor or his palace.

The subjective side was the direct intention of damaging or destroying the above real estate objects belonging to the imperial family. But if, during the uprising against, there was enough intent to be held accountable, then, with great obstinacy, having one intent was not enough. The criminal was liable for great obstinacy if there was a fact of a crime.

The subject of the crime could be any person, regardless of gender and age. Fathers and sons of a criminal over 16 years old were sentenced to death and punished with beheading. A distinctive feature of these crimes is that when executing punishment, they did not distinguish between leaders (*shows*) and accomplices (*tsun*). In fact, with family responsibility, the status of the subject of a crime was automatically assigned to all members of his family.

The sons of a criminal under the age of 15, mothers and daughters, concubines, as well as wives and concubines of sons, male grandfathers and grandchildren, older and younger brothers, like their *buutsui*, were enslaved, and all their property was subject to confiscation. It is worth noting that such a category as slaves also belonged to property and was subject to confiscation.

Family-wide responsibility for these crimes was not subject to men over 80 years old and women over 60 years old, belonging to the family of the offender and falling under general family responsibility. Also, the men of *Duj*<sup>8</sup>, and women of *Feiji* were not liable for this crime.

As for the crime of **intent of treason** (*moe pan*), then it was understood as a betrayal of the country and the transition to the side of the enemy. The enemy was understood as both internal and external enemies of the state.

The object of this crime were public relations related to ensuring the security of the state, the essence of which also consisted in conscientious loyal service to the emperor.

The objective side acted in any form implying treason; it could be espionage, the disclosure of state secrets, any manifestation of assistance to representatives of a foreign state or rebels and insurgents in their anti-state activities.

The Tang Criminal Code stated: “Anyone who has intentionally committed treason is punished by hanging. If the action has already begun, then all those guilty are punished with beheading” [2, ju 17].

The subjects of this crime of intent of treason were considered to be persons who together deliberately made plans for treason to the state. From this category of intruders, it was prescribed to separate people who were forced to go after themselves. The legislation did not explain how these persons could be forced and made to go after the criminals. Also, the question of evidence of their lack of intent to commit treason remained open.

<sup>8</sup>*Duji* - is the highest of the three disability groups in Tang law: crazy, blind in both eyes, devoid of two limbs

Relatives of the offender fell under family responsibility; thus, the wives and sons of the offender were punished with an exile by 2000 li and 60 punches with heavy sticks.

If the offender carried out a group of 100 or more people to commit this crime, all their relatives were punished with a reference to 3,000 li and 100 blows with heavy sticks.

In all these cases, all relatives were supposed to have 3 years of hard labor. This is evidenced by the articles of the 28th chapter of the 3rd Tang Penal Code.

Exceptions were wives and sons 15 years of age or younger. In relation to the sons buy off (*shu*) was an option. Women could not go to exile alone, and in this case the punishment by exile was replaced by the punishment with heavy sticks and work in a fixed place.

If the sons were 16 years old or more, then they were sent into exile, and their mothers got rid of the work upon reaching the place of exile. The unmarried daughters of the offender were not subject to exile, since they were not equated with sons.

### **Crimes Against State Security in Traditional Japanese Law**

Just like in China, in Japan, the emperor has been and still is the central and main figure in the state.

According to ancient tradition, the emperors of Japan were direct descendants of the sun goddess Amaterasu<sup>9</sup>. Therefore, in a metaphysical sense, all crimes directed against imperial power were crimes directed against the goddess Amaterasu. The sun goddess in Japan is one of the dominant and most revered goddesses in Shintoism.

Crimes against state security were regulated by Chapter VII of the “*Taiho Ritsuryo*” Code. This chapter contained 54 articles. However, not all articles were related to the field of state security regulation. It also included crimes directed against human life, health, and freedom, such as murder, forced slavery, property crimes: theft, robbery, extortion, etc. Of the 54 articles, only 3 regulated crimes against state security:

- **Rebellion against the sovereign (Art. 1).**
- **Rumors of participation in the rebellion (Art. 3).**
- **High treason (art. 4).**

Section 2 of Chapter VII of the “*Taiho Ritsuryo*” Code provides for the punishment of the criminal’s relatives and enshrines the notion of family responsibility. Family responsibility becomes the rule of law.

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<sup>9</sup>Amaterasu Omikami (照大神 amaterasu o: mikami, “the great deity that illuminates the heavens”) is the sun goddess, one of the dominant deities of the all-Japanese Shinto pantheon. According to legend, her great-grandson Jimmu was the first earthly emperor of Japan and reigned back in 660 BC.

The crimes in Article 1 of Chapter VII of the “*Taiho Ritsuryo*” Code can be divided into three parts for the convenience of analysis: the first part regulates crimes related to the organization of rebellion and conspiracy to destroy the imperial hall and tombs; the second part is crimes related to incitement to the above crimes; the third part - crimes related to the conspiracy and destruction of the main Shinto temple<sup>10</sup>.

Thus, according to Article 1 of Chapter VII, in the event of the disclosure of a **rebellion against the emperor or a conspiracy to destroy the emperor’s hall or the tombs of the emperor**, all those responsible were executed by decapitation. Fathers, sons and slaves of the criminal turned into slavery. The exception was 80-year-olds and the category of *tokusitsu* - terminally ill, they were released from punishment. Grandfathers and grandchildren, the elder brothers of the criminal were sent into exile, even if they did not have cohabitation with the criminal.

The object in this crime, as well as in similar crimes in the Chinese code of Tang, was the emperor and everything associated with his imperial person.

Crimes aimed at the destruction of the imperial palace, residence or imperial burial place did not fall into the category of property crimes, but was regarded as crimes against the person of the emperor.

The subjects of this crime, in addition to the criminal himself, are all members of his family, from parents to children of brothers, since this article provided for family-wide responsibility. The property was subject to confiscation to the treasury.

If the criminal could not raise a rebellion of people subordinate to him and involve influential people with him, that is, the crime was in essence considered unfinished, the criminal was still beheaded. Only, unlike the first case, his parents and sons did not turn into slavery, but were sent into exile. The property was not subject to confiscation.

If the offender **talked about rebellion and carried out incitement to rebellion**, he was liable to punishment as witchcraft in accordance with Section 17 of Chapter VII of the “*Taiho Ritsuryo*” Code. If these conversations and incitements concerned a conspiracy to destroy the imperial dweller or tomb, the offender was put to death by hanging.

Family responsibility in this case is governed by

2 of Chapter VII of the Code, according to which, if relatives admitted *endza* (accomplices in the crime), but did not live together with the criminal, their property was not confiscated. Also, if the relatives lived with the criminal, but did not participate in the commission of the crime, then their property was not subject to confiscation.

<sup>10</sup>Shinto shrine (Jingu) to Ise-Jingu (Ise-Jingu, Jzingu Jap. 勢 勢 神宮) in the city of Ise, Mie Prefecture, dedicated to the deity Amaterasu o: mikami

In the event of the **destruction of the main Shinto temple**, the object was also the emperor. Since the main Shinto shrine of Ise-Jingu was essentially an imperial temple, it was in it that the regalia of imperial power were stored<sup>11</sup>. Therefore, the attempt to destroy this temple or its destruction was regarded as an attempt on the person of the emperor.

When uncovering a conspiracy to destroy the main Shinto shrine, the criminal was punished with 1 year of hard labor. If the temple was still destroyed, the punishment was a distant exile. Relatives of the offender fell within the scope of Article 2 of Chapter VII of the Code.

All the crimes listed in Article 1 of Chapter VII of the “*Taiho Ritsuryo*” Code had a common object of crime - the emperor and everything related to his person.

The objective aspects of all crimes in article 1 of chapter VII of this code are different. In the first part, these are actions aimed at organizing a rebellion, as well as actions aimed at organizing a conspiracy to destroy the imperial palace and tombs. In the second part of the article, these are actions aimed at incitement to create a rebellion. In the third, actions aimed at organizing a conspiracy to destroy the main Shinto temple, or actions taken to destroy it.

The subjects in this article are almost the same in all crimes. So, for example, the subjects in the first two parts were individuals. Relatives of the criminals also fell under family responsibility. In the third part, the subject was an individual, but his family was not affected by family responsibility.

The subjective side of all crimes in this article is common. It was expressed in direct intent, but the purpose of the crimes is different.

**High treason** (*muhon*) crimes were regulated by Article 4 of Chapter VII of the Code, which provided for punishment for intent by hanging. If the crime has already been committed, then the conspirators were decapitated, and their sons were sent to the middle exile. The subjective side of the crime was characterized by both direct and indirect intent.

### Conclusion

As already mentioned at the beginning of this article, the basis of Chinese and Japanese traditional law was taken by the traditional law of China and Japan during the empire. In particular, the provisions of the Chinese Criminal Code “Tan Lu Shu and” actually formed the basis of the Japanese Criminal Code “Taiho Ritsure”.

Having examined the above crimes against state security in ancient China and ancient Japan, the following features can be highlighted.

The system of crime against state security in the norms of the Japanese code is fully borrowed from Chinese traditional law. So we see that the system of crimes against state security in Chinese traditional law, which consisted of a crime: the intent of a coup, the intent to destroy the imperial hall and temple, high treason, is completely identical to the system of these crimes in traditional Japanese law. In addition, Japan even adopted the hierarchical arrangement of these norms in the articles.

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<sup>11</sup>Ise-Jingu is the repository of national treasures, in particular the Holy Mirror, and the main Shinto shrine in Japan

Thus, the system of norms of the crime against state security in traditional Japanese law is a kind of tracing-paper of the corresponding system of norms of traditional Chinese law.

In view of the succession of Confucian teachings by Japan, the metaphysical attitude towards the Emperor in Japan and China was also identical. In this regard, there were no differences between the objects of the crime against state security.

On this material, it becomes apparent that Japanese law has borrowed from the traditional Chinese law the concept of family responsibility. As for the structure of the norms of crimes against state security, it is also identical, but the amount of sanctions in these crimes is different.

For example, the Criminal Code of the Tang Dynasty, unlike the Japanese code of Taiho Ritsure, provided for capital punishment in the form of the death penalty as part of a family-wide responsibility for the intent of the Uprising Against.

Summarizing all of the above, we come to the following conclusions:

1. The system and structure of the norms of crimes against state security in traditional Japanese law were completely borrowed from Chinese traditional law, and in particular from the “Tang Lu Shu” Code.

2. The content of the norms was distinguished by the subjective part of the crimes, as well as the severity of the sanctions. As for the penalties in the Chinese Penal Code, they were more severe than penalties for this category of crimes in Japanese traditional law. This can be understood since such rigidity of laws in Japan would have disastrous demographic consequences, unlike China, which was naturally taken into account by Japanese lawmakers.

3. The existence of this succession in the creation of norms governing crimes against state security in Japanese law is characterized by a similar metaphysics of Chinese and Japanese society of that time, which was based on Buddhism and Confucian morality, and as a result, on fixing the emperor’s dominant sacred place as the son of Heaven in the case of China, or as a direct descendant of the sun goddess Amaterasu in a metaphysical representation of the Japanese society of that time.

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在功能方法的框架下, 向非语言学生教授英语语法的特点  
**FEATURES OF TEACHING ENGLISH GRAMMAR  
TO NON-LINGUISTIC STUDENTS IN THE FRAMEWORK  
OF THE FUNCTIONAL APPROACH**

**Rybkina Alla Anatolyevna**

*Candidate of Pedagogic Sciences*

*Associate Professor at the Department of methods  
of teaching foreign languages of Samara branch  
of Moscow City University*

**Ageenko Natalia Vladimirovna**

*Candidate of Pedagogic Sciences*

*Associate Professor at the Department of foreign languages  
Samara State Technical University*

**Startseva Natalia Valerievna**

*Candidate of Pedagogic Sciences*

*Associate Professor at the Department of foreign languages  
Samara State University of Social Sciences and Education*

抽象。 本文讨论了实现非语言大学外语教学主要目标的新方法。 在高等教育中教授英语语法的功能性方法为专家掌握专业外语交际技能创造了条件。 社会文化, 交际, 信息, 社会心理能力可以在大学教授外语的过程中形成。 功能方法起到了解决这个问题的重要作用, 从语言功能的角度来看, 它被理解为语法单位的研究。

关键词: 功能方法, 交际导向原则, 语法能力, 言语训练。

**Abstract.** *The article discusses new approaches to the implementation of the main goals of teaching foreign languages in non-linguistic universities. A functional approach to teaching English grammar in higher education creates the conditions for the specialist to master the skills of professionally oriented foreign language communication. Sociocultural, communicative, informational, socio-psychological competencies can be formed in the process of teaching a foreign language at a university. A significant role in solving this problem is played by the functional approach, which is understood as the study of grammatical units from the standpoint of their functionality in the language.*

**Keywords:** *functional approach, the principle of communicative orientation, grammatical competence, speech training.*

The ongoing process of globalization has led to a variety of different approaches to teaching English as a foreign language in universities. According to the Federal State Educational Standard of Higher Education (undergraduate level), requirements for foreign language proficiency by students of non-linguistic specialties are increasing. This means the possession of the main ways of implementing the current communicative context and the system of language knowledge, which includes knowledge and skills of working with grammar material of a foreign language.

A.A. Mirolyubov claims that difficulties in teaching grammar “depend on the complexity of the phenomenon itself, the richness and diversity of morphological forms, the presence of homonymic phenomena; from the interfering influence of the native language, the presence or absence of similar or related phenomena in the native language; from the complexity of mental operations necessary for the use or recognition of a grammatical phenomenon” [7, p. 112].

The traditional principles of teaching grammar, derived within the framework of the concept, are known, but reflective principles tested in practice and built on the analysis of the real experience of teachers are more valuable. Their difference can be represented by the following provisions:

<b>Traditional</b>	<b>Reflective</b>
• reflect the state of ideas in the scientific community	• reflect the beliefs of teachers
• rely on the scientific experience of researchers	• rely on the practical experience of teachers
• derived from theoretical discourse	• derived from teaching experience
• are of general abstract nature	• are specifically applied in nature
• prompted by theoretical logic	• prompted by teaching practice

The formation of grammar skills in the process of teaching a foreign language can be organized in terms of various methodological approaches. The modern methodology of teaching a foreign language offers ambiguous definitions of the term “approach to learning”:

- (I.L. Bim) initial conceptual position, starting from which the researcher considers most of his other conceptual positions [1];
- (I.A. Zimnaya) global and systemic organization of the educational process, which includes all its components on a par with the subjects of pedagogical interaction - teacher and student [4];
- (E.I. Passov) one of the methodological principles of the learning process [8].

In accordance with the objectives, it is customary to single out five approaches to learning: personality-oriented, communicative, competency-based, sociocultural and a relatively recent functional approach [10].

Personally-oriented teaching of a foreign language is based on the use of educational communication, immersing the student in real language communication, creating a language environment around him. From a methodological point of view, this approach assumes the presence of tasks of different volumes and levels of complexity in the process of classroom and extracurricular learning activities, the variability of the rate of assimilation of educational material, the help of a teacher in the process of pair work of shift staff.

A communicative approach to learning involves the convergence of the learning process in terms of its nature with the process of real communication. E.A. Melnikova defines it as follows: “A communicative approach is an approach that is aimed at the formation of students' semantic perception and understanding of a foreign language, as well as the mastery of language material for constructing speech utterances” [6, p. 208]. The main goal of this approach is considered to be the formation of communicative competence of students.

The competency-based approach to teaching a foreign language arose due to the need to form a number of students' competencies: mastering the skills and abilities necessary for independently setting goals and making decisions for actions both in typical and non-standard situations.

The sociocultural approach to learning is based on an understanding of culture as “a wide interconnection of social phenomena that are the results and means of social activity and development” [5, p. 4]. In the framework of this approach, the educational process is carried out by immersion in various cultural spheres and areas of the country of the studied language.

The functional approach associated with the direction of language learning from the meaning to the form and function of certain linguistic phenomena has become a relatively recent approach to teaching a foreign language. Studying grammatical units from the standpoint of their functionality in the language not only allows us to show the interaction of these units at different language levels, but also to form in students certain skills for using them depending on the purpose of communication.

Grammatical skill is determined by G.V. Bokareva as “a synthesized action performed in skill parameters and providing adequate morphological and syntactic design of a speech unit of any level in speech” [2, p. 51]. In other words, a grammatical skill is an automated use of grammatical phenomena to express communicative intent in a given situation, and a functional approach involves the movement of thought from meaning to how it is expressed and what communicative purpose it pursues. This implies the basic principles for teaching grammar as part of a functional approach:

- 1) speech orientation, in which training should be based on communication and have a practical orientation;

2) functionality, when grammatical phenomena and constructions are assimilated from the point of view of their function, which they perform in speech;

3) situationality, i.e. organization of training based on situations and communication problems that are relevant for students of different levels of language proficiency and areas of interest;

4) novelty that provides the dynamics of the forms of work, the variability of the materials used, the alternation and combination of various types and forms of organization of classes, creating all the conditions for the appearance of involuntary memorization in students.

In the framework of the communicative-functional approach, N.D. Galskova and N.I. Gez reduce the requirements for learning grammar to the following [3, p. 312]:

1) maximum authenticity of the educational material, without artificial examples and far-fetched situations of communication;

2) distinction between formal, functional and semantic aspects to facilitate the task of establishing links between them in certain contexts for students;

3) sufficient volume for the most effective assimilation and consolidation of grammatical material in new contexts;

4) reliance on previously learned material using illustrative clarity;

5) most concise, accurate and simple form of presentation of the material, adequately reflecting the essence of the grammatical phenomenon, the absence of terminological congestion;

6) variety of types and forms of work, including individual, pair and group.

As the main stages of work on a new grammatical phenomenon, the authors distinguish: familiarization, initial fixing, development of skills and abilities to use grammar in oral and written communication.

Explanation (familiarization) of the grammatical phenomenon, according to N.D. Galskova and N.I. Gez includes the disclosure of its formal characteristics and semantics, an explanation of the function performed in the speech context, and the initial consolidation of this phenomenon. For example, the grammatical forms presented in sentences are considered in comparison with another form in order to demonstrate cases of their use in accordance with the communicative intention of the speaker. For example, the difference between Past Continuous and Past Perfect Continuous is explained by the difference in the completeness or incompleteness of long-term action in the past:

*James was cooking dinner when somebody knocked on the door.*

*James had been cooking that night and that's why he was so tired and couldn't come to the party with us.*

After explanation is given for a new grammatical phenomenon, students are invited to highlight it in a specific context, to jointly reveal its form and meaning,

and also to determine the main features of its use. The explanation ends with the formulation of a generalizing rule containing a number of differential features of a given grammatical phenomenon, characterizing its features in oral and written communication. And the final stage of the explanation is to check the understanding of the new material and its primary consolidation, which includes simple exercises:

a) *I met Steve at the train station. He ... (had been waiting, was waiting) for his mother's train to come from New York.*

b) *The sun was shining brightly when I left my apartment in the morning, but the grass was wet and there were puddles all over the place. It ... (was raining, had been raining) all night.*

E.I. Passov gives his classification of the stages of work on grammatical material: perception, imitation, substitution, transformation, reproduction and combination [8]. A huge role in the stage of perception is played by a preliminary hearing. With a well-organized pre-hearing (demonstration of a grammatical phenomenon in the speech flow using an intonation pause, stress, voice emphasis), students are able to perceive the same type of phrases that have been emphasized, and to understand what function these phrases realize. As a result, students have a speech stereotype, which is the basis for a grammatical skill.

At the imitation stage, the foundations of the connection between the auditory and speech-motor images of the grammatical form are laid, the understanding of how the speech model is formed and what function it performs in speech is strengthened.

The substitution stage begins to form the operation of designing speech units, which fills one or another communicative model. A generalization of the model appears, the ability to reproduce by the principle of analogy develops (determine the meaning of the grammatical form in the situations presented; choose the grammatical form from several presented; indicate the grammatical phenomena in the text that express ...; indicate the grammatical form that is used in the sentences during translation into English).

One of the main advantages of the functional approach is “speech training,” which, as a rule, is not used at all in traditional methods when forming a grammatical skill. In a functional approach, grammar training takes place on a fairly significant amount of material when considering a large number of diverse situations. The action by analogy in speech conditions involves the construction of phrases and sentences not by the rule, but by analogy with the sample and in accordance with the speech task. The correctness of speech acts is achieved by regular reinforcement, the frequency of similar phrases.

The disadvantages of this kind of tasks include the underestimation of the principle of consciousness in learning and the cognitive processes characteristic of mastering a foreign language, in addition, there is the difficulty of creating a genuine "speech environment" when conducting conditional speech exercises.

At the transformation stage, the above processes go to a higher level, the operation of registering speech units is consolidated and the operation of independent use of the model is born. The stage of reproduction completes the formation of the operation of independent use of the model, as well as the internal image of the model (express your opinion, give examples from your life; prove, explain, formulate recommendations, arguments, advice on different situations, topics, etc.).

The most advanced in the strategy of forming grammatical skills of E.I. Passov is the combination stage. It begins with a repetition of the stages of transformation and reproduction, but already with the use of new grammatical material and new exercises, which can significantly strengthen the grammatical skill. Then controlled combination follows: the studied model is alternately combined with those basic models that are used together with it in the flow of natural speech. The methodological value of performing such exercises is associated with the ability to move from grammar ability to skills.

Transformation, reproduction and combination are performed, for example, using:

- tasks of problematic speech thinking, which are formed on guesses, on the search for similarities and differences, on the exclusion of superfluous, on the sequence of actions, etc.;
- exercises of verbal interaction, when tasks are not feasible without a partner (partners), respectively, are the tasks in pairs, small groups (for example, using all studied constructions of the past tense to model a communicative situation that is not thematically limited and present it in the form of dialogue or polylogue);
- exercises involving "informational inequality" of students (for example, interviewing)

Based on pedagogical experience, we will try to formulate the following directions for improving the process of teaching the grammar of students of non-linguistic specialties. Firstly, professionally-oriented foreign language communication of students will be more effective if the basis for their training will be the comprehensive formation of grammatical competencies and skills of speech activity in a foreign language. Secondly, teaching grammar as part of a functional approach should be based on the professional needs of students. Thirdly, the formation of grammatical competence is achieved by gradually consolidating the functions of grammatical phenomena, selected on the basis of professionally significant situationality. Fourth, higher results in teaching grammar are determined by the implementation of a set of grammatical tasks.

Practical work with students of non-linguistic specialties has revealed a number of problems, each of which requires a binding solution. Students had difficulty situationally using grammatical phenomena. Many students learned to use only very simple grammatical structures in speech, it was difficult for them to use various connecting elements of the language, which makes speech, utterances naturally sounding and logically constructed.

Since the functional approach as a modern method of teaching grammar goes through the stage of active development, in domestic practice, teachers are working on creating effective teaching and methodological complexes, the content of which will contribute to the active learning of functional grammar. The need to correct the educational literature is noted by such specialists as I.L. Bim, A.V. Volovik, O.Yu. Iskandarova, N.N. Boldyrev, A.A. Verbitsky, N.A. Corbina et al.

The set of exercises presented in textbooks, teaching aids, educational and methodical complexes, on Internet sites intended for teaching a foreign language in non-linguistic specialties, absolutely ignore the stages of learning grammar as part of a functional approach. There are violations of basic didactic principles from simple to complex and consistent, systematic job offer. A mix of tasks is noted, which is a negative point for students in the framework of independent work on the study of a foreign language (including English grammar). All of the above determines the need for selection of tasks by the teacher. The selection of exercises for teaching grammar as part of a functional approach really does require special attention from the teacher, since the task formulation and the creation of a language context should also be consistent with the objectives of the lesson, taking into account the number of hours of practical exercises devoted to the study of certain topics and sections [9].

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教育中的应用(附加和专业): 教学方面

**ELECTRONIC NOTE ARCHIVES AND THE APPLICATION  
OF THEIR FUNCTIONAL IN ARTISTIC EDUCATION  
(ADDITIONAL AND PROFESSIONAL): PEDAGOGICAL ASPECT**

**Titova Svetlana Sergeevna**

*Lecturer, Postgraduate*

*South Ural State Institute of Arts named after P.I. Tchaikovsky*

*Teacher*

*Children's Youth Center "Children's Development Center "Xingtai"*

**Morozva Olesya Petrovna**

*Teacher*

*Children's Youth Center "Children's Development Center "Xingtai"*

*Chelyabinsk, Russia*

抽象。这项工作致力于在音乐和理论学科的框架内在教育过程中使用电子音乐档案。根据其功能分析了许多电子音乐档案,通过搜索和下载乐谱的方便性,通过流派,作曲家,乐器在档案馆中呈现的音乐素材的性质,转换成必要的键的可能性。编制了许多电子音乐档案的同步表。给出了在艺术教育(附加和专业)的音乐和理论学科框架内使用电子音乐档案的形式。

关键词: 音乐理论学科, 教育学, 电子音乐档案, 零件, 换位, 搜索功能, 音乐文件格式, 教学过程中电子音乐档案的使用, 音乐编辑中音乐档案的MIDI文件处理, 电子音乐分类 档案

**Abstract.** *This work is devoted to the use of electronic music archives in the educational process in the framework of musical and theoretical disciplines. A number of electronic music archives were analyzed, by to their functioning, by the possibility to transpose into the necessary key, by the convenience of searching and downloading scores, by the nature of the musical material presented in the archive by genre, composer, instrument. Synchronic table of a number of electronic music archives is compiled. The forms of working with electronic music archives in the framework of the musical and theoretical disciplines of art education (additional and professional) are given.*

**Keywords:** *Musical and theoretical disciplines, pedagogy, electronic music archives, parts, transposition, search functions, music file format, the use of electronic music archives in the pedagogical process, work with MIDI files from music archives in music editors, classification of electronic music archives*

### The main part

Printed materials - textbooks, workbooks, music collections, methodologically integral and didactically tested teaching aids. With a number of advantages, printed educational materials have a number of significant drawbacks in their application - cumbersomeness, heavy weight (if a student needs these lessons not for one lesson per day) and, unfortunately, not all educational materials are always available for purchase in their printed form. Relevant to the appeal to multi-media resources [7]. The acute problem is the selection of an executable musical repertoire, if musical scores generally exist in a limited number, have not been reprinted or purchased by libraries in print.

Musical literature has a special specificity, in contrast to general educational materials. There are large databases that provide access to electronic book periodicals presented by electronic textbooks: Rukont, Doe, Elibrary, CyberLenink. Some of the electronic databases also contain electronic textbooks: “Bustard”, “Enlightenment”, “Ventana-graph”, “Astrel”, “CET”, “Binom. Laboratory of Knowledge”, “Academic Book”, “Russian Word”. In addition to paper products, they promote electronic textbooks as their reading, using not just PDF versions, but reading software - with the ability to underline, bookmark, play audio and video applications, follow hyperlinks and more. The normative document regulating the types of electronic publications is: GOST R 7.0.83-2013 SIBID. “Electronic publications. The main types and output information” paragraph 4 contains the classification [1].

One of the authors considering the classification of electronic textbooks is G.G. Shvarkova - graphic designer, specialist in electronic education and computer graphics, researcher of computer mathematical systems (Belarusian State University). In a number of works, she co-authored with Yu.V. Poznyakom, V.M. Golynsky. For example: Shvarkova, G.G., Galynsky, V.M. Modern interpretation of the electronic textbook. Typology, necessary structural elements (2006), and Shvarkova G.G., Poznyak Yu.V., Galynsky V.M. A model for organizing and delivering content in a virtual educational space (2012) [14].

Depending on the goals set by the authors and the capabilities of the developers, electronic textbooks can have a variety of qualities. In the literature there is a classification of electronic textbooks, electronic manuals or educational and methodical complexes for various reasons: by the presence of interactivity [2]; by availability; according to the system in which the textbook was developed, etc. The following criteria are considered the most essential criteria in the classification today: accessibility and presentation (structuring) of the material [3; 9; 13]. The study of the features of the use of electronic textbooks is more covered at present than the study and use of electronic music archives. Which became the basis for the implementation of this work. The main provisions of which we give in the framework of this article.

At present, a complete classification of electronic music archives has not been created, which would be taking into account all the characteristics of such archives at present. An attempt to understand the functioning of electronic music archives is made in this paper.

The presence of additional functions in addition to viewing the image of the musical score is distinguished by many modern electronic musical archives (similar to electronic textbooks, unlike simple static images of the scanned original source of a printed textbook or musical score) - listening, visualization on the instrument during sounding, transposition, saving in formats for later work in musical editors, sounding under a metronome, unloading parts - everything that is in demand among performers for working with different material. In terms of interactivity and functioning, modern electronic music archives are becoming a relevant product for both training and practical activities of a musician. The selection of high-quality material for the repertoire of a musician-performer is a key task in the pre-executive period, good material is the key to successful creative training of a musician.

**The main problems of finding material in the handling of printed sheet music**, according to the authors of this work: - 1) some notes are published in a limited edition and are difficult to find in print (notes of early editions, non-reprinted notes, foreign collectible editions, etc.), 2) the high complexity of working with catalogs of printed publications, and the greater accessibility of work with electronic catalogs and electronic music archives; 3) the restriction on the number of copies of pages from a printed publication in libraries under the law (the ban on the complete copying of the entire publication in one visit) and, in contrast, the ability to download full scores in electronic music archives for review;

Mobility, navigation, search and ease of selection are **key advantages of electronic music archives** over printed music editions. There are lists of archives [5], [6]. Turning to the consideration of a series of archives, we came to some conclusions. Modern technologies allow not just digitizing musical text in a format, for example, pdf. Most musical materials are translated through musical editors with the subsequent ability to select parts from a specific work, and the ability to transpose them into a tone convenient for the performer (the latter functions, in most cases, are found in paid versions of electronic music archives). In addition, in paid versions of archives there are not only musical material, but also sound files of these works, which you can listen to before playing and familiarize yourself with the sound of the selected work. Such sound files can be converted through the program-converters into music editors and view the score, upload and export and music editors video sound works. Full-fledged multifunctional work with musical text in excellent quality, ease of navigation are key characteristics that distinguish the electronic format of musical text from the printed equivalent.

**The structure of electronic music archives is equipped with convenient navigation and a search function in different categories:** by instruments, by genres, by styles, by composers, by performers.

Some electronic music archives are **unified** (“Music Archive of Russia”, “Music Archive of the Russian Federation”, “Mutopia Project”, “Musica Neo”, “IMSLP”, “Musedata”, “Music Library of Ukraine”, “MuseScores”, “Free-scores””, “Sheet Music Archive”), **some represent only specific notes**. For example, electronic music archives - for guitarists (“Golden Guitar Studio”, “Arhive Jean-François Delcamp”, “Statens musikbibliotek”), for choral musicians (“Horist.ru”, “Choral public domain library”), for pianists (“Piano in Russia”), for populists (“Music archive of Sergey Pikulin”), for wind instruments (“World of Trombone”, “Trumpet Club”, “Partita”), for violinists (“Akuratnov.ru”).

For example, the ability to edit notes and the availability of MIDI format are in such electronic music archives as: **«Mutopia Project» [12]** - musical works are free to download, modify, print, copy, distribute, perform and record - all in a public domain or under Creative Commons licenses, in PDF, MIDI and LilyPond editable files (free for downloading MIDI files, LY files). An independent student can translate MIDI files into musical editors for further work with the score, which provides greater freedom for working with musical material.

Some electronic music archives provide direct access to files in the finale format (“**Gutenberg Project Music Section**”), in some there is a full-base search for musical themes by genre, by first note, by interval, by direction of melody (“**Theme finder**” **function in “Werner Icking” and “IMSLP” [10]**), by the first notes and by the words (**the “TUNEdb” function in “Werner Icking”**) is convenient if you forget the exact name of the work that you need to find or select the works to mix with each other in the direction melodies, by genre, by the beginning of a melody, etc. .

Some electronic music archives have a built-in audio file player, there is a visualizer on the piano keyboard, there is a function to print online and share in social networks (“**Musescore**” [11]), which allows to not use additional editors to search by listening to a file for it visualizations and stuff - everything is in one window online (basic functions are free, when setting up displaying for instruments for a fee - the “Pro” version), there is a search function on a topic with typing on the keyboard online “IMSLP”, there is also a listening function Niy online (free), but the unloading of lots will be paid.

The transpose function exists in such electronic archives as, for example (in most cases, paid functionality): “**Music archive of Russia**” [4] (to order, at the moment with payment of the cost - transpose, it is possible to order notes from an audio recording, and order notes in formats of musical editors “Finale” and “Sibelius” with payment of cost), “**Music archive of Sergey Pikulin**” (custom-made writing of a score for any compositions, set of notes, transposition into a convenient

key, arrangement for the necessary composition of instruments - price is negotiable, apisanie backing tracks, writing notes on the record), «Musescore» (available in a mobile version in «GooglePlay» and «AppStore» online right away without a reservation, the tone is displayed while in the alpha over the score of the dialog box). Having studied the functionality of a number of electronic music archives, a synchronic summary table was compiled. The authors do not exclude the availability of other electronic music archives; this table includes the archives studied so far by the authors.

*Table “Electronic music archives”*

№	Name	Access	Country	Search by category and collection	Free / Paid	Transpose	Presence of MP3, MIDI and LY score files
1.	Music archive of Russia ("MAR") catalog of links to other archives	<a href="http://notarhiv.ru">http://notarhiv.ru</a>	Russia	By instruments Vocal notes: by genre, by country, alphabetically	Free	Paid	At request
2.	Music archive of Sergey Pikulin (folk instruments)	<a href="http://web-4-u.ru">http://web-4-u.ru</a>	Russia	By instruments alphabetically	Free	Paid	At request
3.	Mutopia Project Sheet music for everyone	<a href="https://www.mutopiaproject.org/">https://www.mutopiaproject.org/</a>		By instruments, by composers, by styles, by performers	Free		Free
4.	The music section of the Gutenberg project:	<a href="http://www.gutenberg.org/wiki/Gutenberg:The_Sheet_Music_Project">http://www.gutenberg.org/wiki/Gutenberg:The_Sheet_Music_Project</a>		By composers, by works	Free		Free mp3, finale
5.	Werner Icking Music Archive: (currently integrated with the "IMSLP" archive)	<a href="http://icking-music-archive.org/">http://icking-music-archive.org/</a>		There is a search for musical themes by genre, by first note, by interval, by direction of melody	Free		Free mp3
6.	Choral Public Domain Library	<a href="http://www.cpdl.or">http://www.cpdl.or</a>			Free		
7.	Trombone world	<a href="http://trombone.su">http://trombone.su</a>	Post-Soviet domain	By composers, by instruments by the programs of children's music schools and children's art schools	Free	-	

№	Name	Access	Country	Search by category and collection	Free / Paid	Transpose	Presence of MP3, MIDI and LY score files
8.	Trumpet Club (trumpet)	<a href="http://trumpetclub.ru">http://trumpetclub.ru</a>	Russia	By instruments by genre by didactic purposes, by lot	Free	-	
9.	Golden Guitar Studio	<a href="http://teslov-music.ru">http://teslov-music.ru</a>	Russia	By to composers, Ancient romances and songs	Free	-	
10.	Akuratnov.ru (violin)	<a href="http://akuratnov.ru">http://akuratnov.ru</a>	Russia	By composers	Free	-	
11.	Partita (brass band)	<a href="http://partita.ru">http://partita.ru</a>	Russia	By genre, alphabetically, by number of instruments	Free	-	
12.	Horist.ru	<a href="http://horist.ru">http://horist.ru</a>	Russia	By composition of votes, by genre affiliation (church and secular)	Free	-	
13.	Music Archive of the Russian Federation	<a href="http://нотныйархив.рф">http:// нотныйархив.рф</a>	Russia	By instruments	Free	-	
14.	Musica Neo	<a href="http://musicaneo.com">http://musicaneo.com</a>	Russia	By instruments, by genres, by composers	Free Paid (notes with performance licenses)	-	
15.	Piano in Russia	<a href="http://piano.ru">http://piano.ru</a>	Russia	By composers, by didactic purposes, by claviers	Free	-	
16.	«International Music Score Library Project» («IMSLP») scans of scores	<a href="http://imslp.ru">http:// imslp.ru</a>	Russia	By composer, by country, by instrument, by genre, by melody. Downloading parties is paid (online when paying)	There is free (partially and not all) and paid	<b>Paid</b>	online search function by melody, chord, keyboard input, there is online listening
17.	Musedata	<a href="http://musedata.org/">http://musedata.org/</a>	Russia	By composer, by part	Free		
18.	Notomania	<a href="http://notomania.ru">http:// notomania.ru</a>	Russia	By genre, by performer, by composer, by subject	Free		

## Scientific research of the SCO countries: synergy and integration

№	Name	Access	Country	Search by category and collection	Free / Paid	Transpose	Presence of MP3, MIDI and LY score files
19.	Music library	<a href="http://nlib.org.ua">http://nlib.org.ua</a>	Ukraine	By instruments, by way of performance, by composers	Free	-	
20.	Daniel Roizman Music Library	<a href="http://roisman.narod.ru">http://roisman.narod.ru</a>	Russia	By composers, alphabetically	Free		mp3 files
21.	<b>Jean-François Delcamp</b> site of the French guitarist Jean-Francois Delcam (for guitar)	<a href="http://www.delcamp.net/ru/index.html">http://www.delcamp.net/ru/index.html</a>	France	By composers	Free		
22.	Statens musikbibliotek - <b>The Music Library of Sweden</b> – Carl Oscar Boije af Gennass (for guitar)	<a href="http://www.muslib.se/ebibliotek/boije/indexeng.htm">http://www.muslib.se/ebibliotek/boije/indexeng.htm</a>	Sweden	By composers	Free		
23.	VARIATIONS Prototype: Online Musical Scores	<a href="http://www.dlib.indiana.edu/variations/scores/">http://www.dlib.indiana.edu/variations/scores/</a>	USA	By way of performance, by composers	Free	<b>Paid</b>	
24.	Muscores	<a href="https://muscore.com/">https://muscore.com/</a>		By instruments, by number of instruments, by upload date and update, by artist/composer	Free	Available in mobile version on GooglePlay and AppStore	built-in audio player, visualizer on the piano keyboard, (there is a free and paid versions)
25.	Free-scores	<a href="http://free-scores.com">http://free-scores.com</a>	USA	By instruments by composers by genre by level of execution by styles	There are free notes and paid	-	
26.	Sheet Music Archive	<a href="http://sheetmusicarchive.net">http://sheetmusicarchive.net</a>	USA	By composers, by instruments, by way of performance	There are free notes and paid	-	

Visualization of the score for the study of the score [7], the creation of musical mosaics for theoretical tasks on knowledge of a musical work (Solfeggio (for dictations including timbres), Musical literature, Listening to music - in additional education, “History of music” - in vocational education), working with musical files of scores (online, for example, in “MuseScore” and through separate music editors) in mp3, MIDI, LY, finale format, transpose to study the required tonality of musical text, mixing from playing MIDI files of works through MUSHUP applications, creating video material for video quizzes based on scores and visualizing them through music editors, arranging works for the necessary lineups of voices and instruments - a wide range of possibilities of a number of electronic music archives we have studied.

It will be useful to work with electronic music archives and within the disciplines of “Harmony”, “Theory of modern composition”, “Analysis of musical compositions” in vocational education - when you can work qualitatively with musical text, make, if necessary, visualize the score (with building a harmonic grid, with visualization of consonances, conducting voices, etc., for example, by inverting a MIDI file from the music archive to the program “MAMPlayer”, “Able MIDI Editor”, “Orion”, “Cubase”, etc.

### Conclusion

The relevance and novelty of the result consists in summarizing and comparing data on the functioning and capabilities of electronic music archives, in proposals for practical use in providing musical and theoretical disciplines of art in additional and professional education. The prospectivity and significance of the study lies in practical recommendations and generalization of information on the use of electronic music archives for the musical and theoretical disciplines of art in additional and professional education and the possible interest in research by art education teachers conducting musical and theoretical disciplines.

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作为篮球学生体育文化基础的动力  
**MOTIVATION AS A BASIS FOR PHYSICAL CULTURE  
OF BASKETBALL STUDENTS**

**Piterkina Marina Valentinovna**

*Senior Lecturer*

**Khamidullina Guzel Ferdinantovna**

*Associate Professor*

*Kazan National Research Technological University*

*Kazan, Russia*

注解。 维持健康的主要因素是身体活动，它影响社会的活动和福利。 成功实施任何活动（包括体育和体育）的主要组成部分是动力。 对于年轻人来说，必须形成成果的动力。 主要是为了每个人的动机，并给她足够的困难。 因此，在什么情况下不能通过强制手段创造动机。 主要目标 - 让学生感兴趣。

关键词： 篮球， 动机， 学生， 运动。

**Annotation.** *The main factor in maintaining health is physical activity, it affects the activities and welfare of society. The main component for the successful implementation of any activity, including sports and sports, is motivation. For young people motivation of achievement of result must be formed. Motivation mostly for everybody it, and to instil her difficult enough. For this reason not under what circumstances motivation can not be created by means of compulsion. Primary objective - to interest a student a task.*

**Keywords:** *basketball, motivation, student, sport.*

Physical education (P.E.) in institutions of higher education is inalienable part of educational-pedagogical process, rationally assisting to education of healthy, physically developed, socially active personalities. One of the most popular student types of sport is basket-ball. Basket-ball, as bright and "fashionable" type of sport, in a greater degree, what other playing kinds, allows to combine a collectivism and demonstration of the personal qualities, development of that will be entailed by the height of interest in the healthy way of life on the whole. Student basket-ball is able actively to assist to forcing out of student environment of the negative and asocial phenomena, to appearance of sense of responsibility for a result. Basket-ball is a game collective, success of that depends on harmony of actions and mutual understanding of players, that is arrived at due to the submission of own interests to command interests.

