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**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

International Conference



Beijing, China 2019

上合组织国家的科学研究：协同和一体化
国际会议

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Part 2: Participants' reports in English

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**“Scientific research of the SCO countries: synergy
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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 56 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,
member of the Chinese Academy of 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”

社会经济发展区域战略发展过程分析
**ANALYSIS OF PROCESS OF DEVELOPMENT OF SOCIAL AND
ECONOMIC DEVELOPMENT REGIONS STRATEGY**

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postgraduate

Rostov State Economic University

注解。区域发展的战略规划是一个管理过程，是当局和管理层开展的一系列一致和有针对性的行动。由于将该过程分为几个阶段，因此可以确保实现目标和目标的层次结构，以及在每个阶段形成主体和管理对象的组合。制定区域发展战略计划是区域科学及其在区域管理过程中实际实施的最重要任务，并且正在该区域最高领导层的联合工作过程中实施。从事区域经济学的科学家。本文讨论了构建区域发展战略规划的主要问题，战略区域规划阶段，提出了目标指标体系，可以评估所应用的规划算法的正确性。

关键词：区域发展，战略地域规划，领土规划发展算法。

Annotation. *Strategic planning of the development of a region is a management process and is a chain of consistent and targeted actions carried out by the authorities and management. Due to the division of this process into stages, it becomes possible to ensure the implementation of a hierarchy of goals and objectives, as well as to form a composition of the subjects and objects of management at each stage. The development of a strategic plan for the development of a region is the most important task of both regional science and its practical implementation in the process of managing a region, and it is being implemented in the process of joint work of the region's top leadership and scientists working on regional economics. The article discusses the main problems of building a strategic plan for the development of a region, stages of strategic regional planning, presents a system of target indicators, which allows to evaluate the correctness of the planning algorithm applied.*

Keywords: *regional development, strategic territorial planning, territory planning development algorithm.*

Strategic planning is a management tool that can be used at the planning stage of the socio-economic development of a region [2]. The procedure for strategic planning of a territory's development begins with an awareness of the region's

mission and the objectives of the procedure, the selection of suitable strategies for use, the determination of the availability of the necessary resources and the possibilities of their additional involvement and subsequent distribution. In the broad sense of the word, strategic planning can be perceived as a consistent set of actions and managerial decisions aimed at achieving the established goals. At the same time, traditional management tools are used - analysis of existing problems, environmental assessment, SWOT and PEST analysis, development of development scenarios, construction of a decision tree, forecasting the socio-economic development of the management object.

Strategic planning affects all stages of the region’s management cycle, and is also implemented at all levels of management, both external and internal, of the subsystem’s socio-economic system. This process is reflected in Figure 1.

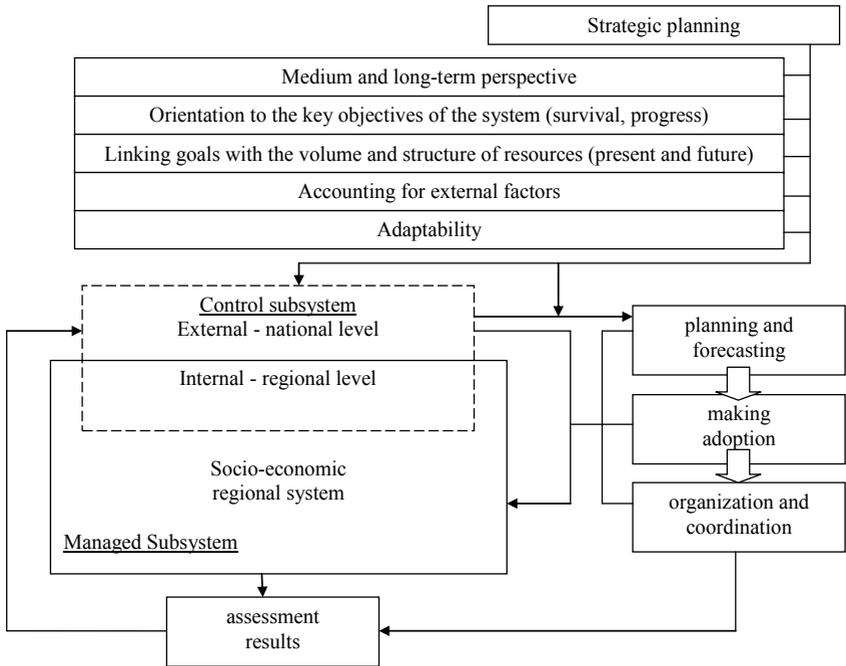


Figure 1 - Place and specificity of strategic planning in the management of socio-economic development of the region

All of these steps are implemented taking into account the main characteristics of strategic planning. It should be noted that the planned development goals of the region should be linked to both the volume and structure of the available resources (both the internal resources of the region itself and possible external resources, for example, funds from the federal budget or international structural funds), and also with potential resources that can be created in the process of implementing the strategy (which may also be one of its priority areas).

Strategic planning for the development of a region has its own specifics, and in order to correctly implement it, it must be borne in mind that from the position of a systematic approach, a region as an object of strategic management is not “monolithic”, since it is a combination of six interconnected macro subsystems: regional economy, production sphere, agro-industrial complex; social, financial, economic and managerial areas.

At the first stage, the development goals of the region are defined. On this, it is required to clearly formulate a system of development goals that meet the requirements of measurability, attainability, orientation in time and consistency. Since the main goal of development of any region is sustainable improvement of the quality of life of its inhabitants, it can be described with the help of certain characteristics and parameters of the region’s development as a multifunctional economic entity integrated into the Russian and world economy, open to investment and favorable for living.

The second stage of regional development planning includes an analysis of the external environment of its development, in the process of which the main socio-economic indicators are assessed - the volume of GDP, the investment climate, the level of various risks, inflation rates, and the prospects for economic growth. A comparative analysis of the economic development of other regions is also carried out, and on the basis of this, conclusions are drawn about the degree of influence on the development of various external factors. This analysis identifies the industries and activities that are priority for the region and are able to provide it with specific benefits and economic well-being, which allows it to form a system of measures aimed at supporting these particular industries and realizing the potential of the region [1].

The third stage planning allows us to reveal the internal potential of the region’s development for evaluating the weak and strong sides - that is, here again there is a SWOT analysis present, only at the local level. The specificity of conducting a SWOT analysis of a territory (unlike organizations) is that three types of resources available in the region will be assessed: human, natural, and economic resources.

At the fourth stage of strategic planning, opportunities for using existing advantages and prospects for creating new ones are assessed. This stage includes an assessment of the possibilities of applying the advantages that already exist in the region; analysis of the results of the implementation of previous programs aimed

at the socio-economic development of the region; identifying factors that in the past led to success or failure in the implementation of socio-economic development programs; identification of internal factors of regional development; identifying areas of activity and factors that may contribute to the creation of added value, and according to the results of this study - thinning the goals of economic development of the region.

It is at this stage that the distinctive features of the region come to light, which can make it unique in comparison with all the others and give it additional competitive advantages, but also can significantly limit its development.

The development of the concept and strategy of the region's development is carried out at *the fifth stage* planning, during which the final results on the regional development goals are formulated, the list of the most significant factors influencing its development is approved, the mechanisms and methods of managing regional development are approved and applied to the region. These results are summarized on the basis of defining new development trends of the region, taking into account regional particularities, as well as the stage of development at which the region is currently located..

The document formed on the basis of the completion of this stage should contain information on the priority directions of the region's development, available resources for development, as well as a list of the region's competitive advantages. Based on the consideration of these aspects, alternative strategies are formed, their comparative evaluation is made, the best option is selected, which is further developed by using interesting ideas and suggestions contained in other strategy options that were not chosen for implementation..

At the sixth stage, an action plan is developed and the strategy is implemented. As a rule, this plan contains a detailed list of activities required for the implementation of the goals set, a timetable for their implementation, a list of responsible persons, a list of indicators that will serve as criteria for the effectiveness of achieving the goal, expected results, a financial plan, and a plan of control measures to track progress of implementation strategy. Since at this stage decisions are made regarding the financing of all activities, it is very important to ensure that these costs are targeted. To this end, at the level of regional and municipal authorities, budgeting methods are often used, result-oriented, as well as a system of key performance indicators.

The seventh, final stage of planning is associated with the subsequent analysis of the effectiveness and efficiency of the adopted development strategy; therefore, it is carried out already after all the measures envisaged by the strategy have been implemented. Following the results, the goals and methods of their achievement are adjusted. Also, control measures can be cross-cutting in nature and carried out throughout the entire period of the strategy implementation in the form of moni-

toring the socio-economic condition of the region with tracking of how the situation changes during the implementation of certain measures. It is also possible to monitor the main indicators of the development of the region at the end of each intermediate stage of the strategy implementation.

Monitoring and evaluation of activities are needed in order to make sure that ongoing activities lead to the intended results, budget funds are used efficiently. If the implementation of the strategy shows good results, then there is no need to adjust it. It is worth noting that it is necessary to implement and monitor and periodically evaluate the activities implemented - these procedures are completely different and are aimed at identifying different indicators - the results are monitored during the monitoring, and during the evaluation, a comparison of the results obtained with the standard and planned indicators is made.

The target indicators of the success of the implementation of the strategy of the socio-economic development of the region are such indicators as increasing income, improving education and health, reducing unemployment, and improving the state of the environment. In fact, the system of criteria and indicators that measure these criteria will be based on the development goals of the regions. Despite some differences between countries and regions in the hierarchy of values and for development, international organizations assess the degree of development of countries and regions for some universal integral indicators, one of which is the human development index, which is calculated using three indicators of economic development: life expectancy at birth, the intellectual potential and value of per capita income, taking into account the purchasing power of the currency and reducing the marginal utility of income.

It is important to understand that when implementing a strategic approach to managing the socio-economic development of a region, this is not about an unambiguous and accurate prediction of the development of the external environment and the impact of external factors on it, which is impossible with a one hundred percent result in the long term. However, strategic planning involves identifying the maximum number of such possible external factors, both negative and positive, and also, which is especially valuable, allows leveling or using respectively their influence through the development and implementation of certain measures and management decisions.

The consistent implementation of these stages of strategic planning for the development of a region makes it possible to identify macroeconomic characteristics and assess the level of interregional ties [3], analyze the current socio-economic situation of the region, make an intelligent choice of the strategic direction of modernization and growth of the regional economy, carry out organizational and economic measures conducive to the development of the territory, as well as using key indicators to assess the degree of achievement of the planned results

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在市场转型的初期, 俄罗斯国民经济中的经济和投资过程的金融监管
**FINANCIAL REGULATION OF ECONOMIC AND INVESTMENT
PROCESSES IN THE NATIONAL ECONOMY OF RUSSIA IN THE
INITIAL PERIOD OF MARKET TRANSFORMATIONS**

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Lebedev Aleksey Vitalevich,

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*Ural Federal University named after the first President of Russia B.N.
Yeltsin*

注解。 本文介绍了在市场改革开始阶段预先确定俄罗斯经济中投资活动金融监管的因素的回顾性方面。 对俄罗斯联邦国民经济固定资产投资额进行了动态比较。 确定了投资活动动态的周期性趋势, 并显示了主要世界和俄罗斯科学家在经济和金融领域对评估在俄罗斯进行私有化运动的程序问题的立场。 结论是基于冲击私有化战略的实施结果, 政治动机在形成新金融体系过程中的主导地位, 冲击私有化战略确定了多年的投资趋势, 同时增加了国家对经济的影响。

关键词: 金融体系, 社会经济发展, 投资, 金融监管。

Annotation. *The article presents retrospective aspects of the factors that pre-determine the financial regulation of investment activity in the Russian economy during the period when market reforms began. A dynamic comparison of the volume of investments in the fixed capital of the national economy of the Russian Federation was made. The cyclical trends in the dynamics of investment activity are determined and the positions of the leading world and Russian scientists in the field of economics and finance on the issue of evaluating the procedure for conducting a privatization campaign in Russia are shown. The conclusion was made about the dominance of political motives in the process of forming a new financial system based on the results of the implementation of the shock privatization strategy, which determined investment trends for many years while increasing state influence on the economy.*

Keywords: *financial system, socio-economic development, investment, financial regulation.*

Fundamental scientific research in the field of financial regulation of economic processes is obviously due to the importance of investments in the national economy of any state. For Russia, the role of investment is all the more significant, given the difficult period of market reforms that have required the state to rebuild the financial system both in institutional and infrastructural aspects. Economic growth requires investment, whose role in the financial support of the needs of the economy is difficult to overestimate. In this regard, conducting research on the theoretical and applied aspects of state financial regulation of the investment sector should take into account a retrospective analysis of the impact of political and social transformations in Russian society, which had a tremendous impact on the national economy and financial system.

The events that occurred at the initial stage of market reforms predetermined many processes in the Russian economic system and determined the existing features of the financial system and investment trends, which, in turn, determine the potential growth and development of the Russian economy. When analyzing the dynamics of the parameters of the financial system, the authors proceed from identifying patterns of state investment policy based on the neoliberal concept of macroeconomic regulation, and not from assessing the influence of spontaneous, abstract market forces, which allows a critical analysis of the current state of the Russian financial system.

Figure 1 shows the dynamics of investment in fixed assets in the Russian economy from 1990 to 2019; 1990 is taken as the starting point.

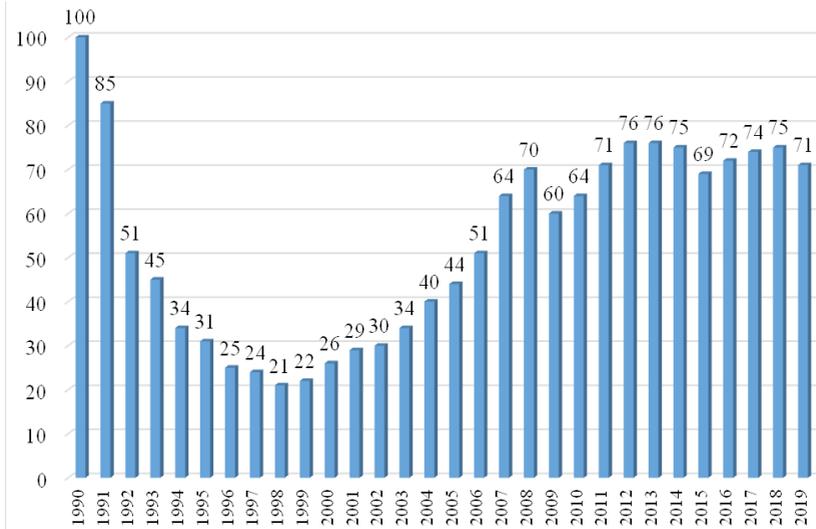


Figure 1. The dynamics of investment in fixed assets in the economy of the Russian Federation in 1990 - 2019 (in% by 1990)

These figures allow to identify well-defined trends in the dynamics of investment activity that are of interest in the aspect under discussion:

1) in 1990 - 1998, an investment decline was seen, accompanied by a nearly fivefold decrease (to 21%) in the volume of investments in relation to the 1990 figure. The reason for this, obviously, are market reforms affecting the political, socio-economic and financial systems.

2) since 1999 there has been a recovery in investment activity (up to 70% of the 1990 level), while it is important that the rate of investment grew on average by 12% annually. The main reason for such a successful investment period is the foreign economic situation, in particular, world prices for hydrocarbons grew steadily: the price of Brent oil ranged from 32.15 (1999) to 105,23 (2008) USD per barrel. This important condition for Russia ensured the growth of all macro-economic indicators and made it possible to attract external and generate internal investment flows.

3) from the end of 2008 and throughout 2009, Russia was affected by an acute phase of the global economic crisis, coupled with a fall in world prices for hydrocarbons, which led to a decline in investment in the national economy to 60% compared to 1990;

4) in 2010, a period of some recovery began, accompanied by an investment recovery;

5) in 2014 - 2015, a new investment recession began, caused by a combination of very negative external factors for Russia: geopolitical events that resulted in the exchange of economic sanctions and a sharp deterioration in the price situation on the international hydrocarbon market.

In-depth study of the causes of large-scale upheavals of the investment situation in the national Russian economy since the beginning of the market reforms of the post-Soviet period makes it possible to systematize the factors that caused these shocks according to the principles of fundamentality and situationality. The first is the radical nature of market reforms, based on a specific privatization scenario, which caused a rapid dismantling of the administrative-command mechanism for the functioning of the planned financial system and the investment processes determined by it. Obviously, the administrative-command principles of regulation of the financial system imply that the state acts in several roles: the only subject of investment activity; the only investor who carries out central planning and financing of capital investments; and sole manager of economic results for the financial support of the needs of expanded reproduction. It is obvious that such a system implies a complete financial and economic dependence of all economic entities in the investment sphere.

Revealing the essence of the factors that caused the deep restructuring of the financial system of Russia, we highlight the following content.

1. Fundamental factors include:
 - 1) shock scenario of market reforms;
 - 2) complete dismantling of the administrative and financial mechanism for financing investments;
 - 3) radical methods of conducting a nationwide privatization campaign.
2. Situational factors due to the formation of macro-conjuncture due to the influence of fundamental factors:
 - 1) a deep decline in production;
 - 2) a catastrophic decline in incomes of the population and economic entities;
 - 3) virtually no financial sector, in the form in which it existed in all developed countries of the world;
 - 4) hyperinflation;
 - 5) ineffective financial and socio-economic policy of the state in the regulation of the financial system and investment relations.

The beginning of the market restructuring of the economic system led to the complete loss by the state, as the main regulatory institution, of monopoly status and influence on the financial system. The role of the state began to transform to the position of the regulator of financial and investment processes. In the period before the beginning of the two thousand years, there was a certain failure of regulatory competencies: new financial and legal institutions for the Russian economy were formed; there was a significant reduction in the share of budget funds in the structure of sources of financing investments: from 78% in 1990 to about 20% by 1998. Owing to these processes, Russian enterprises, which for decades had neither the skills nor the need for independent investment activity, could in a really short period fit into the dynamic business environment of global trends.

Regarding the evaluation of the results of the privatization campaign, representatives of financial science identify two main scenarios for its conduct, conventionally referred to as “organic” and “accelerated”, following the terminology of J. Kornai. The differences of these scenarios, according to the authors, are in the goals set by the state. Thus, the ultimate goal of the organic scenario is to create a class of efficient owners by dispersing state assets through open sale to investors at real market prices. The main feature of this scenario is its length in time. According to the American economist, the Nobel laureate in economics of 1972, C.J. Arrow, it is advisable to carry out privatization only at a moderate pace: the savings required for the private acquisition of production factors accumulate very slowly, so it takes time to determine the real selling value of fixed assets production; the manufacturing sector needs to be restructured prior to privatization.

In Russia, a decision was made to elect another privatization scenario - accelerated - which is focused mainly on the rapid elimination of state property in order to prevent, in the opinion of J. Kornai, the threat of restoration of the communist past.

Many Russian scientists agree with this opinion, in particular, the rector of the Russian Academy of National Economy and Public Administration (RANEPA), Professor V. Mau notes that privatization can pursue three goals: political, economic and fiscal; while the first is to strengthen the political regime. Of course, the situation of the 1990s implied absolute domination of precisely the political goal. The real mechanisms of the privatization campaign under the accelerated scenario in Russia were the distribution of state assets at symbolic prices among a narrow circle of people close to this or that authority. One of the most painful results of privatization was the colossal disproportion in income distribution, which caused permanent vulnerability of property rights and their lack of legitimacy in the eyes of public opinion. The emerging and increasing stratification of society based on the deformation distribution of income after almost thirty years continues to have a significant impact on the financial regulation of economic and investment processes in the state, and also entails destructive consequences for the entire national economy.

The implementation of the shock privatization strategy has led to the fact that a significant part of the real production sector has become controlled by structures and individuals who are not ready for responsibility for the results of their activities in managing business entities and the impossibility of their development. The consequence of these processes was the formation and mass distribution among the new owners, rent-oriented, irrational from the standpoint of long-term investment efficiency, behavior.

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研究在俄罗斯引入限制性措施对跨境互联网零售的可能后果
**STUDY OF THE POSSIBLE CONSEQUENCES
OF THE INTRODUCTION OF RESTRICTIVE MEASURES
IN RUSSIA FOR CROSS-BORDER INTERNET RETAIL**

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注解。 本文介绍了俄罗斯消费者对跨境零售电子商务市场的可能反应, 在 Aliexpress 全球交易平台上购买商品, 以及国家实施限制性措施的研究结果。

关键词: 互联网商务, 跨境在线商务, 政府在线商务监管, 免税门槛, 速卖通市场

Annotation. The article presents the results of research of the possible reaction of Russian consumers of the cross-border retail e-commerce market, purchasing goods on Aliexpress's global trading platform, on the imposition of restrictive measures by the state

Keywords: Internet commerce, cross-border online commerce, government regulation of online commerce, duty-free threshold, Aliexpress marketplace

The Russian Federation is the largest state in Europe in terms of the number of Internet users. According to Miniwatts Marketing Group, their number increased in 2017 by 3.4% and exceeded 10.955 million people [1]. The level of Internet penetration in Russia at the beginning of 2018 reached 76.4%. This figure is 98% among young people under 30 years old, 83% in the age group from 30 to 54 years old, and 36% among people over 55 years old. More than half of adult Russians (51.5%) access the Internet from smartphones [2]. Moreover, about 10% of the time spent on the web, Russians spend on the choice and purchase of goods. Today, over 24 million people in our country are already online shoppers, of whom about two-thirds purchased goods abroad. According to estimates of the Association of Internet Commerce Companies (AICC), the total volume of the e-commerce market in Russia was 1 trillion. 40 billion rubles.

Despite significant growth in the domestic market for online commerce (7%

in 2018), the market for cross-border e-commerce (the purchase of goods by individuals in Russia in foreign online stores) is growing much faster (23% in 2018). The number of overseas orders increased from 147 million in 2014 to 300 million in 2018 [3]. The share of cross-border trade in the total volume of the Russian Internet trade market is steadily approaching 40%. There are two main reasons why Russians buy goods from overseas sellers — low prices and a wider range. However, Russian online retailers are forced to conduct their activities in unequal conditions, since the cross-border trade model used in Russia until 2019 assumed a difference in the margins of foreign and domestic businesses at 30% due to the absence of duties, value added tax (VAT), certification procedures, etc. From 2010 to 2018, Russia had one of the world's highest thresholds for duty-free import of goods from foreign online stores — € 1,000 or 31 kg of parcels per month per person. The analysis of foreign experience in the regulation of cross-border imports allows us to identify four groups of countries in terms of the tax burden:

1. Countries with a missing minimum value of goods that allow imports with full exemption from taxes (for example, in India goods for personal use are subject to a 35% tax; in China, tax rates range from 11.9% to 60% depending on the commodity categories).

2. Countries with a low minimum threshold for full exemption from taxes (for example, CA \$ 20 (€ 14), Thailand 1000 THB (€ 23)).

3. Countries with a high minimum threshold for importing goods with full tax exemption, including import customs duty and VAT (for example, Singapore SGD 400 (€ 236), US \$ 800, Japan JPY 10,000 (€ 76)). However, these countries have low rates of VAT and customs duties (for example, in the US, VAT is not charged, in Japan it is 5%, and import customs duties are paid at rates of up to 5.6%).

4. Countries with multi-level import regulation, having both a minimum threshold for importation of goods on full tax exemption (in almost all EU countries - € 22, in the UK - £ 15), and the minimum threshold at which import of goods is exempted from paying import duties (€ 150 for EU countries), but involves the payment of VAT (VAT rates in EU countries range from 17% in Luxembourg to 25% in Sweden). Import duties are typically 4–6%. In addition, France, Poland and Sweden reset the VAT exemption threshold for postal items [4].

Taking into account foreign experience, the Russian government took the initiative to gradually reduce the cost of goods purchased on the Internet, which can be brought in duty-free. In particular, a proposal is being considered to reduce the threshold for duty-free importation of goods by individuals to € 20 per package by 2021. In addition, other restrictions are proposed on the import of foreign goods, which can significantly affect the situation with the online retail market in Russia, which requires a detailed analysis [5].

The goal of our research in 2017-2018 was to analyze current trends in the

economic aspects of the cross-border segment of the online retail market of the Russian Federation. Based on the goal, the following tasks were formed: identifying the preferences of Russian Internet buyers, analyzing the statistics of the site "aliexpress.com", studying the reaction of Russian buyers of goods from the site "aliexpress.com" to the introduction of restrictive measures.