Basketball is a game collective, success of that depends on harmony of actions and mutual understanding of players, that is arrived at due to the submission of own interests to command interests. Game basket-ball forms for the students of institutions of higher learning of ability and skills of the optimal participating in collective work so necessary to the future specialists technical and any profile of other profile.

However lacks of the traditional system of PE and sport are in institution (orientation exceptionally on control norms and corporal component of training process in institutions of higher learning, not taking into account interests of students, ignoring of intercommunication of PE with other types of education) of higher learning, the decline of interest stipulated in engaging in physical exercises, limitation of motive activity, low level of theoretical, physical and psychological preparedness of students[3,5].

B. A. Viatkin in-process "Role of temperament considers in sport activity", that than stronger nervous system - the positive influence of motivation more affects and than weaker - the anymore her negative influence on motive qualities. An interesting, enthralling (difficult) game causes at weak uncertainty, alarm, to lose dread, enhanceable responsibility, agitation, while at strong is a confidence, wave of forces, desire to fight for a high result. Consequently, influence of motivation on development and display of motive qualities and forming of motive skills depends on basic typology property of the nervous system - force of excitative process.

Motivation is an important factor for the achievement of good scores. The real estimation of the possibilities stimulates success of performances, and also teaches to overcome failures, that helps both in sport and in studies and further work. For young people motivation of achievement of result must be formed. This process it is necessary to divide into the stages that can be attained in the near and remote future, orient on growth rates. At the choice of direction of forming of sport motivation for basketball-players we leaned against the next well-known in a theory sport training and positions of sport psychology, and also on the scores got by us: 1. Influence of межличностных relations in a command on strengthening and maintenance of sport motivation of basketball-players. 2. A leading place is in the structure of motivation. For sportsmen on this stage motivation trends with an orientation on the achievement of success. 3. Influence of positive emotions on training carried out by sportsmen. 4. Forming for the sportsman of adequate self-appraisal and planning on the basis of it competition aims. 5. Development for the sportsmen of effectiveness of sport activity (training competitions) [1,2,4].

Motivation is the most powerful lever for that what to get desired. This aspiring realized by a man to activity, purposeful action, decision of the put tasks. Aspiration is internal and shows up only then, when it is to the end understood by a subject. Motivation a certain necessity (physiological, spiritual, valued) is the basis

of, after satisfaction of that, an impulse to the action goes down substantially. This internal process aleak individually. He will not make off to the that moment, while a necessity will not be satisfied or she will not be replaced by another impulse to the action. And here for a student - sportsman a stimulus is important. Stimulation is a measure of external support due to that affecting comes true activity of man. A main task of such process is an acceleration, declension of sportsman to the feasance of the expected action, drawing on all reserves of organism for gaining end. Stimulation can be both positive (reward) and negative (threat of application of approvals) and proceeds until a process is active.

Stimulation can be effective for a whole sport command. The additional measures of encouragement (enhanceable sport grant and enhanceable material help) will help students to work for the good of the command more active and better. Motivation mostly for everybody it, and to instil her difficult enough. For this reason not under what circumstances motivation can not be created by means of compulsion. Primary objective - to interest a student a task.

For every trainer-teacher it is important to teach the student of basketball-player to analyse and it is adequate to estimate the possibilities. To put before itself attainable aims and pick up the row of stimuli for their achievement. It is impossible to assume development of demotivations are the phenomena, on the essence opposite to motivation. She shows up in the decline of capacity, loss of interest, absence of activity and indifference to training. In the command types of sport the maximal result of every player is important to the not ground. For a trainer-teacher, it is important to be able correctly to manage sportsmen, that each of them executed the functions most effectively. For this purpose it is needed to understand how it is possible to explain one or another sportsman.

Primary objective - to interest a player a task. All of us know surprizing scores that sportsmen show on competitions or championships. Often, it is not simple the troop landing of adrenalin or simple *везение* is a charge of motivation, that a man gets from an audience or from a fight against a rival. When a sportsman sees that for him people are ill on tribunes, and competitors look wickedly, in expectant of failure, it is desirable simply to roll a rival and show to all, what you deserve. Thus, going in for sports now, a student-sportsman not only penetrates in secrets maximal human possibilities but also determines the way of rational development and use, present for everybody natural abilities in his professional and public activity, promoting a general capacity, strengthening the health the same.

For education of confidence in the process of engaging in basket-ball it is necessary to create situations in that students have the opportunity successfully to realize plan. Achievement of the put aims, even the conscious approaching to them is a main factor satisfying with of young man the activity depends on that.

It is known also, that in the process of co-operating of the functional systems of organism of man with the meaningful for him scores of activity there is the most exact adaptation of biorhythms of physiological processes to the rhythm of work, the increase of power potential of organism grows. A very important moment is aspiration to achieve objective, in many cases resulting in the excellent performance of the put objective. Students with a high requirement in such aspiration in any situation, where they are estimated, show a large persistence and show the best scores [6].

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混合音频文件, 笔记编辑, 笔记文本的flash动画的软件应用程序和编辑器: 类型, 工作原理, 音乐和理论学科的教学方面

**SOFTWARE APPLICATIONS AND EDITORS FOR MIXING AUDIO FILES, NOTE EDITING, FLASH ANIMATIONS OF NOTE TEXT: TYPES, PRINCIPLES OF WORK, PEDAGOGICAL ASPECT IN MUSICAL AND THEORETICAL DISCIPLINES**

**Titova Svetlana Sergeevna**

*Lecturer, Postgraduate*

*South Ural State Institute of Arts named after P.I. Tchaikovsky*

*Teacher*

*Children's Youth Center "Children's Development Center "Xingtai"*

**Figlovskaya Olga Andreevna**

*Lecturer at the Municipal Budgetary Institution of Continuing Education*

*Children's Art School №9, Chelyabinsk*

*Student*

*South Ural State Institute of Arts named after P.I. Tchaikovsky,*

*Chelyabinsk*

抽象。 本文致力于研究Mashup应用程序, flash编辑器, 音乐编辑器。 尝试描述用于混合动画乐谱可视化的应用程序和编辑器类型的分类。 形成了Mashup应用程序, flash编辑器, 音乐编辑器的总结和比较表。 作为艺术教育(附加和专业)的一部分, 介绍了在音乐和理论学科中使用混合动画乐谱的可能选项。

关键词: 音频文件混合, 音乐文本动画, 理论和音乐学科, Mashup应用程序, Flash编辑器, 音乐编辑, 教学技术, 艺术教育。

**Abstract.** *This article is devoted to the study of Mashup-applications, flash-editors, music editors. An attempt was made to describe the classification of types of applications and editors for the visualization of mixed animated musical score. The summary and comparative table of Mashup-applications, flash-editors, music editors is formed. Possible options for working with a mixed animated musical score in musical and theoretical disciplines as part of art education (additional and professional) are presented.*

**Keywords:** *audio file mixing, musical text animation, theoretical and musical disciplines, Mashup applications, flash editors, music editors, pedagogical technologies, art education.*

**The main part.** Musical education, even more than general educational disciplines, requires modern and relevant teaching aids aimed at the imaginative perception of students. It is the musicians who, through perceived images and their own level of knowledge, transmit musical representations in the works performed, it is as a result of listening to music that musical-figurative representations are formed. In our opinion, it is possible to specify and direct the perception of musician students as precisely as possible through the use of visualization tools, teaching materials presented on the basis of multimedia technologies. In this paper, an attempt is made to further develop the provisions presented by the published writings of the authors on this issue: S. Titova Visualization of a musical work (2017) [11]; Methods for the development of musical perception and musical-figurative representations of students (2017) [12]; On the polymodality of musical perception (2016) [15]; Multimedia resources at solfeggio lessons at the Children's Art School (2015) [14]; Musical literature in music school using modern information resources and technologies (2012) [13]; Titova S.S., Figlovs-kaya O.A. Relaying the material of masterpieces of world music classics in media content samples (animated films, movie films, video ads) (2019) [17].

The starting point for further research was the work: on issues of digital media audio mixing - Alhreisat, H.M. (2008) [2], on the use of Wash Mashup applications, S. (2009) [18], the use of media content as an element of the educational process Gubanov, A. Yu. (2017) [3], on the use of media in the educational process - Starikov, D.A. (2011) [10], on information computer technologies in music education Ostankovich, D.V. (2012) [7], on the construction of graphic information Likhachev, A. Yu. (2007) [4], on the methodology of teaching computer graphics to students Chernyakova T.V. (2010) [19].

**Consider sequentially and in relation to the musical theoretical disciplines (additional and professional education):** 1) applications and editors for mixing information of audio files, 2) music editors; 3) flash animation programs.

**Programs with mixing functions** (“Acid Music Studio”, “Adobe Audition”, “Audacity”, “Audio Editor”, “Djay 2”, “FL Studio”, “Linux MultiMedia Studio”, “MAGIX Music Maker”, “MAGIX Samplitude”, “Mixcraft”, “Pro Tools”) in most cases [2] provide the ability to visualize the graphic scheme of the work (displaying soundtracks, displaying rhythm and melody movements in each voice; moreover, the rhythmic display will be equivalent to the length of the displayed rectangular figures), some programs provide the opportunity saving the file in musical notation with the subsequent function of saving to PDF format ( «Cakewalk-Sonar», «Logic Pro», «Steinberg Cubase»). These programs and mixing applications contain the function of saving in MIDI, mp3 formats. In addition, there are specialized mixing applications - an example of this is “Mashup 2” [18; five]. The purpose of using mixing products, in our opinion, can be quite broad: it is possible to select your favorite audio files, assign them to mix among

themselves, manually or automatically. The resulting summary file can serve as the basis for materials on the quiz, dictation. You can add a video series and construct a video in order to determine genres, composers, works; the quiz can be devoted to the work of a single composer or to a separate direction in music (baroque, classicism, romanticism, foreign music of the twentieth century, Russian and Soviet music), musical works of a certain country (France, Austria, Poland, etc.). If you encounter difficulties in selecting material for mixing, you can turn to the automatic selection of melodies in electronic music archives (“The music section of the Gutenberg project”), a full-base search for musical themes by genre, by first note, by interval, by direction of melody (“Theme finder” function in “Werner Icking” and “IMSLP”), by first notes and by words (“TUNEdb” function in “Werner Icking”).

Having studied the functionality of a number of programs with the function of mixing audio files, Mushup applications, a summary synchronistic table was compiled. The authors do not exclude the existence of other software products, this table includes programs that are currently studied authors of this work.

**Table 1** “Programs with the function of mixing audio files, Mushup-applications”

№	Program name	Type	Developer	OC	Interface language	Version	Official site
1	Acid Music Studio	Digital audio workstation	Sony Creative Software	Microsoft Windows	English, French, German, Japanese, Spanish	Paid	<a href="https://www.magix.com/ru/muzyka/acid/acid-music-studio/">https://www.magix.com/ru/muzyka/acid/acid-music-studio/</a>
2	Adobe Audition	Audio editor	Adobe Systems	Microsoft Windows, Mac OS X	English, French, German, Japanese, Spanish	Free	<a href="https://www.adobe.com/ru/products/audition.html">https://www.adobe.com/ru/products/audition.html</a>
3	Audacity	Audio editor	Audacity Team (authors - Roger Dannenber, Dominic Mazzoni)	Linux, Mac OS X, UNIX, Microsoft Windows, ReactOS	Russian and others	Free	<a href="https://www.audacityteam.org/">https://www.audacityteam.org/</a>
4	Audio Editor	Sound file editor	FAE Distribution, Inc.	Microsoft Windows	Russian	Free	<a href="https://free-audio-editor.com/">https://free-audio-editor.com/</a>
5	Cakewalk-Sonar	virtual music studio, MIDI / audio sequencer	Cakewalk	Microsoft Windows	Russian and others	Paid	<a href="http://www.cakewalk.com/Products/SONAR">http://www.cakewalk.com/Products/SONAR</a>
6	Djay 2	Digital audio station	Algoriddim	Microsoft Windows, Android, iOS, Mac OS X	English	Paid	<a href="https://www.algoriddim.com/djay-android">https://www.algoriddim.com/djay-android</a>

№	Program name	Type	Developer	OC	Interface language	Version	Official site
7	FL Studio	Digital Sound Workstation	Image-Line Software (author - Didier Dembren)	Microsoft Windows, Android, iOS, Mac OS X	English	Paid	<a href="https://www.image-line.com/flstudio/">https://www.image-line.com/flstudio/</a>
8	Linux MultiMedia Studio	Digital audio station	The LMMS Team	Linux, BSD, Unix, iOS, Microsoft Windows	Russian and others (16 languages)	Free	<a href="https://lmms.io/">https://lmms.io/</a>
9	Logic Pro	Sequencers, Audio Editors	<u>Apple</u>	Mac OS X	English and others	Paid	<a href="https://www.apple.com/logic-pro/">https://www.apple.com/logic-pro/</a>
10	MAGIX Music Maker	DAW	Magix Software GmbH	Microsoft Windows	Russian and others	Paid	<a href="https://www.magix.com/">https://www.magix.com/</a>
11	MAGIX Samplitude	DAW	Magix Software GmbH	Microsoft Windows	Russian and others	Paid	<a href="https://www.magix.com/ru/muzyka/samplitude/">https://www.magix.com/ru/muzyka/samplitude/</a>
12	Mashup 2	Create Mashup	Mixed In Key LLC	Microsoft Windows, Mac OS X	English and others	Paid	<a href="https://mashup.mixedinkey.com/">https://mashup.mixedinkey.com/</a>
13	Mixcraft	Digital audio workstation	Acoustica, Inc. (Yosemite Valley, CA)	Microsoft Windows	Russian	Paid	<a href="https://mixcraft.ru/">https://mixcraft.ru/</a>
14	Pro Tools	Digital Sound Workstation	<u>Avid Audio</u>	Microsoft Windows, Mac OS X	English	Paid	<a href="https://www.avid.com/en/pro-tools">https://www.avid.com/en/pro-tools</a>
15	Steinberg Cubase	Digital audio station	<u>Steinberg</u>	Microsoft Windows, Mac OS X, Android	English	Paid	<a href="https://www.steinberg.net/en/home.html">https://www.steinberg.net/en/home.html</a>

Consider the functionality of **music notation programs** for musical and theoretical disciplines. In order to obtain a musical display of a sound file, if this function is not in the previously described sound programs, it is possible to use MIDI files that we import into a music editor, this allows you to work not with abstract sound geometric tracks, but in the usual musical notation text. For greater visual effect for educational purposes, the display of notes can be selected in the form of images of musical instruments or photographs of composers or other graphic objects instead of notes. In this case, you can turn off the display of calm (rhythmic organization will be shown with a different number of objects per measure). Thus, a hint can be reached on the timbre of the instrument, on a particular composer, for example when designing a video quiz.

An example of this is the video “70 classical works in one play” (2019), “57 classical works of 33 composers in one play” (2016) [1], posted on the YouTube channel of “Grantwoolard” (instead of notes in the video, photos were displayed composers, which facilitated the perception and recognition of musical works).

A file in a music editor, for example, in Overture (version 4.0), can be saved to YouTube, as a result, a video file is obtained from the music editor with the function of viewing the score while playing the music. The function is very good

when you need to work with the score, the music editor program on the computer is not preinstalled. In addition, musical scores can be played and published on popular resources (“YouTube”, “SoundCloud”, “Facebook”) through the music editor program “Sibelius” [16]. This video can be used as an illustration in the lessons of “listening to music”, “music literature” and “solfege” when it becomes necessary to work simultaneously with the sound of a work and working with a score (which simplifies the process of controlling the movement of a melody in musical text).

Having studied the functionality, a number of musical editors, a synchronic summary table was compiled. The authors do not exclude the presence of other music editors, this table includes the editors studied by the authors at the moment.

**Consider the use of flash animation programs.** Not only sheet music can serve as material for creating a methodological product for the study of musical works. So, for example, it is possible to use graphic images by processing them in flash-editors. The key idea will be that the images should indicate the movement of the melody and help to perceive musical works through the imagery. For example, it is possible to use the “Line Driver” application, which assigns the movement of a musical work through graphic lines, designating dynamics, tempo notes, voice direction, and sometimes numbering the measures of a musical work, counterpoint of voices by including several directions of movement. The resulting material can be saved in video format and overlaid with the audio editors of a specific piece of music with video editors. An example of this is “In the Cave of the Mountain King” by E. Grieg (2017) [20], symphony No. 5 (with moll) by L. Beethoven (2018) published on the YouTube channel by DoodleChaos.

It is also possible to use animation of static images (“Gimp”, “KoolMoves”, “Line Rider”, “Vectorian Giotto”, “Xara Designer”). An example of this is “Flight of the Bumblebee” from “Tales of Tsar Saltan” N. A. Rimsky-Korsakogo [8] published on the YouTube channel at Concert Choir of Saint-Petersburg. This video can be used both for studying the work, and for biographical topics.

Having studied the functionality of flash animation programs, a synchronic summary table was compiled. The authors do not exclude the presence of other software products, this table includes the programs currently studied by the authors of the work.

*Table 2 “Note Editors”*

№	Program name	Developer	OC	Interface language	Version	Official site
1	Capella	Capella-Software AG (Germany)	Microsoft Windows, Mac OS X	English	Paid	<a href="https://www.capella-software.com/us/index.cfm/products/capella/info-capella/">https://www.capella-software.com/us/index.cfm/products/capella/info-capella/</a>
2	Denemo	Authors - Matthew Hiller, Adam Tee	FreeBSD, Apple, Mac OS, Microsoft Windows.	English	Free	<a href="http://denemo.org/">http://denemo.org/</a>
3	Finale	MakeMusic (author - Phil Farrand)	Mac OS X, Microsoft Windows	English	Paid	<a href="https://www.finalemusic.com/">https://www.finalemusic.com/</a>
4	Graphire Music Press	EditWorks/Lorenz Corporation (author - Gregg Sewell)	Mac OS, Microsoft Windows	English	Paid	<a href="http://www.graphire.com/">http://www.graphire.com/</a>
5	Igor Engraver	NoteHeads (author - Peter Bengtson)	Macintosh, Microsoft Windows	English	Paid	<a href="http://www.noteheads.se/Welcome.html">http://www.noteheads.se/Welcome.html</a>
6	LilyPond	GNU Project (authors - Han-Ven Ninghuis, Jan Nyuvenhuysen)	GNU/Linux, Microsoft Windows, Mac OS X, Linux	English and others	Free	<a href="http://lilypond.org/">http://lilypond.org/</a>
7	Maestro	Maestro Music Software	Android	Russian English German	Paid	<a href="https://www.musicaeditor.com/ru/music-notation-software.html">https://www.musicaeditor.com/ru/music-notation-software.html</a>
8	MuseScore	open-source (author - Werner Schweyer)	Android, Microsoft Windows, Mac OS X, Linux	Russian and others	Free	<a href="https://musescore.org/ru">https://musescore.org/ru</a>
9	MusiXTeX	Authors - Daniel Taupin, Ross Mitchell, Andreas Egler	Microsoft Windows, Mac OS X, Linux	English	Free	<a href="https://www.ctan.org/pkg/musixtex">https://www.ctan.org/pkg/musixtex</a>
10	NotateMe	Neuratron Ltd	Android	Russian	Free and paid	<a href="https://play.google.com/store/apps/details?id=com.neuratron.notateme&amp;hl=ru">https://play.google.com/store/apps/details?id=com.neuratron.notateme&amp;hl=ru</a>
11	Overture	<u>Sonic Scores</u> (author - Don Williams)	Microsoft Windows	English	Paid	<a href="http://sonicscores.com/overture/">http://sonicscores.com/overture/</a>
12	Sibelius	Sibelius Software	Microsoft Windows, Mac OS X, RISC OS	English and others	Paid	<a href="https://www.avid.com/en/sibelius">https://www.avid.com/en/sibelius</a>
13	TuxGuitar	Julian Gabriel Casadesus, Herman Andres Casadesus, Nahuel Portilla, Nikola Kolarovich, Aron Spike	Linux, Mac OS X, Microsoft Windows	Russian and others	Free	<a href="http://www.tuxguitar.com.ar/">http://www.tuxguitar.com.ar/</a>

*Table 3 “Programs with flash animation function”*

№	Program name	Type	Developer	OC	Interface language	Version	Official site
1	Gimp	Raster graphics editor	GNOME Foundation (authors - Peter Mattis, Spencer Kimbell	Linux, Mac OS X, Microsoft Windows, FreeBSD, Solaris, AmigaOS 4	English and others	Free	<a href="https://www.gimp.org/">https://www.gimp.org/</a>
2	Kool Moves	Animation software	Lucky Monkey Designs	Microsoft Windows	English Russian	Paid	<a href="https://koolmoves.com/">https://koolmoves.com/</a>
3	Line Rider	Video game application	Emergent Studios	Apple	English, Russian, Tatar, Bashkir	Paid	<a href="https://www.linerider.com/">https://www.linerider.com/</a>
4	Vectorian Giotto	Animation software	Vectorian Inc.	Microsoft Windows	English	Free	<a href="https://vectorian-giotto.software.informer.com/3.0/">https://vectorian-giotto.software.informer.com/3.0/</a>
5	Xara Designer	Graphics editor	Xara Group Ltd	Microsoft Windows, Linux	English	Paid	<a href="https://www.xara.com/us/designer-pro/">https://www.xara.com/us/designer-pro/</a>

In addition to the use of teaching materials designed in editors and applications independently, for the study of musical notation, their location on the piano keyboard or other instrument (guitars, flutes, etc.), it is possible within the disciplines of “General Piano”, “Special Instrument”, and “Solfeggio”, “Fundamentals of musical literacy” in additional education, “Elementary theory of music” in vocational education, it is possible to use application games [3] “NoteWorks”, “Mussila”, “Jungle Music”, “AprenderNotes”, “Music Notes”, “PianistHD”, “Theory of Muses yky”, etc.

It will be useful to work with sound mixing programs, Mushup-applications, music editors and programs for Flash-animation [4; 9; 18] and in the disciplines “Listening to music”, “Musical literature”, “Solfeggio”, in additional education, in the disciplines “History of music”, “Methods of teaching theoretical disciplines”, “Analysis of musical works”, in vocational education - when you can work qualitatively with musical text, make, if necessary, visualize the score (with the arrangement of the movement of voices, with the visualization of harmonies, etc.), design video quizzes, video material for dictations, including polyphonic ones (where each los displayed in a different color or a graphic object) and timbre (where images of musical instruments) will be used instead of notes.

**Conclusion.** The relevance and novelty of the result consists in summarizing and comparing data on the functioning and possibilities of working with sound mixing programs, Mushup applications, music editors and Flash animation programs, in proposals for practical use in providing musical and theoretical disciplines of art in additional and professional education. The prospects and significance of the study lies in practical recommendations and generalization of information on the use of sound mixing programs, Mushup applications, music editors and Flash animation programs for the musical and theoretical disciplines of additional and professional art education and the possible interest in research by art education teachers, conducting musical-theoretical disciplines.

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未来教师创新思维形成过程中的问题技巧

**TECHNIQUE OF QUESTIONS IN THE PROCESS OF FORMATION  
OF INNOVATIVE THINKING OF FUTURE TEACHERS**

**Ahmetzhanova Galina Vasilevna**

*Doctor of Pedagogic Sciences, Full Professor*

*Head of the Department*

*Togliatti state university*

**Emelyanova Tatiana Vitalievna**

*Candidate of Pedagogic Sciences, Associate Professor*

*Togliatti state university*

抽象。 本文通过引入教育过程中提出问题的技术, 考虑了学生创新思维形成的问题 - 未来的教师。

关键词: 创新思维, 大学教育过程, 高等教育, 未来教师, 提问技巧。

**Abstract.** *The article considers the problem of the formation of innovative thinking of students - future teachers through the introduction of the technique of posing questions in the educational process.*

**Keywords:** *innovative thinking, educational process at the university, higher education, future teacher, question-posing technique.*

Innovation is critical for the successful functioning and development of any organization and is directly related to the education system. Among the necessary characteristics of innovative education are informatization and digitalization, unconventionality, modernization, a shift in emphasis from the knowledge paradigm to practice-oriented activities.

At the same time, studies show that it is inherent for a person to resist innovation. For example, Harvard University professor Kalstaus Juma (2016) is convinced that one of the main reasons for this rejection is the traditional desire to maintain stability. We should note however, that in the modern world, the desire for stability is not only equivalent to stagnation, but also guarantees the death of the system.

According to E. L. Umnikova (2011, p. 12), stability and commitment to the once established routine, strict adherence to the educational program and curriculum are characteristic of many other educational institutions. Innovative ones work in the search mode, develop and implement new pedagogical technologies and form the new content of educational programs.

A study of the willingness and involvement of teachers in innovative activity, which was attended by teachers of universities and colleges, school teachers, was conducted by I. Filchenkova (2017). The results of the study, in particular, showed: 15% of respondents have a high level of involvement in innovative activity, and the average level is 52%. At a low level of involvement in innovative activity are more than a third (33%) of teachers who took part in the study.

Mulder P. (2013), after conducting an in-depth analysis of the publications of American business consultants David S. Weiss and Claude P. Legrand, and based on his own experience, is convinced that the innovations that are born through innovative thinking lead to the development of any system, and, thanks to thinking outside the box, the level of innovation can be greatly improved.

David Whitney (2015), the founder of Emergent Ventures, identifies five stages of the innovation process, each of which, in our opinion, is correlated with such concepts as logic, research, creativity, communication, which corresponds to the basic structural elements of innovative thinking:

- The exact specification of the problem to be solved.
- Free and open thinking about possible solutions to the problem.
- Selecting several possible solutions and conducting research on each of them to determine the most suitable.
- Testing the most suitable option.
- Launch of a "prototype".

The formation of the components of innovative thinking, namely the determination of a problem, reflection, selection and research of possible solutions, is facilitated by the application of the technique of posing questions.

A study was conducted at the Department of Pedagogy and Teaching Methods of the Togliatti State University in the academic year 2018-2019, during which, when working with students, future primary school teachers, we used the technique of posing questions. The study was attended by students of 1-4 courses (119 people) undergraduate in the direction of training "Pedagogy and Psychology of Primary Education".

When teaching students, special attention was paid to four categories of issues that are especially important for the formation of innovative thinking. We have formulated questions and determined their relationship with the structural components of innovative thinking, given examples of questions related to a particular category (Table 1).

The questions in the table include those that motivate students to:

- research, search for additional information;
- analyze information for better understanding;
- share their feelings;
- practical application of acquired knowledge.

Questions that encourage students to research and search for information, help them in general to understand for themselves the essence of future professional activity in the context of changing the structure and content of the educational process. Since questions prompting research encourage students to seek information in modern psychological and pedagogical research, it is useful to ask them before analyzing publications on relevant topics. This focuses students and allows them to find answers in the writings of scientists and practicing educators.

**Table 1**

*Interrelation of components of innovative thinking and categories of questions*

index №	Components of innovative thinking	Question Categories	Question examples
1	Research component	Questions prompting research and search for additional information	What is the essential difference between innovative education and traditional?
			What are the new meanings and modern approaches to education?
			What can serve as a source of innovation?
			What are the specifics of innovation management in education?
			What role does the knowledge of the educational services market and its development trends play in the work of a teacher?
2	Logical component	Questions prompting the analysis of information for better understanding	What are the factors and conditions that determined the historical viability (or, conversely, nonviability) of a particular pedagogical idea?
			What is the significance of a specific pedagogical idea for modern pedagogy, what are the prospects for its further development?
			What is the essence of the interaction (or mutual exclusion) of a specific pedagogical idea with modern educational standards?
3	Creative component	Questions prompting pedagogical creativity	How did you feel when applying innovative training methods during your field trip?
			What helped or prevented you from freely using innovative approaches in the educational process? What feelings did you experience, having achieved (or not having achieved) success?

index №	Components of innovative thinking	Question Categories	Question examples
4	Communicative component	Questions prompting the practical application of acquired knowledge, to building constructive communications with students	<p>Have you ever thought about the impact of innovative pedagogical approaches on personality formation?</p> <p>Is there a difference in the perception of innovative pedagogical approaches by you and trainees?</p> <p>What is the impact of innovative pedagogical approaches on team relationships?</p> <p>What is the impact of innovative pedagogical approaches on the relationship between teacher and students?</p>

Such questions should lay the foundation for understanding the problem, based on which you can deepen understanding of the specifics of the activities of the modern teacher and teacher of the future. So, the question “What is the essential difference between innovative education and traditional?” Led to the creation of an informational background. The answers given by students led them to a deeper question: "Am I ready for the implementation of innovations in education?" The inclusion of these questions in the course of classes showed that most students recognize the need to introduce innovations in the modern educational process, but for various reasons they consider themselves unprepared for innovation. So, 75% of respondents are not sure of the adequacy of their own choice of the necessary innovative products, which indicates a lack of understanding of the essence of certain pedagogical innovations.

Questions prompting analysis to improve understanding (a logical component of innovative thinking) were asked after students got acquainted with the training material. The purpose of such questions is to encourage students to analyze the relationships and contradictions of pedagogical objects and phenomena for a wider and deeper understanding of information. As a rule, analytical questions suggest several possible answers (Table 1).

The question “What is the essence of the interaction (or mutual exclusion) of a specific pedagogical idea with modern educational standards?” Demanded from students a thorough analysis of documents and activities of educational institutions of various types. As a result, students revealed, for example, that the pedagogical heritage of K.D. Ushinsky, who emphasizes the importance of children's play and its role in raising a child, finds continuation in a modern school: the educational value of the game is being revived, media games, flash games and other types of games are being developed and implemented in the educational process.

In addition, students conducted a comparative analysis of interpretations of the definition of “gaming technology”. The result was an understanding by students of the ambiguity in the interpretation of the definition of "gaming technology." Particular attention was paid to the development problem and the requirements for innovative gaming technologies. In addition, the main provisions that should be guided in the design of such technologies were specified. It is important that the majority of students (87% of the total number participating in the experiment) were able to identify the problems of using pedagogical (including gaming) technologies in practice.

The next block included questions that are designed to encourage students to take a deeper personal acceptance of a professional position, help to more deeply feel the importance of professional activity in their own life and in the life of a developing society, develop “pedagogical inspiration” and the desire to be creative in their professional activities (creative component of innovative thinking).

The question, which is traditionally asked by future teachers, and, as a rule, does not lead to inspiration: "What innovative didactic methods did you use in the course of production practice?" The answer to this question is a list of methods that can be found in a textbook on pedagogy. However, this question could be asked differently: "What did you feel when applying innovative training methods in the course of production practice?" Such questions encourage students to turn to the “memory of feelings”, help to convey the essence of innovative processes in education from the students' minds to their hearts, and push them to consciously and purposefully move away from the traditional paradigm in education to the mastering and development of pedagogical innovations.

Here are examples of students' answers to one of the questions designed to encourage students to be creative: “What helped or hindered the free use of innovative approaches in the educational process?” The most popular (over 80% of respondents) was the answer: “Arsenal of didactic games for interactive whiteboards in schools is small, I would like to learn how to independently develop such games.

Among the answers to questions prompting the practical application of the acquired knowledge in the course of interaction with students (the communicative component of innovative thinking), the students' answers to the question “Have you ever thought about the impact of innovative pedagogical approaches on the education of specific aspects of the personality of children?” were of particular interest.

So, in the affirmative, only 32% of the student's respondents answered this question. At the same time, more than 60% of students admitted that they never thought about the impact of innovative pedagogical approaches on the upbringing of specific aspects of the personality, expecting from their application only to improve the learning outcomes of students. In the process of analyzing the events

of pedagogical practice, students noted that as a result of the application of pedagogical innovations, the class became more united, some of the children managed to demonstrate their hidden talent, someone ceased to be an "outcast" in the class, etc. This allowed us to conclude that the answers to these questions contribute to the student's awareness of their individuality in pedagogical activity, turn their consciousness to their own feelings and to the feelings of the pupils. The result was a search for reserves for more effective work, identification of the causes of possible or true professional problems, the desire to establish productive communication with students (Table 2).

**Table 2**

*The results of an experiment on the formation of innovative thinking of students through the application of the technique of posing questions (based on observation)*

<b>index №</b>	<b>Components of Innovative Thinking</b>	<b>Experiment Results</b>
1	Research component	Confident knowledge of information retrieval methods on the Internet and on the sites of educational institutions, more pronounced critical thinking in relation to information
2	Logical component	The formation of the need to analyze their own pedagogical experience and introduce the innovative experience of others, taking into account their creative personality
3	Creative component	Individual and group generation of ideas, the ability to move away from the "template", increasing the propensity to master, apply and disseminate relevant, socially significant innovations in teaching practice
4	Communicative component	The ability to build (in the course of pedagogical practice) interaction with students in the context of achieving pedagogical goals, to establish pedagogically appropriate relationships based on innovative pedagogical methods

One of the important conclusions of the work on introducing the technique of posing questions in the process of formation of innovative thinking was the understanding that it is necessary to separate the "low" cognitive questions (questions about facts, questions for testing knowledge) including the reproduction of the information received, and the "higher" cognitive questions (interpretative, evaluative, logical, etc.), including the mental manipulation of information to obtain a thoughtful, meaningful, personally significant response. Based on the results of the implementation of the technology in question, a number of conclusions were made:

1. In the process of answering questions, unnecessary comments from the teacher should be avoided, this may deprive students of the desire to seek participation in the discussion, since they will see that the teacher himself seeks to give an answer and, apparently, considers it the only right one. In addition, such a position of the teacher can make students feel that their contribution to the discussion is not so important, as a result of which they will lose interest.

2. All students should be involved in meaningful discussions, at the same time, caution should be exercised when addressing one of the students at a time when it is clear that he is not ready to answer. Do not allow one or more students to dominate the general discussion. Thank students for their willingness to participate in the discussion of a specific issue.

3. Listen carefully and ask clarifying questions that encourage students to more openly share their thoughts and feelings, and in many cases give them the opportunity to develop their creative pedagogical potential.

4. Accept any, even erroneous in your opinion, answer in a positive manner. This provides a sense of psychological security for the student, preserves his psychological health, develops a personal and professional personality, contributes to the formation of a non-standard, innovative outlook on professional activities.

Further research will be aimed at creating psychological and pedagogical conditions for the formation of innovative thinking of students, which will enable future teachers to formulate arguments, freely share their opinions, develop the ability to think together and negotiate, model “higher order” thinking, encourage creativity and the generation of ideas.

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远程教育平台 (LMS) 及其在混合学习计划中的能力  
**DISTANT EDUCATION PLATFORMS (LMS) AND THEIR CAPACITIES  
IN BLENDED LEARNING PROGRAMS**

**Orlov Andrey Vladimirovich**

*Pitirim Sorokin Syktyvkar State University*

*Institute of Foreign Languages*

**Scientific Supervisor Bart Maria Vyacheslavovna**

*PhD in Philology*

*Pitirim Sorokin Syktyvkar State University*

*Syktyvkar, Russia*

抽象。 该文章描述了教育计划的远程教育机会。 设计全面评估信息和通信技术高等教育中的有效性。

关键词: 混合学习, 远程教育, 远程教育平台。

**Abstract.** *The article describes distant education opportunities for educational programs. Designed comprehensive assessment of the effectiveness of the use of information and communication technologies in higher education.*

**Keywords:** *blended learning, distance learning, distant education platforms.*

During the last years the questions of information assurance, quality and efficiency of education are raised in education area. Different ways are offered for their solution, one of them is informational technologies in education. They promote the effective development of such an educational form as distant education. The distant education at the present stage is qualified as an interaction between teacher and student at a distance. This interaction represents all appropriate to the academic activity components (purposes, contents, methods, arrangements, learning tools). It is implemented by specific ways of internet technologies or by other devices that involve interactivity. By analyzing current researches in the field of distant education, I've got an opportunity to indicate a number of apparent advantages which this form offers.

They are:

- access to education for all groups of people without health restraints
- education cost reduction
- lifelong education
- individual educational paths for every student
- possibility to have tutorial progress at any convenient time
- knowledge rating applications

**Blended learning** is an approach to education that combines online educational materials and opportunities for interaction online with traditional place-based classroom methods. It requires the physical presence of both teacher and student, with some elements of student control over time, place, path, or pace. While students still attend "brick-and-mortar" schools with a teacher present, face-to-face classroom practices are combined with computer-mediated activities regarding content and delivery. Blended learning is also used in professional development and training settings [1,2,3]

**Distance learning**, also called distance education, e-learning, and online learning is a form of education in which the main elements include physical separation of teachers and students during instruction and the use of various technologies to facilitate student-teacher and student-student communication. Distance learning traditionally has focused on nontraditional students, such as full-time workers, military personnel, and nonresidents or individuals in remote regions who are unable to attend classroom lectures. However, distance learning has become an established part of the educational world, with trends pointing to ongoing growth. In U.S. higher education alone, more than 5.6 million university students were enrolled in at least one online course in the autumn of 2009, up from 1.6 million in 2002. [4]

**The purpose of this research project** is to compare distant learning platforms and analyze their opportunities offered in academic activity.

**Project objectives:**

- to become familiar with blended learning control systems
- to study the toolkits of LMS: Moodle, Futurelearn, Canvas, Coursera

**Distant education platform Moodle** is designed for online courses and possessed of the optimum set of lifetime abilities for blended learning realization. For the branch learning students of full-time education can combine the traditional full-time classes with self- instruction in distant course. Such approach in branch matter developing allows:

1. to minimize absence from school problems (missed topics are being studied in distant platform and there also required practical exercise are in progress).
2. to realize the anticipated learning principle (the new material review before full-time classes, ability to repeat it after classes)
3. to develop student's info-communicational competence [5]

**Distant education platform FutureLearn** offers free courses developed by leading Universities and Institutes of the world. All educational packages are provided in an easy-to-use form and available for any electronic devices including smartphones and tablets. Students have an opportunity to learn the detailed curriculum of chosen course in advance. Various articles and text matters, audio and video records are represented as a matter for learning with Futurelearn. All this components are accompanied with small tests that examine the information obtained by student. The

students can also ask related questions online and discuss them with other students. After studying and understanding, it's recommended to mark the material as complete. After that it's possible to go to the next section and tasks. [6]

**Distant education platform Canvas** offers different courses. Most of them are free, but several partnership programs present themselves as commercial projects. Teachers can work out their own courses on this platform. After registration a user comes to the Russian-language platform that simplifies the navigation. It is possible to add assistants and teachers to the courses. It is also possible to add students via e-mail or self-subscribe system. The students' results can be watched only after the users register in this system as students. Backup and all manuals are in English. [7]

**Distant education platform Coursera** is the world MOOC'S leader due to the courses quantity and number of authorized users. It started in January 2012. This platform was created by two professors from Stanford Andrew Ng and Daphne Koller. Coursera offers its users distant MBA-programs in cooperation with universities. Coursera for Business is a special program for common users, who want to get a diploma or certificate in corporate educational centers. The emphasis is put on getting a specialty, not only taking any course. These programs initially require payment, but students understand which profit they can get during these courses. [8]

Having analyzed the platforms above I've come to the conclusion, that all of them are useful in distant learning and comprise an integral part of blended learning. All these platforms put the students into to language environment and form special skills for independent search of needed information on different themes.

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6. <https://www.futurelearn.com/using-futurelearn>
7. <https://www.canvaslms.com/higher-education/>
8. <https://www.coursera.org/browse>

№	LMS	Advantages	Toolkits
1	Moodle	<ul style="list-style-type: none"> <li>- free using ability</li> <li>- easy to install and update by jumping to new versions</li> <li>-Moodle distribution in open and original code.</li> </ul>	<ul style="list-style-type: none"> <li>- glossary</li> <li>- lectures</li> <li>- workshop</li> <li>-forum</li> <li>-chat</li> <li>-quiz</li> <li>-test</li> <li>-task</li> <li>-workbook</li> <li>-Wiki</li> </ul>
2	Futurelearn	<ul style="list-style-type: none"> <li>A great deal of courses</li> <li>Availability of certificates</li> <li>A wide research area of courses</li> </ul>	<ul style="list-style-type: none"> <li>-tests</li> <li>-tasks</li> <li>-video</li> <li>-comments, chat</li> </ul>
3	Canvas	<ul style="list-style-type: none"> <li>- free using</li> <li>- Russian language</li> <li>- authors can offer their courses</li> </ul>	<ul style="list-style-type: none"> <li>-wiki- pages;</li> <li>-tests:</li> <li>-tasks;</li> <li>-wide opportunity to import ready-for-use courses;</li> <li>-rating and inter-rating tools;</li> <li>- academic activity analytics of the whole course and of each student separately;</li> <li>-ability to take conferences discussions;</li> <li>- document's editing</li> </ul>
4	Coursera	<ul style="list-style-type: none"> <li>- world MOOC'S leader</li> <li>-courses in different fields</li> <li>-the true university education</li> <li>-online programs for master degree</li> </ul>	<ul style="list-style-type: none"> <li>-education purpose – from the general to the special, concrete and measurable</li> <li>-tasks – frequent, with flash feedback</li> <li>-course matters – are selected to achieve the goal</li> <li>-community – enriches the experience, improves the course</li> </ul>

社会对称的一些原则

SOME PRINCIPLES OF SOCIAL SYMMETRY

**Togunov Igor Alekseevich**

*Doctor of Medical Sciences,*

*Professor at the Department of management at*

*The Vladimir branch of The Russian Presidential Academy of National  
Economy and Public Administration*

抽象。本文介绍了作者从结构对称性和功能不对称性的角度来理解社会组织的形式，内容和演变的方法。揭示了组织概念模型的作用及其与条件绝对坐标系的对应关系。

关键词。社会系统，对称性，对称性破坏，组织演化，建模。

**Abstract.** *The article presents the author's approaches to understanding the form, content and evolution of social organizations in the light of structural symmetry and functional asymmetry. The role of the conceptual model of organization and its correspondence to the conditionally absolute coordinate system is revealed.*

**Keywords.** *Social systems, symmetry, symmetry breaking, evolution of organizations, modeling.*

Social organizations are, to a certain extent, highly ordered structures, all the elements and characteristics of which are in the corresponding regular structural and functional relationships.