Most of all goods in foreign online stores, citizens of Russia buy in China. In 2017, out of 290 million cross-border shipments, 91% came from packages from the People's Republic of China. The most popular marketplace among Russians is AliExpress - its share was 86.8%. About 37 million unique users visit the AliExpress website every month, and the total number of visits approaches 148 million per month. 20 million Russians make purchases on AliExpress annually. [6] For Aliexpress, the Russian market is targeted, this fact is confirmed by SimilarWeb statistics: the largest amount of traffic to the aliexpress.com site comes from Russia - 28.34%, followed by Brazil, whose visitors make up only 5.73% traffic of "aliexpress.com".

In Russia, according to AICC statistics, the cost of 64% of purchases on Aliexpress is less than € 22. Based on the above data, we can make the assumption that the popularity of this site among Russians, if the amendment on customs duty is adopted, will not fall significantly. In order to confirm or deny this assumption, an electronic survey was conducted in the social network "Vkontakte", in the group "Aliexpress for men." The group was selected both by the number of subscribers (more than 640,000 people), by attendance (average daily viewing is 160,000 views), and by the criterion of "preferred product groups", which were Electronics and Tools. It is in these product categories there is a higher average check. In addition, the audience of this group by 75% consists of mobile users (that is, they easily master new technological capabilities, and, therefore, are prone to acquiring innovative products) [7]. The community members were asked the question "How will you behave in the case of the introduction of a duty of 30% of the excess of the cost of goods more expensive than € 20" and offered five answers. The last answer is "I don't shop on Aliexpress." It was proposed in order to exclude from the sample those who have not made purchases on the specified site. This option was chosen by 329 people (6.1%). The sample size was 5376 people. Consequently, the number of targeted respondents was 5047 people. The survey results are presented in diagrams 1 and 2.

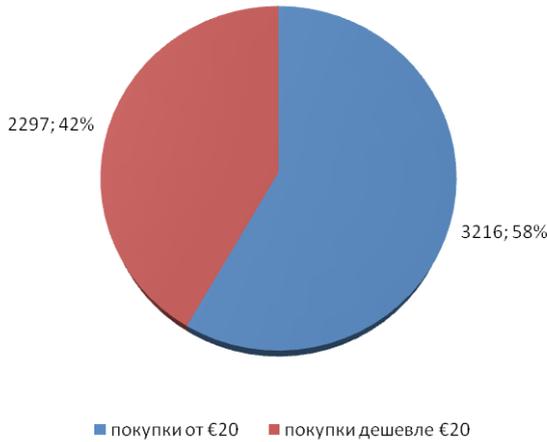


Diagram 1. Distribution of respondents by purchase cost on AliExpress

Among them, the votes were distributed as follows: 1597 people chose the option "Make purchases on Aliexpress more than € 20, in case of introducing a duty of 30%, I will stop doing it"; 174 people chose the answer option "I make purchases on Aliexpress are more expensive than € 20, in case of introducing a duty of 30%, I will continue to buy"; 1190 people voted for the option "I make purchases on Aliexpress are more expensive than € 20, in case of introducing a duty of 30%, I will buy less"; 86 people voted for the option "I make purchases on Aliexpress no more than € 20".

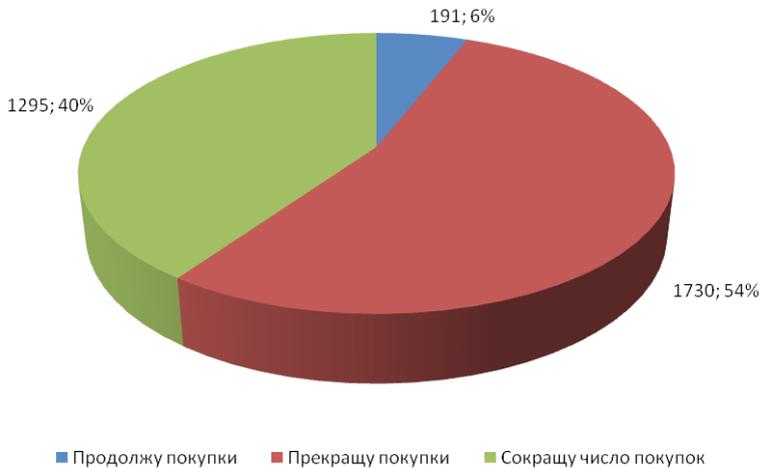


Diagram 2. Changes in the behavior of buyers purchasing goods more expensive than € 20

Therefore, we can conclude that our assumption is partially true. 42% of respondents do not make purchases more expensive than € 20, thus, the amendment on customs duty for goods worth more than € 20 will not affect them, respectively, they will continue to purchase. However, the fact that only 3% of the target respondents (6% of those who buy goods more expensive than € 20) answered that they will continue to do this shows that if the amendment is adopted, the audience buying goods more expensive than € 20 will decrease significantly. This is also indicated by the fact that 32% of target respondents (54% of those who buy goods more expensive than € 20) answered that if they introduced a duty, they would stop buying, and 24% of target respondents (40% of those who bought goods more than € 20) would buy on Aliexpress is less.

However, in practice government regulation has affected not only the size of the duty-free threshold, but also the procedure for processing and collecting taxes and duties. And if the threshold itself is still far away from € 20 (€ 500 per month), then the endowment with additional powers of the Federal State Enterprise “Russian Post” leads to sad reflections. The Post of Russia will interact with the electronic system of the Federal Customs Service (FCS), where it will send information on each international shipment, including personal data of the buyer. The FSUE will also take into account and indicate the total weight and value of the goods that the buyer purchased for the calendar month [8]. The new policy can significantly increase the time of delivery of goods and force buyers to search for the necessary goods in the Russian territory. True, Tmall earned in the territory of the Russian Federation in October 2017 can partially solve this problem.

Based on the study, the following conclusions were made:

- Most Russian consumers prefer to shop online on the Chinese site "Aliexpress".
- In the case of introducing a tax for foreign manufacturers, “Aliexpress” will probably not completely shift the tax burden to customers, but take advantage of the new division of Alibaba - the Tmall platform.
- If substantial amendments to the tax code are adopted, the popularity of the website “Aliexpress.com” among Russians buying expensive goods will be significantly reduced.

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在俄罗斯使用加密货币作为支付手段的前景
**PROSPECTS FOR THE USE OF CRYPTOCURRENCY
AS A MEANS OF PAYMENT IN RUSSIA**

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注解。 本文讨论了在俄罗斯联邦使用加密货币作为支付手段的前景。 找出加密货币出现的原因。 我们考虑在各国经济中使用加密货币的外国经验, 包括在中华人民共和国。 分析了国家实施货币政策的不可避免的风险, 在加密货币不是发行人的情况下。 制定了限制加密货币使用的提案, 以防止资本从该国出口并减少其使用, 从而将经济定为刑事犯罪。

关键词: 区块链技术, 加密货币, 波动率, 比特币, 采矿, 货币政策。

Annotation. *This article discusses the prospects for using cryptocurrency as a means of payment in the Russian Federation. Find out the reasons for the emergence of cryptocurrency. We consider the foreign experience of using cryptocurrency in the economies of various countries, including in the People's Republic of China. Analyzed the inevitable risks in the conduct of monetary policy by the state, which in the case of cryptocurrency is not their issuer. Formulated proposals to limit the use of cryptocurrencies in order to prevent the export of capital from the country and reduce their use in order to criminalize the economy.*

Keywords: *blockchain technology, cryptocurrency, volatility, bitcoin, mining, monetary policy.*

One of the most respected international finance experts in Russia, Professor of the Department of International Finance at MGIMO, Doctor of Economic Sciences Valentin Katasonov in 2016 published a rather serious work entitled "Death of Money. Where are the "masters of money." Metamorphosis of debt capitalism. In this book, Professor V.Yu. Katasonov argues that if bankers and transnational corporations are not immediately rebuffed, then a planetary electronic-banking concentration camp awaits us all, in which a person becomes a slave, deprived not only of all economic and political rights, but also of any opportunity to exercise free will.

The instrument of such a "reformat" of society and man, I am sure V. Katsanov, is the destruction of cash. And then humanity will be planted by bankers on a leash of cashless payments and complete dependence on the "owners of money."

Justifying such a pessimistic scenario, V. Katsanov is based on the fact that the world is experiencing a serious financial crisis, despite the fact that the mass of money issued by central banks and commercial banks is growing rapidly. Thus, according to the data of the International Monetary Fund and the Bank for International Settlements, the aggregate amount of money supply of all countries of the world, expressed in aggregate M2, in 2010 was just over \$ 50 trillion. By early 2015, the money supply exceeded \$ 71 trillion. A gain of more than twenty trillion dollars. However, the work of the "printing presses" of banks did not bring relief to the world economy. The reaction of society and that part of entrepreneurs who do not belong to the circle of "owners of money" are actions aimed at reducing dependence on official money. Among other things, such actions include various projects for the issuance of new types of money. In the scientific literature such money is called differently: alternative, other, additional, parallel. This emphasizes that such money is different from official money [12, p. 338-339].

Of particular interest to us in the framework of our research is virtual money. There are more than 1,000 cryptocurrencies in the world, and Intrinsic Coin Offering ICO is gaining momentum. Such accommodations are not regulated. They are used by startups to avoid the exhausting process of raising capital from venture capitalists and banks. With ICO, a new cryptocurrency is sold to everyone - and usually for Bitcoins [5, p. 5].

Bitcoin is the most popular in the world of crypt. Bitcoins get to the owner either when buying for state currencies, or during a kind of mining - mining, when the computer owner installs on him a special program for processing payment transactions of the entire system. Payments through Bitcoin are public, but also anonymous, since the address from which the money was received cannot be tied to a real person. Unless he himself wants to reveal himself [21].

In March 2017, the main Bitcoin trade was conducted in China. Now they are discovered by investors in the US, which now accounts for more than five times more transactions than in China. In 2016, more than 95% of bitcoin trading was in Chinese exchanges, where it is trading in RMB. But in January 2017, the People's Bank of China began checks on the Huobi, OkCoin, and BTCC exchanges, and the share of bitcoin transactions in RMB fell to 13%. In March 2017, it became known that China will ban anonymous transactions with Bitcoin, the authorities will report suspicious transactions of the exchange [5, p. 5]. Other largest buyers were Russia, Brazil and South Africa. They are interested in Bitcoins, can stir up internal problems and the threat of a fall in national currency rates, and demand in the United States may indicate a surge in speculative activity [13, p. 16].

Particularly worth highlighting the popularity of bitcoins in China. The Bitcoin system and its program code make it possible to perform practically unfalsifiable, unregulated and anonymous operations, which makes Bitcoin and its analogues a very useful tool. Now it has become especially useful for the people of China - for example, for the withdrawal of capital from the country [14, p. 9].

From the above list of countries in which Bitcoin is most popular, China, Russia, Brazil and South Africa are all countries included in the BRICS. These countries are united by strict regulation of foreign economic activity, on the one hand, while Russia is even under sanctions from Western countries. In such circumstances, the subjects of the market economy of these countries inevitably look for ways to bring capital abroad. Bitcoin is such a cash settlement tool.

Analyzing the prospects of the spread of cryptocurrency in money circulation, it can be noted that a number of countries, including Russia, China and India, have chosen prohibitive measures to use cryptocurrency as a settlement tool. No one guarantees security of funds, and this is the main problem of the crypto-money market. Transactions between wallets are irreversible and anonymous. Thus, an attacker, having gained access to the user's wallet, can assign the funds to the latter without any consequences for himself.

In Russia at the end of 2014, the possibility to make a cryptocurrency a settlement tool was directly excluded. The Bank of Russia referred transactions with this currency to the “doubtful” category and was ready to potentially equate the exchange of Bitcoins for rubles or any other currency, as well as for goods or services, to money laundering. True, the Bank of Russia later softened its position [4, p. 9].

A very principled position on this issue was taken by the Prosecutor General's Office of the Russian Federation, which, in particular, noted in its press release: “In accordance with Article 27 of the Federal Law “On the Central Bank of the Russian Federation (Bank of Russia)”, the official monetary unit (currency) of the Russian Federation is ruble [1, p. 18]. The introduction on the territory of Russia of other monetary units and the issuance of monetary substitutes is prohibited... [4, p. 9].

However, gradually, this principled position of the official state bodies began to gradually change. The digital economy, largely at the suggestion of President Vladimir Putin, has become one of the main topics of the St. Petersburg International Economic Forum (SPIEF). The domestic press has been filled with comments and analytics - can new technologies in finance and banking pull Russia out of stagnation? The head of Sberbank, German Gref, is considered the locomotive of this idea [19, p.16].

Another supporter of the spread of cryptocurrency in Russia was Business Ombudsman Boris Titov, who suggested that the Bank of Russia regulate cryptocurrency following the example of Japan, which recognized them as a means of payment.

Chairman of the State Duma Committee on the Financial Market, Anatoly Ak-sakov, also suggests that cryptocurrency should be considered a financial instrument on a par with securities and derivatives. These VAT transactions are not taxed, therefore, transactions with cryptocurrency should not be taxed, he believes [11].

But the former head of the Central Bank of the Russian Federation, Sergei Dubinin, believes that Bitcoin and other cryptocurrencies are akin to the one used by Lehman Brothers investment bank, whose bankruptcy on December 15, 2008 was the culmination of the global financial crisis of 2008–2009 ... In addition to high technology for bitcoin there is nothing. Those who buy cryptocurrencies, says Sergey Dubinin, need to remember that their growth is based only on expectations that may not come true. For example, at the turn of 2014–2015, the expectation of a dollar exchange rate of at least 100 rubles was universal [18, p. 10].

In general, in the financial world, there gradually begins a sobering-up about the promise of the introduction of cryptocurrency in settlements. For example, the head of Bridgewater Associates, one of the largest hedge funds in the world, Ray Dalio said that he did not share optimism about the future prospects of Bitcoin. According to Ray Dalio, Bitcoin is a classic example of a bubble subject to high speculative activity.

Recently, more and more representatives of the US financial establishment have come up with critical assessments about the future prospects of Bitcoin as an independent currency. Jamie Dimon, head of JP Morgan, the largest US bank in terms of market capitalization, Mohamed El-Erian, Allianz chief economic adviser and a number of other representatives of the financial markets - one of the richest people on the planet Warren Buffet, and businessman Mark Kyuban made negative comments on Bitcoin [20].

Some experts believe that Russia is able to successfully adapt the Japanese model, and the technological ban on cryptocurrencies is equated to an iron curtain. However, we cannot share this point of view, because the introduction of the Japanese model, which requires a high degree of transparency of operations, completely loses this indisputable advantage claimed by corrupt Russian officials as the anonymity of operations conducted with cryptocurrencies. Our assumption is confirmed by the case of the arrest of our compatriot in Greece.

According to the popular Russian newspaper Komsomolskaya Pravda, in July 2017, a 38-year-old Russian was detained in Greek Thessaloniki, who for six years headed a criminal group for conducting illegal money transactions on the MTC cryptocurrency exchange.

The American authorities claim that in all that time, a man managed to launder \$ 4 billion through a Bitcoin transaction. It was the United States that filed a request with Greece to detain a possible criminal. Abraham Ayvazidis, the head of the security police of Thessaloniki, said that the 38-year-old Russian was on vaca-

tion in the country, and when they found out about this in America, they asked for measures to immediately arrest him [3].

A brief report about the arrest of a 38-year-old Russian, posted at Komsomolskaya Pravda, cannot but raise some questions. For example, why the United States is so persistent in its fight against cybercrime in Russia. In Russia itself, in which almost all of the corrupt Russian elites arrested accounts in Western banks. The answer can only be that the Americans view cyber-currency as a way to ensure that their corrupt political elites are able to export capital from Russia with impunity, but it is almost impossible to control this capital flow. If you stick to this version, then we can assume that the US government understands that cryptocurrency is a way to bypass the personal sanctions imposed by Western countries against corrupt Russian officials.

It seems to us that it was precisely the corruption of the Russian elite that caused the digital revolution, which began to develop at an accelerated pace from above. The then First Deputy Prime Minister Igor Shuvalov told RBC that the government was discussing the placement of mining centers near powerful electric power generators: "But for now this is a discussion, there are no specific projects yet" [15, p.1]. An attempt to develop mining (mining) cryptocurrencies under the control of the state, according to the authoritative Russian newspaper Vedomosti, for some reason seems to be the most real in the general digital fever. Perhaps, because mining is in some way a specialization of Russia, the newspaper ironically.

The fact that Russian President Vladimir Putin became interested in the digital economy became known at the St. Petersburg Forum 2017. Russian Prime Minister Dmitry Medvedev on July 28, 2017 signed the program "Digital Economy". Ministries and departments urgently began discussing new opportunities and projects based on blockchain technology. It can be assumed that some of them will be successfully implemented and useful. You can also assume that most of the budget money will be spent in vain, as is often the case with public money, especially in conditions of campaigning.

But mining cryptocurrency looks very intriguing. However, it is not clear how miners will show profits and pay taxes - except to sell cryptocurrency in dollars, and then convert into rubles, suggests Nikolai Kashcheev from Promsvyazbank. Another question arises: is bitcoin for a state an industrial product or a product of intellectual activity? And will not sanctions hit Russian mining? After all, domestic processors will be needed - they won't buy Chinese [15, p.1].

Meanwhile, despite all the above problems and unresolved issues, the inter-departmental working group on risk assessment of cryptocurrency turnover under the State Duma began discussing amendments to civil legislation, which allows for ICO in Russia. According to experts, such amendments must be made after the adoption of the law on cryptocurrency.

At the moment, competition has arisen between jurisdictions that want to attract a part of the cryptocurrency market. To integrate into global financial markets, Russia needs systemic solutions that increase investor confidence in the jurisdiction and reduce potential risks. Experts believe that in these conditions, the sooner the State Duma starts to develop a draft law, the better: the market is already developing and Russia should not miss the chance to keep at least part of it [17, p. 18].

In Russia, the negative attitude towards cryptocurrencies is gradually changing to a cautiously positive one. It is necessary to clearly regulate the conduct of operations with cryptocurrency and introduce special mechanisms that could allow us to understand what risks we will have in this regard. An example of such an approach is the recent adoption by the European Parliament of changes to the Fourth EU Directive on combating money laundering [10, p. 9].

While there is persistent talk about the creation of legislation regulating the circulation of cryptocurrency in Russia, some commercial structures are already accepting bitcoins to pay for their goods. According to the Vedomosti newspaper, the prosecutor's office checked the LavkaLavka farm, which has become Bitcoin-accepting. The prosecutor's office did not reveal any violations, but issued a warning: “on the territory of Russia, it is possible to accept (for payment) only rubles, and monetary substitutes are prohibited” [8, p. 19].

In the current uncertainty about attitudes towards cryptocurrencies in Russia, the state should say its weighty word, against which, by and large, their creation is directed. In the end, on October 4, 2017, the Bank of Russia set out its position on this issue in its announcement. This report says that recently the number of requests from participants in the financial market and the media about cryptocurrencies, which have become widespread in the world, has sharply increased.

Taking into account the high risks of circulation and use of cryptocurrencies, the Bank of Russia considers premature admission of cryptocurrencies, as well as any financial instruments nominated or associated with cryptocurrencies, to circulation and use in organized trading and clearing infrastructure in the Russian Federation to handle cryptocurrency transactions and derivative financial instruments on them.

In this regard, the Bank of Russia draws the attention of citizens and all participants in the financial market to increased risks when using and investing in cryptocurrency [7, p. 3].

In general, the Russian authorities cannot yet form their attitude towards cryptocurrencies. Russian regulators and lawmakers occasionally promise a crypto law in the foreseeable future. But their position does not look straightforward. Over the past couple of years, the attitude to cryptoeconomics has gone from proposals for criminal liability for operations with bitcoins to the proclamation of the

blockchain of new oil. And back to the proposals of the Ministry of Finance, first restrict the operations of individuals, and later make them similar to the purchase of federal loan bonds and to the ideas of the Bank of Russia to limit exchange trading and, in principle, again consider digital currencies a surrogate [6].

By order of President Vladimir Putin, until the end of 2017, the Ministry of Finance and the Bank of Russia were to prepare a basic draft law on the regulation of cryptocurrency, but it has not appeared so far.

Thus, it was put an end to the debate about whether to prohibit cryptocurrency in Russia. Now we have to pass laws regulating the release and circulation of cryptocurrencies. It is assumed that the Bank of Russia, the Ministry of Finance and Rosfinmonitoring will be responsible for the regulation. There is an opinion that only qualified investors, including individuals, will be admitted to transactions in cryptocurrencies in Russia [9, p. 3].

Thus, the use of credit currencies as a means of payment in any country will inevitably lead to the emergence of another and, by no means, non-state currency. The parallel use of two currencies for cash settlements will be accompanied by a decrease in the effectiveness of monetary policy by the central bank of the state. And second, it is the danger of using cryptocurrency to carry out transactions for criminal purposes. In this regard, in our opinion, the currency can be used only as a tool for investing free cash of individuals and legal entities, but not as a means of payment.

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数字经济作为社会经济增长的一个阶段
**DIGITAL ECONOMY AS A STAGE
OF ECONOMIC GROWTH OF SOCIETY**

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注解。为了寻找关于数字经济在经济知识体系中的地位问题的答案，作者分析了世界经济增长理论，确定了数字经济中固有的特征，提出了他自己对数字经济的看法。后工业社会理论的发展D. Bellona。

关键词：数字经济，经济增长阶段理论，数字经济的鲜明特征。

Annotation. *In search of an answer to the question about the place of the digital economy in the system of economic knowledge, the author analyzed the world theories of economic growth, identified characteristics inherent only in the digital economy, suggested his own vision of the digital economy in the development of the theory of post-industrial society D. Bellona.*

Keywords: *digital economy, theories of the stages of economic growth, the distinctive features of the digital economy.*

In the doctrine [1] for the classification of various economic systems or types of economics, it is customary to use two main criteria: the predominant form of ownership of the means of production and the method of coordination and management of economic activity.

Based on the above criteria, it is rather conditional that the following types are distinguished: traditional; command; market; mixed

Distinctive features of each of these types are presented in Table 1.

Fundamental studies of the digital economy are not yet fully formed, there are diverse publications and individual statements by scientists and practitioners regarding this area of public relations. However, in modern Russia, the definition of “digital economy” has received normative consolidation. In accordance with the Strategy for the Development of the Information Society of the Russian Federation for 2017–2030 [2], a digital economy is an economic activity in which the key factor in production is digital data, processing large volumes and using the results of analyzing them in comparison with traditional forms of business significantly improve the efficiency of various types of production, technologies, equipment, sales, delivery and storage of goods and services.

According to the above strategy, a digital economy should have its own ecosystem, that is, a partnership of organizations ensuring the continuous interaction of their technology platforms, applied Internet services, analytical systems, information systems of state authorities of the Russian Federation, organizations and citizens.

The author attempted to conduct a comparative analysis of the types of economics known to science with the digital economy, which was unsuccessful, the accepted criteria did not allow to reflect the essence and specifics of the digital economy by separating it from others. However, this experience led to the conclusion that the digital economy is not an independent separate type of economy, but a stage of economic growth of society. However, it must be emphasized that the most optimal type of economy that would contribute to the emergence of a digital economy is a market or a mixed one.

Based on the above, the phenomenon of the digital economy is proposed to be considered within the framework of the development of the theory of stages of economic growth proposed in 1960 by Walt Utmen Rostow and continued at the junction of the 20th and 21st centuries by D. Bell and E. Toffler.

The rationale for the theory of economic growth was presented by W. Rostow in the book *Stages of Economic Growth, Non-Communist Manifesto* [3], published in 1960. The basis for the separation of growth stages, U. Rostow, defined technical and economic criteria: innovation in technology; economic growth rate; sectoral structure of the economy; consumption structure; investment growth rates, etc.

Considering the stages of economic growth through the prism of the above criteria, W. Rostow identified five such stages: 1) traditional society; 2) transitional society; 3) takeoff or rise; 4) maturity; 5) high level of mass consumption. In 1971, in his work “Politics and Stages of Growth,” W. Rostow added a sixth stage — the search for a quality of life. Characteristic features of each of the stages are presented in Table 2.

In the opinion of W. Rostow, all countries should go through the indicated stages, keeping the indicated sequence.

The concept of the stages of economic growth of W. Rostow was developed in the theory of post-industrial society.