Studies of the models of such organizations revealed their structural symmetry and functional asymmetry.

In general, symmetry expresses the degree of ordering of a system or object. Symmetry is the immutability (invariance) of the shape, properties and characteristics of an object with respect to any transformations (operations) over it.

In a broad sense, symmetry is a concept that reflects the order existing in objective reality, a certain equilibrium state, relative stability, proportionality and proportionality between parts of the whole.

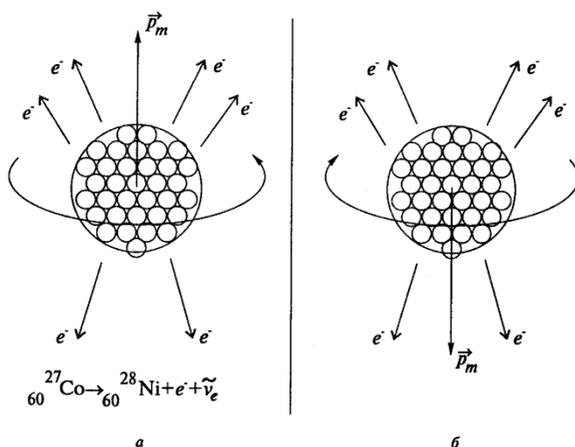
In a broad sense, symmetry is a concept that reflects the order existing in objective reality, a certain equilibrium state, relative stability, proportionality and adequacy between parts of the whole.

Asymmetry is the opposite concept of symmetry and reflects the violation in the objective world of order, balance, relative stability, proportionality and adequacy between the individual parts of the whole, associated with change, development and organizational restructuring. Already from this it follows that asymmetry can be considered as a source of development, evolution, formation of the new [4].

Thus, symmetry ensures the stability of the organization as a system, and asymmetry (dissymmetry), according to one of the principles of P. Curie, creates a phenomenon. The universality of the Curie principle is so great that it can be used to describe any natural phenomena from micro to megaworld.

A particular type of symmetry breaking is mirror dissymmetry.

The properties of mirror asymmetry are called cirality, or chirality.



**Fig. 1.** *β*-decay of Co:  
*a* - not observed; *b* - observed

So in 1848, Louis Pasteur discovered that chemical processes in living organisms do not have mirror symmetry: either left-handed molecules or right-handed ones dominate in them. He began to consider mirror asymmetry as the most striking difference between living and nonliving matter, and ultimately proclaimed it to be the fundamental principle of nature, the significance of which goes far beyond the chemistry of living matter.

"Life" as it appears before us, "Pasteur wrote," is a function of the asymmetry of the Universe and a consequence of this fact. "

Chirality is manifested in the differences between left and right. Chiral objects are objects that cannot be combined with their mirror images. The type of mirror asymmetry associated with the rotational moment makes it possible to distinguish between chirality on the right - |D>- and |L>- forms of rotation.

Quite deeply, the property of chirality has been studied in physics, chemistry, and biology. Studies of the chirality of social systems may be of some interest. One or another type of system functioning is associated with chirality.

So in the microworld, the asymmetry of the left and right is detected (Fig. 1).

In biological organizations, “living” molecules can be of only one orientation - “left” or “right”, i.e. here it is of the **chiral purity of the living**. For example, a DNA molecule, as is known, has the form of a spiral, and this spiral is always right. In glucose formed in the body - dextrorotatory form, in fructose - levorotatory.

Therefore, the most important ability of living organisms is to create chiral pure molecules. According to modern concepts, it is the chirality of molecules that determines the biochemical boundary between living and nonliving. ”

No scientific publications were found in accessible sources in which generalized, deeply systematic results of studies of the properties of symmetry and asymmetry (in particular chirality) as applied to social type organizations were presented. At the same time, some authors who study the problems of social (production) systems casually mention some properties of symmetry and asymmetry, both in the structure of these organizations and in their social, economic and other components.

Radchenko Ya.V. [5] examining the laws of social organization, which express the most general connections inherent in different types of social systems, determines the specificity of these laws, among other things, the fact that they (these laws) "have historical symmetry." In the theory of organization, along with other laws, the law of correspondence and symmetry is considered.

K. Levi-Strauss in his work “Structural Anthropology” [2], studying social structures in central and eastern Brazil, notes the apparent symmetry that exists between the settlements of various tribes - Sherente and Bororo. “In both tribes, the settlements have the shape of a circle (Fig. 2), they are divided into exogamous dual halves (phratries), each of which is divided into four clans, with a male house in the middle.

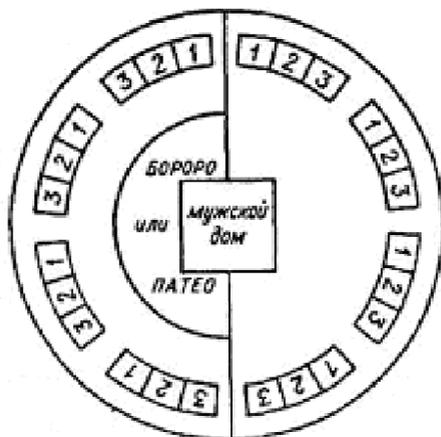


Fig. 2. Bororo settlement plan

Here is what V. Malinowski writes in his research [3]: “the dual organization can be clearly revealed in the division of the tribe into two halves; it can be completely forgotten; but I dare to predict that wherever thorough research is done, - in any wild society, symmetry of structure will be found as a necessary basis for mutual obligations. Dual-exogamous division is only a special case of the general law of social symmetry.”

K. Polanyi [1] studying the institutional models of an economic organization, concludes that “equivalence and redistribution are able to ensure the functioning of the economic system without the help of any records and complex administration, only because the organization of the company meets the requirements of such a solution with the help of concepts of symmetry and centrality”.

The symmetry of the structure of society is manifested in the forms of its organization, for example, in the formation of symmetrical marriage groups at the initial stage of its occurrence. The dictatorial power of more developed societies expresses a sharp asymmetry in the shape of the socio-system and is therefore unstable. The democratization of power, apparently, is a form of realization of symmetry.

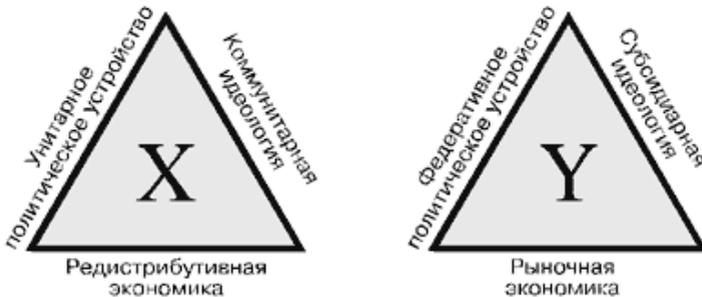
Closest to the understanding of symmetry and especially chirality of social structures, was S.G. Kiridin [6]: “... the whole variety of specific features of most states that existed and exist on the earth can, at a certain level of abstraction, be presented in the form of two ideal types, qualitatively different institutional matrices that aggregate a real variety of social ties. We called them X and Y - matrices. Despite the apparent simplification, we believe that such a division reveals deep and significant differences, which are not always taken into account in socio-economic studies to the proper extent.”

Some clarification is needed on what the author understands by the category of “institutional matrices” (Fig. 3).



*Fig. 3. Schematic representation of the institutional matrix*

The institutional matrix is an objectively existing historically developed system of basic institutions that regulate the interconnected functioning of the main social subsystems - economics, politics and ideology. The institutional matrix ensures the integrity of society and the possibility of the progressive development of the state in the presence of material conditions, representing a stable form of social integration. The institutional matrix underlies the changing empirical states of specific societies; it is constantly reproduced in the course of historical evolution. There are two types of institutional matrices - the X-matrix (eastern) and the Y-matrix (western) (Fig. 4).



*Fig. 4. Difference between X and Y-matrices*

The institutional X and Y matrices described by S. G. Kirdina are essentially not symmetrical in the classical sense of the category “symmetry”, but are nothing more than forms of manifestation of the chirality of social organizations - left-side and right-sided, i.e. can conditionally be correlated with  $|D\rangle$ - and  $|L\rangle$  - forms of rotation.

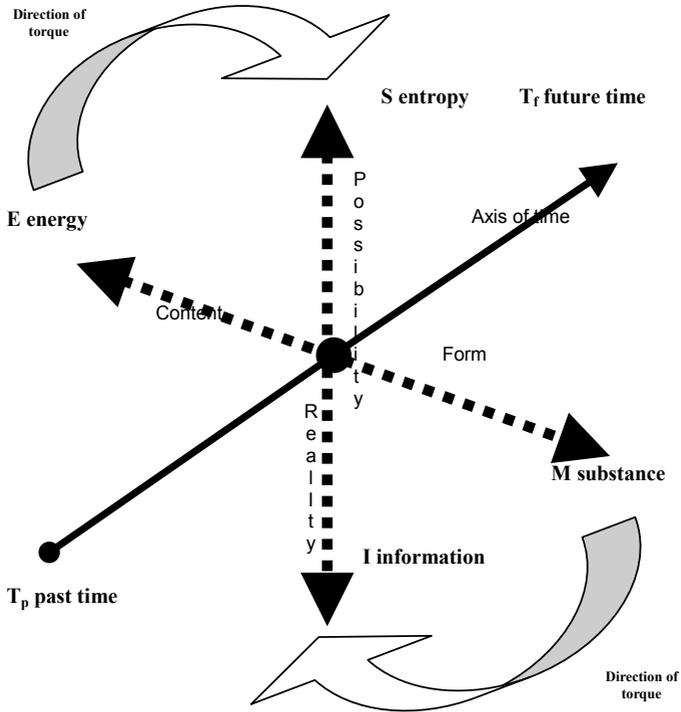
Right-hand rotation of the institutional matrix leads to social integration such as a market economy, i.e. Y - matrix (eastern), which corresponds to  $|D\rangle$ - form of rotation. Left-side rotation of the institutional matrix leads to social integration such as a redistributive economy, i.e. X - matrix (western), which corresponds to  $|L\rangle$ - the form of rotation.

It must be emphasized that the first studies and conjectures about the fundamental structural symmetry and functional asymmetry of social organizations date back to 1997. [7] They were expressed and framed as a conceptual model of organization in the study of market-based social structures in healthcare.

The use of the obtained conceptual model of organization as a kind of tool that allowed a number of studies of applied social organizations to be carried out. These studies in their development [8] revealed certain patterns in the social (production) organization — its universal structural and logical essence, symmetry of form, and asymmetry of content (function).

We represent the conditional structural and logical model of organization as a dialectical unity of four fragments: form of organization (D), content of organization (B), actual state (essence) of organization (A), possible state of organization (C).

The interconnectedness of these four characteristics describing the world device is integrated, as follows (Fig. 5).



*Fig. 5. Coordinates of the correspondence*

*“Matter (M) - Energy (E) - Entropy (S) - Information (I) on the time axis ( $T_p - T_f$ )*

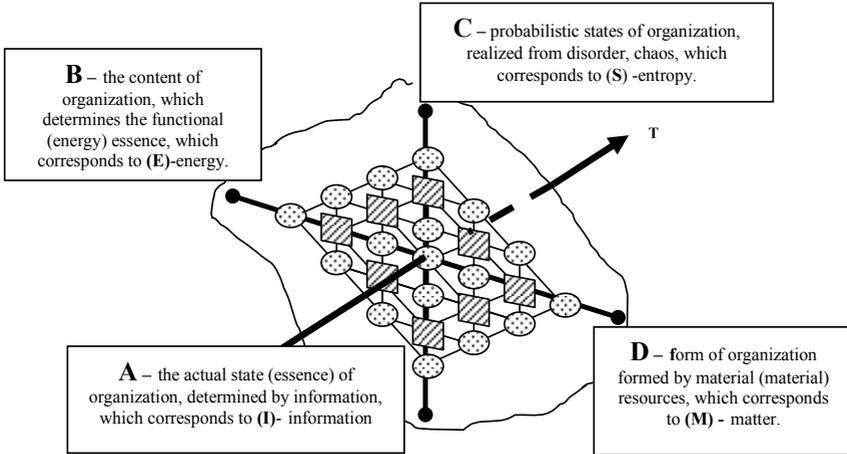
The correspondence of points in Fig. 5 defines a model conventionally called the **“Absolute coordinate system of organizations” (ACSO)**.

Models of applied systems, in particular social organizations, were designated as **“Relative coordinate systems of organizations” (RCSO)**.

Comparing the coordinate system model of the organization’s life cycle traditionally represented in the scientific literature with the coordinates of the organization’s matrix model, we find the following correspondences:

- ⇒ category (M) - “matter” conditionally correlates with **(D) - form of organization;**
- ⇒ category (E) - “energy” conditionally correlates with **(B) – content of organization;**
- ⇒ category (S) - “entropy” conditionally correlates with **(C) - possible condition of organization;**
- ⇒ category (I) - “information” conditionally correlates with **(A) - the actual state (essence) of organization.**

The organization’s coordinates are a kind of cast of the coordinates of the “matter – energy – entropy – information” system. Thus, in the RCSO system, points traditionally represented by a linear diagram of the organization’s life cycle are characterized as follows (Fig. 6).



*Fig. 6. Organization model in the maturity phase of its life cycle*

This absolute coincidence of the ACSO and RCSO points determines the actual, relatively stable existence of organization.

The addition of motion vectors determines the helical motion of the system with  $|D\rangle$ - or  $|L\rangle$ - forms of rotation and is characterized by symmetry breaking. Such an organization movement in the RCSO is mediated by the fundamental nature of the movement of the basic forms of matter in ACSO. The rotational movement of the system in the RCSO can be right or left, coincide or not coincide with the rotational movement of the ACSO.

It is chirality (left-side or right-side rotation) that determines the type and essence of a particular social organization.

It should be assumed that the evolution of any system is a real manifestation of complex mechanisms related to the general structure and movement of the space-time continuum. These mechanisms provide a choice of probabilistic states, such structures and relationships of system elements that allow to form and fix a symmetrical form in an organization, while preserving the functional asymmetry or chirality, which to a certain extent ensures the development and functioning of the organization.

It is precisely in this that the difference in the states of the organization, in the peculiar acquisition by the organization that has completed the next stage of its functioning, of a state absolutely similar to the initial point of its previous occurrence, lies the deep meaning of the manifestation of the law of S-shaped continuous development of the organization as a system.

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UDC 297

社会正义: 可兰经的背景  
**SOCIAL JUSTICE: KORANIC CONTEXT**

**Almuhametov Ali Raufovich**

*Associate Professor, PhD, Head of Education Department*

**Ilimbaev Rizabek Battalovich,**

*PhD Doctoral Candidate, Lecturer*

**Smagulov Kurmet Nurmuhambetovich**

*PhD Doctoral Candidate, Lecturer at the Department of Islamic studies  
Egyptian University of Islamic Culture Nur-Mubarak*

注解。本文从古兰经知识的角度揭示了对社会正义的理解。本文详细分析了被调查社会正义社会不同层面之间复杂而重要的相互关系。伊斯兰教条的基本原则是将物质转化为精神的优先权。在所提出的研究中, 社会正义的概念既适用于宇宙, 也适用于社会和个人。作为一个人和社会生活的基本规律, 社会经济均衡规律得到了发展, 这决定了精神需求对个人物质需求和欲望的支配。根据研究结果, 可以得出结论, 为了在特定社会中实现社会公正, 有必要在一个人生活的每个领域考虑社会因素, 并在每个领域平等地实施社会项目。

关键词: 正义, 社会, 古兰经, 物质, 不公正, 人性。

**Annotation.** *This article reveals an understanding of social justice in terms of koranic knowledge. The article gives a detailed analysis of the complex and significant interrelationships between different layers of society of the social justice under investigation. The basic principle of Islamic dogma is the priority of the transformation of the material into the spiritual. In the presented research the concept of social justice is applied both to the Universe, to the society, and to the individual. As the basic law of the life of a person and society, a law of socio-economic equilibrium is advanced, which dictates the dominance of spiritual needs over the material needs and desires of individuals. According to the results of the study, it can be concluded that in order to achieve social justice in a given society, it is necessary to consider social factors in each area of a person's life and to implement social projects in each area equally.*

**Key words:** *justice, society, Koran, material, injustice, humanity.*

## Introduction

The concept of justice refers to the category of eternal companions of human community, along with the values of human life itself, freedom and dignity. Man always wanted not just to live, but to live free, dignified, in fairness. The desire of people for justice, the search for its meaning, criteria, is one of the most significant pages of history. In essence, appealing to justice, people at all times sought to satisfy or protect their very specific material interests: property, life and position in society, evaluating in terms of "justice - injustice" the existing order, actions of the supreme or local authorities, individuals or social groups, competitors. The idea of justice, as historical experience testifies, having mastered the minds and hearts of vast masses of people, becomes a powerful factor in transforming social relations, manifesting itself precisely as an idea of social justice.

Social justice, as an ideal, the highest value, the most important human motivation has attracted the attention of philosophers of all times and peoples: "Cornerstones" in the foundation of the European tradition of philosophical understanding of this phenomenon were laid by the ancient thinkers Plato, Aristotle and Epicurus. In the era of the Middle Ages, social justice was interpreted as part of a religious approach [1; 79].

In recent decades, the topic of social justice has constantly been in the field of vision of Western social scientists, testifying to the serious crisis of "classical" liberalism, the growing tendency of socialization in capitalist countries. The liberal interpretations of justice (J. Rawls, R. Dworkin, R. Nozick and others) in the modern philosophical discourse of the West are criticized by the communitarians (A. MacIntyre, M. Nassbaum, A. Sen, M. Sandel, C. Taylor and etc.), which oppose the liberal idea of a person as a free and rationally acting individual, the idea of social conditionality of a person, its rights, freedoms, ideas and principles.

K. Marx in "Criticism of the Gotha Program" and V.I. Lenin In the "State and Revolution" considered the problem of the relationship between social justice and social equality as a real socio-historical task (solved "here and now" and not transferable to "heaven", as in the Christian Orthodox tradition) transforming society by establishing social equality. This problem, thanks to the Soviet experience of socialist creation, which legitimized such political and legal institutions as universal suffrage, the consolidation of the fundamental rights and freedoms of citizens in the Constitution and legislation, has acquired the status of objective reality. Based on this approach, the following definition of the category of social justice was developed in the Soviet period: "Social justice is a measure of equality (and inequality) in the life situation of people, classes and social groups, objectively determined by the level of material and spiritual development of society."

The idea of social justice initially, in the process of the formation of man and society, declared itself as one of the priorities in the entire system of public consciousness. Starting from the religious and mythical views of ancient society, the teachings of the first philosophers to the present day, an appeal to social justice was invariably present in assessing all aspects of public life (“up to how the dead should be buried and what honor they should be given”), it determined socially-state principles (“guiding star of legislative activity”). In the concept of social justice, thinkers of all times and peoples have invested meaning, an assessment of what is done and deed from the standpoint of historically formed ideas about what is due and desired [2; 379].

Marx K., Engels F. mentioned that justice manifests itself in different ways in its various forms and changes exclusively as a result of the social development of a particular society, most visibly revealing itself in morality and law as a measure of hope and accomplishment, a holistic assessment of human actions, at the same time, it is not limited only to this hypostasis of its own. The objective criterion of justice that we have indicated is the level of humanization of society, i.e. personality position in it: the degree of its economic, political and social liberation; the level of satisfaction of her material and spiritual needs; the state of her psychophysical and social health is also used in the fields of economy, politics, aesthetics and other areas of public life [3; 402].

Consequently, social justice in its broadest sense is one of the main socio-philosophical categories that reveal the internal laws of the development of society as a system, the origins of the formation of its individual institutions. That is why in this case it is more accurate to use the category of “social justice” rather than the concept of “justice”. The latter with less clarity reflects the extremely wide volume and content of the most significant attribute of the phenomenon being determined. In our interpretation: “Social justice is a socio-philosophical category for designating the actual state of social relations, reflected in the public consciousness in terms of their compliance with people's ideas about the proper social order, ensuring free development, a decent standard and quality of life for all citizens.”

### **Justice in the Koran and Hadith**

In the Islamic worldview, justice means giving everyone their due place and equal treatment of everyone. As in the tradition of the West, justice is considered a moral virtue in Islam. Justice is similar to equality in the sense that it creates a state of equilibrium in the distribution of rights and duties, but they are not identical. Sometimes justice is achieved through inequality, as an unequal distribution of wealth. The Prophet Muhammad in one of his sayings noted: “Seven categories of people, Allah, cover His canopy on the Day when there will be no other canopy except Him: a just ruler ...” [5; 1712].

The Prophet Muhammad also conveyed the words of the Most High: “O My slaves, I have forbidden injustice to Myself and I forbid it to you. Therefore, be afraid to act unjustly” [5; 2577]. Thus, justice is a high moral principle and objectivity, since it prescribes its proper place for everything.

### **Importance of justice**

In the Koran, justice is represented by the highest dignity. This is one of the most valuable qualities, which occupies a place of importance next to the belief in the Unity of God (tawheed) and the recognition of Muhammad as His prophet. The Almighty says in the Koran: “Verily, Allah commands to observe justice ...” [4; 16:90]. In another ayah “O those who believed! Be steadfast for the sake of Allah, testifying impartially ...” [4; 5: 8]. Thus, we can conclude that justice is the duty of every Muslim, and injustice is forbidden.

The central role of justice in the Koranic system of values can be seen in the verse “We have already sent Our messengers with clear signs and sent down the Scriptures and Libra so that people adhere to justice ...” [4; 57:25]. The phrase “Our messengers” means that justice was the goal of all revelation and scripture sent to humanity. Ayat also shows that justice must be measured and implemented according to the standards and guidelines established by revelation.

From an Islamic point of view, it is believed that any path leading to justice is in harmony with Sharia. God requires justice. He did not prescribe a specific route, any established methods, but also did not declare invalid the specific paths leading to justice. Defined general guidelines for its achievement. Therefore, all means, methods, paths leading to justice and not violating the laws of Islam are allowed.

### **Justice to all**

The justice prescribed by God in the Koran is not limited to a particular race, religion, color, beliefs. A Muslim must be fair to both a friend and an adversary, as described in the Koranic text [4; 4: 135], [4; 5: 8], [4; 60: 8]

The scholars of the Koran concluded that this rule is valid in relation to people of all nationalities, religions, in fact, to all of humanity. According to the Koran, justice is an obligation, therefore the Prophet was ordered: “... But if you make a decision, then judge them impartially ...” [4; 5:42], “We sent the Scriptures to you truly, so that you handle the lawsuits between people as Allah showed you ...” [4; 4: 105].

The Koran is a scripture dedicated primarily to establishing the principles of faith and justice. The Koran requires justice to be performed for all, and declares it the right of all people. To do justice is trust placed by God on a person, and, like to everything entrusted, we must approach this with all responsibility. So, the Almighty commands: “Verily, Allah orders you to return the property entrusted to storage to its owners and judge fairly when you judge among people ...” [4; 4:58].

The ayah speaks of justice immediately after the call to fulfill his duty and return the trustee. It follows from this that justice is one of the most important powers of attorney.

### **Justice as a personal quality**

The Almighty calls for justice for every believer. This quality, as part of the faith in God, any Muslim should try to cultivate in himself. The Koran says: "... Be fair, for it is closer to godly fear ..." [4; 5: 8], "... When you utter a word, be fair, even if it concerns a relative ..." [4; 6: 152]. Moreover, the Messenger of Allah taught: "Be God-fearing and be fair to your children."

In the Koran one can find specific examples of justice. For example, a fair attitude to orphans: "Do not approach the property of an orphan, except for the benefit of him, until he reaches adulthood. Fill the measure and scales in fairness ..." [4; 6: 152, see also 89:17, 93: 9 and 107: 2]

Fair trade, which is mentioned in the verse, is devoted to the whole Surah of the Holy Koran "The Hanging Ones" (Mutuffin). In it, the Almighty threatens to punish the unjust in trade, transactions, business ...

Justice in polygamy is also discussed separately. The Almighty calls for equal relations with all wives. Ayat begins with a reference to orphaned girls to whom they may be unjust. Once they have reached marriageable age, they should be married, even if it will be a polygamous family, especially if the number of women exceeds the number of men, as was the case after the battle of Uhud. Nevertheless, the Lord warns: "If you are afraid that you will not be equally fair to them, then be content with one ..." [4; 4: 3].

The famous Islamic jurist Sarahsi said: "To do justice is considered the most noble expression of humility, after faith in God. This is the greatest of all duties assigned to the prophets ... and the most compelling justification of the primacy of man on earth" [6].

The Holy Koran pays great importance to divine justice and in many verses speaks of Allah as one who never inflicts injustice on anyone: "Verily, Allah does not show injustice to people in any way, but people themselves act unjustly towards themselves" [ 4, 10:44]. Allah is above all to oppress people, He is above to repair injustice in their relation. And if any troubles occur with people, then in most cases they themselves are to blame for what happened to them.

With some degree of certainty, we can say that the aforementioned ayat is a continuation of the previous ayahs, which refer to stubborn people who accused the Messenger of Allah of lying. In the previous verses of Sura Yunus it is said that these stubborn people have eyes, but they cannot see, they have ears, but they cannot hear, they have intelligence, but they do not understand. And all this is a consequence of their evil deeds, which, like a veil, have closed their sight, hearing and mind from knowing the truth. Their evil deeds do not allow them to distinguish truth from lies, and they themselves are guilty of being punished in the afterlife, and there is no fault of Allah Almighty, who in fact only wishes them good.

It follows that if vision, hearing and reason are not used for the purpose for which they were created, then gradually they will lose their ability to recognize the truth and lead their owners into the darkness of error. This is a divine tradition, a law to which all life in the world is subject. The Supreme Lord directs all living things to perfection, by His grace having prepared everything necessary for this, He does not oppress his slaves, but, on the contrary, wishes them to achieve absolute happiness in both worlds. If people perform good deeds, then they will benefit themselves, if they commit pious acts, then only they will suffer damage from them in this or the afterlife. Each is rewarded according to his merits. Allah dissociates himself from the very concept of injustice, which never had a path to His essence. He is just himself and prescribes justice to all his slaves, so that they are fair in relation to the Creator, as well as in relationships with each other. And is it possible to imagine that Allah will call people to be fair to each other, while He himself is tainted by evil deeds? Of course not. The Holy Koran notes: “Verily, Allah commands to do justice, to do good and to bestow relatives. He forbids abominations, reprehensible acts and lawlessness. He exhorts you, perhaps you will remember the edification” [4, 16:90].

In the next verse, the concept of divine justice is given a new meaning, more extensive. If in the first ayah it was said that Allah in no way shows injustice to people, then in this ayah the slightest injustice is denied in relation to the whole world. She does not just deny, the verse says that Allah does not even want any oppression of his creations. “Indeed, Allah does not desire injustice for the worlds” [4, 3: 108]. Allah does not oppress a living being or an inanimate.

The whole universe is covered by divine justice, everything is in its place, harmony reigns everywhere, not a single phenomenon and not a single process contradicts the general structure of the world order. Orderliness and justice are fundamental principles of the structure of the world, and according to these principles, everything in the world, obeying divine laws, is involved in the process of moving to perfection. Based on this kind of ayah, Imam Ghazali, in his work “Revival of Religious Sciences”, commenting on this ayah writes: “In this ayah the word “ worlds ” is mentioned in the plural, which indicates the following undeniable truth. Any injustice, no matter how insignificant, will entail negative consequences throughout the universe, since the universe is a single whole” [7; 189-190].

The prophets and Islamic scholars on an ongoing basis have been explaining to people the true meaning of divine justice so that they are correctly aware of the principles and goals of religion. The Messenger of Allah spoke of the all-encompassing justice of Allah: “Verily, Allah is a Just Judge, and only Allah makes decisions” [8; 517]. In this prophetic hadith, the concept of divine justice has the broadest meaning. It can be interpreted both as the justice of Allah in relation to people, and as justice expressed in harmony and order reigning in the world cre-

ated by Him. In another reliable hadith, transmitted by Imam Bukhari, it is transmitted that Allah has 99 beautiful names, and the one who keeps them in himself will go to heaven. Among these beautiful names are Al-Muksit (Just), which does not unequivocally indicate the need for a Muslim to describe this quality in order to achieve bliss in both worlds [9; 283].

### **Causes of injustice that come from a person**

Why does a person, despite the fact that both religion and his own inner nature call him to justice, often contradict this call and commit bad deeds? There are several such reasons. Injustice sometimes arises from the material needs of a person when, instead of making efforts to satisfy his needs in the right way, he tries to do this through an encroachment on the rights of others, through theft or open aggression.

Sometimes the cause of injustice is elementary ignorance and nescience, when a person really does not know and does not understand what he is doing. At times, this is facilitated by following a person to his passions, his indefatigable desires and ambitions, a thirst to be better than others. In this case, a person satisfies his passions with the oppression of other people, in this way he gives an answer to the call of his inner desires, with which he is unable to control. Another cause of injustice is weakness and spiritual powerlessness, when a person goes about other people and does not try to do anything in order to become independent in their actions.

Also, the causes of injustice can be attributed to anger, envy, desire for revenge, pride, stubbornness. But can the above cause the injustice of Almighty Allah, who has all the attributes of perfection and beauty and which is devoid of the slightest flaws and vices? After all, He does not need anything, He is the possessor of the most complete knowledge and wisdom, He is not inherent in following passions and base desires, He is omnipotent and almighty, He is devoid of envy, stubbornness, desire for revenge. Therefore, it should be noted once again that Allah Almighty is absolutely fair, merciful and compassionate, since He has not even the slightest reason to oppress anyone. And if He will punish sinners, criminals, tyrants and wicked people, it is only because of sins and crimes committed by themselves, and not because He needs to punish them or that retribution for their sins will add to His greatness and power (“Allah does not commits injustice even with a speck of dust”[4; 4:40]).

According to the Islamic thinker Saeed Qutub, for the implementation of social justice in society, it is necessary to streamline the two components of justice in each unit of society. Well-known factors of justice are two things: 1) the inner world of a person, his upbringing and formation is promoted by instilling in him such qualities as mercy, alms, forgiveness, gentleness, self-sacrifice, etc. 2) the external factor, legislative provisions and the executive branch, which in Islam is presented in the form of Sharia.

Based on these factors, Islamic Sharia forbids monopoly, greed, stinginess, usury, illegal use of other people's property, corruption and the accumulation of capital to the detriment of the economy of society. But since these factors are subject only to Allah Almighty, there can be no question of social justice outside Islamic rule [10; 76, 228].

Modern Islamic analyst Jamal Banna argues that the social and economic justice that took place in Islamic history, namely in the era of the reign of both Omars, was distinguished by two main points: the fair distribution of resources between each object of society, and social solidarity that has spread since when Omar ibn Khattab legitimized the allowance for each newborn, and received continuation in the form of social benefits of Omar ibn Abdul Aziz to every poor citizen [11; 104].

A large number of Islamic thinkers and jurists associate social justice and social uplift with the problem of poverty, and see a way to its implementation through improving the material conditions of socially vulnerable segments of the population.

The founder of the Zahiri madhhab, Ibn Hazm, in his book *Muhalla* speaks of the need for the state to impose a duty on the wealthy subjects of a society to help needy citizens of a given society. In the event of an attempt to avoid or evade this kind of responsibility, the state has the right to retain a certain part of the wealth of its wealthy entities in favor of the poor. In the same way, if the funds received in the course of collecting compulsory alms (Sunset) are insufficient to cover the living wage of people in need, the state has the right to introduce additional fees in favor of the above, in the form of luxury taxes, etc. The reason for this provision is the hadeeth that the Prophet listed all types of property subject to sunset, until we made sure that none of us has the right to surplus [12; 328].

Ibn Hazm completes the sunset section of *Muhalla's* book, citing scholars' opinions about the inadmissibility of eating the forbidden Muslim living in society if someone has excess food allowed because the owner of the food is obliged to feed the hungry. In such cases, a Muslim has the right to take what is appropriate for him, even by force [13; 156-159].

Imamul Haramain Juveini was of the same opinion. Moreover, in his opinion, the ruler of the Islamic state has the right to confiscate (with subsequent security from the confiscated) all property of a secured object of society if his lifestyle does not fit the appearance of a Muslim, or in the case of unjustified use of the property entrusted to him by Allah [14; 204-290].

Imam Ghazali in the book "Ihya ulum ad-Din" in the section of poverty and asceticism states that the cause of poverty in society and social injustice lies in the inadmissible form of the acquisition of certain goods. Subsequently, the acquisition by each person of property not permitted by Sharia, by inertia, the society goes into the category of social injustice and poverty in a certain part of it. On the

other hand, Imam Ghazali argues that poverty and social vulnerability are more spiritual than material. Analyzing the Sufi point of view of Ghazali, one cannot say that he offers certain steps to establish social justice in society [15; 189-190].

The author of the book "Mazhmug al-Fatava" ambiguously points to the concept of justice as the basic principle of Islamic Sharia, regardless of the scope of its application. The state plays a paramount role in the implementation of social justice. Since only it can make society and its individual reckon with Islamic values or Sharia. The inequality of society is represented by Ibn Taymiyyah as negative. The obligation of each person is to achieve material independence for further dedication to full worship of God. Thus, the state should not, in introducing the social justice of Ibn Taymiyah, limit itself to providing a living wage for its citizens. The responsibility of the state, in the name of achieving the material independence of each object of society and the liberation of a person to fulfill the original goal in its creation, includes a fair distribution of profits, depending on need, between rich and poor. Ibn Taymiyah is one of the few Islamic thinkers who hold the opinion that additional fundraising is necessary, by sunset, from the wealthy sections of society, in order to achieve social justice, in favor of the poor. These requisitions should be issued to socially vulnerable segments of the population as bonuses to wages, for settlement and social stability. According to Ibn Taymiyyah, this particular type of settlement corresponds to the spirit of Islamic Sharia, which, striving for equality in society, does not want to cultivate in it the flaws of the greed of capitalism and the laziness of socialism [16; 161].

According to our contemporary Abdul Hamid Barahimi, all Islamic scholars and thinkers discussing the topic of social justice repel the sunset Institute in their works. Thus, the stumbling block, as one of the pillars of Islam, is the sunset. And its correct execution in all instances will play a paramount role in any area of society [17; 57].

The author of the book "Islamic vision of work in the social sphere" cites the concept of Islamic Sharia of Imam Shatibi. For its implementation, the state must systematically monitor each institution of its society. The degree of perplexity of each institution of society is expressed in the following table, where the number of pluses corresponds to the degree of attention paid to a particular problem.

Thus, Abdullah Dabbagh argues that in order to achieve social justice in a particular society, it is necessary to consider social factors in each sphere of a person's life and to implement social projects in each sphere respectively [18; 278].

Sharia goals	Freedom of religion	Life and Health	Freedom of thought	Freedom for procreation	Property protection
Religious	+++	++	++	++	++
Family	++	++	++	+++	+
Economic	+	+	+	+	+++
Political	++	+++	+++	+	++
Social Security	++	++	++	++	++

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公司智力潜力的结构: 谓词逻辑数学装置背景下“智力潜力” - “智力资本” - “知识产权”概念的比例

**THE STRUCTURE OF THE INTELLECTUAL POTENTIAL OF A CORPORATION: THE RATIO OF THE CONCEPTS OF "INTELLECTUAL POTENTIAL" - "INTELLECTUAL CAPITAL" - "INTELLECTUAL PROPERTY" IN THE CONTEXT OF THE MATHEMATICAL APPARATUS OF PREDICATE LOGIC**

**Bulatetskaya Alena Yuryevna**

*Candidate of Sociological Sciences*

*Associate Professor*

*Perm State University*

抽象。 文章揭示了公司智力潜力的结构, 分析了智力潜力, 智力资本, 知识产权等概念的相关性。 使用谓词逻辑的数学装置描述这些概念之间的关系。 作为评估员工能力(专业智能)的程序的基础, 制定了管理公司智力潜力领域的基本概念之间关系的方案。

关键词: 企业, 智力潜力, 知识资本, 知识产权, 能力, 能力, 专业智能。

**Abstract.** *The article reveals the structure of the corporation's intellectual potential, analyzes the correlation of such concepts as intellectual potential, intellectual capital, intellectual property. The relations between these concepts are described using the mathematical apparatus of predicate logic. A scheme of the relationship between the basic concepts of the sphere of managing the intellectual potential of a corporation is developed as the basis of the procedure for assessing the competence (professional intelligence) of employees.*

**Keywords:** *corporation, intellectual potential, intellectual capital, intellectual property, competency, competence, professional intelligence.*

When forming their own concept of human capital management and assessing the potential of employees, corporations may encounter two problems: terminological, related to the delineation of the basic concepts of the theory of human capital and finding the relationship between them, and methodological, related to the search for the most objective, comprehensive and operational method of such an assessment.

Despite the fact that the concepts of “human capital”, “intellectual capital”, “intellectual potential”, and “intellectual property” are not new in the thesaurus of science, researchers still do not have a single opinion on the distinction between these concepts. It is still unclear which type of capital is part and which is whole in relation to each other - human capital includes intellectual capital, or vice versa, do the concepts of “intellectual capital” and “intellectual property” coincide, are the concepts “capital” and “potential” is one and the same.

In the broad sense of the word, human capital — a certain stock of health, knowledge, skills, abilities, motivations that are expediently used in a particular sphere of social reproduction formed as a result of investments and accumulated by a person, that contributes to the growth of labor productivity and production efficiency and thereby lead to growth earnings of particular person [1, p. 14].

Intellectual capital is the sum of the knowledge of all employees of the corporation, which ensures its competitiveness. Thus, “knowledge is capital ... not for the one to whom it belongs, but for the one who uses it for profit, that is, capitalizes, who appropriates the surplus value created by the subject of knowledge” [2, p. 37].

Intellectual property is a specific area of human activity, within the framework of which benefits are formed that, by virtue of their origin, have certain special characteristics. Intellectual property focuses on the understanding that access to the use of these benefits in a certain sense can be limited [3, p. ten].

Many authors identify the concept of intellectual capital with the concept of intellectual property, which is created by employees of the corporation on the basis of their knowledge and experience and replenishes the intangible assets of the corporation. However, the concept of “intellectual capital” is much broader than the concept of “intellectual property.” If the latter is legislatively fixed, then the term “intellectual capital” is not used today in any legal document anywhere in the world. At the same time, this concept allows to combine all the results of human intellectual activity and more fully characterize them [4].

To date, there is no unity in views on the content of the category of “intellectual potential”, and the prevailing ideas do not fully meet the requirements of the interpretation of this concept. An analysis of domestic research in this area in recent years allows us to state that most of them come down to three points of view: firstly, “intellectual potential” should be considered as a combination of any resources; secondly, as an indicator characterizing the state or level of development of an object; thirdly, as ability (opportunity). In addition, almost all researchers distinguish between the intellectual potential of the individual and the potential of the system (society, region, company) [5].

Among researchers of the human factor in the economy of a corporation, such concepts as competence and competency are popular [6].

In order to solve the problem of separation of concepts, it is necessary to turn to the etymology of the basic terms: capital, potential, competence, competency. Often there are problems of accurate definition of the concept due to incorrect translation of words from a foreign language. So, according to the English-Russian dictionary [7], the above terms have the following English equivalents: 1) competence - способность, умение; 2) competent - знающий; 3) capital - состояние; главный, основной, важнейший; 4) potential - возможность.

In addition to the translation, we add the meaning of these terms in a common, non-special interpretation [8]:

1. Competence - 1) The range of issues in which someone is knowledgeable. 2) The circle of one's authority, rights.
2. Competent - 1) Knowing, knowledgeable, authoritative in any field. 2) Possessing competency (noun - competence).
3. Capital - the value which, as a result of the use of hired labor, brings surplus value.
4. Potential - the degree of power in any respect, the totality of any means, capabilities.
5. Property - 1) Material values, estate owned by someone or in his full possession. 2) The right to own something.

These definitions allow us to make the following distinction between concepts intersecting in content, as well as to determine their relationship. We describe the relationship between these concepts using the mathematical apparatus of predicate logic [9].

1. *The concepts of "intellectual potential" - "intellectual capital" - "intellectual property"*.

$Q_s$  potential - is an opportunity, the ability of a system to solve tasks of any level of complexity. It is this level of complexity that determines the value of the potential  $n(Q_s)$ . This is an internal resource of the system, formed by it from the simpler resources coming from the environment. Capital  $C_s$  - is that part of the internal resource of the system (its potential  $Q_s$ ), that is used to produce the product of system  $P$ :

$$C_s = Q'_s \subset Q_s \mid P = F(Q'_s), \quad (1.1)$$

where  $F$  - is the functioning (activity) of the system within which the product (result)  $P$  is obtained.

The task of managing intellectual potential can be represented as follows:

$$C_s \rightarrow Q_s, Q_s \rightarrow \max \quad (1.2)$$

i.e. it consists in stimulating the employee to use all his intellectual potential for the good of the organization and increase its level. The following points may serve as an obstacle to this:

1)  $P = F(Q) \mid Q \ll Q_s$  - the intended result of the employee's activity does not require too much effort, in this case the employee has no incentive to increase his intellectual potential, which in the absence of an influx of new knowledge can degrade, i.e. move to a lower level of complexity compared to the previous one;

2)  $P = F(Q) \mid Q \gg Q_s$  - the intended result of the employee's activity requires knowledge that he does not possess, in this case, the employee may have an incentive to increase his intellectual potential, but only if he is not limited in time; otherwise the result will not be as desired.

If the potential and capital are in the ratio (1.1), then the property is related to them as follows:

$$O_s = P' \subset P \mid (P' = F(C_s)) \wedge P' \subset R \wedge DOC(P') \wedge REG(P', S). \quad (1.3)$$

Here R is the resources of the employee (system), which he gets ready, and does not create them in the process of functioning.

Intellectual property is just such a resource that differs from others in that it was created in the system itself and not obtained from the environment. This is a documented (predicate  $DOC(P')$ ) form of intellectual capital, which either has a completely new quality that has never been shown in such systems before, or, due to an increase in the  $Q_s$  level, has a low degree of uncertainty that allows it to be presented as a specific solution that will not require time from the employee (system) for its formation.

Moreover, if the use of intellectual property is assumed not only by the employee (system), but also by his colleagues (environment), then expression (1.3) will change as follows:

$$O_s = P' \subset P \mid (P' = F(C_s)) \wedge DOC(P') \wedge REG(P', S). \quad (1.4)$$

The formula does not indicate which employee's activity resource the  $O_s$  intellectual property will be, but the  $REG(P', S)$ , predicate, which establishes the correspondence between intellectual property and its author, is important. The importance of this predicate is explained by the following:

1) Information on intellectual capital registered in a certain way allows to accurately establish its author in case of conflict;

2) Information registered in a certain way allows to determine who is responsible for the occurrence of conflicts in the coordination of the activities of individual employees.

Thus, the concept of "intellectual potential" is more voluminous in relation to the concepts of "intellectual capital" and "intellectual property":

$$Q_s \supset C_s \supset O_s. \quad (1.5)$$

2. *The concepts of "human potential (capital)" - "intellectual potential (capital)".*

Here it is necessary to turn to the basics of formal logic, that of its kind, which is called extensional, i.e. comparing concepts in terms of their content rather than volume [10]. The concept of "intelligence" is secondary to the concept of "man", because all properties of intelligence are inherent in man, but not all properties of man are inherent in intelligence. Therefore, the concept of "intellectual potential (capital) ( $C_I$ ) is secondary to the concept of "human potential" ( $C_H$ ) and is included in many concepts that allow us to define it:

$$C_H \subset C_I \quad (1.6)$$

With such a formulation of the question of the correlation of these concepts, which is undoubtedly correct from the point of view of logic, the problem arises of separation from the structure of the intellectual potential of that part of it that has not yet been converted into capital and property. In the presentation of intellectual potential as an interconnected aggregate of human, structural and organizational capital [11, p. 52-54] the concept of "human capital" corresponds to it, however, above we determined the primacy of this concept in relation to the concept of "intellectual capital", therefore, this concept cannot be used in the structure of intellectual potential. The distinction between the concepts of "competence" and "competency" helps to resolve emerging problem.

3. *The concepts of "competence" - "competency".*

When separating these concepts, the following definition can be taken as a basis. "Competency is an area of activity significant for the effective work of the organization as a whole, a range of issues in which an individual needs to be knowledgeable for the effective performance of work. Therefore, competency is an indicator that measures a person's awareness of specific issues in a particular position. It is convenient to interpret competency as a name of the scale, and competence as a level on a scale. Hence the conclusion - within the framework of his competency, an employee works well if the competence is high, and poorly if it is low "[1 2, p. 732].

In other words, competency is an employee's field of activity (system function) F, presented as an interconnected set of characteristics of this activity:

$$F = \{k^F_1, k^F_2, \dots, k^F_n\} \quad (1.7)$$

Information elements describing these characteristics, in their totality, give a *competency model*:

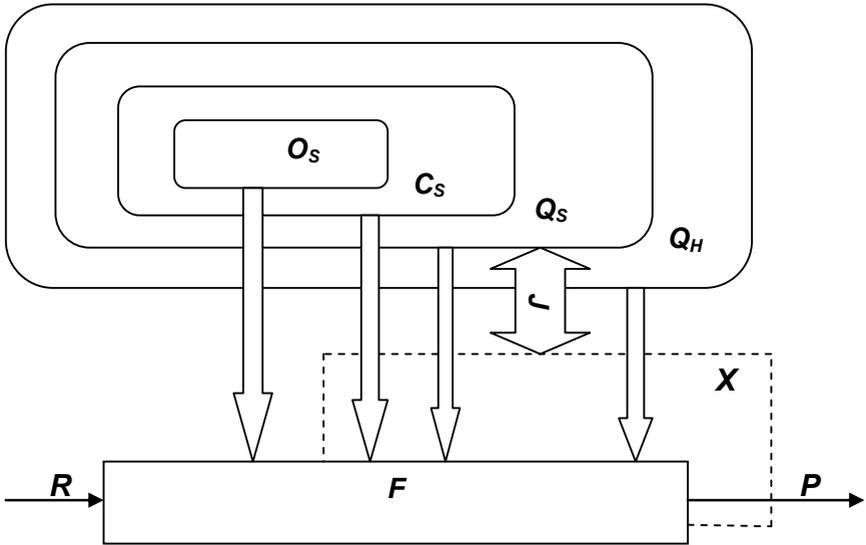
$$X = \{x(k^F_1), x(k^F_2), \dots, x(k^F_n)\} \quad (1.8)$$

In this case, competence is a correspondence of the following form:

$$J = \{(a, x(k^F_i)) \in A \times X \mid x(k^F_i) \in Q_{\mathcal{J}}\}, \quad (1.9)$$

i.e. compliance of competence (as a subject area of an employee) and his level of knowledge in this subject area, which are part of his intellectual potential.

Thus, the obtained distinction between the basic concepts in the field of intellectual potential management of a corporation allows us to find their relationship (Fig. 1),



**Fig. 1.** The scheme relationship between the basic concepts of the sphere of intellectual potential management

where:

- $F$  (employee function);
- $Q_H$  (human potential) represents the potential of the employee,  $Q_S$  (intellectual potential) - the intellectual component of this potential;;
- $C_S$  and  $O_S$  (intellectual capital and intellectual property) - these are control actions or an intellectual (informational) resource for exerting this impact;
- $X$  (competency) corresponds to the head's idea of the employee's performance;
- $J$  (competence).

Thus, to obtain an assessment of the intellectual potential of an employee of a corporation within the framework of the concept of human capital, one can assess the level of his competence  $J$  within the competency  $X$ . It can also be called professional intelligence.

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在柔道多年培训阶段培养模型设定目标  
**TRAINING MODEL SETTING GOALS AT THE STAGES  
OF MANY YEARS OF TRAINING IN JUDO**

**Bagadirova Susanna Kimovna**

*Candidate of Pedagogic Sciences, Associate Professor;*

*Head of the Department of Psychology*

*Adyghe State University*

*Maykop, Russia*

抽象。 该研究分析了我们自己设计的目标设定能力建设模型的关键概念和要素，并在传统的柔道训练系统中进行了测试，特别注意其实际实施规定，包括模型设计要素；目标设定能力建设会议的目标，任务和内容；以及目标设定领域的目标知识库和技能。 通过实际模型试验实验发现新的目标设定能力建设模型是有益的。

关键词：目标设定能力建设模型，柔道

**Abstract.** *The study analyzes the key concepts and elements of the goal-setting competence building model of our own design that was tested within the traditional judo training system with a special attention to its practical implementation provisions including the model design elements; objectives, missions and content of the goal-setting competence building sessions; and the target knowledgebase and skills in the goal-setting domain. The new goal-setting competence building model was found beneficial by a practical model piloting experiment.*

**Keywords:** *goal-setting competence building model, judo*

Rapidly growing competence in the modern sports urges the sport science to explore the ways to mobilize individual mental resource for competitive progress, with the goal-setting competence being ranked among the key elements of such resource. We give a special priority to this competence since it is known to spearhead the athletic training process and effectively develop sport motivations, determination and insistence; and heavily contribute to the competitive performance on the whole i.e. fully mobilize the necessary physical and mental resource for the success. Despite the special attention given by many to the goal-setting competence for the athletic progress, practical trainings to develop this competence are still limited and uncoordinated, and no practical training models to develop the

competence have been offered as yet.

Having analyzed the relevant theoretical and practical studies, we found a shortage of the research provisions for this issue, with the situation seriously complicating the efforts to develop theoretical and practical grounds for the training models to build up the goal-setting knowledge and skills in athletes.

Objective of the study was to develop theoretical and practical grounds for the training models to build up the goal-setting knowledge and skills in athletes, and test benefits of a new goal-setting competence building model to complement the long-term training process in judo.

The goal-setting competence building model was designed on the following practical grounds and concepts. Practical provisions were developed based on the L.S. Rubinstein and A.N. Leontyev's practice-centered approach; L.S. Vygotskiy's interiority ideas; O.K. Tikhomirov's concept of the goal-setting mechanisms; and the V.D. Shadrikov's mental performance system genesis concept in application to a professional service.

The model was designed to: be effectively individualized in the goal-setting competence building process; require high competency of the coaching team for success of the process; be customizable to every stage, goal and mission in the long-term training process; secure high focus on the personal progress/ ontogenesis in the goal-setting competence building process. The model algorithm was also designed to facilitate transition from the external (coach's) assistance in the goal-setting basics learning phase to cooperative trainer-trainee's attempts followed by a self-reliant goal setting activity and mastery.

We believe that any goal-setting competence building model shall be designed with a special attention to the anticipated qualitative and quantitative progress criteria to rate individual age-specific personality progress in a long-term training process.

Our progress analysis of the goal-setting competence ontogenesis showed the adolescent age with its growing socializing activity being the most sensitive period for the trainings, when the adults-assisted progress in the goal-setting domain triggering expected transformations to give rise to the self-reliant development driven by the individual progress objectives and agenda [1].

The goal-setting competence trainings comprise, in our opinion, the key progress tool that needs to be supported by the above practical provisions to facilitate the qualitative and quantitative age-specific transformations at every stage of the long-term training process.

Therefore, we would recommend the primary goal-setting skills being mastered at the judo basics learning stage to later use this background for the fully-fledged goal-setting competence building at the individual resource mobilizing stage.

**Table 2. Phased goal-setting skills and competence building in the training process**

<p>At the <i>judo basics learning stage</i>, the athlete should develop the following goal-setting skills: (1) Progress modeling and forecasting skills with every interim goal clearly spelled out; and (2) Progress tests and analysis</p>	<p>At the <i>individual resource mobilizing stage</i>, the athlete should develop the goal-setting competences in: (1) Theoretical and practical training process goals setting principles and methods; (2) Progress forecasting, managing and testing versus the goals set; (3) Effective selection of the goals attainment methods, with the necessary resource being analyzed and mobilized for success; and (4) Making progress analysis, with the results analyzed versus the plans/ forecasts</p>
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The goal-setting competence building model of our own design was piloted at the Ya.K. Koblev’s Judo Sport School of Olympic Reserve in the Republic of Adygea and Republican Sport Excellence School in Maikop, with the school training curricula complemented by the model testing experiment. Sampled for the study were the judo basics learning groups (n=126) and individual resource mobilizing groups (n= 92) whose progress was tested by the N.M. Peysakhov Self-Control Skills Test for adolescents. The adolescent self-control ability (with the goal-setting competence being its core part), in the N.M. Peysakhov’s opinion, may be classified into the following eight elements: contradictions analysis; progress forecast; goal setting; planning; progress rating criteria; decision making; self-control and tests; and corrections.

**Table 3. Training program**

<b>Judo basics learning stage</b>	<b>Individual resource mobilizing stage</b>
<p><i>Objective:</i> develop goal-setting skills <i>Missions:</i> 1. Improve motivations for goal-setting knowledge to facilitate progress in this domain. 2. Develop informed planning/ progress programming abilities. 3. Develop process modeling and progress rating skills</p>	<p><i>Objective:</i> develop goal-setting competences/ <i>Missions:</i> 1. Improve motivations for goal-setting knowledge to facilitate progress in this domain. 2. Shape up the knowledgebase for successful goal setting and attainment process 3. Master goal setting concepts and technologies.</p>
<p>Session 1: Short- and long-term goals Session 2: Interim and final goals Session 3: Team and individual goals Session 4: Progress rating methods</p>	<p>Session 1: Goal setting as a part of self-control Session 2: Goal setting methods Session 3: Goal setting tools Session 4: Goal attainment</p>

The pre-experimental tests unsurprisingly rated the judo basics learning groups with poor self-controls (with the goal-setting competence as its core element) – since this age group is known to mismatch own ambitions versus actual capacities [2]. The individual resource mobilizing groups were tested (by the pre-experimental Peysakhov Self-Control Skills Test) with average self-control on every scale, and we believe this level is by far short for the highly competitive sport [3]. The practical training phase of the model testing experiment included the theoretical and practical training modules with the progress rated by individual tasks/ exercises.

The pre- versus post-experimental objective progress tests showed progress of the judo basics learning groups from the poor to moderate levels, with the statistically significant growth tested on every test scale. The goal-setting competence building model, hence, was found beneficial as the athletes mastered the progress modeling and success forecast skills; and developed the abilities to analyze the achievements versus goals [2].

The pre- versus post-experimental tests of the individual resource mobilizing stage groups showed the statistically significant progress from the moderate to high goal-setting competences on every test scale, with the athletes demonstrating high motivations for the goal-setting; good knowledge of the goal setting concepts and technologies; abilities to design and manage own performance for success; find solutions and manage the progress; analyze, mobilize and control the available resource; and analyze the results versus the plans [3].

The study demonstrates benefits of the new goal-setting competence building model that successfully develops the volitional qualities and self-controls, gives special knowledge, skills and competences – that cannot be expected to grow naturally without special focused trainings. It was also demonstrated that the goal-setting competences need to be cultivated by reasonably staged trainings. We believe that the new goal-setting competence building model and its test data may be highly beneficial for sport science on the whole and practical training systems in different sports in particular.

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城市环境中户外广告感知的特征 (世界评论)

## THE FEATURES OF OUTDOOR ADVERTISING PERCEPTION IN URBAN ENVIRONMENT (WORLD REVIEW)

**Vorozheykina Vera Alexandrovna**

*Associate Professor*

*Department of communication design and graphics*

*Novosibirsk state university of architecture, design and art*

**Cherkasova Darya Konstantinovna**

*student*

*Department of communication design and graphics*

*Novosibirsk state university of architecture, design and art*

抽象。在本文中给出了户外广告的世界经验。我们考虑了世界上大约十个城市。在每一个中我们都发现了放置户外广告的特征。广告图像及其颜色特征根据在一个或另一个城市中普遍存在的因素的范围而彼此不同。作者考虑了亚洲和欧洲一些城市户外广告应用的特点,广告画面实现的特点,观众的感知以及广告建构与空间城市环境因素的相互作用。

关键词: 设计师, 投影广告, 城市环境, 色彩理论, 户外广告, 平面广告。

**Abstract.** *There is a world experience of the placing of the outdoor advertising given in this article. About ten cities of the world were considered by us. In each one we have found the features of the placing of outdoor advertising. Advertising image and its color features differ from each other according to the range of factors, prevailing in one or another city. The authors consider the features of application of outdoor advertising in some cities of Asia and Europe, the character of the advertising picture realization, its perception by the viewer and the interaction of advertising construction with the elements of spatial urban environment.*

**Keywords:** *designer, projection advertising, urban environment, color theory, outdoor advertising, print advertising.*

Advertising image undoubtedly has either good or bad influence on the viewer. Its main purpose is to attract an attention of the potential consumer, motivate him or her to do some necessary actions. There is its unique image of the outdoor advertising in every country of Eurasia, which fits into the architectural space or brings disharmony into it. The matching of the image with the cultural values of the inhabitants plays a very important role. Not each advertising image can be perceived positively by different nations. By saying advertising image, we imply “means of visual communication, which gives new information about the product to the potential customer using the system of visual-expressive means”. [1]

The developing of the advertising in Europe goes faster than in Asia. The problem is in fact that usually outdoor advertising has bad influence on the spatial and architectural environment, changes it, or even harm mental health of the locals. Advertising message can be perceived by a consumer differently depending on the consumer's age and education. The elder generations can take the advertising message negatively or don't get its sense at all because of their established preferences. The younger generation is more loyal to the new information and the images they see in advertising can affect to some of their life attitudes.

M. V. Baranova describes advertising as a cultural phenomenon in her dissertation. Also she defines factors, which affect to its perception. The first one is common for all civilizations. It includes the hedonistic ideal of the humanity, the pursuit of comfort and convenience, which promotes technical progress. The second one is theoretical and practical. It applies to modern conditions. [2] N. E. Eroschenkova says in her dissertation researches, that the advertising is an integral part of the social communication system and urban social and cultural environment. The image of advertising has common and specific qualities connected with information and propaganda, society and culture. The national and cultural context is quite important among them. [3]

Due to the living standards and cultural traditions, there is the range of strict limits in Europe, which refers to the outdoor advertising. The European experience shows, that the commercial informing is not as important as the cultural appearance of the city and its preserving. There is the design-code, which prescribes some advertising setting exact rules. For example, advertising can be set on a special pedestal, which fits into the city environment harmoniously.

Design of some poster pedestals in Paris (France) repeats the urban architectural environment, so the outdoor advertising is fitted into the environmental space harmoniously (Ill.1). It complements the whole picture of the street, as well as the harmoniously mixed details in the outfit of the stylish person. The image of the advertising itself is made up on the basis of rules, such as, for example, using a certain font style and color color scheme.

During the USSR period, the advertising setting on the poster pedestals was usual in Soviet Union countries. After the fall of the "iron curtain" the appearance of the advertising campaign was spontaneous, so the advertising image often was borrowed by means of blind coping (Ill.2).

Unlike European countries, where all the innovations were set gradually in order to preserve the cultural heritage, the same process in Russia included chaotic outdoor advertising, especially in cities without metropolitan status. There is the direct dependence of advertising on monetary equivalent, so in some Russian advanced cities we can see almost total ban on the outdoor printing design and following the trends of the West. Since the 80s printing advertising has been replaced by multimedia advertising, which is mobile enough, unlike the previous one.



*III. 1. A poster pedestal in Paris*



*III. 2. An outdoor advertising in Moscow*

The widescreen advertising in today Europe is a relic of the past. It is represented in smaller quantities than in Russia. All the advertising standards are ordered by public policy. The tendency to get rid of the visual noise appears together with traditional aspiration for clean, minimalism and order. Finish design obeys the rule “less means more”. It is known that the advertising signs are only allowed in Finland. (III.3)



*III. 3. One of Finnish streets*



*III. 4. Outdoor advertising in Japan*

J. - M. Dru, who is one of world famous advertiser, describes his experience of the advertising investigation. He explored its features in different countries. He concluded, that the advertising image depends on the country culture directly. Also he noticed, that it can be affected by complex political and cultural factors as well as by geographical position. J. - M. Dru says, that each country has individual design product, despite the same design tools and the same type of the preparing program used to teach advertising specialists all over the world. He mentions, that the French advertising image is usually presented by symbols and compares French approach with Japanese. [4]

As for the Asian economically developed countries, there you can see the mix of traditions and innovations. It is known that Japan is famous for its ideographic writing traditions, so advertising image can make up some symbols, which have lots of meanings and can be conjectured by viewers (III.4).

The advertising image in Thailand, with its plenty of bright and motley colors and specific architecture, contrasts with strict European conservatism. Advertising images there are full of spectral colors, but it matches to the architectural and spatial environment of Thailand cities (III.4).



*III. 5. Thailand outdoor advertising*



*III. 6. Afghanistan outdoor advertising*

The dependence of advertising elements appearance on monetary component exists in less developed countries, too. The example is Afghanistan, where the poor cities are full of outdoor advertising. The advertising placement order is not followed there. There are lots of national colors and usually there is a ban on the image of people in local advertising images (III.6).



*III. 7. Novosibirsk (Russia) outdoor advertising*



*III.8. Novosibirsk (Russia) outdoor advertising*

There are a lot of different advertising constructions in Siberia, such as billboards, city boxes, firewalls, roof panels, pillars, advertising stands, superboards, arches, pennants, signboards, light boxes, electronic displays, city formats advertising (III.7-8). The advertising constructions themselves are usually gray or black. If their setting was based on the design-code, they can stay unchanged during some years. Russian cities have a specific continental climate with clear change of seasons, so the transformation of some advertising messages can depend on a season. We can see the advertising with school uniform and autumn leaves on its background in the beginning of September, while the advertising of warm coats will appear in winter. So we can see, that the season of year can change not only the weather, but also a psychological condition of local people. That is why the advertising message will change the character of its graphic image, too.

J. - M. Dru wrote: “Advertising ads are the mirror of the society”. Advertising message forms by means of composition, font and color. These means are unique for each culture. The images of the outdoor advertising should be perceived in good way by locals and not to be harmful for their psychological condition at the same time. There is the advertising renouncement trend in some big cities due to the fact that the huge quantity of advertising elements, set too close to each other, do not do their job and make the “visual noise”. Some of the advertising messages we have seen we made up unprofessionally. It is hard to read them and their simplicity, ordered by customers, is extra and annoying.

Lots of advertisers want their ads to be set in the most popular places of the city, so one advertising construction can include different advertisements, which belong to different owners. There are lots of buildings nearby the highways or the roads significant for the city, which are full of outdoor advertising. Usually the color specific of the surrounding advertising production is not taken into account so it destroys the integrity of the architecture perception [5]. The distraction of color harmony spoils the advertising aesthetics and reduces its informative function. The advertising on the architectural constructions usually takes big spaces. Also it can be hard to read from short distances. At the same time the graphic image looks like a color spot from the long distance. The mix of the chaotic color combinations has a bad influence on the psychological condition of the inhabitants.

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现代信息社会中虚拟人格现象

**THE PHENOMENON OF A VIRTUAL PERSONALITY  
IN A MODERN INFORMATION SOCIETY**

**Bizyukova Maria Sergeevna**

*Senior Lecturer*

*Moscow State Pedagogical University*

抽象。 本文致力于研究在信息社会框架下出现的虚拟人格现象。 文章揭示了现代人格在信息社会中的适应性问题，虚拟化过程的具体情况，以及社会网络作为虚拟人格形成的实际空间的考虑。

关键词：信息社会，社会虚拟化，虚拟现实，虚拟人格，社交网络，自我实现。

**Abstract.** *The article is devoted to the consideration of the phenomenon of virtual personality arising in the framework of the information society. The article reveals the issues of adaptation of a modern personality in the information society, the specifics of the virtualization process, as well as the consideration of social networks as an actual space for the formation of a virtual personality.*

**Keywords:** *information society, virtualization of society, virtual reality, virtual personality, social networks, self-realization.*

The rapid transformation of everyday practices in connection with the impact of developing information and communication technologies is becoming increasingly relevant and affects the essence of modern sociocultural space. Every day, we feel fundamental changes in the production, consumption and dissemination of information, which leads to significant changes in all areas of public life, transforming the specifics of communication. There is a process of informatization of space, which, of course, has a significant impact on education, culture, social sphere, etc.

As the American political scientist Zbigniew Brzezinski noted: “A post-industrial society is becoming technotronic, i.e. a society that in cultural, psychological, social and economic relations is formed under the influence of technology and electronics, especially developed in the field of computers and communications.” [1, p. 94]. Technotronic qualitative changes leave their mark on the character of imaginative perception of reality. The new generation is experiencing and creating the world thanks to visual communications, which speak of the destruction in the information society of the system of traditional intergenerational transfer of knowledge, namely the interpretation of the sociocultural space, based on reading and research on cultural values.

American sociologist S. Lash in the work "Criticism of information" [6, p. 99]. describes the specifics of the modern information society and speaks of the birth of new patterns of production, distribution and exchange, in which information is constantly streamlined by the intellectual property system. S. Lash concludes that the new social reality is characterized by uncertainty and even irrationality. The reason for this is information as such, which becomes not just a value of the modern era, but a fetish of modern society.

The sociocultural environment, value systems, the information and communication space itself are transforming. Recently, it is difficult to imagine our existence without the Internet, including without network communities in the Internet. Social networks now play an important role and are an integral part of human life, both professional and private. Information technology, the Internet and social networks as a component of objective reality affect the individual in different ways, changing everyday practices and crowding out the usual forms of work, communication and entertainment.

There is a substitution of real actions, feelings and emotions, that is, the replacement of the real with virtual. Such a replacement includes an increasing number of different phenomena: the process of cognition and emotional states, communication and self-realization, the process of real communication between people is gradually turning into communication between images that may absolutely not correspond to their carriers. The culture of modern space is increasingly acquiring a virtual character, starting not to reflect, but to simulate reality.

It should be noted that in modern society the tendency of virtualization, that is, replacing the real with the virtual is clearly manifesting itself. Such a replacement includes an increasing number of different phenomena: the process of cognition and emotional states, communication and self-realization, the process of real communication between people is gradually turning into communication between images that may absolutely not correspond to their carriers. The culture of modern space is increasingly acquiring a virtual character, starting not to reflect, but to simulate reality.

There is a virtualization of society as a whole, as well as an individual. It is difficult to disagree with D. V. Ivanov [3, p. 355], a domestic researcher developing the topic of society virtualization and simulation processes in modern society, that the implementation of modern information technologies leads to a focus of social conflicts and changes, the focus of which is moving into the cultural sphere, resulting in the development of new and decline in cultural results. D.V. Ivanov notes that "Modern society is structured by the will for virtuality." [2, p. 75].

The Italian sociologist Franco Ferrarotti noted that the man of the information society is immersed in virtual reality and is increasingly moving away from his cultural level. Virtual reality becomes not just a mediator in a person's relationship with the world, but often replaces it, becoming the exclusive environment of human life, as a result of which a person gains a greater degree of freedom, which he realizes in virtual reality.

In the framework of the virtualization of modern society, visibility becomes an essential factor in the construction of any social practices: social interaction, socialization, as well as socio-cultural self-identification of a person. The cultural identity of a modern person is formed under the influence of visual content, due to the dominance of visual images, through the playing of roles and imitation of Others and an ideal project of oneself constructed in a real image and likeness.

Our everyday reality is now determined by large volumes of user content, the emergence of new social networks and various virtual communities, the emergence of new communication gadgets that open up a new visual virtual space. The age of information technology, when information and communication come to the fore, places high demands on the internal potential of a person, first of all, on its intellect, creative abilities, desire and ability to realize its abilities. And modern communicative virtual platforms, namely social networks allow them to realize their capabilities.

Thus, the most important issue of the modern global space is the problem of adapting the modern personality to the information space, the formation of personality, the problem of self-identification and the emergence of a virtual personality, which is a projection of real identity.

The individual's contacts with the modern world of technology remove him from personal real contact with the outside world, which leads to the separation of personality, its departure into virtuality and the transfer of his psycho-emotional sphere of life to the virtual space of social networks. Currently, social networks represent a new space for self-realization, where a person represents himself as an actor of everyday reality, revealing his creative potential. Currently, there is no doubt that the use of information technology and being on social networks leads to significant changes in personal development, in the human psyche, transforming motivational processes, consciousness, activity and interpersonal relationships. The owner of the page himself constructs his image, collecting it from his impressions, fantasies, ideas about himself, the opinions of others and the expectations of society. Social networks are a platform for the emergence of a virtual personality, where a modern person must "experiment" with his own identity for full adaptation to modern space. "Experimental" self-realization takes place in a virtual communicative space, which affects self-realization outside of social networks, in reality. Taking successful pictures, choosing the most successful camera angles for

photographs, a modern person captures his ideal self forever, making sure that this ideal image - is the ideal image of a real person. This is an attempt to again, successfully go through the process of becoming a person, re-fill oneself with meaning, re-construct his body in reflection. Own "I" is constructed using a personal home page on social networks.

Jürgen Habermas argues that the determining technique is language, so that when mastering techniques, a person strives to comply with social norms, preserving his originality: "A person's understanding of himself depends not only on how he describes himself, but also on those patterns that he follows. The self-identity of the "I" is determined simultaneously by how people see themselves and how they would like to see themselves." [5, p. 235]. A "virtual self" can be created in order to acquire a new experience - in this context, the concept of "experimenting with identity" is most appropriate.

A network identity that differs from a real identity not only expresses something already in the person, but may also be a desire to experience something that has not been tested before. It is known that the desire for such experimentation with identity, the desire to try yourself in more and more new roles, to acquire new experiences - is a feature of open identity, that is, such a state of identity, which is characterized by a search for alternatives for further development [4].

We can conclude that the virtual projection of the personality and the real self of the personality are elements that mutually condense each other. The process of self-determination of a person and gaining a virtual identity very soon begins to affect the real person. A real user becomes dependent on his virtual projection, expanding knowledge about the world around him, broadcasting certain social norms and values, models of social behavior and rules of interaction.

The information society provokes the development of virtual identity, and the virtualization of the personality directly affecting the information society accelerates and complicates the process of informatization. Thus, the communicative reality of social networks today has acquired a socializing function and the emergence of a virtual personality can be considered as a positive result of the adaptation of a person in a super-informational technological space.

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纠正二氢槲皮素对Khanty-Mansiysk自治区城市居民氧化代谢状态的影响，管道  
水处理质量低

**CORRECTING INFLUENCE OF DIHYDROQUERCETIN  
ON THE STATE OF OXIDIZING METABOLISM  
AT PERSONS RESIDENT IN THE CITIES OF KHANTY-MANSIYSK  
AUTONOMOUS OKRUG WITH LOW QUALITY  
OF PLUMBING WATER TREATMENT**

**Minyailo Larisa Anatol'evna**

*Deputy head physician*

*Federal budgetary health institution*

*"Center for Hygiene and Epidemiology in KMAR-Ugra"*

**Korchina Tatyana Yakovlevna**

*Doctor of Medical Sciences, Full Professor*

*Professor at the Department of medical and biological chemistry*

*Budget institution KMAO-Ugra*

*"Khanty-Mansiysk State Medical Academy"*

**Korchin Vladimir Ivanovuch**

*Doctor of Medical Sciences, Full Professor*

*Head of the Department of normal and pathological physiology*

*Budget institution KMAO-Ugra*

*"Khanty-Mansiysk State Medical Academy"*

抽象。 Khanty-Mansiysk自治区(KMAO, Tyumen Oblast)的天然水域的特征是Fe和Mn含量增加(分别比最大允许浓度高2.6和1.7倍)。在KMAO城市(Nyagan, Nefteyugansk)的71名居民中,水处理质量差(自流水用氯消毒),先前确定了脂质过氧化(LPO)指标:脂质氢过氧化物 - HPL和硫代巴比妥酸活性产品 - TBA-AP,结果证明超过了生理价值的上限。抗氧化防御系统(ADS)的指标:总抗氧化活性 - TAA和硫醇状态 - TS低于参考值的下限。发现氧化应力系数(COS)超过最大允许水平上限的6.7倍以上。为了代谢校正的目的,所有检查的个体服用植物来源的抗氧化药物 - 二氢槲皮素(DHQ),剂量为60mg /天,持续30天。校正后,LPO产品的平均显著性( $p < 0.001$ )减少1.3倍,OAA增加2.3倍( $p < 0.001$ ),相对于COS的显著降低,TS增加近1.2倍。超过4.7次( $p < 0.001$ )。

因此,天然抗氧化剂二氢槲皮素以60mg /天的剂量摄入一个月有助于降低LPO产品的含量,降低COS,并且增加了居民体内防御的ADS活性。 KMAO城市的水处理质量差。

关键词: 北方地区, 饮用水, 氧化应激, 二氢槲皮素。

**Abstract.** *The natural waters of the Khanty-Mansiysk Autonomous Okrug (KMAO, Tyumen Oblast) are distinguished by an increased content of Fe and Mn (2.6 and 1.7 times higher than the maximum permissible concentration, respectively). In 71 residents of KMAO cities (Nyagan, Nefteyugansk) with poor-quality water treatment (artesian water is disinfected with chlorine), lipid peroxidation (LPO) indicators were previously determined: lipid hydroperoxides - HPL and thiobarbituric acid active products - TBA-AP, which turned out to exceed the upper limit of physiological values. Indicators of the antioxidant defense system (ADS): total antioxidant activity - TAA and thiol status - TS were below the lower boundary of the reference values. It was found that the coefficient of oxidative stress (COS) exceeded by more than 6.7 times the upper limit of the maximum allowable level. For the purpose of metabolic correction, all examined individuals took an antioxidant drug of plant origin - dihydroquercetin (DHQ) at a dose of 60 mg / day for 30 days. After correction, a statistically significant ( $p < 0.001$ ) decrease of 1.3 times in LPO products and a 2.3-fold increase ( $p < 0.001$ ) of OAA, an increase in TS of almost 1.2 times against the background of a significant decrease in COS of more than 4.7 times ( $p < 0.001$ ).*

*Thus, the intake of the natural antioxidant dihydroquercetin for a month at a dose of 60 mg / day contributed to a decrease in the content of LPO products, a decrease in COS, and an increase in the ADS activity of the body's defense in residents of KMAO cities with poor-quality water treatment.*

**Keywords:** *northern region, drinking water, oxidative stress, dihydroquercetin.*

**Introduction.** The main sources of drinking water supply in the settlements of the Khanty-Mansiysk Autonomous Okrug (KMAO), which is part of the Tyumen region, are groundwater. The two largest cities of the okrug: Surgut and Khanty-Mansiysk are provided with drinking water after high-quality cleaning (deferrization by deep aeration and disinfection using UV). In other KMAO settlements, including the cities of Nyagan and Nefteyugansk, underground water is only disinfected with the addition of chlorine compounds. Along with food, water is one of the links in the nutritional chain through which chemical elements enter the human body. Studies of tap water, conducted in the cities of Nyagan and Nefteyugansk, showed a significant excess of the MPC: iron (Fe) 2.6 times, and manganese (Mn) 1.7 times [3].

Studies have established that with the excessive intake of heavy metals (Fe and Mn) into the human body, in order to preserve the internal environment of the body, it is able to mobilize internal reserves to a certain limit. However, after some time, a violation of homeostasis occurs. It is important to note that an indicator of the degree of adverse effect of a chemical on the human body is its concentration in tissues, reflecting its content in the environment [8].

The most important cause of the toxic effects of heavy metals, in our case Fe and Mn, is the oxidative stress they initiate, which contributes to the production of an increased amount of reactive oxygen forms (ROF), which triggers the LPO process of cell membranes. The activity of the antioxidant system (ADS) of the body can be different depending on the strength and exposure of the prooxidant factor, as well as the initial state of the body and the presence of optimal amounts of antioxidants [5].

The availability of food antioxidants to a large extent determines the functional state of the antioxidant defense system. The best known exogenous nutritional antioxidants are vitamins and flavonoids. Flavonoids and vitamins are an extensive group of biologically active compounds with antioxidant effects. Phytopreparations (in our study dihydroquercetin - DHQ), in comparison with synthetic counterparts, have a milder therapeutic effect, their structure is similar to metabolites of endogenous origin, which allows the human body to successfully include phytopreparations in the metabolism. The advantages of DHQ are: safety of use, the absence of adverse reactions, a high degree of antioxidant activity, a wide spectrum of action (detoxification, radioprotective, anti-inflammatory, antihypoxic, hepatoprotective, etc.) [4].

**Goal:** to study the effect of dihydroquercetin on the antioxidant system in residents of the cities of the Khanty-Mansiysk Autonomous Okrug using low-quality drinking water.

**Materials and methods.** Conditionally healthy residents of KMAO cities with poor-quality water treatment (Nyagan, Nefteyugansk) were examined - 71, of which 29 (40.8%) were men and 42 (59.2%) were women, the average age was  $38.3 \pm 8.9$  years. This study was conducted in compliance with the requirements of biomedical ethics and was accompanied by voluntary written informed consent of the subjects.

Previously, we determined the parameters of LPO and ADS: LPO products: lipid hydroperoxides (HPL) and thiobarbituric acid active products (TBA-AP) using test kits from "BCM Diagnostics"(Germany) and "AGAT" - (Russia). Determination of the state of total antioxidant activity (TAA) and thiol status (TS) was carried out using commercial kits from "Cayman Chemical", "Immundiagnostik AG" - (Germany) on an automatic biochemical analyzer from "AU - 680 Beckman Coulter"- (USA) and "Konelab 60i" (Finland). The oxidative stress coefficient (COS) was calculated by the formula:  $COS = HPL \times TBA-AP / TAA \times TS$  [6].

For the purpose of metabolic correction, all examined residents of Nyagan and Nefteyugansk took an antioxidant drug of plant origin - Baikal dihydroquercetin, (state registration certificate № RU. 77.99.88.003.E.002700.06.17; TU 10.89.19-001-168222879-2017), LLC "KAKHOR-PRODUC" Russia, Irkutsk Oblast, Zima at a dose of 60 mg/day for 30 days.

The resulting digital material was processed using MS Excel and STATISTICA 8.0. The arithmetic mean (M), standard deviation ( $\sigma$ ), minimum (min) and maximum (max) values were calculated. The significance of differences in the studied parameters was analyzed using the Student-Fisher criterion: differences at  $p < 0.05$  were taken as reliable.

**Results and discussion.** As can be seen from the table, the intake of DHQ for 1 month contributed to an almost 1.3-fold decrease in the LPO products of both primary (HPL) and secondary (TBA-AP) in the examined individuals of Nyagan and Nefteyugansk, which was evidence of the antioxidant spectrum of action this flavonoid.

**Table**

*Indicators of lipid peroxidation and antioxidant activity after correction with dihydroquercetin in residents of Nyagan and Nefteyugansk*

indicator	physiologically optimal values	surveyed residents of KMAO cities with poor quality water treatment (n = 71)				p
		before correction		after correction		
		M $\pm\sigma$	min $\leftrightarrow$ max	M $\pm\sigma$	min $\leftrightarrow$ max	
HPL, $\mu\text{mol/l}$	225-450	486,7 $\pm$ 66,1	242 $\leftrightarrow$ 1165	380,2 $\pm$ 51,8	338 $\leftrightarrow$ 427	p=0,207
TBA-AP, $\mu\text{mol/l}$	2,2-4,8	5,4 $\pm$ 1,3	4,72 $\leftrightarrow$ 5,96	4,2 $\pm$ 1,9	2,9 $\leftrightarrow$ 4,8	p=0,449
COS, cu	1,6-2,3	15,5 $\pm$ 1,5	4,7 $\leftrightarrow$ 17,1	3,3 $\pm$ 0,5	1,6 $\leftrightarrow$ 4,5	<b>p&lt;0,001</b>
TAA, $\mu\text{mol/l}$	0,5-2,0	0,41 $\pm$ 0,07	0,32 $\leftrightarrow$ 0,49	0,96 $\pm$ 0,05	0,58 $\leftrightarrow$ 1,32	<b>p&lt;0,001</b>
TS, $\mu\text{mol/l}$	430-660	412,6 $\pm$ 72,3	234 $\leftrightarrow$ 634	498,7 $\pm$ 69,1	343 $\leftrightarrow$ 599	p=0,391

Iron is an essential chemical element, the main role of which is participation in many redox reactions of the body and providing the human body with oxygen (96% of the iron is in the blood). It has been proven that both deficiency and excess Fe have a negative effect on human health. Studies have established that an excess of Fe entering the human body with food in a chelated state does not have a negative effect. Moreover, Fe, which enters the human body in combination with other pollutants, exhibits the properties of a prooxidant and an immunosuppressant [9]. According to generally accepted ideas, one of the main mechanisms of toxicity of Fe ions is the catalysis of the decomposition of  $\text{H}_2\text{O}_2$  (Fenton reaction):  $\text{Fe (II)} + \text{H}_2\text{O}_2 \rightarrow \text{Fe (III)} + \text{OH} + \text{OH}^-$ . In this reaction, the formation of a hydroxyl radical (OH) occurs, which has a very high reactivity and is able to induce the oxidation of proteins, lipids, nucleic acids and other biologically important molecules [11]. Iron chelating agents, such as DHQ, lead to a decrease in the concentration of catalytically active Fe (II) ions, which prevents the development of oxidative stress [2].

Manganese is a vital trace element involved in blood coagulation, regulation of bone and connective tissue metabolism, and is a cofactor of enzymes: transferase, hydrolase, lyase, superoxide dismutase, arginase, glutamine synthetase. However, excessive intake of Mn into the body disrupts the functioning of the blood system, immune, bone and excretory systems, gastrointestinal tract, potentiate metabolic disturbances, damage to the central nervous system and oxidative stress. Strengthening the LPO processes and reducing the antioxidant defense of the body contributes to the development of oxidative stress, which underlies the pathogenesis of more than 100 diseases, which can cause an increase in the incidence in residents who drink drinking water of a similar mineral composition [10].