Daniel Bell in 1973 proposed the following vision of world development. In the book “The Future Post-Industrial Society”, he proposed three stages in the development of society: pre-industrial, industrial, post-industrial.

Each of the stages has its own distinctive features of the economy, the general characteristics of which are presented in Table 3.

An alternative variant of the ideas of post-industrial society is the theory of

"super-industrial civilization", developed at the end of the 20th century by Alvin Toffler in the books "Shock of the Future", "Third Wave" and "Power Shift" [3].

The theory of E. Toffler is based on the idea of "waves of change", the essence of which is to change the stages of civilizational development of the positions of Eurocentrism. E. Toffler identified three such waves:

- the agrarian wave of civilization is the basis of the economy in the branches of agriculture and the extractive industry;
- the wave of planetary changes - characterized by an industrial revolution;
- the wave of a super-industrial society - a feature of which is the excess of the number of employees of managerial and intellectual labor over the number of workers engaged in physical labor.

Summarizing all the listed theories, it can be stated that the evolution of social relations in time and space is inevitably connected with the transformation of the economic system. The development of the technical and technological potential of countries is a driving factor in this process - this is a common feature of any type of economy, and the factor that distributes one type of economy from another is the socio-political relations that exist in the relevant society.

Modern society is characterized not only by the development of computer and telecommunication technologies, but by the general computerization and the ever-growing digitalization. Information has acquired particular value, the amount of information exceeds the level of knowledge, and the cost of information has a monetary equivalent. The geographical mobility of people is increasing, and therefore the borders of states are being erased. Along with the information to the special type of values include "time".

In addition, modern society is in a state of active development of international economic integration and searching for answers to questions arising in connection with this (such as: choosing ways to regulate integration processes, preserving sovereignty and the national economy of states or their loss, etc.).

It seems that the most optimal and relevant at the present stage of economic development is the periodization proposed by D. Bell. The level of development of post-industrial society creates conditions for the emergence and spread of the digital economy.

Only after going all the way through technologically evolutionary changes could a very active development of an information-based economy be created — a digital economy. Information has acquired the properties and functions of capital, despite the fact that the new value and value of information, as well as the ways of its transmission are on the verge of the real and the illusory.

Thus, the conclusion follows that the digital economy is the result of the evolution of society, its technical and scientific progress.

Digital economy exists and develops simultaneously with traditional (well-known science) types of economies (command, market, mixed), because it does not replace the existing system of economic relations, but complements and modernizes it.

Digitalisation undoubtedly contributes to the globalization of the world economy. In the conditions of the digital economy, inevitably, the issues of integration of national economies, the formation of new models of economic, social and political organization of society will have to be solved.

Digital economy will change political and social institutions and the principles of their functioning, the economic structure of society, the labor market and the human environment [4].

Already, the manifestation of the digital economy in society can be traced to the individual, inherent only to her characteristic features:

1. Special - intangible form of implementation.

The digital economy, so to speak, is based on indirect relations that are possible only in the form of electronic exchange of digitized data.

2. Special tools expressed in complete and inseparable dependence of economic relations on telecommunications networks and computer equipment.

This factor distances the digital economy from the real (or traditional) economy. In the case of exclusion from the relationship of telecommunications networks and computer equipment, the digital economy becomes impossible.

3. The unprecedentedly high rate of implementation, as individual operations, and economic activities of the subjects as a whole.

This factor, without a doubt, should have the most favorable effect on the pace of development of virtual economic relations, but it is he who can serve as an aggravating circumstance in the event of crises. Lightning-fast connections can collapse with the same speed, causing a chain reaction (the “domino principle”).

4. The appearance of previously unparalleled types of goods, services and money, whose existence is possible only in digital (electronic) form. Examples of this are e-commerce (or commerce), the production of virtual (or digital goods), and settlements through electronic money.

5. All of the above entails the transformation of the forms and methods of regulating new economic relations.

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Table 1
Comparative analysis of types of economies

Criteria	Key features by type of economy			Mixed economy
	Traditional economy	Command economy	Market economy	
Prevailing ownership	Community (developed nepotism), less common - private. Transfer by inheritance.	State ownership is predominant, private ownership is almost absent	Private property	Combining different shapes
Methods of regulation of the economy	The emphasis is on customs and traditions. Inheritance of leadership positions, detailed regulation of private life, multiple taboos.	Determined by the policy of the administrative center. Monopolism.	Freedom of entrepreneurship, the role of the state is minimal, consisting in ensuring the observance of the rights of entrepreneurs	Limited state influence on economic relations, with the support of enterprise development
Methods for the allocation of resources and benefits	Uneven distribution of resources and goods (depending on the status of the consumer, taking into account the estates, castes.)	State planning methods	Competition, material resources belong to private individuals.	The influence of the state on the redistribution of resources, the prevention of unemployment and other social problems
Pricing methods	The wide distribution of small-scale production and manual labor. Producers are pricing based on consumer solvency	The formal nature of commodity-money relations. Pricing by the state.	The market mechanism takes into account economic benefits, changes in supply and demand	Market pricing is limited to state influence on pricing.

Table № 2

Characteristic stages of growth of economic development (U. Rostow)

Stage of growth	Special features
Traditional society	Primitive and stagnant agricultural production with the use of manual labor, a hierarchical social structure, power in the hands of landowners, the resulting national income is spent mainly on consumer needs.
Transition society	Prerequisites are being created for a sharp acceleration of economic growth rates; new scientific and technological discoveries are beginning to be applied in production.
Rise	The industrial revolution, a sharp increase in the technological level, a radical change in production methods, an accelerated pace of creation of new technologies and equipment, the development of infrastructure. All this leads to a sharp economic growth.
Maturity	The formation of an industrial society, the active development of industry, the emergence of new industries, changes in the structure of employment due to the growing number of highly skilled workers.
High level mass consumption	Solving the problem of personal consumption comes to the fore, traditional manufacturing industries (machine-tool construction, metallurgical, and other types of industry) go to the side, giving preference to the services and production of goods for personal use.
Search for quality of life	Spiritual values come to the fore, much attention is paid to the spiritual development of man.

Table № 3

Stages of world economic development (D. Bell)

Stage of development	Characteristic features of the economy
Pre-industrial	The economy is based on agriculture, fishing and mining of natural resources.
Industrial	The dominant importance is acquired by the processing industries, technological production of goods..
Postindustrial	Telecommunications, computerization of production and the process of sharing information and knowledge, the development of the global movement of capital and currency values are becoming widespread.

制定克拉斯诺亚尔斯克边疆区木材加工综合体战略时的战略规划方法
**METHODS OF STRATEGIC PLANNING WHEN DEVELOPING THE
STRATEGY OF TIMBER PROCESSING COMPLEX
OF KRASNOYARSK KRAI**

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注解。 本文介绍了通过行业分析, 确定优势和劣势以及优先发展方向, 对克拉斯诺亚尔斯克边疆区木材工业综合体进行战略分析的各个阶段。

关键词: 战略, 战略分析, 行业分析, 因素, SWOT分析, PESTE分析。

Annotation. *This article presents the stages of conducting a strategic analysis in relation to the timber industry complex of the Krasnoyarsk Krai with the help of industry analysis, identifying strengths and weaknesses and priority development directions.*

Keywords: *strategy, strategic analysis, industry analysis, factors, SWOT analysis, PESTE analysis.*

Krasnoyarsk Krai is one of the key regions of the Russian Federation in the field of forest industry, since about 15% of Russia's forest land is located on the territory of the Krasnoyarsk Krai.

The forest industry is a set of industries that harvest and process wood, produce finished products of varying degrees of complexity from wood resources. The timber industry complex of the region is represented by forestry and logging, timber processing and furniture production [1].

At present, the Krasnoyarsk Krai Forestry Complex is a fairly dynamically developing sector of the regional economy.

To assess the state of the timber industry complex, an analysis of the statistical data presented in Table 1 was conducted.

As can be seen from the data, an active development of the timber industry complex of the Krasnoyarsk Krai is observed, new types of products are emerging,

and production volumes are increasing. In general, according to the analysis, we can conclude about the positive dynamics of revenue indicators by product.

The instability of the production of furniture and sleepers can be explained both by the increase in imported products on the Russian market and by the expansion of sales markets for products of enterprises from neighboring regions of the Russian Federation. Positive dynamics is observed in terms of sales of plet and sawn timber - the most profitable types of products in the timber industry complex of the Krasnoyarsk Krai.

Table 1 - Dynamics of production volumes of the main types of products of the timber industry complex of the Krasnoyarsk Krai [7]

Product name	Years			
	2014	2015	2016	2017
Lumber, thousand m ³	2316,0	2418,3	2748,6	3136,6
Fiberboard, million m ²			34,6	33,4
Sleepers, thousand pieces	154,4	162,6	183,2	-
Furniture, thousand pieces, including				
Tables	47,9	46,9	57,7	-
Chairs	69,4	42,6	37,5	-
Cabinets	69,9	74,2	94,0	-
Beds	22,0	22,2	20,1	27,1
Sofas	39,7	34,8	47,5	38,7
Pellets, thousand tons	114,1	115,9	144,4	160,6

One of the problems of activity for any industry is the problem of survival and ensuring the continuity of development. Depending on the current conditions and circumstances, this problem is solved differently in different ways, but the basis of the solution is painstaking and time-consuming work to create and implement competitive advantages.

Strategic analysis occupies a middle place between the functions of collecting, processing information and making decisions. The task of strategic analysis is that of the various types of data, often disparate, reflecting separate events and facts, an overall, coherent picture of the organization, to identify the inherent development trends and patterns and to provide objective information material for making the most correct decisions [4].

Strategic analysis is a means of converting information obtained from an analysis of the environment into alternative strategic development plans. The assessment of the factors of the external and internal environment of the timber industry complex of the region is carried out using the PEST-analysis, SWOT-analysis and industry analysis.

Thus, the analysis of external opportunities and threats, as well as the strengths

and weaknesses of the forestry complex, using the SWOT matrix, provides an overview of the strategic status of the complex [3].

Under the external business environment refers to a set of factors affecting the company and affecting the efficiency of its operation.

To assess the influence of external factors on the Krasnoyarsk Krai of the Krasnoyarsk Krai, PESTE-analysis is a marketing tool designed to identify the political, economic, social, technological and environmental aspects of the external environment that affect the industry as a whole [6]. Figure 1 presents a list of factors for carrying out a PESTE analysis of forestry.

The factors presented can be taken into account when using such a strategic analysis tool as the SWOT matrix. The matrix of the SWOT analysis of the timber industry complex of the Krasnoyarsk Krai is presented in Figure 2.

Political factors	Economic forces	Social factors	Technological factors	Environmental factors
<ul style="list-style-type: none"> • government support for the industry • export authorization • favorable geographical position • demand for forest products in the region 	<ul style="list-style-type: none"> • availability of markets • development of new products • allocation of financial benefits to logging enterprises • increase in the cost of production 	<ul style="list-style-type: none"> • demand for environmental materials • availability of educational institutions for the training of specialists in the industry • development of private housing 	<ul style="list-style-type: none"> • deep processing of wood • available timber base • timber harvesting • formation of industrial clusters 	<ul style="list-style-type: none"> • illegal deforestation • increase in the number of fires • the presence of pests • reforestation development • inefficient use of forest resources

Figure 1 - Environmental factors affecting the forestry complex of the Krasnoyarsk Krai

A well-constructed strategy should be oriented towards the use of opportunities that are adequate to the resources of the forestry complex, and provide the most complete protection against threats associated with changes in the external environment. The purpose of industry analysis is to determine the attractiveness of the industry and individual markets within the industry [5].

Sectoral analysis allows us to understand the structure and dynamics of the industry, its characteristic capabilities and existing threats, highlight the driving forces behind the development of the industry, identify key success factors and, with this in mind, develop a development strategy.

The main directions of sectoral analysis are in the general overview of the situation, identifying the driving forces and key success factors. Assessment of the current state in the industry is to analyze the main economic indicators of the industry and their dynamics

Strengths	Opportunities
<ol style="list-style-type: none"> 1. Favorable geographic location; 2. Available timber base; 3. Availability of financial resources for development; 4. The presence of stocks of forest resources, allowing to increase the volume of harvesting; 5. Demand for environmental materials; 6. Formation of clusters; 7. Availability of training institutions. 	<ol style="list-style-type: none"> 1. Potentially capacious market for timber sales in Russia and abroad; 2. The weakening of foreign trade barriers; 3. Growth in demand for secondary resources; 4. Development and introduction of new specialized technologies; 5. Creation and implementation of a mechanism for integrated wood processing; 6. Improving staff skills.
Weak sides	Threats
<ol style="list-style-type: none"> 1. Low rate of development of hard-to-reach forests; 2. Inefficient use of forest resources; 3. The growing number of fires, illegal deforestation, destruction of plantations; 4. Low rate of reforestation; 5. Narrow product range; 6. Excess of import over domestic consumption; 7. The slow process of integrating enterprises of the forestry complex. 	<ol style="list-style-type: none"> 1. Tighter government regulation; 2. The invasion of competing regions of powerful companies; 3. The fall in demand as a result of changes in consumer needs; 4. The deterioration of the political situation in the country and the world; 5. Reduction in exports and imports; 6. Reducing the attractiveness of professions in the field of forestry; 7. Lack of investment.

Figure 2 - Matrix SWOT-analysis of the Krasnoyarsk Krai

The listed methods of strategic analysis will allow to reasonably develop options for development strategies. The development of the Krasnoyarsk Krai Forestry Complex Development Strategy is based primarily on strengths. In conjunction with the possibilities, it is likely to develop the most effective development strategy, but do not forget about the weaknesses of the complex.

A well-constructed strategy should be focused on the use of opportunities that are adequate to the resources of the timber industry complex of the Krasnoyarsk Krai, and provide the most complete protection against threats associated with changes in the external environment.

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衡量就业质量的方法论问题

METHODOLOGICAL PROBLEMS IN MEASURING THE QUALITY OF EMPLOYMENT

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注解。以社会为导向的经济模式需要理解和解决新问题。只是找工作并不是确保许多人生活水平的充分因素。这里最相关的科学成就是显示就业,工作和收入需求,地点,新内容和对生活水平的影响的发展趋势。本文的目的是确定研究就业质量的方法问题。本文首先回顾了自1960年代以来致力于劳动力市场质量特征的经济学文献。还介绍了国际组织,特别是国际劳工组织和联合国欧洲经济委员会编制的统计框架分析。通过调查这一背景,揭示了各种方法问题。总之,本文展示了先前对发展中国家,特别是俄罗斯的研究的局限性,并提供了纠正与之相关的一些方法问题的第一步。进一步研究被认为是解决已发现的问题。

关键词: 就业质量, 劳动力市场, 国际劳工组织, 联合国欧洲经济委员会, 工作质量, 就业效率, 工作生活质量。

Annotation. *social-oriented model of the economy requires understanding and solving new problems. Just having a job is not a sufficient factor in ensuring living standards for many people. The most relevant scientific achievements here are those which show development trends of the need for employment, work and income, their place, new content and influence on the standard of living. The purpose of this article is to determine methodological problems in studying the quality of employment. The paper starts with a review of the economic literature devoted to quality characteristics of labour market since the 1960's. Analysis of statistical frameworks prepared by international organizations, in particular, the International Labour Organization and the United Nations Economic Commission for Europe, is also presented. Through investigating this background, various methodological problems are revealed. In all, this paper demonstrates the limitations of previous research with regard to developing countries, particularly, Russia, and provides the first step in correcting some of the methodological problems associated with it. Further research is considered to solve identified problems.*

Key words: *quality of employment, labour market, International Labour Organization, United Nations Economic Commission for Europe, job quality, employment efficiency, quality of working life.*

Introduction

Employment is central to the life of people in many countries not only in terms of time and providing income. It also affects the quality of life in many respects. It is often the key to social and economic advancement; it provides identity to people and opportunities to socialise with others. To reconcile the interests of all stakeholders – workers, employers and the government – and to manage the situation, it is important to collect systematic information on the quality of employment according to the country-specific circumstances. This research explores existing concepts on measuring the quality of employment, their limitations and application particularly for developing economies in an effort to motivate the search for additional indicators that can better capture employment quality. To assist developing countries (in particular, Russia) to monitor and develop their policies for improving the quality of employment, set of statistical indicators should be created. It will help employers and policymakers increase the well-being of workers, improve situation on the labour market and the living standards.

Much work on this question is done by Brendan Burchell, Kirsten Sehnbruch, Agnieszka Piasna and Nurjk Agloni (2013) who investigated existed literature on employment quality from 1960's. The big drawback here is that all research works have been done in developed countries and for developed countries as well as statistical frameworks presented by big international organizations, in particular, the International Labour Organization and the United Nations Economic Commission for Europe. Actually, labour markets in developed and developing countries are characterized by different conditions that should be taken into account when measuring quality of employment. It should be mentioned that there was also an attempt to measure the quality of employment in low income countries (Sabina Dewan and Peter Peek, 2007) but suggested indicators must be checked for Russian stakeholders' importance and relevance.

The significance of measuring the quality of employment is obvious and approved by many countries. The aim of this article is to reveal problems in existing debates on the quality of employment and to determine what constitutes quality employment in Russian circumstances. Transition economy of Russia and cultural specificity of its people should be taken into account in creating or adapting the existed statistical frameworks for measuring the quality of employment.

The article starts with review of literature on the question and existing statistical tools. This analysis gives the opportunity to find methodological problems. Then the comparison of related concepts is given. And finally the outline of the statistical framework for measuring the quality of employment in Russian circumstances is presented.

Methods

The concept of employment quality is of high interest within the European Union. It has been a central topic for many international organizations during several decades. But while investigating existed research, several problems have become

very obvious. First of all, there are different concepts that are used interchangeably, specifically, the quality of employment, the job quality, the quality of working life / the work quality, the efficiency of employment (notion widespread in the Russian Federation). Secondly, there is the question about applicability of existed research made upon the European countries or countries-members of some international organizations like OECD or UNECE. Here we have two other problems: the question about the level of assessment (employer-, employee- or government-level) and low availability of data in developing countries in contrast to European countries which have conducted several surveys to get an appropriate information for measuring the quality of employment: European Working Conditions Survey (EWCS), European Social Survey (ESS), Eurobarometer, European Quality of Life Survey (EQLS), etc.

To solve these problems a range of theoretical and practical works has been explored. The most valuable work was done by Burchell et al. (2013). The article gives detailed overview of papers dedicated to the qualitative features of employment. The authors do not show the difference among the aforementioned concepts but they give a lot of references on other researchers concerned with this topic. Investigation of all papers revealed the specifics of each concept which will be presented in the Results section.

Besides the theoretical papers handbooks and statistical frameworks made by different international organisations give a wide understanding of how it is possible to measure the quality employment and what the difference between it and the job quality, the quality of working life / the work quality, the efficiency of employment is. Among all developments the most significant were taken here:

- European Commission, 2001 (EU Laeken);
- United Industrial and Employers Confederation of Europe, 2001 (UNICE);
- European Trade Union Institute, 2008 (ETUI);
- Employment Committee, 2010 (EMCO);
- International Labour Organization, 2012 (ILO);
- European Foundation for the Improvement of Living and Working Conditions, 2012-2013 (Eurofound);
- United Nations Economic Commission for Europe, 2015 (UNECE);
- Organisation for Economic Co-operation and Development, 2015 (OECD).

Results

Each organization listed above presented a set of indicators for measuring the quality of employment, the job quality, the quality of working life, the work quality. Examination of them can make it possible to understand the difference among the concepts and whether they can be used in developing countries, particularly, in the Russian Federation.

The study of all applied works, statistical frameworks and theoretical papers gives a rough idea about the differences among the similar concepts. The best description of concepts' difference is given by S. Cazes, A. Hijzen and A. Saint-Martin (2015):

- job quality refers to the attributes of the job itself (e.g. independently of workers characteristics);
- employment quality relates to broader concepts linked to the features of the employment relationship;
- work quality refers to the ways and conditions under which the activity of work can affect the well-being of workers.

The concept of work quality seems to be close to the concept of working life quality. The concept of employment efficiency is widespread in the Russian Federation. Works devoted to effective employment reveal the following characteristics:

- the use of labor without loss of working time and with minimal social costs;
- achieving the highest economic effect;
- identifying the level of labor productivity at which the population's need for work is satisfied;
- ways to achieve full employment;
- optimal combination of the need for jobs and labor contributions of employees with the aim of the effective functioning of production.

Russian scientists propose to measure effective employment through a system of indicators: the level of employment by professional work, the level of employment in the public sector, the proportions of the distribution of labor resources by areas of socially beneficial activities, rational distribution structure of workers by sectors of the economy and others¹.

Reviewing the researchers' positions on the concepts of “quality of employment”, “job quality”, “efficiency of employment” and “quality of working life / work quality”, we can systematize the information received and present it in the form of a table showing the differences between these concepts (Table). Criteria of comparison are aspects which can be found in all sources of literature presented above. The comparison options can be divided into groups: the influence of different entities (the state / government and an enterprise) on the indicator; focus of each concept - on the worker or on the production; the possibility and nature of measurement and, as a result, the definition of a qualitative model of employment.

¹Gaga, V.A. Economics and sociology of labor: social and labor relations / Gaga V.A. - Tomsk: Publishing house of Tomsk State University, 2008. - 340 p.; Ilyash, O.I. Labor Economics and Labor Relations / O.I. Ilyash, S.S. Grinkevich. - Kiev: Lira-K, 2010. - 476 p.; Labor market / S.G. Ermolaeva. - Ekaterinburg: Publishing house of Ural State University, 2015. - 108 p.; Labor market and incomes / Under total. ed. N. A. Volgin. - M.: Filin, 1999. - 280 p.; Labor Economics and Labor Relations, Ed. G.G. Melikyan, R.P. Kolosova. - M.: Publishing House of Moscow State University, Publishing House of CheRo, 1996. - 623 p

Table. Comparative characteristics of the categories "quality of employment", "job quality", "efficiency of employment", "quality of working life"

Comparison options	Comparison categories			
	Quality of employment	Job quality	Efficiency of employment	Quality of working life
Feedback from the government	strong	weak	average	weak
Role of enterprise	high	high	high	high
Employee orientation	strong	weak	average	strong
Production orientation	average	strong	strong	weak
Impact on the employment related result	indirect	direct	direct	indirect
Possibility of measuring	high	low	high	average
Nature of measurement	objective	objective ²	objective	subjective
Employment model	social	productive	social-productive	social

Discussions and Conclusions

The table shows that “job quality” category has production nature and “quality of working life” – social. Quality of employment and efficiency of employment are close in their characteristic features. The difference is that efficiency of employment aims to achieve economic results, while the quality of employment affects the prosperity of the state through the implementation of a socially oriented course of economic development.

Because employment is more a macroeconomic indicator then the measurement of its quality involves the study of the objective characteristics of employment from the perspective of an employee, which should be ensured by an employer and guaranteed by the state / government. Thus, the coordination of all stakeholders’ positions can be achieved. Through the decent employment conditions for an employee it is possible to achieve higher productivity and efficiency of labor and, as a result, faster, intensive progress at the state level, which will inevitably lead to an increase in the standard of living.

This is the reason for monitoring the quality of employment in a certain country to take particular micro- and macroeconomic actions. The two most prominent works in measuring the quality of employment were made by the International Labour Organization and the United Nations Economic Commission for Europe.

The ILO Decent Work presented the set of statistical indicators on decent work. They can help to describe a quality of employment in the country for academic and policy goals. This paper can be very useful as it gives, in particular, quantitative information for doing any analytical research works. The authors of the UNECE

²The results of labor activity are evaluated as a result of its organization.

statistical framework introduced a number of statistical indicators for measuring dimensions of employment quality. The statistical framework and its set of indicators can be used as a statistical toolbox according to the specific requirements and institutional background of a country. While these papers are useful for an analysis of employment quality, their limitations connected with the European policy environment will require some adaption to meet the needs of Russian circumstances.

S. Dewan, P. Peek (2007) made an attempt to measure the quality of employment in developing countries. The authors argued that current, widely used employment and unemployment indicators are not suitable for developing countries. They suggested additional indicators such as discouragement, underemployment, the working poor, excessive hours of work and the nature of a contract. The results of this article can be used for measuring the quality of employment in Russia as well because it is considered as a developing country so we can explore the opportunities and limitations of suggested indicators.