Excessive accumulation of free radicals in the body is one of the causes of premature aging and the development of many human diseases. The concentration of free radicals in the body increases due to a decrease in the activity of the human antioxidant system caused by various factors, including heavy metal loading, the use of poor-quality drinking water, unbalanced nutrition, etc. [6].

The results of a study of the state of ADS showed a significant 2.3-fold increase in total antioxidant activity ( $p < 0.001$ ) and an increase in thiol status by almost 1.2 times in the Okrug population living in Nyagan and Nefteyugansk after taking DHQ for 1 month. It is noteworthy that during the initial examination of the residents of Nyagan and Nefteyugansk, the average LPO values exceeded the upper limit of physiologically optimal values. At the same time, the results of a study of ADS protection activity revealed that the average TAA and TS values for residents of cities with poor-quality water treatment before DHQ intake were less than the lower boundary of the reference values (table).

After correction of DHQ in residents of KMAO cities with poor-quality water treatment, the average values of both LPO and ADS values began to correspond to physiologically adequate indicators. However, the most significant changes we observed in respect to COS: after DHQ correction in the examined individuals of Nyagan and Nefteyugansk, the COS value decreased almost 4.7 times ( $p < 0.001$ ), but still turned out to be higher than the upper limit of the reference values (table).

Along with objective biochemical indicators of metabolic improvement in the examined individuals living in cities with poor-quality water treatment, we also evaluated the effectiveness of DHQ for 30 days using a questionnaire on the quality of their life. After correction, adult residents of the cities of Nyagan and Nefteyugansk noted a clear improvement in well-being, expressed in increased working capacity, normalization of blood pressure, improved sleep, lack of headache, irritability, eye inflammation, etc.

Our data are consistent with the results of studies by other authors, who in experimental and clinical observations revealed that dihydroquercetin has a modulating effect on the basic components of ADS, inhibiting the accumulation of reactive oxygen forms and increasing the body's resistance [1, 7]

Thus, during the study it was found that taking dihydroquercetin for one month contributed to the manifestation of a corrective effect, namely, a decrease in the content of molecular products of LPO, a decrease in the coefficient of oxidative stress and an increase in the activity of ADS defense of the body. This testified to the restoration of the adaptive resources of the body and an increase in its resistance to the action of exogenous toxicants. It is noteworthy that this biologically active supplement not only inhibited the processes of excessive lipid peroxidation, but also contributed to the activation of the conjugated components of the universal cellular antioxidant system, primarily the detoxification system.

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白藜藜草综合质量评价研究  
**RESEARCH ON COMPREHENSIVE QUALITY ASSESSMENT  
OF TRIBULUS TERRESTRIS GRASS**

**Affouf Abdulkarim**

*postgraduate*

*Perm State Pharmaceutical Academy of the Ministry of Health of Russia*

**Blinova Olga Leonidovna**

*Candidate of Pharmaceutical Sciences, Associate Professor*

*Perm State Pharmaceutical Academy of the Ministry of Health of Russia*

**Belonogova Valentina Dmitrievna**

*Doctor of Pharmaceutical Sciences, Full Professor*

*Head of Department*

*Perm State Pharmaceutical Academy of the Ministry of Health of Russia*

注解。对Tri藜藜草进行了药效学研究。选择提取剂以确定Tri藜藜草中提取物的含量。根据“用50%乙醇提取的提取物的含量”评估原料样品的质量。所进行的研究用于制备俄罗斯联邦国家药典的药草文章“Tri藜藜草”，“测试”部分，其中我们建议将“采收物质的含量”列入50%乙醇不低于16%。

关键词: 白Tri藜藜, 药用植物材料, 草, 提取物。

**Annotation.** *A pharmacognostic study of Tribulus terrestris grass was conducted. An extractant was selected to determine the content of extractive substances in the Tribulus terrestris grass. The quality of raw material samples was assessed according to the «content of extractives extracted with 50% ethanol». The conducted studies were used in the preparation of the draft pharmacopeia article «Tribulus terrestris grass» for the State Pharmacopoeia of the Russian Federation, the «Tests» section, in which we propose to include the indicator «The content of extractive substances recovered by 50% ethanol is not less than 16%».*

**Key words:** *Tribulus terrestris L., medicinal plant material, grass, extractive substances.*

Tribulus terrestris grass (producing plant Tribulus terrestris L., family Zygophyllaceae) comprises a complex of biologically active substances (steroidal saponins: dioscin, protodioscin, tribestin, prototribestin, metilprotoribestin, metilprotodioscin, pseudoprotodioscin, tribulozin etc., flavonoids, phenol - carboxylic acids, alkaloids, carotenoids, higher fatty acids) [7]. The Bulgarian company AO

«Sopharma» produces preparation Tribestan [5] from the *Tribulus terrestris* grass, which has a general tonic effect and stimulates the functions of the reproductive system. In men, it restores and improves sexual libido, prolongs the time of an erection. Stimulates spermatogenesis, increasing sperm count and motility. It has a lipid-lowering effect [2,3,4]. The preparation is a dry extract of *Tribulus terrestris* grass, which is obtained by extraction of raw materials with 70% ethanol, while only saponins (furostanol glycosides) are maximally extracted. Evaluation of the quality of the preparation, as well as the raw materials themselves, is carried out according to the content of furostanol glycosides [1]. In this regard, it is advisable to develop an indicator for assessing the quality of raw materials for the content of a complex of biologically active substances.

The purpose of the work is the development of an indicator for assessing the quality of *Tribulus terrestris* grass by the content of extractive substances.

#### MATERIALS AND METHODS

Objects of study - grass specimens of *Tribulus terrestris* collected in the Republic of Moldova, Krim, Syria and the Botanical Garden VILAR during 2016 - 2018.

Extractives were determined by the method of the general pharmacopoeial article OFS.1.5.3.0006.15 «Determination of the content of extractive substances in medicinal plant materials and medicinal plant preparations» GF XIV method 1, given that medicinal plant materials are used to obtain the extract [6].

#### RESULTS AND DISCUSSION

The choice of extractant was established on the combined sample obtained by mixing in equal amounts of these samples. To select the extractant used: purified water, ethanol 50, 70, 80, 90 percent concentration.

Studies on the choice of extractant showed that the maximum amount of extractives is extracted with 50% ethanol (Table 1), therefore this extractant was used subsequently in the development of a quantitative determination of extractives in the studied samples.

**Table 1**

*The choice of extractant to determine the content of extractive substances in *Tribulus terrestris* grass*

№	Extractant	The content of extractives, %
1	purified water	25,28 ± 0,05%
2	ethanol 50%	26,79 ± 0,03%
3	ethanol 70%	24,12 ± 0,09%
4	ethanol 80%	22,36 ± 0,04%
5	ethanol 90%	16,81 ± 0,09%

The next stage of the study was the determination of the content of extractive substances extracted with 50% ethanol in the studied samples (Table 2).

**Table 2**  
*The content of extractive substances extracted with 50% ethanol in samples of Tribulus terrestris grass*

№	Sample	The content of extractives,%
1	Russian Federation, Krim, Laspi bay, peak of mount Kushkaya, 2017	22,58 ± 0,07
2	Republic of Moldova, surroundings Chisinau city, 2017	22,06±0,06
3	Russian Federation, Moscow Botanical Garden VILAR, 2016	16,62 ± 0,03
4	Syria, surroundings of Damascus city, 2018	16,13 ± 0,04

In this way, studies on a comprehensive assessment of the quality of *Tribulus terrestris* grass by the content of extractive substances showed that the maximum amount of extractive substances is extracted with 50% ethanol. To assess the quality of medicinal plant raw materials of *Tribulus terrestris*, we suggest using method 1 GF XIV OFS.1.5.3.0006.15 «Determination of the content of extractive substances in medicinal plant raw materials and medicinal herbal preparations».

The conducted studies were used in the preparation of the draft pharmacopoeial article for the State Pharmacopoeia of the Russian Federation, the section «Tests», in which we propose to include the indicator «The content of extractive substances extracted with 50% ethanol is not less than 16%».

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“Niacid-granules plus” 产品和 “Bioactive keratin”  
含硫饲料添加剂的安全性评估

**SAFETY ASSESSMENT OF THE "NIACID-GRANULES PLUS"  
PRODUCT AND THE "BIOACTIVE KERATIN"  
SULFUR-CONTAINING FEED ADDITIVE**

**Esepenok Konstantin Viktorovich**

*Assistant*

**Sapozhnikova Alla Ionovna**

*Doctor of Technical Sciences, Full Professor*

**Mirzayev Michael Nurbagandovich**

*Doctor of Biological Sciences, Full Professor*

*Moscow state academy of veterinary medicine and biotechnology  
named after K.I. Skryabin*

抽象。 本文介绍了驱虫药Niacid-granules plus以及含硫饲料添加剂Bioactive角蛋白的研究结果,以满足一些质量和安全指标。已确定Niacid颗粒加和生物活性角蛋白属于第四类毒性。

关键词: 质量指标, 急性毒性, 药物, 尼克颗粒加, 饲料添加剂, 生物活性角蛋白, 银黑狐

**Abstract.** *The article presents the results of a study of the anthelmintic drug Niacid-granules plus, as well as the sulfur-containing feed additive Bioactive keratin to meet some of the indicators of quality and safety. It was established that Niacid granules plus and Bioactive keratin belong to the 4th class of toxicity.*

**Keywords:** *quality indicators, acute toxicity, drug, niacid granules plus, feed additive, bioactive keratin, silver-black fox*

Advanced technologies for raising fur animals in animal farms, in addition to proper balanced feeding and progressive conditions, should include timely diagnosis, treatment and prevention of infectious and invasive diseases. The health and safety of the livestock animals, as well as the quality of the skin products, depends on this.

Silver-black fox is susceptible to infection by various parasites. These include parasitic worms (helminths), parasitic protozoa, as well as lice and scabies mites [7].

In the population of helminths of silver-black foxes of cellular content, *T. canis* usually dominates. In silver-black foxes, mixed invasions of parasitosis pathogens are often detected, for example, *T. canis* + *T. leonina*, or *T. canis* + *U. stenocephala* and other associations.

All of the above parasites cause changes in habitats (internal organs of animals): bruising, ulcers, perforation, contributing to this penetration of pathogenic microbes into the blood. In addition, parasites secrete very poisonous substances, the so-called toxins, which weaken animals, greatly deplete his body and often lead to death [5, 8].

To combat helminthiasis of fur animals, a wide range of antiparasitic agents of various biological nature is currently used. At the same time, the preparations and their dosage forms used for processing animals against parasitoses must meet the requirements of the relevant standards or technical specifications approved by the General Veterinary Administration with the State Veterinary Inspection [1, 3, 4].

Today, preparations of the ivermectin group are very popular, which have a wide spectrum of action, have pronounced environmental friendliness and lower toxicity. A very promising domestic drug is “Niacid Granules Plus”. The drug was developed for the treatment and prevention of parasitosis in animals, but has not been tested on fur animals.

Keratin-containing raw materials are used to produce feed additives by converting it into a form assimilated by animal organisms. Processing of keratin-containing raw materials is carried out by hydrothermal, chemical and enzymatic methods. The resulting hydrolyzate is a valuable feed additive [6].

Keratin-containing preparations are used both in the food industry and in other industries: medicine, cosmetology, light industry [2].

Summarizing the data presented in the literature review, it should be noted that the search for cheaper and more affordable domestic anthelmintics and feed additives, including those from wastes of animal origin that are not inferior to imported drugs, is relevant and of great national economic importance.

The purpose of the work is to study the acute toxicity of the drug Niacid-granules plus and sulfur-containing feed additives Bioactive keratin before using them in scientific and economic experience.

The drug Niacid-granules plus is a joint development of LLC “NPO Ecobiovet” and the Moscow state academy of veterinary medicine and biotechnology named after K.I. Skryabin.

In the manufacture of the finished dosage form of the drug Niacid-granules plus ingredients were used, that are approved for use in veterinary pharmacology. Abamectin (a complex of natural (non-hydrogenated) Avermectins B<sub>1a</sub> and B<sub>1b</sub>) previously dissolved in organic solvents served as the active substance (AS) in the preparation of Niacid granules plus. The basis of the drug, which simultaneously serves as a feed bait, was prepared from meat and bone or fish, soy or wheat flour, molasses and water. The drug manufacturing algorithm made it possible to obtain the finished drug in the form of granules based on feed bait containing an antiparasitic dose of 200 µg AS/kg.

Indicators characterizing the quality of the Niacid granules plus drug, including the determination of the appearance, authenticity and mass fraction of AS, extraneous mechanical impurities, are presented in table 1.

**Table 1**  
*Quality indicators of the Niacid granules plus preparation*

<b>Name of indicator</b>	<b>Characteristic and norm</b>
Appearance, color	brown granules weighing 300-400 mg
Authenticity of AS (abamectin): abamectin B <sub>1a</sub> , % no more	85
abamectin B <sub>1b</sub> , % no more	15
Mass fraction of abamectin, %	200 ± 20 mcg/granule
Foreign mechanical inclusions	not allowed

As follows from table 1, the active part of the Niacid granules plus drug, Abamectin contains a complex of natural unhydrogenated avermectins B<sub>1a</sub> and B<sub>1b</sub>, which are stable only if the appropriate storage conditions are observed.

The safety of the drug decreases sharply when the temperature of storage is violated, which is associated with a well-known fact - the negative effect of temperatures above 40-45°C on avermectins [9].

In the process of developing and putting into practice a veterinary medicine, the question arises of their stability, i.e. preservation of the main parameters of the drug during storage. This indicator allows you to regulate the conditions (temperature, illumination), storage time and other important characteristics that can affect the therapeutic and commercial qualities of the drug [9].

To obtain information about the shelf life of the *Niacid granules plus* drug at various ambient temperatures, its experimental samples were stored at a temperature of 5-7°C (Table 2).

**Table 2**  
*The stability of the Niacid granules plus drug when stored in a household refrigerator (5-7 0C)*

Parameter	After 4 months			After 7 months			After 11 months		
	№1	№2	№3	№1	№2	№3	№1	№2	№3
Appearance, color	Appr.	Appr.	Appr.	Appr.	Appr.	Appr.	Appr.	Appr.	Appr.
Content of B <sub>1a</sub> , %	91,8	90,0	92,5	90,4	89,8	91,9	87,9	88,3	83,5
Content of B <sub>1b</sub> , %	8,1	8,9	7,4	9,1	9,2	7,7	9,8	10,2	10,2
General content of avermectins, mcg/granule	200 ± 20	198 ± 19	193 ± 20	201 ± 17	198 ± 22	195 ± 15	191 ± 15	197 ± 20	190 ± 19
Parameter	After 15 months			After 18 months			After 21 months		
	№1	№2	№3	№1	№2	№3	№1	№2	№3
Appearance, color	Appr.	Appr.	Appr.	Appr.	Appr.	Appr.	Appr.	Appr.	Appr.
Content of B <sub>1a</sub> , %	86,9	86,5	89,5	83,8	86,6	84,6	83,2	84,3	79,4
Content of B <sub>1b</sub> , %	10,6	9,8	10,0	10,2	8,9	7,7	7,8	7,4	7,4
General content of avermectins, mcg/granule	202 ± 20	200 ± 20	200 ± 21	193 ± 19	198 ± 22	196 ± 15	176 ± 13	175 ± 15	182 ± 19

Note: samples № 1, №. 2, №. 3 were stored

The research results presented in table 2 indicate that the total content of the active substance Abamectin during storage of the drug Niacid granules plus at a temperature of 5-7°C fluctuates within the limits specified for the drug for 21 months.

Analysis of the results of stability assessment of Niacid granules plus during storage indicates a relatively high stability of the drug. Based on the data obtained, it was assumed that the approximate shelf life of the finished dosage form of the Niacid-granules plus drug can be at least 21 months. Moreover, such an important indicator of the stability of the substance Abamectin, as the ratio of components B<sub>1a</sub> and B<sub>1b</sub>, which according to generally accepted requirements should be at least 80% B<sub>1a</sub> and not more than 20% B<sub>1b</sub>, is not significantly violated.

In experiments on the study of the parameters of acute toxicity of the drug, Wistar rats were used as experimental animals, which received various doses of the drug with intragastric administration by the fixed-dose method. Dose-dependent lethal effects are presented in table 3.

**Table 3**

*Acute toxicity of Niacid granules plus for Wistar rats*

Animal group	Animal number	Amount AS, mg/kg	Survived, heads	Died, heads	% Lethality
1	10	20	10	0	0
2	10	30	9	1	10
3	10	40	7	3	30
4	10	55	5	5	50
5	10	65	2	8	80
6	10	80	0	10	100
7	10	Control	10	0	0

A dose of the drug according with AS below 30 mg/kg was not toxic to animals, and when the drug was administered at a dose of 80 mg/kg, 100% animal death was observed.

Then, the surviving animals were monitored for 3 weeks and the following indicators were recorded: death time, mortality, symptoms of poisoning, body weight and mass coefficients of internal organs (Table 4-5). An autopsy of dead rats revealed, in addition to venous congestion of the internal organs, subpleural hemorrhages, as well as minor hemorrhages in the brain.

In animals that received low doses, lethargy and a decrease in feed and water intake were noted on the first day. On the remaining days, the general condition and behavior of the experimental animals did not differ from the control group.

**Table 4**

*The dynamics of body weight in surviving rats after feeding the drug*

Observation time	Control	Test
0 day	131 ± 6,8	130 ± 11,5
3 day	134 ± 10,9	131 ± 11,3
10 day	145 ± 12,5	134 ± 12,4
18 day	161 ± 11,9	158 ± 13,2
25 day	182 ± 12,0	169 ± 12,0
35 day	196 ± 10,4	192 ± 14,1
45 day	213 ± 10,5	221 ± 12,2

**Table 5**  
*Organ mass ratios in surviving rats (g/kg body weight)*

Organ	Organ mass, g	
	Control	Test
Heart	4,2 ± 0,32	4,4 ± 0,33
Lungs with trachea	6,0 ± 0,16	6,1 ± 0,41
Thymus	1,3 ± 0,15	1,5 ± 0,10
Liver	27,9 ± 2,81	28,2 ± 2,42
Spleen	5,6 ± 0,31	5,8 ± 0,86
Kidney	7,1 ± 0,54	7,5 ± 0,90

Analyzing the data obtained, we can say that the Niacid granules plus drug in the studied doses does not cause macroscopic changes in the internal organs and brain of experimental rats, does not lead to pathological changes in the mucous membrane of the gastrointestinal tract.

The results of the study of acute toxicity, data of necropsy and observation of experimental animals in the post-toxic period allowed Niacid granules to be assigned to toxicity class IV (GOST 12.1.007-76 Harmful substances. Classification and general safety requirements).

As the second component, which was supposed to be used as a feed additive in scientific and economic experiment, was Bioactive keratin, a protein containing sulfur unique in composition and properties. Keratin preparations are actively used in medicine and cosmetology. However, publications of recent years indicate that this protein, obtained from the secondary products of wool processing, may be in demand in animal farming as a biological active sulfur-containing additive to the main diet of fur animals [6].

Bioactive keratin was obtained from tow of sheep wool in accordance with the method described in RF patent № 2092072 [2]. Biosubstance contains native keratin in the form of macromolecules, their associates, as well as a small amount of products of complete protein hydrolysis and minerals (Table 6).

**Table 6**  
*Bioactive Keratin Quality Indicators*

Name of indicator	Characteristic and norm
Appearance	Homogeneous liquid mass
Colour	From light - gray beige to dark gray beige
Smell	Specific
Hydrogen indicator	6,5-7,5
Authenticity	Positive reaction to keratin
Mass fraction of dry matter,%	3,0-10,0
Mass fraction of keratin, % based on dry matter	95,0 - 98,0
Total number of mesophilic aerobic and facultative anaerobic microorganisms, CFU/1g (cm <sup>3</sup> ) of product	no more than 1x10 <sup>2</sup>
Yeast, yeast-like, mold, in 1 g/cm <sup>3</sup> of product	absent
Bacteria of the family Enterobacteriaceac, in 1 g/cm <sup>3</sup> of product	absent
Bacteria of the species Pseudomonas aeruginosa, in 1 g/cm <sup>3</sup> of product	absent
Bacteria of the species Staphylococcus aureus, in 1 g/cm <sup>3</sup> of product	absent

The results of determining the toxicity class of Bioactive keratin are presented in table 7.

**Table 7**  
*Acute toxicity of bioactive keratin when using the dose limit in mice*

Animal group	Amount of animals	Amount of AS, mg/kg	Survived, heads	Died, heads	% Lethality
1	10	0,25	10	0	0
2	10	0,50	10	0	0
3	10	0,75	10	0	0
4	10	1,00	10	0	0
5	10	1,25	10	0	0
6	10	1,50	10	0	0
7	10	Control	10	0	0

Studies have shown that the introduction of bioactive keratin samples in the indicated doses into the body of white mice did not cause any visible clinical signs of toxicosis. The general condition of the animals remained satisfactory. Test animals adequately responded to external stimuli, the appetite was not disturbed. Visible mucous membranes were pink, animals had a smooth, shiny coat, elastic skin. Body temperature were within normal limits, defecation without deviations. No deaths were noted. Introduced doses of 1.5 ml are the maximum allowable volumes of fluids for intragastric administration to mice.

To assess the pathological changes, the animals were autopsy with an assessment of the body surface, injection site, all passages, chest, abdominal cavities and their contents. For macroscopic examination and calculation of mass coefficients, the following were extracted: heart, lungs with trachea, thymus, liver, spleen and kidneys (Table 8).

**Table 8**  
*Organ mass coefficients in surviving mice (g/kg body weight)*

Organ	Organ mass, g	
	Control	Test
Heart	0,17 ± 0,01	0,18 ± 0,01
Lungs with trachea	0,26 ± 0,02	0,26 ± 0,01
Thymus	0,06 ± 0,01	0,05 ± 0,01
Liver	1,88 ± 0,05	1,90 ± 0,06
Spleen	0,23 ± 0,02	0,24 ± 0,03
Kidney	0,28 ± 0,04	0,27 ± 0,02

There were no visible pathological changes during autopsy of animals of all groups. The macroscopic characteristics of the organs corresponded to a healthy organism, the mass coefficients of the organs of animals of the experimental groups did not differ from the values of the coefficients of the organs of the control groups

The results allow us to conclude that the anthelmintic Niacid-granules plus drug, as well as Bioactive keratin feed additives belong to the 4th class of toxicity (GOST 12.1.007-76 Harmful substances. Classification and general safety requirements).

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在高技能运动员射箭的例子中，不同精度和稳定性的目标导向运动的生物学标记

**BIOLOGICAL MARKERS OF GOAL-DIRECTED MOVEMENTS  
OF VARYING PRECISION AND STABILITY ON THE EXAMPLE  
OF ARCHERY OF HIGHLY-SKILLED ATHLETES**

**Trembach Alexander Borisovich**

*Doctor of Biological Sciences, Professor*

**Shestakov Oleg Igorevich**

*postgraduate*

**Minikhanova Ekaterina Ravil'evna**

*master*

*Kuban State University of Physical Education, Sport and Tourism*

抽象。射箭最大成绩的实现不仅取决于高精度，还取决于其稳定性。已经在特定的工作中研究了通过脑电图指示器进行高精度有目的运动的中心组织机制。然而，直到现在才清楚高精度镜头的稳定性。该研究的目的是在瞄准和执行不同精度的射击时检查EEG频谱功率容量。该研究的目的是在瞄准和执行不同精度和稳定性的射击时检查EEG光谱功率作为生物标记能力。

五名运动员在休息和瞄准时遥测记录脑电图。计算高精度和低精度射击的EEG频谱功率容量的各个平均地形图。通过单因素方差分析确定其差异的准确性。根据所有运动员中同等变化的指标，将脑电图频谱功率容量的组图进行整合。在高频范围内，额叶正中结构和侧面视觉区域的低频范围内的电活动增加促进了高技能运动员的最大击球准确性 - 左半球中心的活动增加，促进了规划，形成并实施视觉 - 运动行为。由于中央额叶结构的电活动减少，以及右半球和左半球的高频电活动增加，高素质运动员的击球准确度下降。

所揭示的机制可以通过开发涉及生物反馈的新程序来形成改善运动结果的基础。

关键词：射箭，高技能运动员，高低电流射击，脑电图，组和个体脑电图能量图，高低电流射击的神经生理机制，用于瞄准精度和射击稳定性的脑电图标记。

**Abstract.** *The achievement of the maximum result in archery is determined not only by a high accuracy, but also by its stability. The central organization mechanisms of purposeful movements of a high accuracy by electroencephalogram indicators have been studied in particular works. However, the stability of highly-accurate shots is not clarified until now. The objective of the study is examination of EEG spectrum power capacity when aiming and executing shots of varying accuracy. The aim of the study is examination of EEG spectrum power as a biological marker capacity when aiming and executing shots of varying accuracy and stability.*

*The electroencephalogram was recorded telemetrically in five athletes at rest and when aiming. Individual averaged topographic maps of EEG spectrum power capacity for high and low-precision shots were calculated. The accuracy of their differences was established by single-factor analysis of variance. Group charts of EEG spectrum power capacity were integrated according to equally changing indicators in all athletes. The maximum shot accuracy of highly-skilled athletes was facilitated by an increased electric activity in low-frequency ranges of median structures of frontal lobes and lateral visual area, in high-frequency ranges – an increased activity of left hemisphere centers that facilitate planning, formation and implementing of a visual-motor act. The decrease in shot accuracy in highly qualified athletes occurs due to decrease in electrical activity of central frontal lobe structures, as well as due to increase in high-frequency electrical activity in right and left hemispheres.*

*The mechanisms revealed can form the basis for sport result improving via development of new programs that engage the biological feedback.*

**Keywords:** *Archery, highly skilled athletes, high and low current shots, electroencephalogram, group and individual EEG spectrum power maps, neurophysiological mechanisms of high and low current shots, EEG markers for aiming accuracy and stability of shots.*

**Introduction.** Voluntary human motor activity is goal-directed movements. Central programs that provide visually motor acts include various areas of the cerebral cortex, closely related to each other (Bernshteyn N.A., 1947). Objective biological markers of the Central programs are cortical electrical activity, in especially electroencephalogram (Kropotov, YU.D., 2012). Archery can serve as a model of goal-directed movements with determination of its accuracy (Baydychenko, T.V., 2017). The achievement of the maximum result in archery is determined not only by a high accuracy, but also by its stability. The central organization mechanisms of purposeful movements of a high accuracy by electroencephalogram indicators have been studied in particular works (Napalkov D.A.; Casey M, 2012). However, the stability of highly-accurate shots is not well understood (Trembach A.B., 2018). The objective of the study is examination of EEG spectrum power capacity when aiming and executing shots of varying accuracy. The aim of the study is examination of EEG spectrum power as a biological marker capacity when aiming and executing shots of varying accuracy and stability.

**Materials and Methods.** The examination was participated by five highly-skilled archery athletes. Each subject made 60 shots. The electroencephalogram was recorded telemetrically at rest and when aiming. Brain electrical activity was determined in 19 deflections by 10-20 system. The individual averaged topographic maps of EEG spectrum power were calculated in each athlete within frequency

ranges 4-8; 8-10; 10-12; 12-24; 24-35 Hz. The accuracy of differences in examined indicators was determined by single-factor analysis of variance. The development of averaged group topographic maps of EEG spectrum power was done by integrating individual maps in equally changing indicators for derivations and ranges. This approach allows to reduce the variability of the EEG spectrum power and increase the objective dynamics of electrical activity, which is manifested synchronously in all archers. The number of varying precision shots made by subjects was different. Two groups were identified with high (10 points) and low (7, 8 points) accuracy.

**Results and Discussion.** The analysis of group maps of EEG power spectrum when aiming that was ended with a high-precision shot evidenced that the central area of frontal lobes and the visual center of the left hemisphere are mandatory nerve structures. According to modern approaches, they are closely interrelated with each other and subcortical formations, including hippocampus (Brian H. Bland, Scott D. Oddie, 2001). Activation of neural networks of hippocampal rhythm in the above centers facilitates a stable activity of working memory, attention and sensorimotor integration (Deborah A. Barany, 2014; Leanna C. Cruikshank, 2012; Pavlidou A., 2014). Archery is a visually-motor repetitive activity of maximum accuracy. Automation of motor skills via coordination of a significant number of muscle groups in upper and lower extremities is possible by means of sensory system blockade from external influences that reduce sports result. The result of motor training is activation of electrical activity within the range of 8-10 and 10-12 Hz (Ole Jensen, Ali Mazaheri, 2010). Elevation of this activity leads to inhibition of external signals when aiming. This mechanism is automatically regulated, mostly without consciousness control (Hanneke van Dijk, 2008). We can assume that these neurophysiological mechanisms are the foundation of a high-precision shot. High-frequency electrical activity in group maps when aiming before a high-precision shot was determined in frontal, premotor, lower parietal and visual areas mainly in the left hemisphere. The cortical area activity in expert archers during aiming presentation detected by functional magnetic resonance imaging largely coincides with the above spatial temporal electrical activity (Kim W., 2014). A similar electrical activation of cortical structures is revealed in other targeted movements of high-frequency EEG ranges (Trembach A.B., Kuz'menko Ye.A., 2011; Nicolas Lebar, 2017). The individual maps evidenced that the maximum number of high-precision shots is due to increased activity within 4-8 Hz range in frontal, premotor, motor, parietal areas of left hemisphere and in the visual area right hemisphere. Electrical activity in premotor, temporal, parietal and visual areas of both hemispheres was additionally detected in 8-10 and 10-12 Hz ranges. Decrease or increase in electrical activity compared to the above areas resulted in the decrease of the number

of high-precision shots. Thus, low-frequency electrical activity determines the stability of high-precision shots due to an optimal activation of neural networks; it facilitates the working memory, attention and a limited perception of external stimuli during archery. A significant increase in spatial temporal electrical activity leads to stability decrease in high-precision shots. According to current approaches, the high-frequency electrical activity triggers and implements the visual motor act. To a greater extent, the left hemisphere is activated, despite functioning of both upper extremities in right-handers. There were no significant differences recorded in high-frequency electrical activity between the group and individual EEG spectrum power maps. They were minimal, and it characterizes the cortical center stability that facilitates a high-precision shot. The maximum shot accuracy in highly-qualified athletes is facilitated by an increased electrical activity within low-frequency ranges of median structures of frontal lobes and the lateral visual area, and within the high-frequency ranges – by an increased activity of left hemisphere centers, providing planning, formation and implementation of the visual-motor act.

For low-current shots, electrical activity elevation in group maps of EEG power spectrum was not determined when aiming within the range of 4-8 Hz, while it maintained within the ranges of 8-10, 10-12 Hz in the visual area of the left hemisphere. In our opinion, the absence of hippocampal rhythm and its connection with the visual cortex leads to a shot accuracy decrease. It occurs due to the fact that the above structures reduce the activity of working memory, sensorimotor integration and attention. Within 12-24 and 24-35 Hz high-frequency ranges, the electrical activity was manifested in frontal, premotor, temporal, motor, parietal and visual areas of both hemispheres, mainly in the left one. It was not substantially different from electrical activity in high-precision shots. Individual maps manifested that the minimum number of low-precision shots was determined within 4-8 Hz range in motor, parietal and visual areas, and in 8-10 and 10-12 Hz ranges - additionally in the frontal, premotor, temporal, parietal and visual areas of both hemispheres. In the first two athletes, the electrical activity in low-frequency ranges did not differ significantly from the one in high-precision shots. In our opinion, it is due to the fact that they made the minimal number of low-precision shots (4 and 6). With the number low-precision shots increasing, the spread of cerebral cortex increased activity was significantly elevated within these frequency ranges. Topographic distribution of high-frequency electrical activity increased. Thus, it can serve an indicator of shot accuracy reduction. The decrease in shot accuracy in highly-qualified athletes is due to electrical activity decrease in the central structures of frontal lobes, as well as due to an increase in high-frequency electrical activity in the right and left hemispheres.

**Conclusion.** In EEG power spectrum of group maps, the maximum shot accuracy and its stability in multiple repetitions is determined by continuity of low and high-frequency electrical activity and its distribution in cerebral cortex. In EEG power spectrum of individual maps, the variability of stability of maximum shot accuracy is determined by low-frequency electrical activity depending on its topographic distribution. The comparative analysis of electrical activity in individual and group maps of EEG power spectrum has contributed to identifying the objective electrophysiological markers characterizing the accuracy and stability of implementing a repeated execution of archery sports practice. The mechanisms revealed can form the basis for sport result improving via development of new programs that engage the biological feedback.

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植物生物量的臭氧化。 水在木材臭氧化中的作用  
**OZONATION OF PLANT BIOMASS.  
ROLE OF WATER IN WOOD OZONATION**

**Mamleeva Nadezhda Alekseevna**

*Senior researcher, Ph.D.chem.sciences*

*Lomonosov Moscow State University, Chem. Dpt.*

**Lunin Valery Vasilyevich**

*Prof. Dr. Science, academician RAS*

*Lomonosov Moscow State University,*

*Moscow, Russia*

注解。 臭氧化是植物原料的预处理方法，其目的是随后进行纤维素或单糖处理。 研究了各种含水量 (MC) 的白杨木消耗臭氧的过程。 强调了水在生物质臭氧化中的关键作用。 水是系统的组分，其提供生物质表面基团对试剂的可用性和溶解在水中的一定量的副产物。 作为试剂和副产品运输水的介质在木材臭氧化中起着控制作用。 结论是木材的臭氧化是通过扩散来控制的。 发现55-60%的MC对应于白杨木的最有效臭氧化。

关键词: 臭氧化, 木材, 水分含量

**Annotation.** *Ozonation is a pretreatment method of vegetable raw materials with the aim of subsequent cellulose or monosacharides processing. The process of ozone consumption by aspen wood of various moisture content (MC) was investigated. A key role of water in biomass ozonation is emphasized. Water is a component of the system providing an availability of the biomass surface groups to the reagent and an amount of byproducts dissolved in water. Being a medium for the reagent and byproducts transport water plays a governing role in wood ozonation. It is concluded that the ozonation of wood is controlled by diffusion. It was found that the MC of 55-60% corresponds to the most efficient ozonation of aspen wood.*

**Keywords:** *ozonation, wood, moisture content*

Being an oxidant of aromatic compounds [1,2], ozone has found a wide application as a bleaching agent in the oxidation of residual lignin in paper pulp process [3,4]. Ozonation was applied as a pretreatment method of biomass for intensifying the subsequent process of enzymatic hydrolysis to sugars and ethanol [5-8]. Ozone is considered as a reagent of wood pretreatment with the aim of consequent cellulose processing [9,10].

Direct ozone impact upon the poplar, aspen, pine, spruce, sugar-cane, wheat and rye straw, corn stalk and a number of other plant substrates was studied in [5-14]. It was found lignin destruction under ozone impact on biomass. Ozone treatment of biomass reveals in the formation of a number of carbon acids (oxalic, glyoxylic, formic, acetic, and et al.) [8,11]. It was found carbonyl- and carboxyl-containing aromatic products formed in the process of aspen wood ozonation [14].

It was noted that lignin destructs first of all, followed by hemicelluloses and finally by cellulose degradation. Some authors suppose that cellulose destruction is negligible [8].

It was investigated ozone treatment of a number of biomass types containing water of various amounts. Moisture content of biomass was found to be a significant factor of ozone consumption process, as well as a substrate transformation [5-13]. However, so far, a role of water as a factor of ozonation optimization appears to be not completely understood.

In present research, the ozonation of aspen wood samples containing various water amounts is investigated. The aim of the paper is to analyze a role of water in ozone consumption process and to find out the most principal parameter of the system, controlling in process efficiency.

### Experimental

The sawdust of aspen wood (*Populus tremula*) with a particle size of 0.315 – 0.63 mm was studied. Wood samples of a moisture content (MC) range of 8% - 160% relatively to the mass of oven-dry wood (ODW) were prepared by the penetration of air – dry sawdust (of 8% MC) by water according to [14].

$$MC = (m_{H_2O} / m_{o.d.w.}) \times 100\%$$

To realize a constant residence time of the reagent in the reaction zone the volume of wood samples keeps constant (2.7 ml). The mass of wood samples of various MC was in the range of 1.3-2.1 g [15]. Ozonation of wood samples was carried out using ozone generator Medozone 03/05 (Russia). The experiment was conducted in a flow system with a temperature-controlled ( $t=20^\circ\text{C}$ ) fixed bed reactor. The ozone - oxygen mixture of 90 mg/L ozone concentration was passed through the reactor at a flow rate of 4.4 liter/h. At the experiment completion ozone generation was stopped, the system was purged with oxygen. Ozone concentration was measured using Medozone-254/5 photometer (Russia). The accuracy of measurements was about 3%. Some details of the on the ozonation experiment are published in [14,15]. Experimental runs of ozone consumption by the wood samples of the same MC were four times repeated.

A current value of the ozone consumption  $Q_{abs}(t)$  was computed by graphic integration of kinetic data of Fig 1A, using Eq.(1).

$$Q_{abs}(t) = U \int_0^t (C_t^* - C_t) dt \quad \text{Eq. (1)}$$

$U$  is the gas flow rate (L/s),  $C_t$  and  $C_t^*$  are the current ozone concentration (mol/L) at the outlet and inlet of the reactor containing the investigated sample, respectively.

From this equation  $Q_{abs}(t)$  is defined as a difference between ozone amount leaving the reactor in outlet gas in the blank and experimental run.

The ozone consumption degree  $\alpha(t)$  was calculated using (Eqs. 2 and 3).

$$\alpha(t) = \frac{Q_{abs}(t)}{Q_o(t)} \times 100\% \quad \text{Eq. (2)}$$

$$Q_o(t) = U \int_0^t C_t^* dt \quad \text{Eq. (3)}$$

The  $Q_{abs}(t)$  is a current ozone amount absorbed by the sample, and  $Q_o(t)$  is a current value of ozone amount in the reactor inlet. A current value of the specific ozone consumption ( $Q_r(t)$ ) was calculated, using Eq.4.

$$Q_r(t) = \frac{Q_{abs}(t)}{m_{o.d.w.}} \quad \text{Eq. (4)}$$

$m_{o.d.w.}$  is the mass of oven-dried wood.

### Results and discussion

The kinetic curves of the ozone concentration at the outlet of the reactor containing aspen wood samples are presented in Fig.1A (curves 1-3). The kinetic curve of outlet ozone concentration of the blank run is presented by curve 4 in Fig.1A.

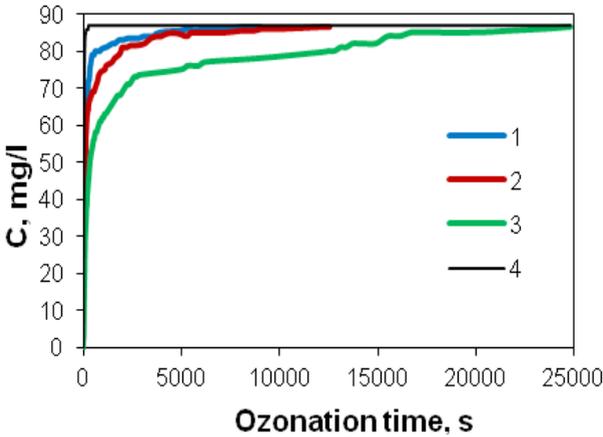
The  $Q_r(t)$  kinetic curves of aspen wood containing different moisture content are presented in Fig.1B. Ozonation is carried out in a flow system, so the moisture content of a sample decreases with the ozonation time [12, 14]. It is seen from Fig.1B that an increase of MC allows higher values of  $Q_r$  to be achieved by the long-time ozone treatment of the wood sample. As a result, the specific ozone consumption corresponding to a completion of ozone exposure ( $Q_r$ ) increases following to the sequence  $Q_{r1} < Q_{r2} < Q_{r3}$  for the samples of Fig 1B.

The slope of the initial linear intercept of ozone consumption kinetic curves can be used for estimating the initial ozone consumption rate. As one can see from Fig.1C, the slope of kinetic curves differs noticeably when the MC of wood sample varies. It is seen that the initial ozone consumption rate of 55% MC sample exceeds both the ozone absorption rate of 30% MC sample, and of 160% MC sample.

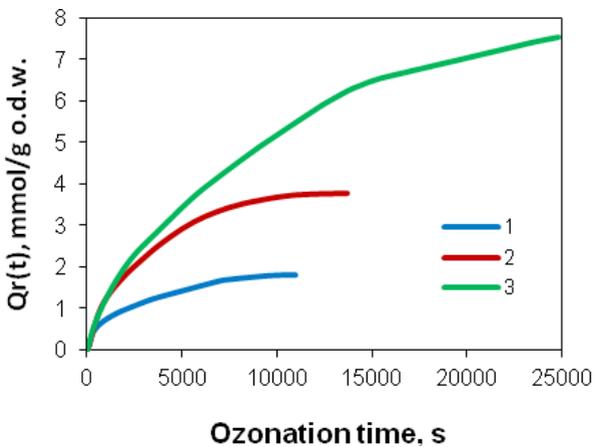
Kinetic dependences of ozone consumption degree  $\alpha(t)$  of the samples of various MC are presented in Fig.1 D. It is seen that  $\alpha(t)$  of the samples decreases from 100% to 11-20% as ozonation time increases. A decrease of  $\alpha$  with ozonation time is due to ozone reactions with less active groups of the sample. The terminate ozone consumption degree corresponding to the completion of ozonation process depends on the MC of the sample.