One more methodological problem in measuring the quality of employment is that there is no universal set of indicators. Therefore, we can only offer one and check it by conducting a survey to know what is important, first of all, for workers and employers. We could suggest a presumptive set which must be checked further:

- i. Safe work environment
- ii. Balance between income and price level
- iii. Working hours and work-life balance
- iv. Time spent searching for a job
- v. Education-job match
- vi. Stability and security of work
- vii. Social protection
- viii. Education and training.

We suppose that the set of indicators given above addresses interests of all stakeholders: workers, employers and the state / government. But further research is needed to assess whether they are important and in what extent.

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俄罗斯形成“开放政府”模式的经验与前景
**EXPERIENCE AND PROSPECTS OF THE FORMATION IN RUSSIA
THE "OPEN GOVERNMENT" MODEL**

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注解。本文所研究的作者假设与俄罗斯开放政府概念的原则和优先事项的实际行动执行不平衡以及研究这种不平衡的制度原因的必要性有关。该研究的目的是制定概念性提案，其实施将有助于消除和消除上述发展中的不平衡。

这篇文章一方面指出了解决许多技术和技术问题的明显成就，这些问题最近阻碍了电子政务，电子民主，开放政府的形成。这些仅包括在州一级部分解决电子环境中公民身份识别的方便和法律重要系统的运作问题，电子民主的要素的运作评级以及缺乏真正的利益。公民参与公共当局的决策，往往在实践中缩小“开放政府”概念的原则，以确保数据的公开性。

在开放政府要素的形成和发展中确定的成功和问题使得作者能够提出并证明他们对俄罗斯联邦实际实施“开放政府”概念的有希望方向的设想。

其中包括：需要制定和实施机制，以确保大量国家公民强制参与公开讨论直接影响其利益的问题，强制性地直接影响采取具有重大社会意义的决定；扩大使用众包作为一种有效，经济和社会有效的工具，使公民参与社会意识的决策。

关键词：电子政务，电子民主，众包，创新，项目公开讨论

***Annotation.** The author's hypothesis investigated in this article is connected with the statement about the imbalance in the practical implementation of the principles and priorities of the concept of open government in Russia and the need to study the institutional causes of this imbalance. The purpose of the study is to develop conceptual proposals, the implementation of which will help to smooth out and eliminate the imbalances noted above in development.*

The article, on the one hand, notes the clear achievements in solving many

technical and technological problems that have recently hampered the formation of e - government, e-democracy, open government. These include only a partial solution at the state level of the problem of functioning of a convenient and legally significant system of identification of citizens in the electronic environment, the rating of the functioning of the elements of the electronic democracy and the lack of real interest of citizens to participate in decision-making by public authorities, often narrowing in practice the principles of the concept of "Open Government" to the task of ensuring the openness of data.

The identified successes and problems in the formation and development of open government elements allow the authors to offer and justify their vision of promising directions for the practical implementation of the concept of "Open Government" in the Russian Federation.

Among them: the need of developing and implementing mechanisms to ensure the mandatory participation of a significant number of the country's citizens in the public discussion of issues directly affecting their interests, their mandatory direct impact on the adoption of socially significant decisions; the expansion of the use of crowdsourcing as an effective, economic and socially effective tool for involving citizens in socially aware decision-making.

Keywords: *E-government, e-democracy, crowdsourcing, innovation, public discussion of projects*

1. Introduction

Since Th. Schumpeter, justified the leading role of innovations in provision of dynamic development of economic systems, the term "innovation", has become the synonym of progress and moving forward, but by the end of the 20th century it becomes the must-have item of new existing everywhere compound terms that characterize progressive changes in all fields and branches of activity.

Innovative education, innovative entrepreneurship, and innovative economy – this is an incomplete list of idioms that have recently entered and entrenched the daily manner of speech. The sphere of public administration, being very conservative basically, today it has also been involved in the processes of innovative modernization. One of the bright external signs of such processes of renewal is the widespread transition to an innovative model of government, based on the active use of information and communication technologies of continuous interaction of the subject and objects of management - the model of Open Government.

In our opinion, the open government is a new stage in the implementation of the traditional principle of democracy, associated with the use of modern information and communication technologies that leads to a qualitatively new level of interaction of citizens, the state and local government. In the context of open government it becomes possible and necessary to develop the institutions of elec-

tronic democracy, which allow to receive both prompt feedback from citizens and, to express their proposals and wishes proactively and directly to the legislative and executive authorities at all levels in an initiative manner.

The author's hypothesis in this article is: the implementation of the main priorities and principles of the concept of "Open government" in Russia has started successfully in general, but it is unbalanced in various areas due to the presence of a number of unresolved institutional problems. Searching for approaches to solve these institutional problems requires the identification of new areas of active practical work of the legislative and executive authorities in Russia. The search and identifying of these new priorities for Russia in the medium and long term is possible as a part of research projects and scientific discussions, which allow to identify both augmented and alternative approaches to solve institutional problems of consistent implementation of the concept of "Open government" in the Russian Federation.

2. Success in implementing the concept of "Open Government"

Despite the fact that more than 6 years has passed since the President's decree № 601 "On the main directions of improving the system of public administration" was promulgated, and it has become essentially a "road map" for building a new model of information interaction between the government and society, the study of the problems and prospects of the "Open government" remains quite an urgent task. This decree defined as a target that in 2018 the share of citizens using e-government services should reach 70%. The Ministry of digital technology development and communication has carried out significant work on the promotion and promotion of electronic interaction with the state. The official website of which states that in 2014, 2016, 2017, the planned figures for the share of citizens using electronic public services were exceeded by 0.2%, 1.3 %, 4.3%, respectively [1].

We believe that the above mentioned facts should also be considered as an example of effective implementation of the principles enshrined in the concept of openness of Federal Executive bodies, approved by the order of the Government of the Russian Federation № 93 - p 30.01 2014 [2]. We can talk about the successful implementation of this Concept, the creation of mechanisms and tools for certification, registration and publication of data, the development and implementation of methods of monitoring and evaluation of the demand for open data, monitoring of state websites.

The harbinger of the concept of Open Government was the Concept of formation in the Russian Federation of electronic government [3], which defined in particular the electronic government as a new form of organization of public authorities, allowing to bring to a new level of efficiency and convenience of organizations and citizens of public services and information about the results of the detail of state bodies through the widespread use of information and communication technologies.

The implementation of the concept of "Open Government" certainly includes the active use of mechanisms of electronic information interaction of various state and municipal authorities, organizations and citizens, but is not limited to them. The category of "open government" is much broader than "e-government", as it also involves the active use of traditional forms of interaction of all stakeholders, contributing to the increase of the degree of participation of citizens and public associations in political process and public decision making.

The development of e-government within the concept of e-government has already moved beyond the interaction with the Executive authorities. In fact, we are witnessing the actual expansion of the concept of "electronic government" and its transformation into the concept of "electronic system of state and municipal management", based on "electronic participation" as a new mechanism of the interactive relationship between authorities and society [4], and the legal concept of e-democracy [5], which in our expert opinion should also be attributed to the success in the field of practical construction of the open government model in Russia. The various branches of government, including the legislative and judicial branches, has already started using e-government and governance tools, and this experience is contributing the overall of effectiveness of public administration.

In this context, it should also be mentioned about the state automated information system "Management" (SAS "Management") created according to the decree of the Government of the Russian Federation dated December 25, 2009 №1088»).

"SAS "Management" is a unified state information system that provides collection, accounting, processing and analysis of data contained in the state and municipal information resources, analytical data, official state statistics data, as well as other information necessary to support management decisions in the field of public administration" [6].

3. Major problems to be addressed

The implementation of the Open Government concept is hampered by a number of problems related to the implementation of the e-government concept. First of all, it is the absence of the concept of identification of citizens in the electronic environment in a legally significant form at the state level. Elements and private solutions of this problem certainly exist, but there is still no single conceptual practical solution that can be mandatory use and available to all citizens of the Russian Federation anywhere in the country. Perhaps one of the ways to solve this problem will be the planned mass transition of Russian citizens to electronic passports and using them under a universal system of electronic authentication.

The next systemic problem can be considered the problem of digital inequality, the solution of which under conditions of significant economic, social inequality of citizens, inequality in the levels of infrastructure and economic development of the regions is also extremely difficult, and is simply impossible without the

support of the state. This problem is so serious and significant that its solution requires the intervention of the Russian President Vladimir Putin, who instructed the government in June 2018 [7] to consider amending the law "on communications", in accordance with which, it is proposed to create mandatory points of collective Internet access without the use of equipment of subscribers in all settlements of Russia with a population of 100 people, thus lowering the threshold from the current 250. The Prime Minister Dmitry Medvedev was appointed to be responsible for the implementing of this order, which also emphasizes the urgency of the problem and the importance of its solution for the country.

The problem of the implementation of the concept of "Open Government" is also a certain optional feedback from the population in relation to certain legislative or management initiatives of the government, public control. In this case, according to our expert opinion, in practice there is a risk of the discouraging involvement of citizens and their communities in these procedures. The absence of any uniform procedural rules or regulations governing quantitatively the minimum thresholds of feedback or the degree of citizen involvement in decision-making and public control procedures can lead in practice to the fact that the created mechanisms of electronic democracy become only nominal elements of the Open government model, which can, but do not lead to genuine involvement society in solving problems of local, regional and national importance. Such a bold thesis, of course, requires serious confirmation and justification, and we are unlikely to be able to complete this task in full under this article. We should only note that according to the data presented on the official website of the SAS "Management", in the section devoted to the survey of citizens on each of the six priority areas of the "Strategy of Russia 2035" [8] from 3449 to 4932 people took part as at 23 June 2018, which in our opinion eloquently illustrates the real low involvement of citizens in the procedure of public discussion and low actual demand of the tools of electronic democracy in Russia, even if we are talking about the most important documents, which really affect the interests of all citizens of the country in the long term.

The fact that the development of elements of the electronic state often "... narrows to the improvement of public administration in order to provide access to information through the use of new information and computer technologies..." [9] is also the problem of goal-setting in the implementation of the principles of "Open Government". In our opinion, the formation of the technical and technological basis is a necessary, but insufficient condition for the practical implementation of the goals and priorities of the development of e-government, e-democracy, open government.

4. Prospects and priorities for the development of open government in Russia

In our opinion, it is necessary to pay special attention to analyze the possibility of fixing procedural aspects and quantitative parameters of the minimum mandatory degree of citizens involvement in the management and decision-making processes, the failure to comply with which will prevent from making these decisions. Quantitative proportions of involvement require separate research and analysis, but in our expert opinion, on the one hand, they should be proportional to the degree of importance of the accepted values, on the other hand they should be proportional to the degree of direct influence on social and personal interests and living conditions, work, leisure time activities of citizens.

Also in this context, the need of developing and implementing a system of additional motivation of citizens to monitor and respond productively to the government's initiatives such as the bills submitted for public discussion, etc., needs additional studies. And the possibility of introducing an individual personalized account of such social and civil activity, expressed in the assignment of individual indices, allowing to count the results of the reporting period for certain individual preferences of financial and non-financial nature on a competitive basis should also be studied. However, let us remind that under this study, we only believe that it is necessary to focus on solving this problem, and we identify some possible ways to its solution.

The experience of China is interesting, worth attention, separate analysis and productive borrowing. In 2014, China's State Council issued a document "Notice concerning Issuance of the Outline Planning for the Construction of a Social Credit System (2014-2020)" [10], which defines the plans of China concerning the construction of the system of social credit. This system is regarded as a basis for the construction and development of a modern harmonious society, a tool for overcoming social contradictions, stimulating mutual trust of all subjects, an essential condition for the strengthening and developing of innovative social management.

The idea of social credit rating in China is based on the successful experience of western countries, where an effective system of private credit ratings is being developed successfully [11]. It is aimed at estimating large business entities and even economies of different countries. China is also planning to make the objects of rating assessments of absolutely all subjects of social relations in the state on a compulsory basis, normalizing the levels of quantitative indicators of the rating, introducing complex mechanisms of remuneration and punishment for achieving certain levels of the rating values.