Figure 2 shows the dependence of ozone consumption rate ( $V$ ) on the initial water content of aspen wood. It is seen that  $V$  of 55% MC sample is the most high as compared to other samples investigated.  $V$  increases within the range of 8 - 55% MC and slightly decreases in the region of higher MC values.

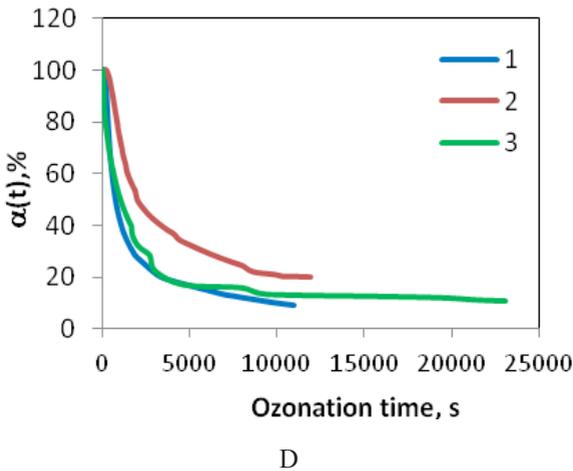
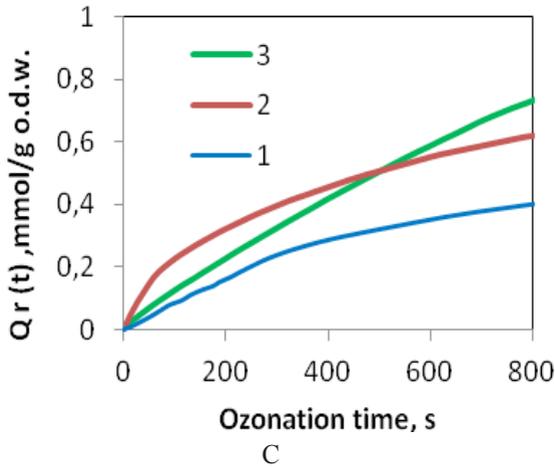
The dependence of ozone conversion degree ( $\alpha$ ), corresponding to the completion of ozonation process is also presented in Fig. 2. It is seen that  $\alpha$  value of 55% MC sample is equal to 20%, and this value is the largest one. It is seen that  $\alpha$  value of 55% MC sample is equal to 20%, and this value is the largest one. The above presented data show that the ozone consumption process by wood of 55% MC is characterized by the best efficiency.



A



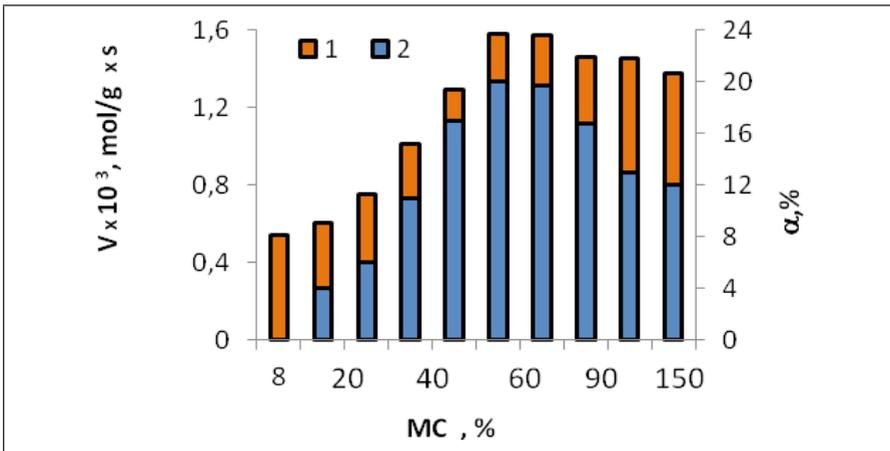
B



**Fig.1.** Kinetic curves of the outlet ozone concentration (A), specific ozone consumption (B), initial intercepts of specific ozone consumption (C) and ozone consumption degree (D) for wood samples. MC, %: 30 (1), 55 (2), 160 (3). The outlet ozone concentration of the blank run (Fig.1A, curve 4)

As it is seen from Fig 2, in the MC region of 8 -55% the dependences of both V and ozone conversion degree are similar. So, it is possible that a value of V may be applied for estimating the efficiency of ozone impact upon biomass sample, as a primary approach.

It is well known that wood swells in water vapor. Swelling is due to formation of hydrogen bonds between water and hydrophilic groups of wood cell walls. Water, absorbed by cell walls, is named “the bound water”, and the water amount corresponding to the complete saturation of cell walls is called the “fiber saturation point” (FSP). Cell cavities of wood of MC above FSP are filled with water. Water filling the wood cavities is named “the free water” [15]. Wood swelling results in many times increasing the wood surface, and for this reason, a number of the substrate reactive groups available to reagent also arise. Therefore, ozone consumption increasing, as well as the initial ozone consumption rate increasing with MC, as it is presented in Fig.1, 2, is obvious.



**Fig. 2.** Initial ozone consumption rate (1) and ozone conversion degree (2) vs initial moisture content of aspen wood samples.

Our data show that the most favorable for ozonation process is MC of 55-60% that exceeds the aspen wood FSP corresponding to 28% MC. The need for some excess water relatively to FSP of the investigated substrate to achieve a noticeable effect of ozone was emphasized by a number of authors [5-14].

A number of surface reactive groups achieves maximum for the sample of 28% MC, and it keeps unchanged for MC above FSP. For this reason, it should be other explanation for the higher ozonation efficiency of wood samples of MC above FSP than that of 28% MC sample. The marked peculiarity may be attributed to the structure of the bound water. It was shown that the bound water consists of three monolayers of water molecules tightly bound each other [16]. Thus, the layer achieves a thickness of about 1 nm. Bound water is characterized by higher density, low molecular mobility; it differs in other physical properties, as compared to the bulk water [16]. It is evident that the structured water layer restricts an inclu-

sion of reagent molecules into the layer. A transfer of ozone molecule of 0.4 nm in diameter into the bound water layer involves problems of a steric character, in addition. For this reason, the ozone concentration in bound water decreases and, consequently, the ozonation efficiency decreases, too.

In the presence of a water exceed above FSP ozone first of all transfer from gas to free water volume. Thermal movement and diffusion result in transfer of water molecules from free to bound water and conversely. These processes provide a transfer of ozone dissolved in free water to the bound water layer, where reactions with surface groups take place. This explanation is consistent with the necessity of water exceed above FSP. It also shows that diffusion play a governing role in the ozone consumption process by the wood.

Therefore, it is seen that the ozone absorption is controlled by both an availability of surface groups and the reagent concentration in bound water, where reactions take place. Apart from reactions in bound water, the ozone is partially demanded in the free water. First of all it comes from the lignocellulose ozonation byproducts dissolved in water.

It was shown in [12] that the content of oxalic acid in water phase increases with ozonation since this compound is more resistant to ozone [12]. In this case content of glyoxalic or formic acid decreases because of their more high reactivity in reactions with ozone. Since water phase arises at high MC, a contribution of water phase reactions of ozone with byproducts increases. So, in the MC region above 55-60%, the ozone consumption process is slow down noticeably by reactions of ozone with compounds dissolved in water phase. With this context the data on ozone conversion degree of Fig. 2 appears to be rather transparent.

Evidently, that there is an optimum ratio between bound and free water amounts which corresponds to the most effective reactions in bound water. This ratio is near two for the case above. It is necessary to mark that this result was obtained under the certain conditions of deciduous wood ozonation. The ratio value can be changed with a change of particle size, and the residence time of ozonation process; it can be another for other types of plant raw materials since this parameter is governed by FSP of the biomass.

### **Conclusions**

The process of ozone consumption by aspen wood of various moisture contents was investigated.

Water is a component of the system providing an availability of the biomass surface groups to the reagent and an amount of byproducts dissolved in water. Being a medium for the reagent and byproducts transport water plays a governing role in wood ozonation.

The moisture content of 55-60% corresponds to the most effective ozonation process of deciduous wood.

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绕过Pismennyi的涡轮喷气发动机  
**BYPASS TURBOJET ENGINE OF PISMENNYI**

**Pismennyi Vladimir Leonidovich**

*Candidate of Technical Sciences, Associate Professor,  
 “Vzlet” branch of the Moscow Aviation Institute  
 in the city of Akhtubinsk*

抽象。提出了一种用于提高双回路涡轮喷气发动机的燃料效率的方法。与第五代发动机 (Trent 1000, GP7270, PW4460等) 相关的预期燃油经济性超过20%。

关键词：双回路涡喷发动机，比油耗，热机，内部热力循环。

**Abstract.** *A method for increasing the fuel efficiency of a dual-circuit turbojet engine is proposed. The expected fuel economy in relation to the fifth generation engines (Trent 1000, GP7270, PW4460, etc.) is more than 20%.*

**Keywords:** *dual-circuit turbojet engine, specific fuel consumption, heat engine, internal thermodynamic cycle.*

In 1941, engineer A.M. Lyulka received a certificate of authorship [1] for the gas-dynamic scheme of a dual-circuit turbojet engine: it was proposed to distribute fuel energy to a larger mass of gas, which, with the same engine thrust, allowed to reduce fuel consumption.

Air-jet engines (AJE) perform in two qualities: as a heat engine and as a mover.

As a heat engine, AJE is characterized by its efficiency  $\eta_e$ . As a mover, AJE is characterized by flight efficiency  $\eta_{\Pi}$ . In general, AJE is characterized by overall efficiency  $\eta_o = \eta_e \cdot \eta_{\Pi}$ .

Lyulka engine effect is based on increased flight efficiency

Academician B.A. Stechkin have found a ratio allowing to determine the flight efficiency of AJE

$$\eta_{\Pi} = \frac{1}{1 + R/(2 \cdot G_B \cdot V_n)},$$

where  $R$  is the engine thrust,  $G_B$  is the air flow rate, and  $V_n$  is the flight speed.

Taking into account that the air flow through the engine for given flight conditions ( $H = const, V_n = const$ ) is defined as  $G_B \approx const \cdot d^2$ , we obtain

$$\eta_{\Pi} \approx \frac{1}{1 + R/(C \cdot d^2)}$$

Here  $d$  — fan diameter;

$$C = 1,256 \cdot M \cdot q(\lambda_B) \cdot \sigma_{BX} \cdot P_H^* \cdot \left(1 - \bar{d}_{BT}^2\right),$$

where  $M$  — Mach number;

$q(\lambda_B)$  — current density at the fan inlet;

$P_H^*$  — external flow braking pressure;

$\sigma_{BX}$  — input pressure recovery factor;

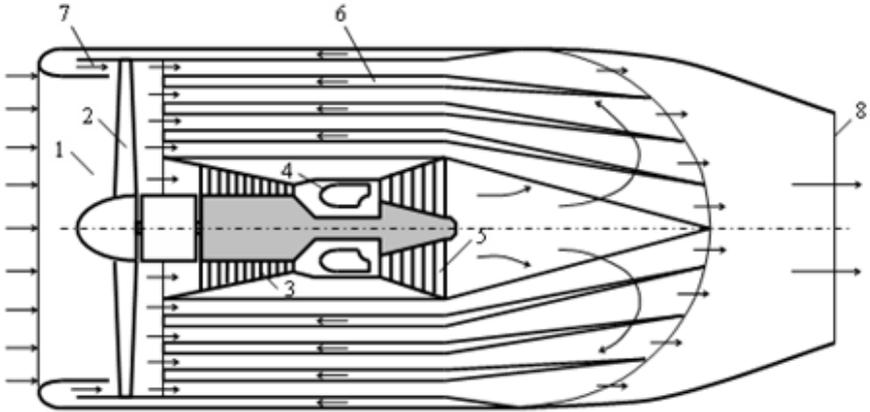
$\bar{d}_{BT}$  — relative diameter of the fan hub.

For subsonic turbojet engines, cruising flight conditions are  $H = 11$  km and Mach number  $M = 0.8$ , the required thrust range is 30 ... 70 kN, the fan diameter is not more than 3.0 ... 3.5 m. Accordingly, the flight efficiency is not more than 0,8 ... 0.85.

The efficiency of the Brighton cycle, which is implemented in the Lyulka turbofan engine, is not more than 0.5. Thus, the maximum overall efficiency of the Lyulka turbojet engine does not exceed 0.4 ... 0.42. This means that the fifth-generation turbofan engine (TRENT 1000, GE90-115B, etc.) actually approached the limit of its gas-dynamic efficiency (their efficiency is 0.36 ... 0.38).

The author proposes to change the gas-dynamic scheme of a turbofan engine (application for the invention RF 2019104270 dated 02.15.2019) using the method of internal thermodynamic cycles [2]. The inner cycle is a cycle that has energy exchange with the outer cycle. An external cycle is a cycle that has energy exchange with the external environment. The absence of energy exchange with the external environment in the internal cycle, by definition, means the absence of external losses, and therefore, the thermal efficiency of this cycle in the composition of the heat engine is unity (all heat, and this is the difference between the heat received and returned to the external cycle, is converted to work). Internal cycles have remarkable properties: they increase the useful work and efficiency (thermal and effective) of a heat engine, and also remove temperature restrictions.

Pismenny turbofan engine (Fig. 1) consists of an input device 1, fan 2, internal and external circuits.



**Fig. 1.** Pismenny two-circuits turbofan engine:

1 – input device, 2 – fan, 3 – compressor, 4 – combustion chamber,  
5 – turbine, 6 – heat exchanger-regenerator, 7 – outlet pipe, 8 – nozzle

In the internal circuit are located: compressor 3, combustion chamber 4, turbine 5, low-pressure cavity (gas channels) of the heat exchanger-regenerator 6, outlet pipe 7 located at the inlet to fan 2. A gearbox is located between the compressor and the fan.

The external circuit is an annular channel ending with a tapering nozzle 8. Inside the external circuit there are air channels of the heat exchanger-regenerator, which connect the cavity behind the fan with the nozzle. The internal cavity of the heat exchanger-regenerator is connected, on the one hand, to the turbine outlet and, on the other hand, to the fan inlet (through the outlet pipe).

The engine does not differ from the operation of the Lyulka turbojet engine except for the heat exchanger-generator.

Hot gas from the turbine flows into the internal cavity of the heat exchanger-regenerator. The gas cooled in the heat exchanger-regenerator through the outlet pipe flows into the cavity located at the inlet to the fan. In order to improve heat transfer, hot gas in the heat exchanger-regenerator is forcibly (due to the kinetic energy of the gas) circulating. The static gas pressure behind the turbine is maintained lower than the total air pressure at the engine inlet (the fan empties the gas cavity of the heat exchanger-regenerator due to the vacuum generated at the inlet).

To maintain the gas temperature in front of the turbine of 2300 K and more, air-liquid cooling of the turbine blades is used [3]. For these purposes, there is a supply of water on board the aircraft.

Figure 2 shows the thermodynamic cycle of the Pismenny turbofan engine in P-v coordinates. Here  $L_{u1}$  – external cycle (the cycle to which energy is supplied), implemented in the internal circuit of the turbofan engine;  $L_{u2}$  – inner cycle (cycle using the energy of the external cycle), implemented in the external circuit of the turbofan engine;  $Q_1$  and  $Q_2$  – heat supplied and withdrawn in the cycle, respectively. The thermal efficiency of the turbofan engine cycle is defined as

$$\eta_t = \eta_{t1} + \eta_{t2} - \eta_{t1} \cdot \eta_{t2},$$

where  $\eta_{t1}$  – thermal efficiency of the first cycle,

$\eta_{t2}$  – thermal efficiency of the second cycle.

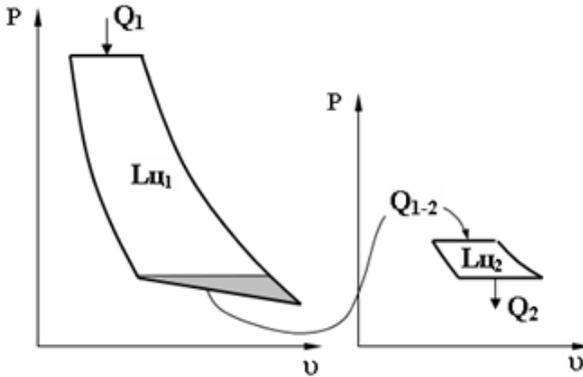
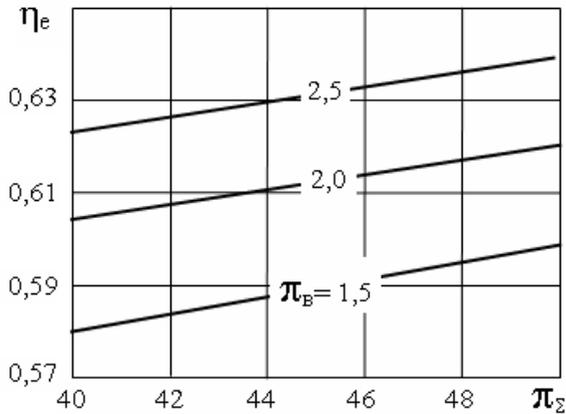


Fig. 2. Thermodynamic cycle of Pismenny turbofan

The external and internal cycles (Fig. 2) are Brighton cycles, the thermal efficiency of which is determined by the degree of pressure increase in the cor-

responding engine circuits (  $\eta_t = 1 - 1/\pi^{\frac{k-1}{k}}$  ). The effective efficiency of the Brighton cycle in a gas turbine engine is usually 20% less than thermal. In our case, the cycle  $L_{u1}$  has useful work larger than the similar Brighton cycle (by the amount of shaded area), in addition, the internal losses in the cycle  $L_{u2}$  are minimized (air speeds are insignificant), therefore, the fraction of internal losses in the cycles  $L_{u1}$  and  $L_{u2}$ , will be at least two times less than in a conventional gas turbine engine. To quantify the efficiency of the turbofan engine cycle (Fig. 2), we accept the assumption that  $\eta_e \approx 0,9 \cdot \eta_t$  .

For a quantitative assessment, Fig. 3 shows the dependence of the efficiency  $\eta_e$  of the Pismenny turbojet engine cycle on the total degree of increase in pressure  $\pi_\Sigma$  and the degree of increase in pressure in the fan  $\pi_B$  . The degree of increase in pressure in the fan  $\pi_B = 1.5 \dots 2.5$  is selected from the condition for ensuring subcritical (critical) gas flow in the tapering nozzle, which is necessary to obtain maximum values of flight efficiency



**Fig. 3.** The dependence of the Pismenny turboprop cycle efficiency on  $\pi_{\Sigma}$  and  $\pi_B$

From Fig. 3 it can be seen that the effective efficiency of Pismenny turboprop engines exceeds the similar efficiency of Lyulka turboprop engines ( $\eta_e$  50%) by 8 ... 15%, that is, 1.16 ... 1.3 times. Accordingly, the maximum value of the overall efficiency of the Pismenny turboprop engine will also be higher, amounting to 46 ... 52%.

Reducing the cost of air travel is an urgent task. The share of aviation fuel costs in total airline costs is approaching 30%. At the same time, the cost of a ton of aviation kerosene has already exceeded \$ 600 and continues to grow. A decrease in fuel consumption by 20 ... 25% during the transition to the new turboprop engine (Fig. 1) is equivalent to a reduction in total airline costs by 5 ... 7%, which amounts to more than 10 billion US dollars per year. In the future, this figure will only increase.

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UDC 664.665

研究不同膳食纤维对小麦半成品和成品质量的影响

**STUDY OF THE INFLUENCE OF VARIOUS DIETARY FIBERS  
ON THE QUALITY OF WHEAT SEMI-FINISHED PRODUCTS AND  
FINISHED PRODUCTS**

**Sadygova Madina Karipullova**

*Doctor of Technical Sciences, Full Professor*

*Saratov State Agrarian University named after N.I. Vavilov*

**Belova Maria Vladimirovna**

*Candidate of Biological Sciences, Associate Professor*

*Saratov State Agrarian University named after N.I. Vavilov*

**Suraeva Alexandra Vasilevna**

*Candidate of Agricultural Sciences, Lecturer*

*Yuri Gagarin State Technical University of Saratov*

*Saratov, Russia*

抽象。本文探讨了各种膳食纤维的功能和技术特性，以便将它们用于烘焙产品的生产中。在该研究中使用以下膳食纤维：小麦纤维，甜菜纤维和苹果纤维。给出了膳食纤维的比较特征，研究了它们对半成品发酵强度的影响，确定了面团的提升力，发酵活性。在实验版本中，膳食纤维的加入量为面粉重量的2.5%，初步水合为1: 1，重点是面团的稠度。在咽镜和吹泡仪上测定试验的流变性质。小麦和苹果纤维样品中的ILF增加了5.1%，甜菜纤维增加了11.5%。使用小麦膳食纤维时，面团形成时间长26.6%，显然，大量不溶于水的戊聚糖可以解释面团形成时间，甜菜纤维含量为13.3%。与对照相比，具有苹果纤维的面团的稳定性分别降低了60%，并且面团的稀释率加倍。面团与小麦和甜菜纤维的稳定性降低了20%，然而，用甜菜纤维稀释面团的速度处于对照水平。根据在吹泡仪装置上获得的数据，当使用甜菜纤维时，与对照相比，面粉的“强度”增加了48%，其特征在于面粉的“强度”弱。开发的技术将扩大用于饮食目的的烘焙产品的范围

关键词：小麦纤维，甜菜纤维，苹果纤维，面团的流变学特征，泡沫图，面粉“强度”，面团稳定性，面团液化。

**Abstract.** *This article explores the functional and technological properties of various dietary fibers in order to use them in the production of bakery products. The following dietary fiber was used in the study: wheat fiber, beet fiber, and apple fiber. A comparative characteristic of dietary fiber is given, their influence on the intensity of fermentation of a semifinished product is studied, the lifting force,*

*the fermentation activity of the dough are determined. In experimental versions, dietary fiber is introduced in an amount of 2.5% by weight of flour; with preliminary hydration of 1: 1, focusing on the consistency of the dough. The rheological properties of the test were determined on a pharynograph and alveograph instrument. ILF in samples with wheat and apple fibers increases by 5.1%, and with beet fibers by 11.5%. The dough formation time is 26.6% longer when using wheat dietary fiber; which, obviously, is explained by a large amount of water-insoluble pentosans, by 13.3% with beet fibers. The stability of the dough with apple fibers is reduced by 60% compared with the control, respectively, and the rate of dilution of the dough is doubled. The stability of the dough with wheat and beet fibers is reduced by 20%, however, the rate of dilution of the dough with beet fibers is at the control level. According to the data obtained on the alveograph device, when using beet fibers, the “strength” of the flour is increased by 48% compared with the control, which is characterized by the “strength” of the flour as weak. The developed technologies will expand the range of bakery products for diet purposes*

**Keywords:** wheat fiber, beet fiber, apple fiber, rheological profile of the dough, alveograms, flour “strength”, dough stability, liquefaction of the dough.

**Introduction.** Dietary fiber deficiency in nutrition is considered one of the many risk factors for the development of many diseases: the development of diabetes mellitus, varicose veins, cardiovascular diseases and a number of other diseases [1-9].

In his studies, Academician A. M. Ugolev proved that fiber is that constituent of plant foods that is not digested in the body, but plays a huge role in its life. Dietary fibers normalize the intestines, cleanse the gastrointestinal tract and enhance its activity, which as a result has a beneficial effect on the entire digestive system. It is important that dietary fiber have the ability to bind water and bile acids, as well as adsorb toxic compounds [2].

Scientists of the Biysk Technological Institute I.N. Pavlov and V.A. Kunichan identified the use of beet fiber and set the limits for the introduction of DF from 5-11% depending on the formulation of praline sweets, which reduces the sugar content of products by 5-10%, calorie content by 40-70 kcal per 100 g of product, increase food and biological value. [5]

The use of functional ingredients in the formulation of bakery products will expand the range of products for specialized purposes, regulate the rheological properties of semi-finished products, increase shelf life, increase the nutritional value of finished products [9].

The purpose of the work is: to study the functional and technological properties of various dietary fibers and their impact on the quality of finished bakery products.

**Materials and research methods.** The characteristics of the dietary fiber used in the work are presented in table 1.

*Table 1 - Comparative characteristics of dietary fiber*

Name of indicator	Dietary fiber		
	Wheat	Beetroot	Apple
Appearance		 <small>Flagma.ru</small>	
Consistency	Has a fibrous structure (aerial)	Has a granular structure, easily crumbling with light mechanical impact, is a homogeneous powder	Has a powder structure
Smell	absent	absent	fruity apple
Taste	Neutral, tasteless and odorless	Neutral	fruity apple
Colour	Light-beige	Light cream	Beige-brown
Moisture content, %	7,4±0,3	10,0±0,2	8,0±0,2

The following raw materials were used in the work: baking wheat flour of the highest grade according to GOST R 52189-2003, pressed baking yeast according to GOST R 54731-2011, food table salt according to GOST R 51574-2000, white sugar according to GOST 33222-2015, table margarine according to GOST 32188-2013, drinking water according to GOST R 51232-98, wheat fibers, beet fibers, apple fibers in accordance with TR TS 021/2011.

Trial laboratory baking was carried out according to GOST 27669. The method of dough preparation is pressure-free. As a control, the unified recipe for the Narznoy loaf according to GOST 27844. In experimental versions, dietary fiber is introduced in an amount of 2.5% by weight of flour, with preliminary hydration 1: 1, focusing on consistency of the dough:

- 1 – control option,
- 2 – with the introduction of wheat fiber in the bakery recipe,
- 3 - with the introduction of beet fiber in the recipe of a bakery product,
- 4 - with the introduction of apple dietary fiber in the bakery recipe,

In the work, we used baking wheat flour of the highest grade produced by the "Grain World" LLC, Saratov (Table 2).

**Table 2 - Quality indicators of wheat flour**

<b>Name of indicator</b>	<b>Indicator values</b>
Moisture content, %	14,5
Colour	white
Smell and taste	peculiar to wheat flour
The presence of mineral impurities	no crunch
Ash content, %	0,55
White, conv.	56,0
Mass fraction of crude gluten, %	28,4
The quality of raw gluten, GSM units	59
Fall number, s	266
Grinding size residue on sieve No. 43	1,08
Infestation with pests of grain stocks	not found
Contamination with dead pests	not found

The gas-forming ability of the wheat semi-finished product was determined by volumetric method on the Yago-Ostrovsky device, the lifting force of the semi-finished product by the time of the ascent of the dough ball, fermentation activity by the height of the semi-finished product.

The following indicators were determined on the pharynograph device: water absorption capacity,%; the time of formation of the dough, min; dough resistance to kneading, min; the degree of dilution of the dough 10 minutes after the start, EF; the degree of dilution of the dough 12 minutes after the maximum, EF; quality indicator of the farinograph, mm (Table 3).

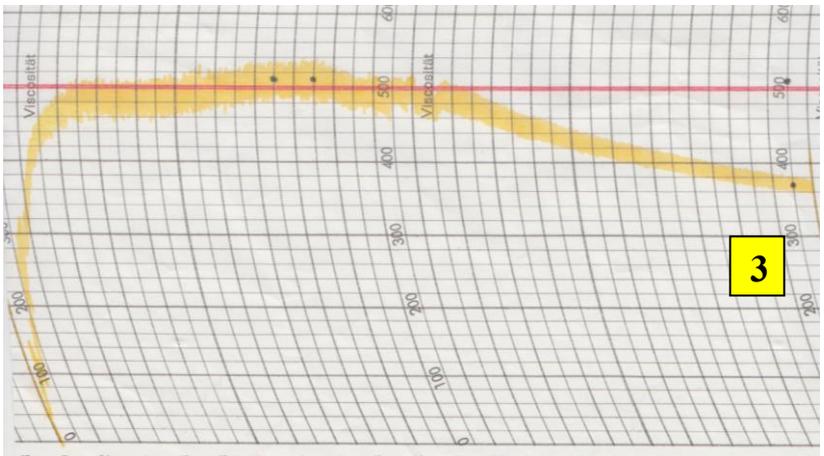
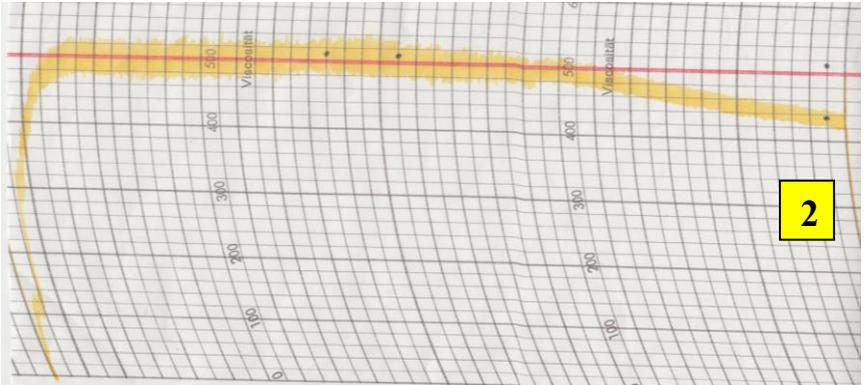
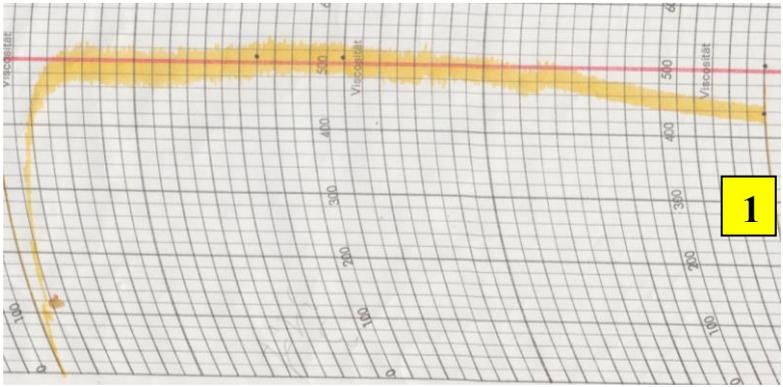
**Results and discussion.** Pharynograms of dough made from wheat flour and mixtures of wheat and dietary fiber are shown in Figure 1.

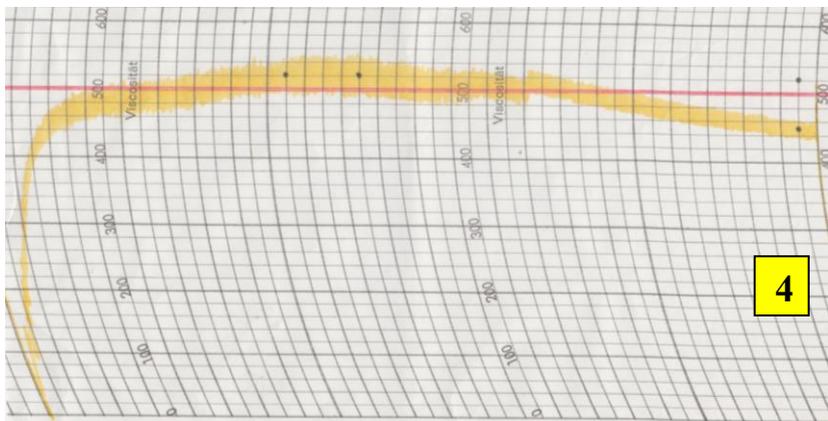
*Table 3 - indicators of pharynography by test variants*

Test material	Quality indicators				
	WAC. %	Dough formation, min	Dough stability, min	Dilution of the dough, E.F.	Valorimetric number: Units val.
Premium wheat flour	62,4	7,5	2,5	70	77
Wheat flour + wheat fiber 2.5%	65,6	9,5	2,0	75	81
Wheat flour + beet fiber 2.5%	69,6	8,5	2,0	70	78
Wheat flour + apple fiber 2.5%	65,6	7,5	1,0	140	68

From the data of table 3 it can be seen that ILF in samples with wheat and apple fibers increases by 5.1%, and with beet fibers by 11.5%. According to scientists from the Voronezh State Agrarian University, wheat fiber has maximum moisture absorption and the degree of swelling, therefore, they are recommended for use in the technology of dairy products, in particular curd and curd products [9]. In wheat semi-finished products, there is high ILF in the "wheat flour - beet fibers" system. At the same time, the dough formation time is 13.3% more with beet fibers, 26.6% more when using wheat dietary fiber, which is obviously explained by a large number of water-insoluble pentosans.

The stability of the dough with apple fibers is reduced by 60% compared with the control, respectively, and the rate of dilution of the dough is doubled. The stability of the dough with wheat and beet fibers is reduced by 20%, however, the rate of dilution of the dough test with beet fibers is at the control level.





**Figure 1 - Farinograms of samples of mixtures:**

1 - control, 2 - with wheat fibers, 3 - with apple fibers, 4 - with beet fibers

On the alveograph instrument, the rheological parameters of the dough were studied: ultimate air pressure, P, corresponding to the elastic deformation of the dough; P / L ratio, the amount of energy expended on inflating the ball until it bursts, W, e.a (Table 4).

**Table 4 - Alveograph indicators for experiment options**

Test material	Quality indicators		
	P, mm	P/L	W, e.a
Wheat flour	80,3	1,67	177
Wheat flour + wheat fiber 2.5%	127,6	3,87	203
Wheat flour + beet fiber 2.5%	158,4	4,52	262
Wheat flour + apple fiber 2.5%	122,1	3,05	229

It was found that the use of dietary fiber leads to an increase in tensile strength, P / L ratio and alveogram area. The study of these indicators is traditionally carried out to indirectly evaluate the "strength" of flour. According to table 4, when using beet fibers, the "strength" of the flour is increased by 48% compared with the control, which is characterized by the "strength" of the flour as weak.

The intensity of the fermentation of semi-finished products can be estimated by the rate of gas generation of the dough from mixtures with dietary fiber, which increases after 120 minutes of fermentation, especially in samples with beet and apple fibers, on average by 18% - 33% compared with the control, which is due to slower absorption of the dietary fiber by yeast. However, the amount of CO<sub>2</sub> released is less by 15.5% in the sample with the addition of beet fibers, therefore, the cost of fermentation in this sample is less (1.49%) compared to other samples. Beet fibers contain

more nutrients, especially calcium, 10 times more than apple fibers and 6 times more than wheat fibers, which also leads to high fermentation activity of this sample. During the fermentation process in the experimental version with the addition of wheat fibers, the dough breaks up, while when using beet fibers and apple, the consistency of semi-finished products is elastic and loosened, which also caused high quality indicators of the finished products (Table 5, Fig. 2). The color of the peel is darker when using beet fibers, and uneven porosity is noted when using apple fibers.

*Table 5 - Quality indicators of finished products*

<b>Name of indicator</b>	<b>Control</b>	<b>1</b>	<b>2</b>	<b>3</b>
Crumb moisture, %	42,0±0,2	42,0±0,1	41,5±0,2	40,0±0,5
Acidity, deg	2,0	1,8	1,6	1,0
Porosity	73±0,5	72±1,0	75±0,5	72±0,5
Specific Volume, cm <sup>3</sup> /g	1,46	1,35	1,33	1,52
Shape stability, HD	0,64	0,37	0,41	0,33

An organoleptic evaluation of the finished product was carried out by a tasting method with the participation of technologists and production masters at the bakery enterprise “Sokur-63” CJSC (Saratov) (Fig. 4).

The degree of satisfaction of the daily needs of the human body in dietary fiber increases by 2.7% with the use of wheat fiber, by 5% with the use of beet fiber (Table 6).

Due to the maintenance of dietary fiber in the bakery recipe, part of the digestible carbohydrates is replaced by non-digestible ones, which favorably affect the digestive system.

**Conclusion.** Based on the results of the studies, the following conclusions can be made: - when using beet and apple dietary fiber in an amount of 2.5% by weight of flour, gas generating capacity, lift and fermentation activity of the semi-finished product increase by 18-33% after 120 minutes of fermentation;

- the introduction of dietary fiber into the dough has a positive effect on its rheological properties, elastic properties, water absorption capacity increase, which led to an increase in the shape stability of the hearths and specific volume of products, and, in turn, the quality of the finished product;

- bakery products with the addition of beet fiber have a brighter, more saturated color compared to traditional technology. Apple fiber baked goods have a rich apple flavor;

- developed technologies will expand the range of bakery products for diet purposes.



**Figure 3 - Appearance of finished products: 1 - control; 2 - with wheat fibers; 3 - with beet fibers; 4 - with apple fibers**

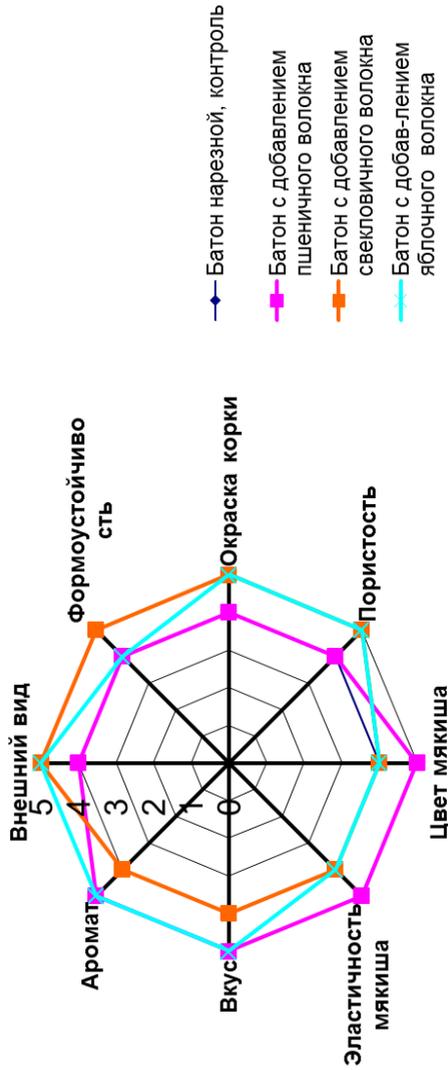


Figure 4 - Profilogram evaluation of organoleptic quality indicators of finished products

*Table 6 - Nutritional value of finished products*

Name of essential nutrients	Control		Wheat fiber variant		Beetroot fiber variant		Apple fiber variant	
	Content in 100 g of product	The degree of satisfaction of daily needs *, %	Content in 100 g of product	The degree of satisfaction of daily needs *, %	Content in 100 g of product	The degree of satisfaction of daily needs *, %	Content in 100 g of product	The degree of satisfaction of daily needs *, %
Proteins, g	8,42	11,22	8,67	11,56	8,57	11,43	8,42	11,22
Fats, g	3,29	3,96	3,35	4,04	3,21	3,87	3,20	3,86
Carbohydrates, g	53,99	14,87	54,39	14,98	54,21	14,93	54,03	14,88
Dietary fiber, g	3,67	12,23	4,48	<b>14,93</b>	5,14	<b>17,13</b>	3,76	12,53
Potassium, mg	136,71	5,47	133,30	5,33	133,30	5,33	137,70	5,51
Calcium, mg	22,69	2,27	22,68	2,26	37,41	3,74	22,84	2,29
Vitamin E, mg	1,95	13,00	1,96	13,06	2,06	13,73	1,93	12,86
Energy value, kcal	279	11,16	282	11,28	280	11,20	278	11,12

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直馏汽油在含沸石催化剂上的预芳构化过程  
**THE PROCESS OF PRE-AROMATIZATION OF STRAIGHT-RUN  
GASOLINE ON A ZEOLITE-CONTAINING CATALYST**

**Munirov Timur Arturovich**

*Competitor of a scientific degree of Candidate of Technical Sciences,  
Ufa State Petroleum Technological University*

**Davletshin Arthur Raisovich**

*Candidate of Technical Sciences  
Associate Professor of "Oil and Gas technology",  
Ufa State Petroleum Technological University*

**Munirova Adel Arturovna**

*Master of the department "Oil and gas technology",  
Ufa State Petroleum Technological University*

抽象。 本文介绍了原料芳构化催化重整过程的研究结果。 作者对经典和组合方法得到的产品的主要特征进行了对比评价。

关键词: 催化重整, 含沸石催化剂, 含铂催化剂, 汽油, 芳烃。

**Abstract.** *This paper presents the results of a study of the catalytic reforming process with preliminary aromatization of raw material. The authors have carried out a comparative evaluation of the main characteristics of the products obtained by classical and combined methods.*

**Keywords:** *catalytic reforming, the zeolite-containing catalyst, platinum-containing catalyst, gasoline, aromatic hydrocarbons.*

In recent years, Russian refineries continue to increase the production capacity of motor fuels [1]. One of the main components of commercial gasoline is reformat, which is characterized by a high octane number. In addition to the volume of products produced, the actual problem is the reduction of motor fuels to environmental standards, which over the years put forward more stringent requirements [2]. In this regard, a significant number of studies covered in the scientific literature, aimed at finding ways to optimize the process of reforming.

One possible way to increase the marginality of the catalytic reforming process is to reduce the cost of production by using less expensive catalysts. There are known studies aimed at reforming n-hexane and n-heptane using zeolite-containing catalysts [3-5]. As a result, it was found that the intensification of aromatization reactions occurs in the temperature range from 350 °C to 450 °C [4].

In addition to experiments on single-component raw materials, the scientific literature describes the study of the process of reforming straight-run gasoline on zeolite-containing catalysts in anhydrous medium [6,7]. Depending on the composition of the mechanical mixture of catalysts, products with an octane number from 61.8 to 85.5 points and a mass yield from 58.4% to 96.5% were obtained [6].

Currently implemented industrial processes produce components of gasoline for the catalysts of Zeoforming and BIMF process. The advantage of such technologies lies in the development of not only gasoline, but diesel fuel in a single installation. In addition, the zeolite-containing catalysts used are resistant to the action of catalytic poisons and do not require preliminary hydro-refining of raw materials [8,9]. However, the existing plants working on the technology of Zeoforming and BIMF, have small capacity (40 thousand tons / year), compared with the classic reforming plants. Thus, studies aimed at the modernization of existing catalytic reforming plants are of not only scientific, but also practical interest.

To study the stability of a zeolite-containing catalyst (60-72%  $\text{SiO}_2$ +38,0-25.6% Of  $\text{Al}_2\text{O}_3$ +1,8-2,2% Zn and 0.15%  $\text{Na}_2\text{O}$ ) in the aromatization process of raw materials for catalytic reforming experiments in the laboratory were conducted. The test run was carried out under the following conditions: initial process temperature 350 °C, pressure 10 ATM, volume speed  $1\text{h}^{-1}$ , reactor volume 10  $\text{cm}^3$ . Every 16 hours the temperature increased by 10 °C to 430 °C. The duration of the experiment was 400 hours with intermediate oxidative regeneration. In order to shift the equilibrium towards the target products, the supply of hydrogen-containing gas was not carried out.

With increasing temperature from 350 °C to 410 °C, a uniform increase in the amount of aromatic hydrocarbons is observed from 17.2% vol. to 23.8% vol. With similar dynamics, there is a decrease in the mass yield of liquid process products from 90.3% to 84%. The number of cycloalkanes and isoalkanes in the temperature range from 350 °C to 410 °C varies insignificantly and ranges from 30.5% vol. up to 33.5% vol. and from 31.5% vol. up to 33.1% vol. respectively.

With an increase in temperature from 420 °C to 430 °C, there is a sharp increase in the number of arenes to 29.3% vol., As well as a decrease in the content of n-alkanes and cycloalkanes to 8.5% vol. and up to 27.4% vol. respectively. The mass yield of liquid catalysis drops from 84.0 to 78.1%. A sharp deterioration in the performance of the process, as a rule, occurs as a result of the intensification of the occurrence of undesirable reactions of coke formation. A further increase in the process temperature was impractical, due to a decrease in the activity of the catalyst. Subsequent oxidative regeneration of the catalyst allowed us to restore its activity to almost the same level.

Next, repeated studies of the process of reforming gasoline on a zeolite-containing catalyst were carried out under conditions similar to previous experiments

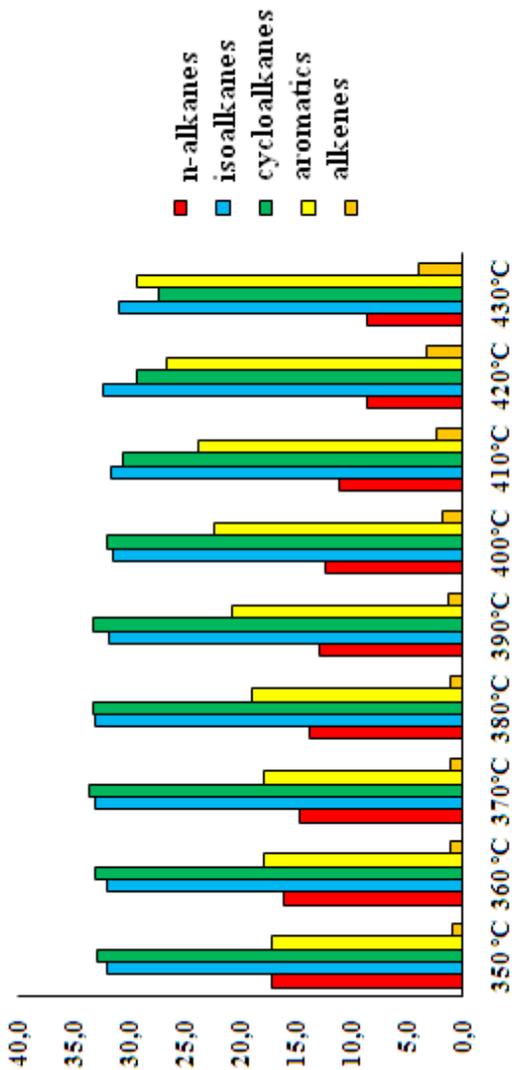
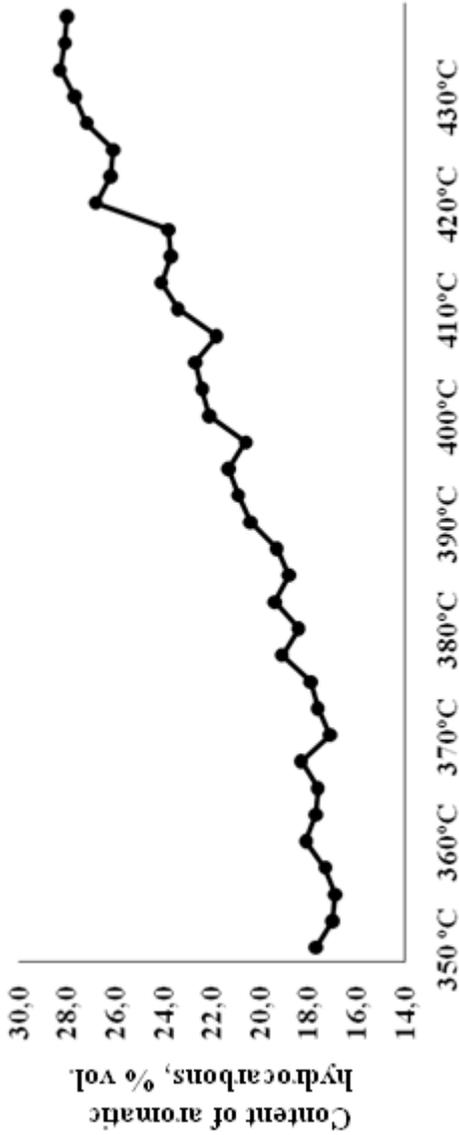
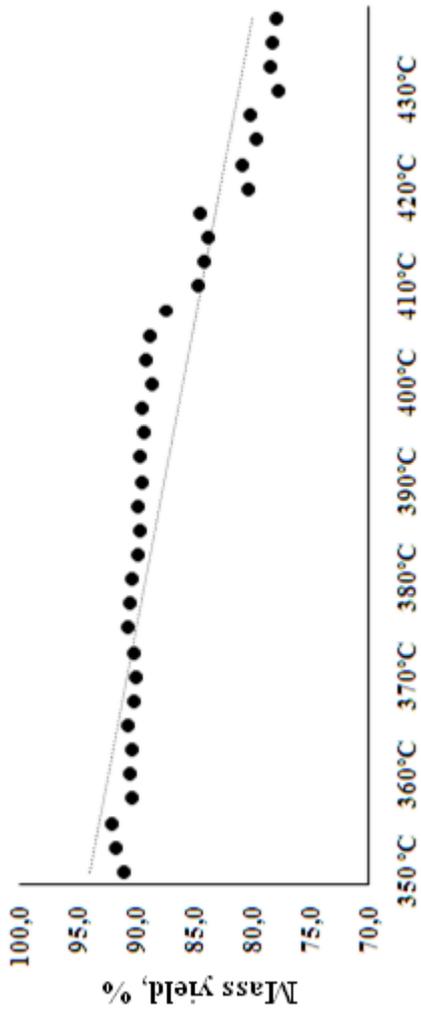


Figure 1. Change in the hydrocarbon composition of gasoline aromatization products with increasing temperature (before regeneration), % vol



*Figure 2. The change in the content of aromatic hydrocarbons in the products of gasoline aromatization from temperature (before regeneration), % vol.*



**Figure 3.** The change in the yield of gasoline aromatization products from temperature (before regeneration), % of the mass

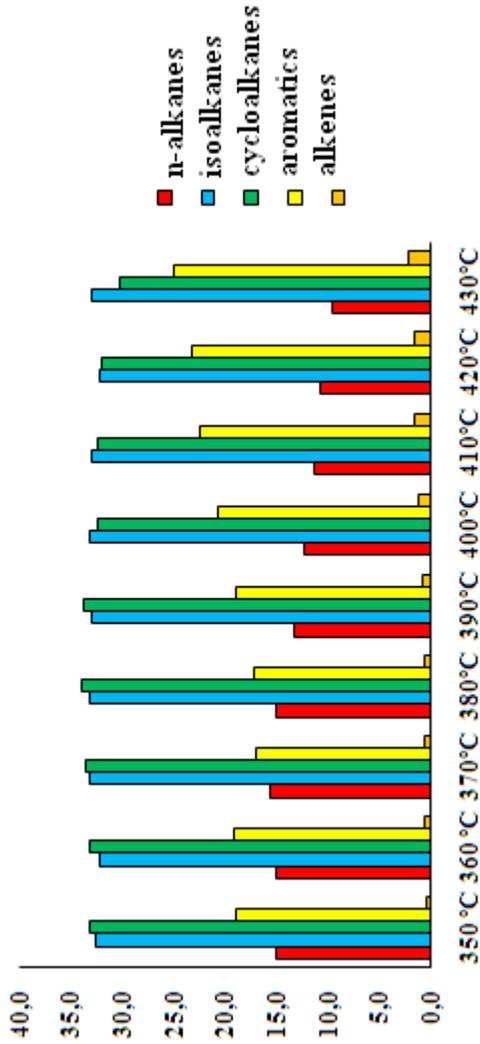
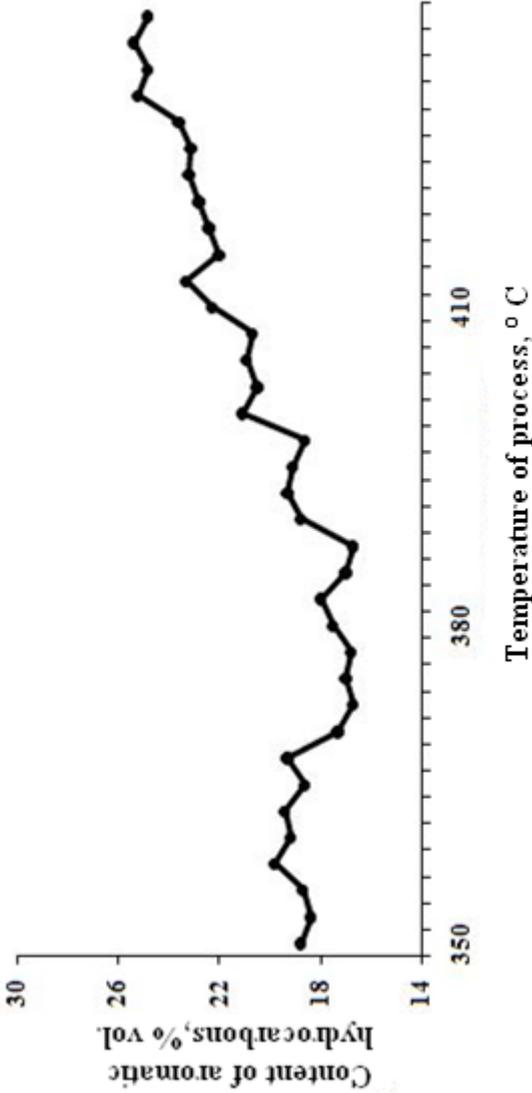


Figure 4. The change in the hydrocarbon composition of gasoline aromatization products with increasing temperature (after regeneration), % vol.



*Figure 5. The change in the content of aromatic hydrocarbons in gasoline aromatization products as a function of temperature (after regeneration), % vol.*

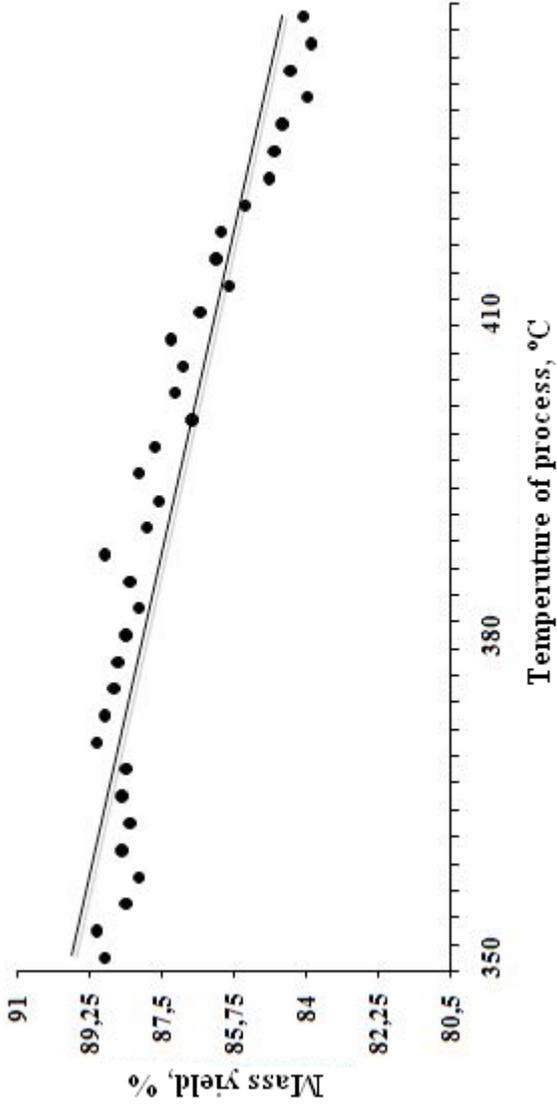


Figure 6. The change in the yield of gasoline flavoring products from temperature (after regeneration), % of the mass

As in previous experiments, with increasing temperature, the content of aromatic hydrocarbons increases, while the proportion of alkanes in the linear structure decreases. In products obtained at temperatures from 390 °C to 430 °C there is a stable increase in the content of aromatic hydrocarbons from 19.0% vol. up to 25.1% vol. The number of cycloalkanes with an increase in the process temperature from 350 °C to 420 °C varies insignificantly from 32.1% vol. up to 33.9% vol.

A significant decrease in the proportion of cycloalkane hydrocarbons to 30.3% vol. observed at 430 °C. The yield of products with a temperature increase from 350 °C to 430 °C decreases from 88.6% to 84.1%. Moreover, the most significant changes in the yield of liquid catalysis are observed in the area corresponding to the temperature range from 390 °C to 430 °C.

To evaluate the effectiveness of the use of raw materials that underwent preliminary aromatization during the reforming process, experimental runs were performed on a platinum-containing Axens RG-682 catalyst in comparison with the classical process. Process conditions: temperature 490 °C, P = 1.5 MPa, a volumetric feed rate of 1.5 h<sup>-1</sup> and a ratio of hydrogen-containing gas to feed 750: 1 nm<sup>3</sup> / nm<sup>3</sup>.

**Table 1 - Characteristics of the products obtained**

	<b>Reforming</b>	<b>Pre-Aromatization + Reforming</b>
The content of aromatics,% vol.	58,0	63,4
The benzene content, % vol.	0,98	0,47
Mass yield,%	84,2	85,1
RON	95,8	96,4

In general the obtained results show the feasibility of further studies of zeolite-containing catalysts at the preliminary stage of the combined process of reforming straight-run gasoline, which allows to increase the basic performance indicators of products, compared with the classical process.

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具有开发和测试火箭发动机钎焊接头控制方法的经验

## **EXPERIENCE IN DEVELOPMENT AND TESTING OF METHODS OF CONTROL OF BRAZED JOINTS OF ROCKET ENGINES**

**Kostyukhin Aleksandr Sergeevich**

*postgraduate*

*St. Petersburg state University*

*of information technologies, mechanics and optics*

注解。对现代火箭发动机的焊接接头质量的高要求以及燃烧室的设计特征不允许在非破坏性测试方面使用现成的传统方法方法。根据规范和技术文件的要求，在控制焊接LRE接头的质量时，允许使用反射辐射，透射辐射，共振，自由振动和声发射的方法来使用声学类型的控制。STC ETALON LLC对LRE燃烧室的样品进行了研究，并选择了最优的NDT方法和工具。由于燃烧室的设计特征以及相对小的焊接缺陷对设备的选择施加了限制，因此提出使用基于超声波的热光激发的非经典NK方法。这种方法非常敏感。但是，通过连续监测，由于扫描速度低，这种方法的应用是不实际的。因此，有人提出使用这种方法来准确评估缺陷特性，并建议连续监测使用高性能直接相控阵。上述解决方案形成了用于编写控制焊接接头的方法的基础。松散的技术经历了实验测试，其性能得到了证实。本文还讨论了在控制火箭发动机焊接接头期间探测器在屏幕上的扫描解释，以及控制过程的计量支持。

**Annotation.** *High requirements to the quality of the soldered joints of modern rocket engines, as well as the design features of the combustion chambers do not allow the use of ready-made traditional methodological approaches in terms of non-destructive testing. In accordance with the requirements of normative and technical documentation, when controlling the quality of soldered LRE joints, it is allowed to use the acoustic type of control using methods of reflected radiation, transmitted radiation, resonant, free vibrations and acoustic emission. STC ETALON LLC conducted research on samples of LRE combustion chambers and the most optimal NDT methods and tools were selected. Since the design features of the combustion chambers, as well as relatively small soldering defects, impose restrictions on the choice of equipment, it was proposed to use the non-classical NK method based on thermo-optical excitation of ultrasound. This method is highly sensitive. However, with continuous monitoring, the application of this method is not practical, due to the low scanning speed. Therefore, it was proposed to use this method for accurate assessment of defect characteristics, and for continuous monitoring to use a high-performance direct phased array. The solutions de-*

*scribed above formed the basis for writing methods for controlling soldered joints. The loose technique underwent experimental testing, where its performance was proved. This article also discusses the interpretation of scans on the screen of a flaw detector during the control of soldered joints of the rocket engine, as well as the metrological support of the control process.*

The most important unit of the LRE is the combustion chamber, which ensures the performance of the entire engine. In this regard, the combustion chamber of the LRE has high requirements for reliability and safety. To ensure reliability and safety, a large number of research works are carried out, in particular quality control of the solder joint [1].

The existing assessment of the quality of the soldering is regulated by OST 92-1190 and in practice, in most cases, is to carry out a metallographic analysis of solder joints. This method of investigation of solder joints has some disadvantages. One of the main drawbacks is the presence of artifacts in the microstructure of the seam, formed during the preparation of the section, which can take on technological defects (foreign etched and inclusions, interfacial boundaries). The second disadvantage is the inability to objectively assess the strength of the solder joint, for example, in the process of embrittlement of the structural components of the seam.



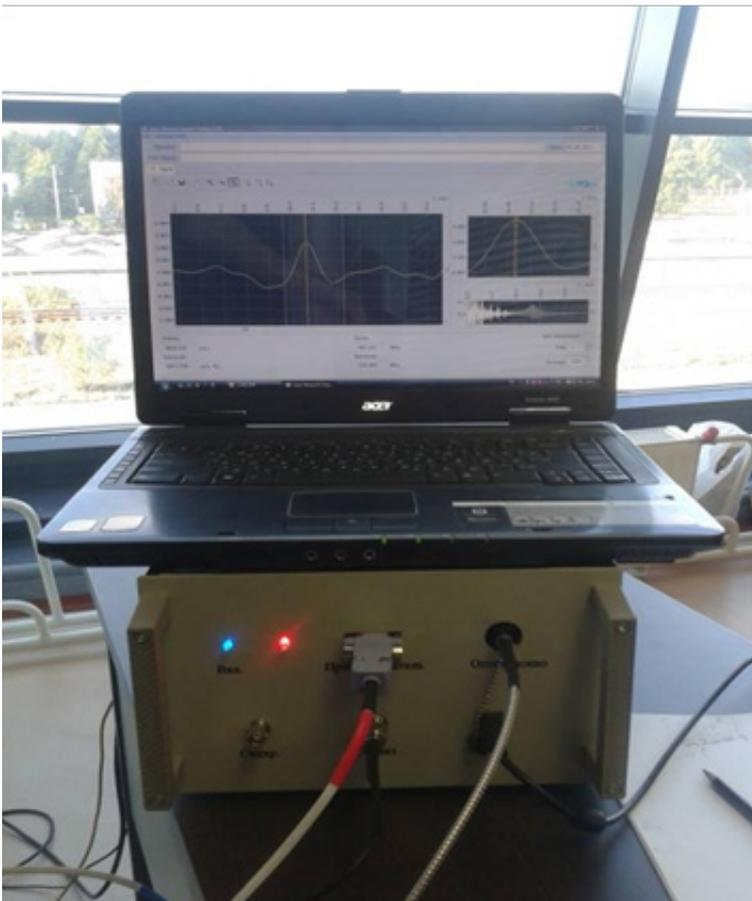
**Figure 2 - Appearance of Olympus OmniScan MX2 flaw detector**

Confirmation of the quality of solder joints is determined only by hydraulic strength tests and pneumatic (air) leak tests.

In connection with the above, it is obvious the need for non-destructive testing methods to detect non-solder joints, non-solder joints and other defects. Ultrasonic echo method was chosen as such method [2].

The following equipment was used to implement the chosen method:

- Olympus OmniScan MX2 flaw detector with 32-element 10 MHz phased array antenna and direct prism (figure 2);
- laser-ultrasonic defectoscope UDL-2M with the PLU converters-12Y01, PLU-6 C-03 [3] (figure 3)

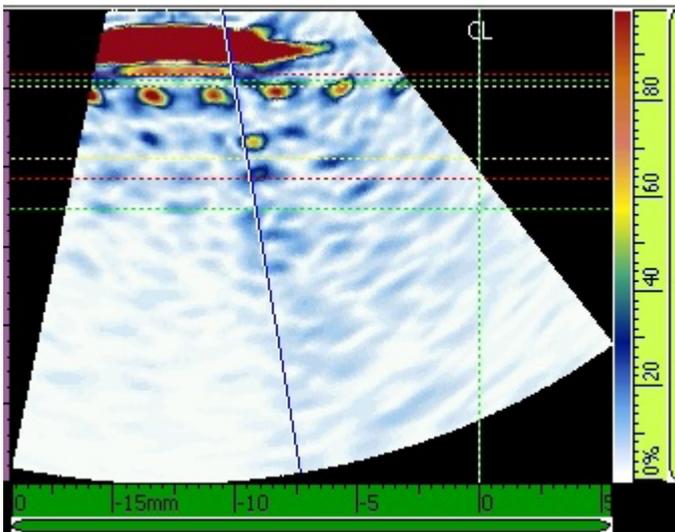


**Figure 3 - Appearance of laser-ultrasonic flaw detector UDL-2M**

Preparation for quality control of solder joints of the combustion chamber of the RD-181 engine included:

- study of technical and technological documentation for the zone between 2 and 3 "curtains" of the combustion chamber of the RD-181 engine, provided by JSC "NPO Energomash»
- development of a set of control samples (CO) sensitivity to assess the sensitivity and configuration of flaw detection equipment;
- development of methodical bases of quality control of solder joints using CO [4];
- retrofitting and revision of the equipment used;
- development of Methods for quality control of brazed connections of the combustion chamber between 2 and 3 "curtains" of the RD-181 engine

In the study of technical and technological documentation in the area between 2 and 3 "curtains" of the combustion chamber of the engine was defined requirements of control (controledienst, the use of couplant and the necessity of sealing gaps 2 and 3 veils, character defects) and a list of required equipment.



*Figure 4 - Interpretation of inspection results obtained using Olympus OmniScan MX2 flaw detector*

Further, with the use of the presented products based on the experience of creating and testing Methods of quality control of brazed joints for the presence of discontinuities (nepraev, chunking) of the ribs of the wall inner and podkarantinnogo nozzle ring upper chambers of the engine 14D23 and experience in the development of methods and means of nondestructive testing to detect defects in friction welding with opening of 2  $\mu\text{m}$  was implemented echo control method and the developed methodical basis of the quality control of brazed joints.

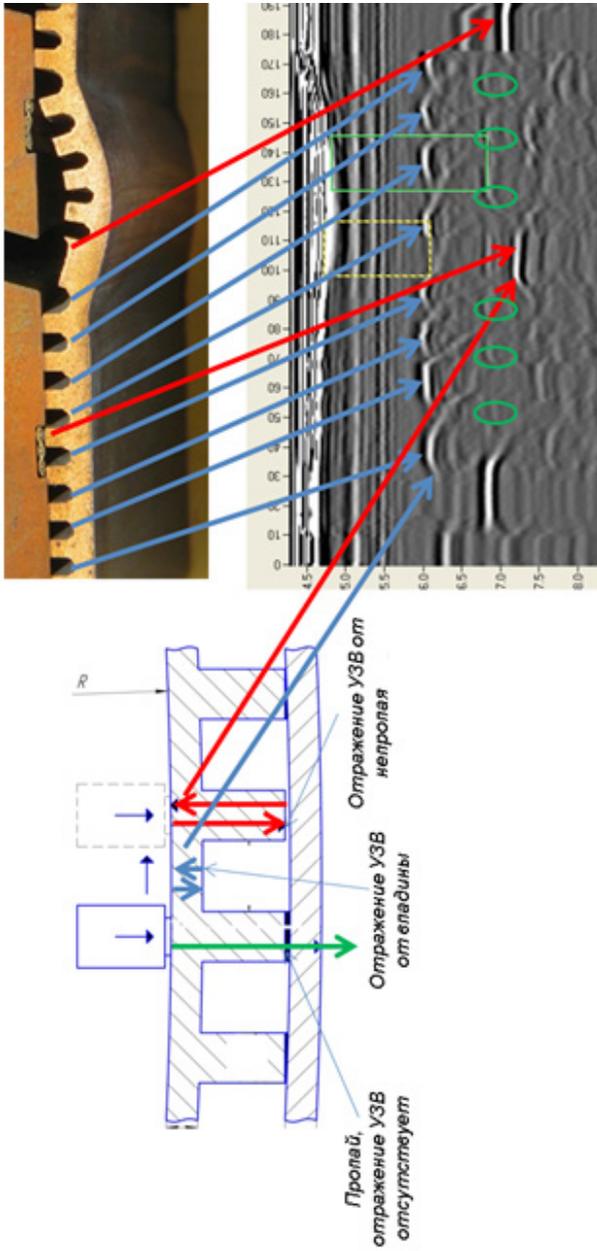


Figure 5 - the scheme of control by echo method and the corresponding interpretation of the control results obtained using the laser-ultrasonic flaw detector UDL-2M

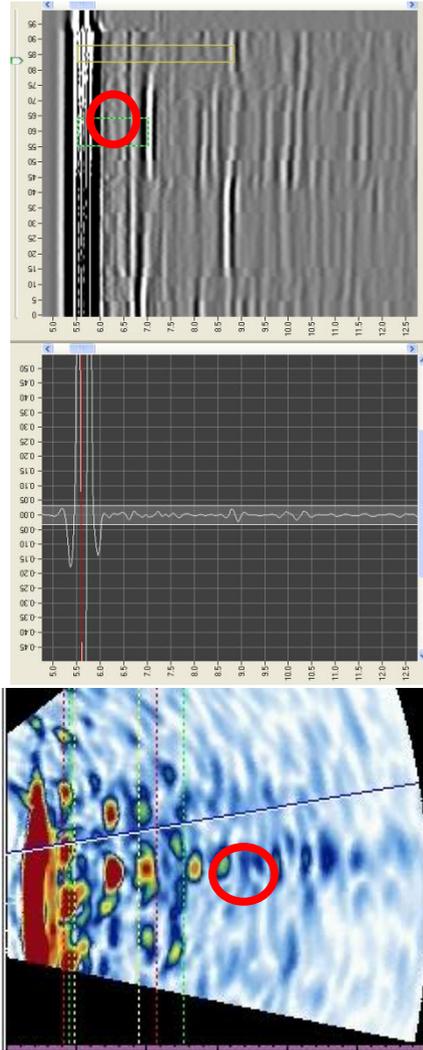
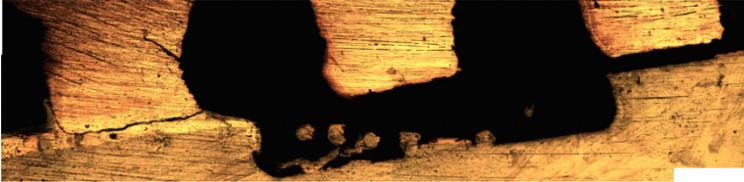


Figure 6 - Acoustic image of detected defects in sample No. 1

Figures 4-5 show the control scheme and the interpretation of the control results. Blue arrows and circles indicate the recorded acoustic signals from the cavities between the ribs, red arrows and circles – reflections from non – solder or structural ducts, green circles-areas in which signals should be recorded in the presence of non-solder or detachment of the ribs.



*Figure 7 - Results of metallographic studies of identified defects*

Further, the working out of the methodical bases of quality control of solder joints on cuttings from the combustion chamber between 2 and 3 "curtains" of the RD-181 engine was performed, which confirmed the applicability of the presented method and means to a given object of control.

To assess the sensitivity and subsequent adjustment of flaw detection equipment during the control was developed CO.

Using a sample made of the clippings of the combustion chamber between 2 and 3 "curtains" of the RD-181 with flat bottomed drill 1.1 mm confirmed by the ability of the presented methods and tools to identify Naropa and the gap opening over 2 mm, a width corresponding to the width of the rib and a length along the ribs than 1.0 mm.

The detected defect was confirmed by the results of metallographic studies (figure 7).

The results of the control sample revealed reflectors, signal amplitude does not exceed the acceptance level (figure 8, 9).

Reflector 1 identified in the center of the sample requires additional destructive studies.

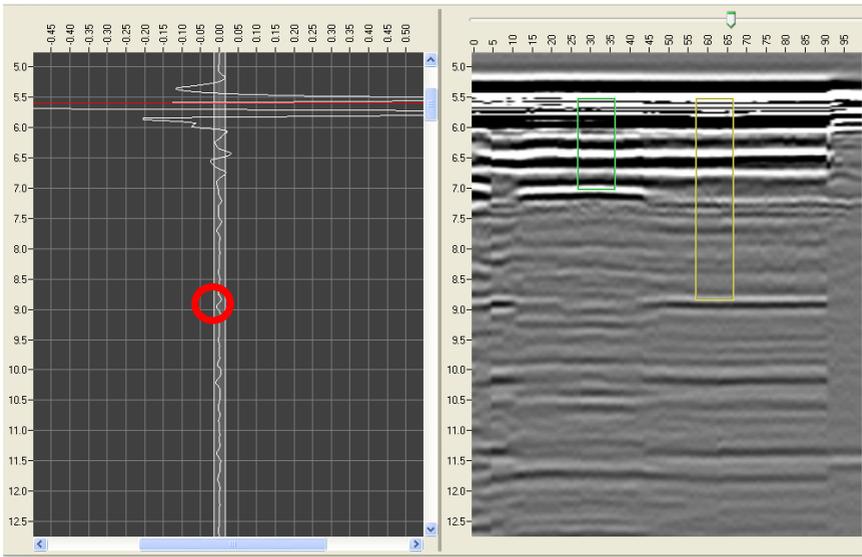
Reflector 2 is confirmed by the results of metallographic studies and is not a critical defect by the measured dimensions (figure 10).

The analysis of the obtained results of quality control of solder joints of samples from the combustion chamber of the RD-181 engine in the zone between 2 and 3 "veils" showed the efficiency and reliability of the developed technique. The detection of non-penetration or detachment with opening more than 2 microns, width corresponding to the width of the rib and length along the rib more than 1.0 mm was confirmed.

After making the necessary adjustments to the methodology related to the features of quality control of the RD-181 engine solder joints in the enterprise, quality control of the RD-181 engine solder joints No. 13A/1B in the zone between 2 and 3 "veils" was performed.



*Figure 8 - Location of the detected reflectors in sample No. 2*



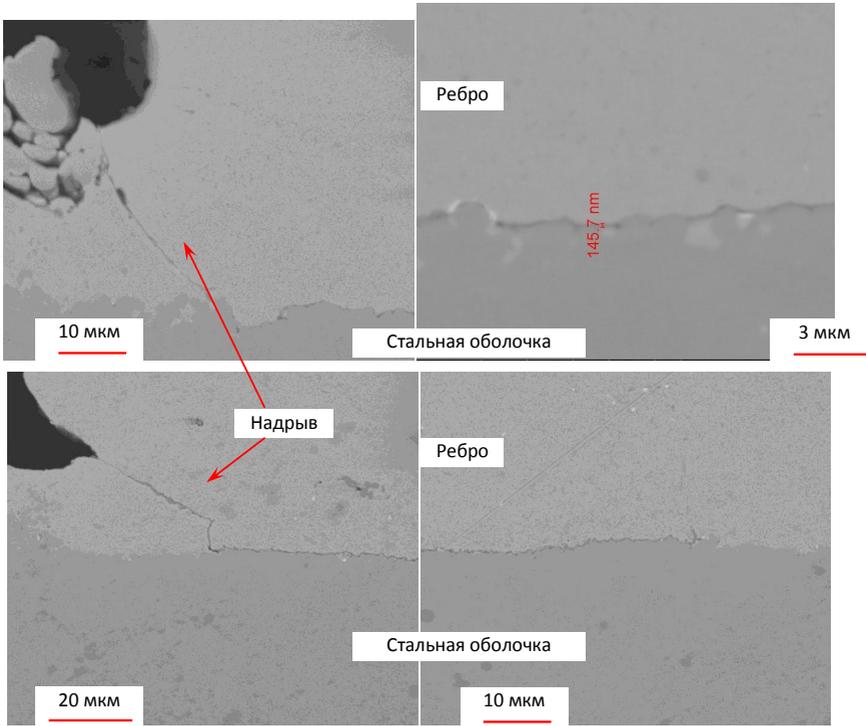
*Figure 9 - Acoustic image of the detected reflectors in sample No. 2*

To carry out the ultrasonic testing and simplify the interpretation of the results of the control, the object of control was divided into 6 sectors (figure 11).

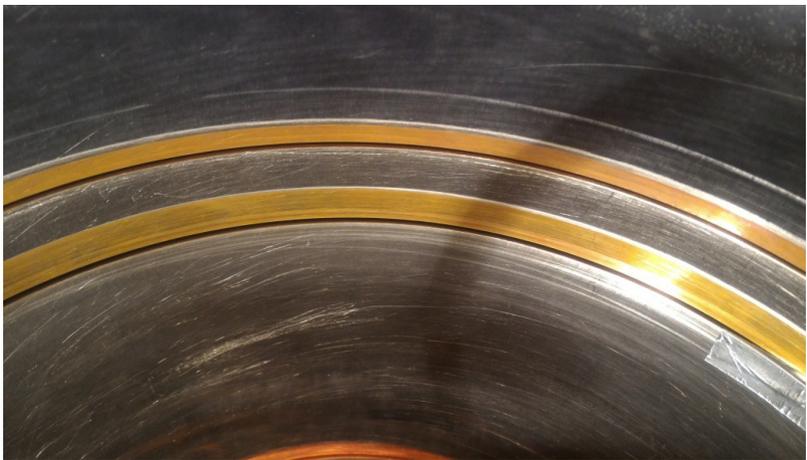
Before carrying out control to avoid falling used in ultrasonic couplant (glycerin) in the channels of the combustion chamber of the veil was sealed with a special tape, the tape is applied the required markings (figure 12).

The control was performed according to the procedure in the following sequence:

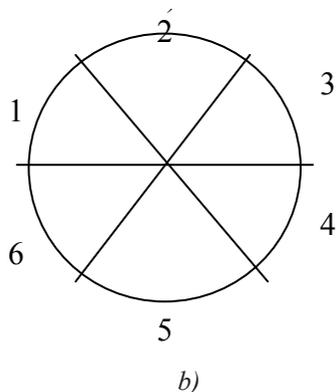
- isolation of curtains and marking in sectors 1-4 (lower sectors at horizontal arrangement of the engine);
- control of sectors 1-4 using the flaw OlympusOmniScanMX2;
- control of disputed and non-controllable for the phased array areas laser-ultrasonic flaw detector UDL-2M.
- removal of contact fluid and degreasing of the combustion chamber;
- revolution of the combustion chamber;
- isolation of curtains and marking in sectors 5 and 6 (lower sectors at horizontal arrangement of the engine after revolution);
- control of the sectors 5 and 6 with the flaw OlympusOmniScanMX2;
- control of disputed and non-controllable for the phased array areas laser-ultrasonic flaw detector UDL-2M;
- removal of contact fluid and channel insulation, degreasing of the combustion chamber;
- analysis of control results.



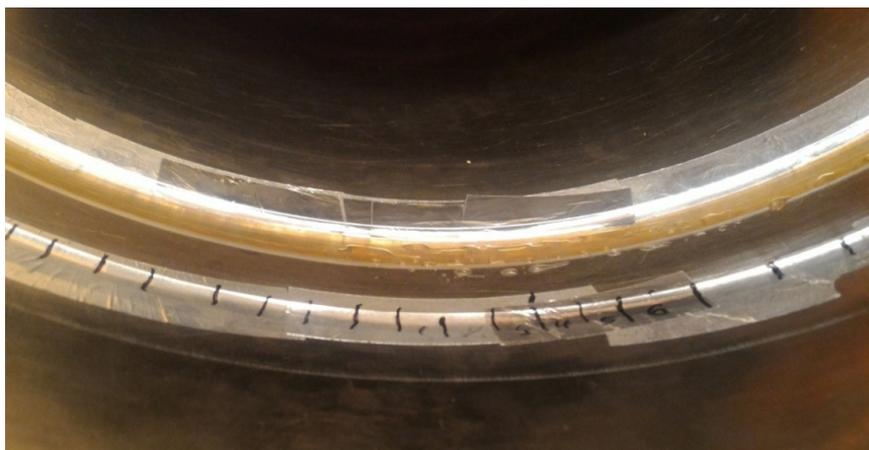
*Figure 10 - results of metallographic studies of sample No. 2*



a)

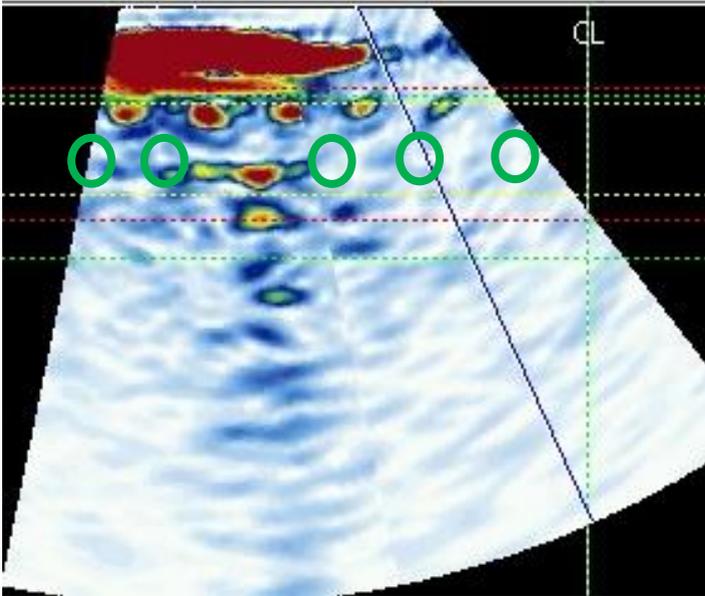


*Figure 11 - A view of the combustion chamber of the RD-181 engine from the inside (a) and a sketch of the object of control with the division of the control area into sectors (b)*



*Figure 12 - view of the combustion chamber with sealed curtains*

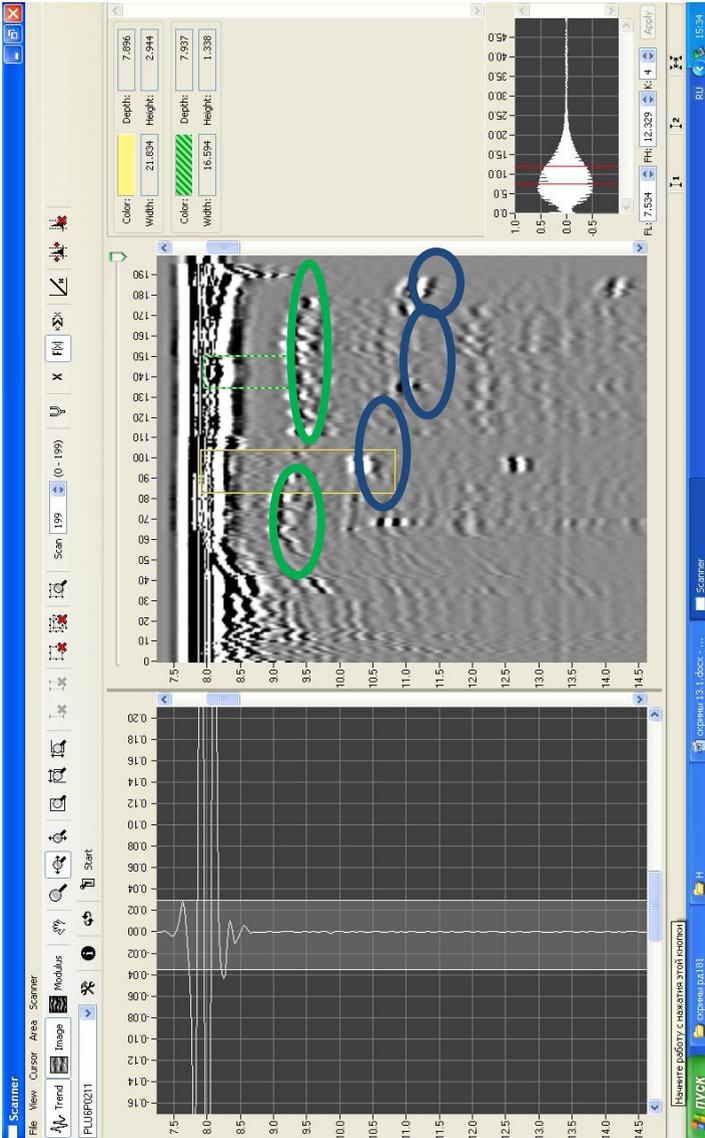
During quality control of solder joints of the RD-181 No. 13A/1 in the zone between 2 and 3 "curtains" with the help of flaw OlympusOmniScanMX2 defects (Naropa or the gap opening over 2 mm, a width corresponding to the width of the rib and a length along the ribs than 1.0 mm) were found (figure 13). The red zone at the depth corresponding to the depth of possible reflections from the edges is the reflection from the edge located in the area of the structural groove (see Fig. the scheme of control by the echo method and the corresponding interpretation of the control results obtained using the laser-ultrasonic flaw detector UDL-2M in figure 4).



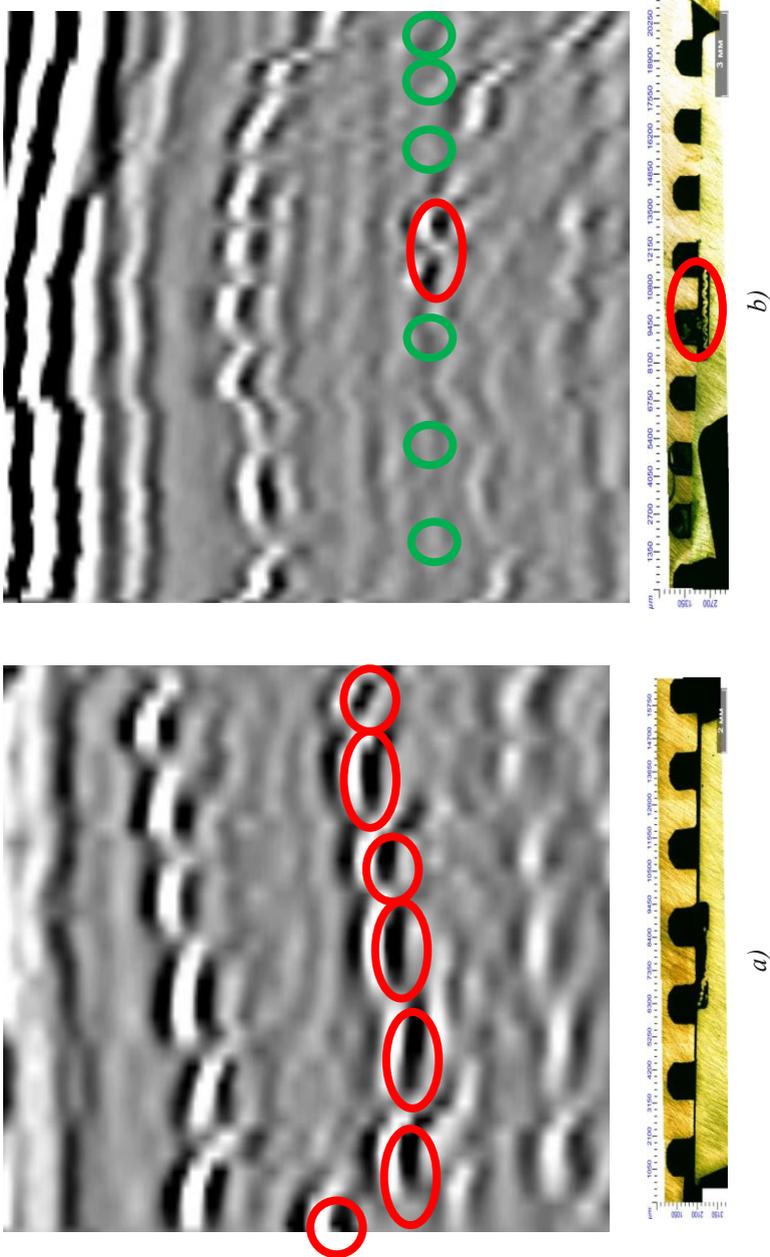
*Figure 13 - Typical acoustic image of defect-free solder joints of RD-181 engine No. 13A/1 in the zone between 2 and 3 "curtains»*

Further, selective quality control of soldered joints of RD-181 engine No. 13A/1B in the zone between 2 and 3 "veils" was performed using laser-ultrasonic flaw detector UDL-2M in 6 sections at the boundaries between sectors according to the Method. No gap or gap with an opening greater than  $2\ \mu\text{m}$ , a width corresponding to the width of the rib and a length along the rib greater than 1.0 mm were also detected (figure 14). Green marker selected reflections from the troughs between the ribs, and the blue from the edges in the place of constructive groove (see the scheme of control by the echo method and the corresponding interpretation of the control results obtained using the laser-ultrasonic flaw detector UDL-2M in figure 4).

When testing the technique on samples with defects, acoustic images of defective areas were obtained (figure 15A). According to the results obtained during the control of the combustion chamber of the RD-181 No. 13A/1 engine, no critical defects were found between 2 and 3 "veils". Figure 15B shows a typical defect-free acoustic pattern corresponding to the controlled combustion chamber.



*Figure 14 - results of the control performed with the help of laser-ultrasonic flaw detector UDL-2M at the boundary between sectors 1-2*



*Figure 15 - Acoustic images of defective (a) and defect-free (b) sections of rd-181 engine solder joints in the zone between 2 and 3 "curtains»*

For the quality control of soldered connections from the combustion chamber of engine No. 13A and verification methods were identified and confirmed critical defects (with opening more than  $2\ \mu\text{m}$ , a width corresponding to the width of the rib and a length along the ribs than 1.0 mm) and defects with dimensions smaller than the accepted critical, which confirms the high sensitivity of the selected methods and tools and the reliability of the method.

The inspection identified the need:

- development of special equipment and automation control;
- conducting additional destructive and non-destructive studies with the production of samples with embedded defects.

Performance of these works will allow:

- to ensure the constancy of the acoustic contact and, accordingly, to increase the reliability of the control;
- reduce the complexity of control;
- to develop control technology providing detection of smaller defects.

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通过大气电气化控制天气

WEATHER CONTROL BY ELECTRIZATION OF THE ATMOSPHERE

**Vladimir A. Grachev**

*D.Sc.(Tech.), Professor, Head*

*Global Ecology Center*

*Faculty of Global Studies*

*Lomonosov Moscow State University*

*Moscow, Russian Federation*

**Mario M. Dominguez**

*Director, Soluciones Climaticas Avanzadas*

*Naucalpan de Juárez Area, Mexico*

**Lev A. Pokhmelnikh**

*Principal Investigator, Soluciones Climaticas Avanzadas*

*Naucalpan de Juárez Area, Mexico*

抽象。该文章介绍了天气控制的电子技术的实验使用结果，其中气象过程大部分依赖于大气的电气状态，并且在能量消耗很小的情况下，有可能控制天气和气候。1996 - 2010年墨西哥实验室实验技术的实验验证。在工程过程中，墨西哥北部和中部地区的降水量增加；国家的几个水库都填满了；北方国家和YUCATAN半岛的森林火灾已经减少；消除墨西哥城市和墨西哥吐鲁番机场雾的吸尘能力；已经避免了墨西哥城预测的洪水；在太平洋和加勒比海东部海岸的飓风减弱的一些结果。

关键词：大气，电气化，降水，烟雾，森林火灾，水库，飓风。

**Abstract.** *The article presents results of experimental use of electronic technology of weather control from which it follows that meteorological processes largely depend on the electrical state of the atmosphere and that with a small expenditure of energy, it is possible to control the weather and climate. Experimental verification of the technology was conducted in the form of field experiments in Mexico in 1996-2010. In the course of the works, precipitation was increased in the Northern and Central States of Mexico; several reservoirs of the country were filled; forest fires were decreased in the Northern States and on the Yucatan Peninsula; the ability to eliminate smog in Mexico City and fog in the Toluca airport was demonstrated; the predicted flood in Mexico City had been avoided; some results of the weakening of hurricanes in the Eastern coast of the Pacific Ocean and the Caribbean are presented.*

**Keywords:** *atmosphere, electrification, precipitation, smog, forest fires, reservoirs, hurricanes.*

## 1. Introduction

The priority of corporate and business interests manifests in many areas, including influence on the environment: the cloud seeding chemical powders dispersion from aircrafts for the purpose of rain blocking/making costs to the countries impressive sums. For 20 years it has been known about the existence of a new electrodynamic theory and promising ELAT-technology [1-3] which is able to eliminate the main cause of forest fires – drought – by creating humid flow from oceans and increasing the moisture content of forest wood to a safe level. However, the technology is not applied.

The science of weather management has a long history. Purposefully it began to develop in the second half of the 20th century. In [4], the opinion was expressed that a series of climate disasters began in 1960 at the same time as there appeared the CIA reports claiming that the government was already capable of managing weather for military purposes. The author concluded that reading the CIA report, it was difficult to get rid of the idea that many climate changes in recent years could well be the result of military experiments. Lockhart Gary said [5] that, on the one hand, we can artificially influence the atmosphere with low power radiation. On the other hand, Charles Yost noted [6] that we know that Northern lights flashes affect weather conditions. If significant disturbances are observed in the ionosphere, the lower atmosphere layers subsequently change their state as well. Two scientists from Stanford University's radiation physics laboratory, C. Chang and U.C. Iman, provide evidence of the possibility of influence on the weather by means of electromagnetic radiation from the Earth [7]. They published a number of papers describing an avalanche of electrons from the magnetosphere. From their point of view, this avalanche of particles can generate secondary ionization, stimulate radiation in the X-ray range and cause significant disturbances in the lower layers of the ionosphere.

In 1974, Dr Robert Halliwell and Gene Katsufakis of Stanford University's electromagnetism laboratories have shown that ultra-low radio waves can cause oscillations in the magnetosphere. They conducted experiments in Antarctica using a 20-kilometer antenna and an amplifier that generated signals at a frequency of 5 kilohertz, allowed them to establish that the processes in the magnetosphere are really affected by such radiation and it causes a flow of high-energy particles, an avalanche falling into the Earth's atmosphere. By turning the signal on and off, scientists could start and stop the particle flow. According to Frederic Jueneman: “The theoretical implication suggested by their work is that global weather control can be attained by the injection of relatively small ‘signals’ into the Van Allen belts (radiation belts around Earth) – something like a super-transistor effect” [8].

Today, we are in a situation similar to the one that happened almost a century ago, when in 1933, Einstein claimed that there were no signs that humanity could

use atomic energy. At the same time, in 1932, V. I. Vernadsky wrote to I. V. Stalin about the need for extensive research in the field of radioactivity. Back in 1910, he insisted at the Academy of Sciences on the need to develop such research. In 1922, he wrote [9]: "We approach a great revolution in the life of the mankind, to which nothing experienced earlier can be compared. The time when a man will master atomic energy, a powerful source that will allow him to build up his life in accordance with his desire, is not far. It can happen within the coming years or it can happen in a century. But it is absolutely clear that it will have to happen. Will a man manage to make use of this power, to direct it to good purpose but not at self-destruction?"

## 2. Materials and methods

The main tool of the technology is an electric current generator to or from the atmosphere – ELAT-station (the technology was also named ELAT), where ELAT stands for electrizer of the atmosphere [2,3]. ELAT-station consists of a DC high voltage source and an antenna – a network of thin emission wires suspended at some height above the ground. When a constant negative potential is applied to the wire relative to the ground, the electric field strength at the wire surface increases and a conduction current or a quiet corona discharge occurs between the wire and atmospheric air. Electrons are carried through the atmosphere by electric fields and non-electric processes (diffusion, convection, wind). The change in the electrical state of the atmosphere involves the earth's surface and the upper conductive layers of the atmosphere. With a positive potential on the wire, the electrons are removed from the atmospheric air. The area occupied by the antenna of the standard installation is 4 ha. The antenna can occupy a circle with a radius of 100 m with a central relatively high mast in the center and several peripheral masts in a circle, between which the emission wires are radially stretched. The antenna can also be in the form of parallel wires stretched above the ground, or even consist of a single wire [2,3].

## 3. Results of ELAT-technology application in Mexico

In Mexico, ELAT-technology has been applied since 1996. Figure 1 demonstrates the results of the first application of the technology in Sonora state. The work was carried out using a single installation located in the vicinity of the city of Puerto de Libertad in July 1996 and 1998. As a result, in July, the same month the work was performed, there was a doubling of precipitation compared to the monthly precipitation statistics for the last 8 years in July. For comparison, the diagram also shows monthly precipitation in June, i.e. in the month without impact.



**Figure 1** The amount of precipitation in June and July in different years in the state of Sonora. Source: National Water Commission

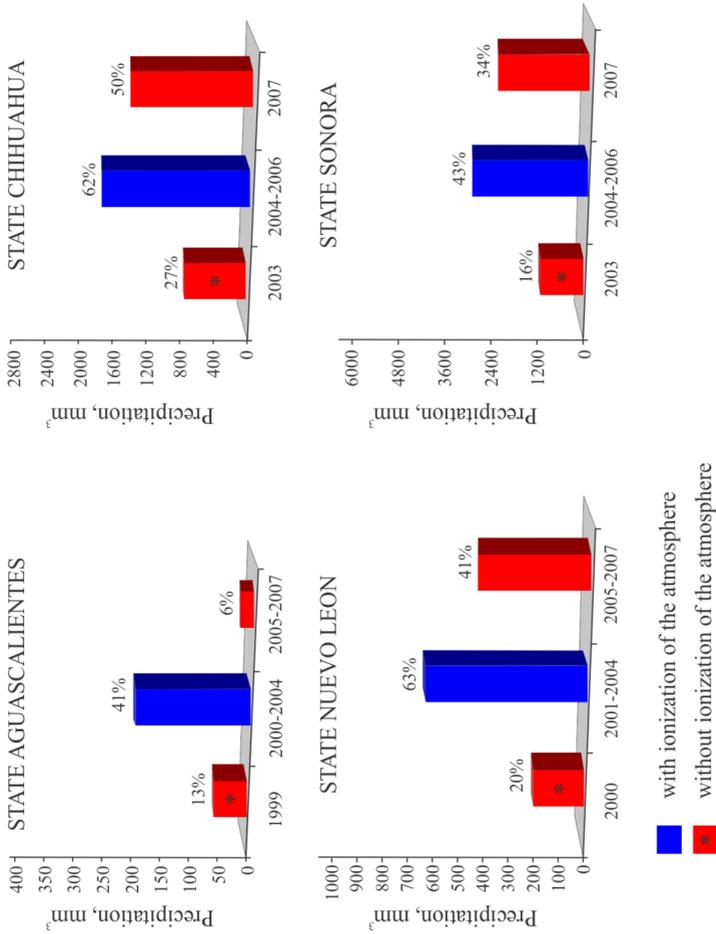
By stimulating precipitation for a number of years, favorable conditions for agriculture were created in the states of Mexico: Sonora, Chihuahua, Coahuila, Nuevo Leon, Durango, Zacatecas and Aguascalientes. As a result, for three years in the state of Coahuila there was a multiple increase in the harvest of honey, and the cotton crop reached a record high, the number of cattle in the pastures increased in weight, the reservoirs were filled with water, the area of forest fires significantly reduced.

Results of the work to stimulate additional precipitation in the Mexican states were estimated by statistical methods of comparison of precipitation in previous years in the neighboring states of Jalisco, Nayarit and Sinaloa (without ELAT application) (Table 1). 100% is the average amount of precipitation in previous years without ELAT application.

*Table 1 Data on precipitation in certain states of Mexico with and without application of the ELAT-technology*

States of Mexico	Years	Precipitation relative to the long-term average annual, %
<b>With electrization of atmosphere</b>		
Aguascalientes	2000-2004	+51
Coahuila	2000-2006	+30
Chihuahua	2000-2004	+45
Durango	2000-2004	+11
Nuevo Leon	2000-2004	+12
Puebla	2005-2006	+4
Sonora	2004-2006	+2
Zacatecas	2000-2004	+25
<b>Mean</b>		<b>+23</b>
<b>Without electrization of atmosphere</b>		
Jalisco	2000-2006	-1
Nayarit	2000-2006	-8
Sinaloa	2000-2006	-36
<b>Mean</b>		<b>-15</b>

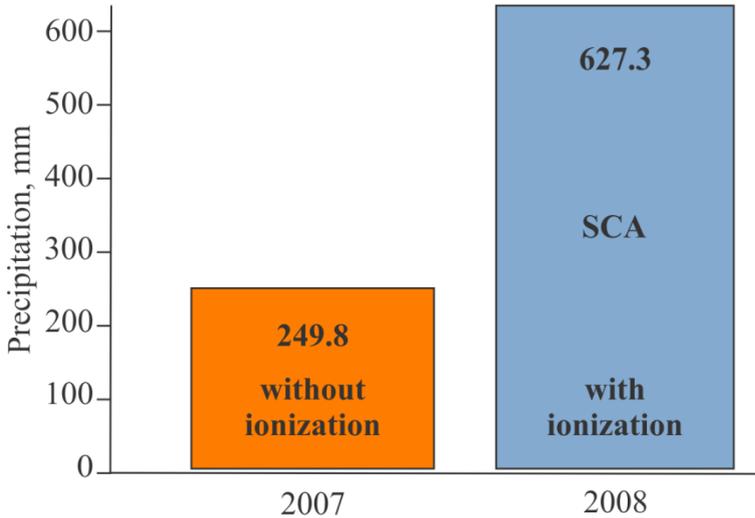
Data from official sources on the filling of reservoirs in four Mexican states in the years of ELAT-technology application and without ELAT application are presented in Figure 2. The work was carried out during the driest months of the year in Mexico (February-April).



**Figure 2** Filling of reservoirs in four states of Mexico in different years. Blue columns are the periods of the ELAI-technology application.

Source: National Water Commission

Data on the amount of precipitation in the water intake area of the Balsas River (Central States of Mexico) for three months of the ELAT operation in 2008 and for the period in 2007 without the ELAT impact are presented in Figure 3.



**Figure 3** The total amount of precipitation in the water intake area of the Balsas River in 2007 (the year without the ELAT-technology use) and in 2008 (the year the ELAT-technology was used).  
 Source: Federal Electricity Commission of Mexico

#### 4. Conclusion

The results of the ELAT-technology application in Mexico evidence that the technology is able to solve environmental problems connected with precipitation. Further research of these processes is required.

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金矿石技术研究  
TECHNOLOGICAL STUDIES OF GOLD ORE

**Nikonenko Tatyana Vladimirovna**

*postgraduate*

*Transbaikal State University*

*Chita, Russia*

抽象。 给出了含金矿床复合样品材料组成特征的研究结果。 相分析结果。 已确定所研究的矿石有利于氧化物浸出，研磨细度为负0.075mm级的80%，通过直接氰化从其中提取83.73%的金。 已经进行了研究以优化矿石氰化方案。 建立了研究中矿石的最佳氰化条件。 最终的结果是将金萃取到溶液中，其含量为89.97%，银含量为67%。

关键词：金，矿石，样品，复合样品，完全化学分析，矿物，矿石矿物学分析，相分析，破碎，矿石研磨动力学，矿石氰化模式，氰化溶液，氰化污泥。

**Abstract.** *The results of work on the features of the material composition of a composite sample of a gold-bearing deposit are presented. Results of phase analysis. It was established that the ore under study is favorable for cyanide leaching, with a grinding fineness of 80% of minus 0.075 mm class, 83.73% of gold is extracted from it by direct cyanidation. Studies have been performed to optimize ore cyanidation regimes. The optimal cyanidation conditions of the ore under study are established. With the final result in the form of extracting gold into solution and which amounted to 89.97%, silver - 67%.*

**Keywords:** *Gold, ore, sample, composite sample, complete chemical analysis, minerals, mineralogical analysis of ore, phase analysis, crushing, ore grinding kinetics, ore cyanidation mode, cyanidation solution, cyanidation sludge.*

The initial ore was crushed to a particle size of 3.35 mm, after which the sample was mixed and weighed suspensions were selected to form a composite sample.

The results of chemical analysis of a composite ore sample are presented in tables 1 and 2.

The average gold content in the composite ore sample, according to direct chemical analysis, was 4.61 g/t, and the silver content was 10.30 g/t.

The total sulfur content in the ore is 0.57%, including sulfide sulfur - 0.42%. The total content of non-ferrous metals (Cu, Zn, Pb) in the sample does not exceed 0.01%; the arsenic content is 0.007%. The organic carbon content in the sample is 0.08%.

*Table 1 – The results of chemical analysis of a composite ore sample*

Element	Analysis method	Units	Content	Element	Analysis method	Units	Content
Au	FAA303M	g/t	4,58 – 4,64 (4,61)	La	ICP90AM	PPM	10
Ag	AAS12EM	g/t	10,30	Li	ICP90AM	PPM	240
S tot.	CSA10VM	%	0,57	Mg	ICP90AM	%	0,61
S sulf.	CSA08VM	%	0,42	Mn	ICP90AM	PPM	480,00
C tot.	CSA10VM	%	1,03	Mo	ICP90AM	PPM	<10
C org.	CSA03VM	%	0,08	Ni	ICP90AM	%	<0,0010
Al	ICP90AM	%	3,77	P	ICP90AM	%	0,05
As	ICP90AM	%	0,007	Pb	ICP90AM	PPM	<20
Ba	ICP90AM	PPM	640	Sb	ICP90AM	%	0,01
Be	ICP90AM	PPM	<5	Sc	ICP90AM	PPM	7,00
Ca	ICP90AM	%	2,27	Sn	ICP90AM	PPM	<50
Cd	ICP90AM	PPM	<10	Sr	ICP90AM	PPM	210,00
Cr	ICP90AM	PPM	190	Ti	ICP90AM	%	0,21
Co	ICP90AM	PPM	<10	V	ICP90AM	PPM	60
Cu	ICP90AM	%	0,0025	W	ICP90AM	PPM	<50
Fe	ICP90AM	%	1,85	Y	ICP90AM	PPM	10,00
K	ICP90AM	%	1,22	Zn	ICP90AM	%	0,003

*Table 2 – Results of silicate analysis of ore by ICP-95*

Oxides	Content, %	Oxides	Content, %
Al <sub>2</sub> O <sub>3</sub>	7,40	MnO	0,06
CaO	3,08	Na <sub>2</sub> O	0,080
Cr <sub>2</sub> O <sub>3</sub>	0,03	P <sub>2</sub> O <sub>5</sub>	0,11
Fe <sub>2</sub> O <sub>3</sub>	2,64	SiO <sub>2</sub>	79,90
K <sub>2</sub> O	1,52	TiO <sub>2</sub>	0,34
MgO	0,97	LOI	5,26

The phase analysis procedure was carried out according to the standard method [3].

The solution was analyzed for Au and Fe; sludge after washing was analyzed for Au content. The results of the phase analysis are presented in the table 3.

**Table 3 – Gold Phase Analysis Results**

Forms of gold	Au content, g/t	Au allocation, %
Free, with a clean surface and in open splices (cyanided)	3,91	83,73
Enclosed in Arsenates of Iron Desorbed from Organic Carbon	0,22	4,7
Coated with oxide films and enclosed in acid soluble minerals	0,07	1,47
Thin, enclosed in sulfides	0,17	3,55
Fine, associated in rock-forming minerals (including in silicates)	0,3	6,55
Source ore	4,67	100

The results of the analysis of productive phased solutions of alkaline treatment, hydrochloric acid treatment and aqua regrowth dissolution for all samples of phase analysis are shown in table 4.

**Table 4 – The results of the analysis of alkaline and acid solutions of phase analysis**

Name of operation	Content, mg/L			
	Au	As	Sb	Fe
Treatment with NaOH	0,01	3,24	0,25	-
Treatment with HCl	0,01	1,81		3402,34
Aqua regia Treatment	0.04	-	-	1220,02

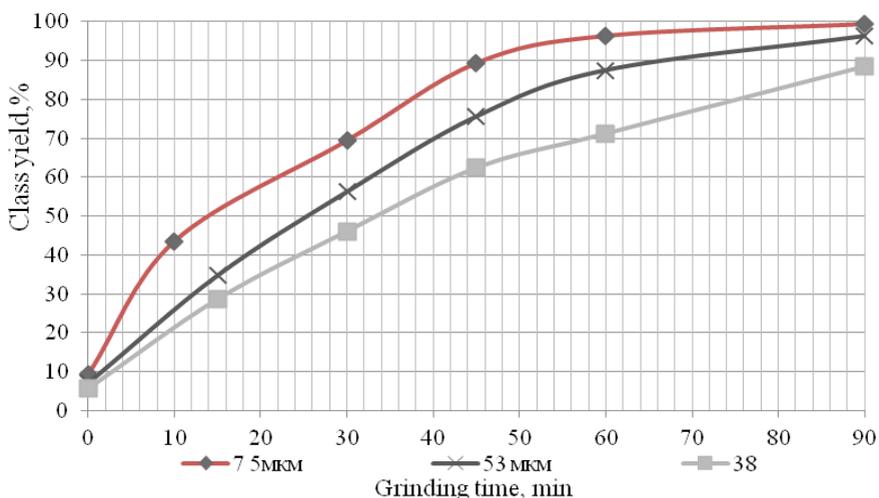
According to phase analysis, direct cyanidation from ore crushed to a particle size of 80 $\mu$  grade minus 0.075 mm, 83.73% of the gold is recovered. The share of “persistent” (not extracted by direct cyanidation) gold is 16.27%. This gold, mainly contained in iron arsenates and desorbed from organic carbon (4.7%), finely dispersed in sulfides (3.55%) and associated with rock-forming minerals (6.55%). The remaining amount of hard-to-recover gold is 1.47% and includes gold coated with oxide films and associated with minerals soluble in acids and alkalis [1, 2].

The sample is represented by fragments of metasomatically altered breccia of porphyry andesite structure cemented by chalcedony-like quartz, sericite-quartz-carbonate metasomatites along them, and fragments of non-mineralized quartz veins.

Ore mineralization forms, from rare to abundant, dispersed disseminated sulfides in oxidized porphyrites, breccias, and sericite-quartz-carbonate metasomatites. The main ore mineral is pyrite. Arsenopyrite, chalcopyrite, sphalerite, galena, magnetite are among the rare ones. Sulfosalts of silver and antimony are

widely distributed - tetrahedrite, freibergite, stefanite. The most common form of silver is sulfosalts, gold and silver - electrum, less commonly kustelit and selenide (fichesserite). The size of the discharge of electrum varies from 2 to 30 microns, kustelita and selenide - does not exceed 1 and 7 microns, respectively. Non-metallic minerals are represented by quartz, mica, carbonates - ankerite, calcite. Among the secondary minerals, clayey ones are developed - illite, kaolinite and goethite. Titanium oxides are found.

Ore grinding was carried out in a laboratory mill with the following parameters: particle size of the starting material - 1.7 mm; weight of the sample - 1 kg; ball weight - 6 kg; grinding time - 0, 15, 30, 45, 60 and 90 min [2]. The crushed products were subjected to wet + dry sieve analysis on sieves: 1.18; 0.850; 0.425; 0.212; 0.106; 0.075; 0.053 and 0.038 mm. The grinding curve of the composite ore sample is shown in Figure 1.



*Figure 1 – Grinding curve of a composite ore sample*

Test studies were conducted according to the standard method of direct ore cyanidation in the agitational mode. The process control and, if necessary, the correction of the cyanidation regime were carried out after 2, 4, 8, 24, and 48 hours from the start of the test [2, 4]. At the end of the test, the pulp was filtered, followed by pulp sludge and its washing with three volumes of water. Then the sludge was dried, and a sample was weighed and isolated for analysis of gold and silver.

The concentration of sodium cyanide in solutions was determined by titration. The concentration of protective alkali was determined by potentiometric method by measuring the pH of the solution.

During the tests, parameters such as grinding size, cyanide concentration, pulp density, the effect of preliminary pulp aeration, oxygen supply and lead nitrate were studied.

To select the optimal size, ore leaching was performed on the size material: 80% of the class 0.075 mm ( $P_{80}$  75  $\mu\text{m}$ ), 80% of the class 0.053 mm ( $P_{80}$  53  $\mu\text{m}$ ) and 80% of the class 0.038 mm ( $P_{80}$  38  $\mu\text{m}$ ). The test results are shown in table 5.

*Table 5 – Optimum fineness test results*

	Name of products	Yield, ml, g	Content, mg/l, g/t		Extraction, %	
			Au	Ag	Au	Ag
C-1	$P_{80} - 75 \mu\text{m}$ ; $C_{\text{NaCN}} - 2 \text{ g/l}$ ; 40 % tt.; $t=48 \text{ h}$ ; NaCN consumption -1,41 kg/t; CaO-0,89 kg/t					
	Cyanidation solution	1569,84	2,59	4,68	86,60	62,03
	Cyanidation sludge	998,20	0,63	4,50	13,40	37,97
	Init. ore (estim.)	1000,00	4,69	11,83	100,00	100,00
C-2	$P_{80} - 53 \mu\text{m}$ ; $C_{\text{NaCN}} - 2 \text{ g/l}$ ; 40 % tt.; $t=48 \text{ h}$ ; NaCN consumption -1,56 kg/t; CaO-0,87 kg/t					
	Cyanidation solution	1577,04	2,68	4,71	90,32	63,68
	Cyanidation sludge	996,40	0,46	4,25	9,68	36,32
	Init. ore (estim.)	1000,00	4,68	11,66	100,00	100,00
C-3	$P_{80} - 38 \mu\text{m}$ ; $C_{\text{NaCN}} - 2 \text{ g/l}$ ; 40 % tt.; $t=48 \text{ h}$ ; NaCN consumption -2,44 kg/t; CaO-1,23 kg/t					
	Cyanidation solution	1590,12	2,84	5,65	91,30	68,93
	Cyanidation sludge	999,93	0,43	4,05	8,70	31,07
	Init. ore (estim.)	1000,00	4,94	13,03	100,00	100,00

The obtained test results confirmed that the gold-bearing ore is favorable for processing it by hydrometallurgical methods, the extraction of gold into solutions, depending on the size of the initial ore, ranges from 86.60 - 91.30%.

At the same time, with a decrease in ore size from 80% of the class 0.075 mm ( $P_{80}$  75  $\mu\text{m}$ ) to 80% of the class 0.038 mm ( $P_{80}$  38  $\mu\text{m}$ ), the extraction of gold increases from 86.60 to 91.30% and silver from 62.03% to 68, 93%

To clarify the optimal ore size, subsequent tests to optimize cyanidation were performed on two sizes:  $P_{80}$  53  $\mu\text{m}$  and  $P_{80}$  38  $\mu\text{m}$ . The test results for the selection of the optimal concentration of cyanide are shown in table 6.

As shown by the results of studies, an increase in the concentration of cyanide in working solutions from 1 to 10 g/l does not significantly affect the results of cyanidation. In the tested modes, the gold recovery varies slightly and amounts to 91.30 - 93.10%, but the cyanide consumption increases from 2.18 kg/t to 8.40 kg/t.

**Table 6** – Results of tests for choosing the optimal concentration of cyanide

	Name of products	Yield, ml, g	Content, mg/l, g/t		Extraction, %	
			Au	Ag	Au	Ag
C-4	P <sub>80</sub> – 38 μm; C <sub>NaCN</sub> – 1 g/l; 40 % tt.; t=48; NaCN consumption -2,18 kg/t; CaO-1,46 kg/t					
	Cyanidation solution	1575,89	2,79	5,24	92,14	65,23
	Cyanidation sludge	999,62	0,38	4,40	7,86	34,77
	Init. ore (estim.)	1000,00	4,77	12,65	100,00	100,00
C-3	P <sub>80</sub> – 38 μm; C <sub>NaCN</sub> - 2 g/l; 40 % tt.; t=48; NaCN consumption -2,44 kg/t; CaO-1,23 kg/t					
	Cyanidation solution	1590,12	2,84	5,65	91,30	68,93
	Cyanidation sludge	999,93	0,43	4,05	8,70	31,07
	Init. ore (estim.)	1000,00	4,94	13,03	100,00	100,00
C-5	P <sub>80</sub> – 38 μm; C <sub>NaCN</sub> - 5 g/l; 40 % tt.; t=48; NaCN consumption -4,26 kg/t; CaO-0,82 kg/t					
	Cyanidation solution	1577,31	2,82	6,12	92,80	74,54
	Cyanidation sludge	999,55	0,35	3,30	7,20	25,46
	Init. ore (estim.)	1000,00	4,79	12,96	100,00	100,00
C-6	P <sub>80</sub> – 38 μm; C <sub>NaCN</sub> - 10 g/l; 40 % tt.; t=48; NaCN consumption -8,40 kg/t; CaO-0,73 kg/t					
	Cyanidation solution	1594,97	2,92	6,07	93,10	74,59
	Cyanidation sludge	999,55	0,35	3,30	6,90	25,41
	Init. ore (estim.)	1000,00	5,00	12,98	100,00	100,00

The results of tests to assess the effect of preliminary pulp aeration with air, oxygen supply and lead nitrate are shown in table 7.

An analysis of the results shows that the supply of oxidizing agents does not affect the extraction of gold into the solution within 24 hours, but the kinetics of leaching increases significantly with increase in oxygen levels.

The supply of oxygen or lead nitrate during cyanidation significantly increases silver recovery after 24 hours.

The test results for the selection of the optimal pulp density are shown in table 8.

Table 7 – Test results for optimizing the cyanidation process

	Name of products	Yield, ml, g	Content, mg/l, g/t		Extraction, %	
			Au	Ag	Au	Ag
C-2	P <sub>80</sub> – 53 µm; C <sub>NaCN</sub> - 2 g/l; 40 % tt.; t=48 h; NaCN consumption -1,56 kg/t; CaO-0,87 kg/t					
	Cyanidation solution	1577,04	2,68	4,71	90,32	63,68
	Cyanidation sludge	996,40	0,46	4,25	9,68	36,32
	Init. ore (estim.)	1000,00	4,68	11,66	100,00	100,00
C-7	P <sub>80</sub> – 53 µm; preliminary aeration of the pulp with air with lime feed - 4 hours; C <sub>NaCN</sub> - 2 g/l; 40 % tt.; t=48 h; NaCN consumption -2,0 kg/t; CaO-0,46 kg/t					
	Cyanidation solution	1593,63	2,70	5,00	90,37	66,57
	Cyanidation sludge	999,80	0,46	4,00	9,63	33,43
	Init. ore (estim.)	1000,00	4,76	11,96	100,00	100,00
C-8	P <sub>80</sub> – 53 µm; cyanidation with increased oxygen consumption -20 mg / l; C <sub>NaCN</sub> - 2 g/l; 40 % tt.; t=48 h; NaCN consumption -1,41 kg/t; CaO-1,27 kg/t					
	Cyanidation solution	1603,54	2,82	5,11	89,31	68,64
	Cyanidation sludge	999,30	0,54	3,75	10,69	31,36
	Init. ore (estim.)	1000,00	5,06	11,95	100,00	100,00
C-9	P <sub>80</sub> – 53 µm; cyanidation Pb(NO <sub>3</sub> ) <sub>2</sub> feed – 1 kg/t; C <sub>NaCN</sub> - 2 g/l; 40 % tt.; t=48 h; NaCN consumption -1,70 kg/t; CaO-1,18 kg/t					
	Cyanidation solution	1560,29	2,79	5,04	88,44	66,56
	Cyanidation sludge	999,80	0,57	3,95	11,56	33,44
	Init. ore (estim.)	1000,00	4,93	11,81	100,00	100,00

An analysis of the test results shows that when cyanidation of ore with a P<sub>80</sub> particle size of 53 µm, with an increase in pulp density from 40 to 55%, there is a slight decrease in gold recovery (up to 0.5%) from 90.32 to 89.89%, but silver recovery increases by 3.3 - 3.7% with an increase in pulp density from 40 to 50% solid. A similar trend is observed when ore is cyanide with a P<sub>80</sub> particle size of 75 µm, with an increase in pulp density from 40 to 55%, gold recovery decreases from 86.60 to 85.54%. According to the results of C-1 - C-13 tests, the most rational parameters of cyanidation of the initial ore were determined: the size of ore grinding - 53 microns (P<sub>80</sub>); pulp density - 50% solid; the concentration of NaCN is 2 g / l. In this case, the extraction of gold in solution will be 89.97%, silver - 67%.

Table 8 – Optimum pulp density test results

	Name of products	Yield, ml, g	Content, mg/l, g/t		Extraction, %	
			Au	Ag	Au	Ag
C-2	P <sub>80</sub> – 53 µm; C <sub>NaCN</sub> - 2 g/l; 40 % tt.; t=48 h; NaCN consumption -1,56 kg/t; CaO-0,87 kg/t					
	Cyanidation solution	1577,04	2,68	4,71	90,32	63,68
	Cyanidation sludge	996,40	0,46	4,25	9,68	36,32
	Init. ore (estim.)	1000,00	4,68	11,66	100,00	100,00
C-10	P <sub>80</sub> – 53 µm; C <sub>NaCN</sub> - 2 g/l; 45 % tt.; t=48 h; NaCN consumption -1,86 kg/t; CaO-1,17 kg/t					
	Cyanidation solution	1328,75	3,30	5,91	90,05	67,43
	Cyanidation sludge	998,80	0,49	3,80	9,95	32,57
	Init. ore (estim.)	1000,00	4,87	11,65	100,00	100,00
C-11	P <sub>80</sub> – 53 µm; C <sub>NaCN</sub> - 2 g/l; 50 % tt.; t=48 h; NaCN consumption -1,92 kg/t; CaO-1,19 kg/t					
	Cyanidation solution	1094,31	4,01	6,95	89,97	67,00
	Cyanidation sludge	998,90	0,49	3,75	10,03	33,00
	Init. ore (estim.)	1000,00	4,88	11,35	100,00	100,00
C-12	P <sub>80</sub> – 53 µm; C <sub>NaCN</sub> - 2 g/l; 55 % tt.; t=48 h; NaCN consumption -1,99 kg/t; CaO-1,22 kg/t					
	Cyanidation solution	988,90	4,54	7,97	89,89	66,93
	Cyanidation sludge	998,40	0,51	3,90	10,11	33,07
	Init. ore (estim.)	1000,00	4,99	11,77	100,00	100,00
C-13	P <sub>80</sub> – 75 µm; C <sub>NaCN</sub> - 2 g/l; 55 % tt.; t=48 h; NaCN consumption -1,42 kg/t; CaO-1,21 kg/t					
	Cyanidation solution	903,05	4,42	7,74	85,54	61,12
	Cyanidation sludge	999,30	0,68	4,45	14,46	38,88
	Init. ore (estim.)	1000,00	4,66	11,44	100,00	100,00

## Conclusions

Studies on the material of a composite sample of a gold-bearing deposit allows us to draw the following conclusions.

1) The main industrially valuable components in the ore are gold and silver, the average gold content in the composite ore sample is 4.61 g/t, silver - 10.30 g/t.

2) Ore is characterized by a low content of non-ferrous metals. The total sulfur content in the ore is 0.57%, including sulfide sulfur - 0.42%. A significant content of associated valuable components in the samples was not noted. Of the harmful impurities in the ore in small amounts there is arsenic - 0.007% and antimony - 0.01%. Organic carbon content in the samples is 0.08%.

3) Mineral composition of the ore is represented by fragments of metasomatically altered breccias of andesites of the porphyry structure cemented by chalcedo-

ny-like quartz, sericite-quartz-carbonate metasomatites along them, and fragments of non-mineralized quartz veins. The main ore mineral is pyrite. Arsenopyrite, chalcopyrite, sphalerite, galena, magnetite are among the rare ones. Sulfosalts of silver and antimony are widespread.

4) Based on the results of phase analysis, it was found that the initial ore is favorable for cyanide leaching, with a fineness of grinding of 80% grade minus 0.075 mm, 83.73% of gold is extracted from it by direct cyanidation.

5) The results of tests for direct ore cyanidation confirmed the high efficiency of the use of hydrometallurgical methods for processing the test ore. With direct cyanidation of ores with a grain size of  $P_{80}$  of 75, 53 and 38 microns, the extraction of gold in solutions varies between 86.60 - 91.30%, silver - 62.03 - 68.93%.

6) During the testing, parameters such as ore fineness, cyanide concentration, pulp density, the effect of preliminary pulp aeration with air, oxygen and lead nitrate were studied.

7) It was found that preliminary aeration of the pulp and additional supply of oxygen and lead nitrate does not lead to an increase in gold recovery within 24 hours, but the leaching rate increases significantly with increasing oxygen levels. Moreover, the supply of oxidizing agents leads to a significant increase in silver recovery (2-5%) and leaching rate.

8) The most rational regimes of cyanidation of the studied ore were established: fineness of ore grinding - 53 microns ( $P_{80}$ ); pulp density - 50% solid; NaCN concentration - 2 g / l; leaching time - 24 hours. In this case, the extraction of gold in solution will be 89.97%, silver - 67%.

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