According to the authors opinion, the use of system elements of individual social credit ratings can allow Russia to make significant progress in solving the problem of low social motivation of inclusion in the processes of public discussion, decision-making, monitoring of their implementation and achievement of targets at all levels of public administration. In this context, social credit rating can

be considered as an intangible asset of the subject of social relations. Just as firms today are seeking to promote and to prevent the loss of goodwill, social actors will receive a powerful and inexhaustible motivation to maximize socially justified and responsible behavior in absolutely all spheres of activity. E-democracy should be considered as an essential tool and institutional framework for the Open Government. The participation of citizens in collective decision-making within the framework of crowdsourcing has already been tested both in making important decisions of regional importance in large cities of Russia, and in the largest and successful companies and projects. Thus, the choice of the official Mascot of the 2018 FIFA world Cup in Russia can be considered a vivid and convincing example of the high efficiency of this tool. It allowed to attract all interested people on a competitive basis, first to develop the Mascot, and then to determine the winner. More than 1 million people took part in the Internet voting when choosing the talisman, and FIFA bought the copyrights for to the Wolf, named "Zabivka" from the author – a student of the Department of graphic design of Tomsk State University Ekaterina Bocharova just for \$ 500 [12,13].

Another striking example is the largest commercial Bank in Russia – PJSC "Sberbank". It has been using crowdsourcing to attract ideas for improving their products and developing promising projects since 2011. According to the information posted on a separate website created for this purpose <http://www.sberbankidea.ru/>, more than 100 000 people have already taken part in the Bank's crowdsourcing projects [13].

According to the authors' expert opinion, the expansion of crowdsourcing practice for the state within the implementation of the concept of e — democracy is also a way of saving on expert analytical research and control and audit activities, systematic work within the volunteering.

The positive social and economic effect of crowdsourcing is also associated with the fact that personal participation in certain projects that affect the public interest, significantly strengthens the personal civil sense of justice, creates a strong and stable internal motivation for a more responsible attitude to the product of all labor and related objects and processes. Public discussion of the federal laws will not only make them better, but it will also raise awareness of people about its purpose and meaning, and it will significantly increase the effectiveness of practical implementation.

Intensive work on the practical implementation of the Open Government concept has been carried out in the regions of Russia for several years. Thus, in St. Petersburg it was officially initiated by the adoption of the decree of the city government №1108 "On the Introduction of Principles and Mechanisms of Open Government in the Activities of the Executive Authorities" on November 15, 2012 [15] in the annexes to which the composition of the Executive Commission, headed

by the Governor, was approved, and an extensive plan of practical measures to ensure the implementation of the principles and mechanisms of open government in the activities of the executive authorities of St. Petersburg was also approved. The above mentioned decree of the government is modified regularly on the basis of the achieved results and emerging challenges. The latest changes and additions to the Decree No. 1108 were made on December 12, 2017, which confirms the relevance of further practical activities to develop the principles and mechanisms of the open government.

The activities of governments and administrations at all levels of government in the Russian Federation are directly or indirectly reflected in the budget of the relevant level of government. In this case, the concept of open government cannot be implemented without emphasizing open budgets at all levels. Unlike many others, including the above-mentioned processes, the open e-budget system is still at an early stage of development. Direct consideration of citizens' preferences in planning income and expenditure, adjusting the priorities of budget policy, assessing the effectiveness of budget expenditures by direct recipients of public services or consumers of public and personal goods financed from the budget functions occasionally, fragmentally, or absent at all.

This situation is hardly fully consistent with the Concept of creation and development of an integrated information system of public Finance management "Electronic budget" [16], which implies, inter alia, "ensuring transparency, openness and accountability of the activities of public authorities and local authorities, as well as improving the quality of financial management of public administration sector organizations by forming a single information space".

5. Research Results

In our opinion the experience of building a model of Open Government, in general can be considered successful. The planned indicators of citizens' involvement in electronic public services are being implemented and exceeded. Considerable progress has been achieved in the development of technical and technological foundations of the Open Government infrastructure. Moreover, we can talk about the obvious signs of an emerging electronic system of state and municipal administration.

Some unresolved problems that constraint on the successful development of the concept of "Open Government" are: the absence of the concept of universal identification of citizens in the electronic environment in a legally significant form; the problem of digital inequality of citizens of the country, which has become the focus of attention of the President and Prime Minister; the rating of the functioning of elements of the electronic democracy system and the lack of real interest of citizens to participate in decision-making by public authorities through existing tools of the electronic digital environment; frequent narrowing the prin-

principles of the concept of "Open Government" up to the task of providing open data in practice.

The priority directions of the open government development in Russia should be the development and implementation of mechanisms that ensure the mandatory participation of a significant part of citizens in public discussion of issues that directly affect their interests, and decision-making, including the expansion of crowdsourcing.

6. Conclusions

Summing up our brief study, we note that the traditional model of public administration in modern conditions has ceased to meet the goals and interests of citizens in many developed countries, including Russia. The bureaucratic system of public administration should be replaced in the nearest future by the open government model based on a fundamentally new model of communication between the government and society.

In many areas, Russia has already succeeded in this context, but it is impossible to talk about the full implementation of the open government concept. The author's hypothesis about the imbalance in the level of practical implementation of key principles, priorities, mechanisms of open government, including in the regional context, was confirmed.

Further practical implementing of the principles and priorities of the "Open Government" concept requires taking into account foreign experience, which shows more effective system solutions that fundamentally change the nature of the relationship of all subjects of social and economic relations in the state today. This necessitates further theoretical study of this problem by the interested parties, improvement of practical mechanisms for the implementation of existing and developing conceptual framework of the "Open Government" model emerging in Russia.

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教育目标和方法：历史和现代性
**EDUCATIONAL GOALS AND METHODS:
HISTORY AND MODERNITY**

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注解。文章从积极的角度强调了现代教育的问题。对教育学史中方法选择的目标和结果进行了对比分析，指出了根据新标准解决培训的主要方法。

关键词：教育教育，历史经验，积极保留，比较分析，专业化，趋势。

Annotation. *The article highlights the problem of modern education from the standpoint of holding positive. A comparative analysis of the goals and results in the choice of methods in the history of pedagogy is presented and the main ways of solving training in the light of new standards are indicated.*

Keywords: *pedagogical education, historical experience, retention of positive, comparative analysis, professionalism, trends.*

Modern trends in the development of education determine a fundamental change in approaches to the organization of the educational process, with the retention of a positive one. At the same time, the historical approach, where the past as a “life-giving shrine” [5, p. 63], is the basis proving that life experience in the pedagogical process has a general meaning in its direction, although in particular methods and goals it is possible to reveal features.

Let's try to comprehend the problem and highlight what is taken as the basis in choosing the goal, methods of education in a given time period and what should be the result?

We believe that the most reasonable in terms of importance in the field of education can be identified system, prevailing in China. The framework of the article explains some simplicity, but we tried to highlight the main thing. First, education received the goal: to approve social sustainability through the selection of the most goal-oriented for government positions. The main method is imitation and “developing the ability to write essays” [6, p.32-35]. The main result was the pres-

tige of an educated person: achievement through a series of multi-day individual examinations of the degree of "blooming talent", "a recognized scientist, suitable for filling the position" and the highest degree - "Forest of pencils", which reached only dozens of candidates.

From the position of modernity, it is the value of the generalized report, the novelty of the interpretation of the topic, the ability to express one's thoughts, highlight the position, can become a criterion of competence and readiness of a specialist in any field. At the same time, it is possible to choose the subject of a scientific treatise, depending on the direction of interests and preferences of the examinee, the diversification of education and its completion are ensured. In addition, the development of the ability to theoretically think in the system of broad information technologies can become the basis of a new specialist model.

If you highlight one more specificity in the organization of education, you can use the experience of ancient Greece (2-9 thousand BC). The goal: the political development of the individual, the formation of free loyalty of the citizen to the state, spiritual chastity, mind control and "intellectual development of the personality" [6, p.51]. The main method is the intellectual development of boys, the development of individual thinking, curiosity, ability to speak, quickly make decisions, self-knowledge, the establishment of life values through sports, music, dance, arithmetic. Of course, we are narrowing the circle, removing methods and conditions, but the very idea of developing a lapidary style, the ability to express briefly the essence of speech interaction, to find a rational statement of thought, speed in choosing a solution - these problems are not solved in modern professional education.

It is impossible in the history of education not to pay attention to the Roman Empire (VIII-VI century BC). Purpose: training strong and strong-willed citizens through family education: "all science from home" [4, p. 57]. As an example, we highlight the focus of government attention on understanding the role of the family, and from the perspective of modernity, the significance of the future specialist's familial literacy, a very important component of professional competence, both from the perspective of pedagogy and from the position of psychological improvement of society.

Perhaps the scientific excursion into history will be incomplete, if you do not select the Middle Ages (XI-XVIII), where the main purpose of education was highlighted discipline. Analyzing the main teaching method, we come to the conclusion that the discipline was viewed as an internal position with absolute freedom to learn and train [6, 112-113].

The universities of that time (Paris, Oxford, Cambridge, Alexandria, and others) are large educational centers, a secular alternative to church schools, they absorbed the ideas of all philosophical schools and their main goal was to clarify the direction of thought of a particular school. The main method is discussions,

declamations, debates, public defense of ideas in the field of astronomy, mathematics, physics, and natural sciences.

It is important to note that the time for the cognitive was favorable (the discoveries of Archimedes, Euclid, new views on the Earth and the Sun, etc.), so the biography (as a way of life and self-manifestation) was one of the criteria for assessing knowledge and educational means of learning: for life, and not for school.

In Russia, from the middle of the 18th century, the enlightenment concept based on serving the state, preparing for the life of the earth and strengthening Russian nationality V.I. Dahl, for example, gave such a definition to the concept of "enlightenment" - "the light of science and reason, warmed by pure morality: the development of human mental and moral forces; scientific education with a clear sense of duty and the goal of life ... "[Vol. 3, p. 702).

If we summarize all the directions of education in the Russian Empire of this period, we can draw attention to the fact that the school case was considered as a "single means" of the public good (Charter of 1786). This was especially evident in the reforms of Peter I. According to his idea, the school case should have a practical orientation. This is evidenced, firstly, by the emergence of schools of mathematical and navigational sciences, the "Russian school" and the "digital school", the surgical, engineering and artillery schools. The main goal was to prepare sailors, engineers, gunners, service people. But the main idea of Peter I is to make Russia open. No wonder there was a wide interest in foreign languages. The children of boyars, servicemen and merchants were taught Greek, Latin, Italian, French, German, Swedish. Learning languages took up three quarters of study time. [4, p.211] For example, (according to the chronicles of I.E. Scheglov) the first Mughal school of translators from the Mongolian language in Eastern Siberia appeared in 1725. The purpose of the school was determined by the need for elementary training of specialists in geodesy, mineralogy, cartography and Japanese.

Continuing the analysis of the historical development of the goal of education in the XIX-XX centuries, we can be sure that the "past works for the future": it is in the past that:

- rationality of education based on the characteristics of age-related psychology and personal qualities (V.I. Vodovozov, L.S. Vygotsky, I. Herbart, N.I. Pirogov, K.D. Ushinsky, A.N. Leontiev),
- fundamentals of teaching as a personally significant matter (I. Pestalozzi, L. N. Tolstoy, V. P. Ostrogorsky, T. I. Shamova, D. B. Elkonin),
- future ideals of realistic education (J.-J. Rousseau, D.I. Pisarev, P.Ya. Galperin),
- some ways to develop self-reliance in learning (I. Herbart),
- understanding the ultimate meaning of learning, teaching and self-improvement (F. Diesterweg),

- learning, taking into account the needs of the time ... observing the unchanging law of the advancement of education and taking into account the human need for equality (L.N. Tolstoy).

V.I. Blinov, E.Yu. Yesenin [2] identified the qualities that the teacher had to comply with:

- state approach (loyalty to the Fatherland and love for the Russian people, understanding their needs, identifying and developing the talents of students);

- religious and philosophical (highlighted humanistic mission in society, religiosity, firmness in Christian beliefs, good knowledge of the subject and methods of teaching it),

- natural science and revolutionary democratic approach (paternal love for children and respect for the child's personality, ability to find an approach not only to a pupil, but also to his family, to unite the efforts of the teacher and parents). natural science and revolutionary democratic approach (paternal love for children and respect for the child's personality, ability to find an approach not only to a pupil, but also to his family, to unite the efforts of the teacher and parents).

Extensive discussions were held about the teacher's mediation between the student and society, between knowledge and life issues, goals of upbringing and the purpose of the public school.

L.N. Tolstoy believed that the task of the teacher was to explain with the help of science: what is the matter of my whole life? What will come of what I do today, what I will do tomorrow, what will come out of my whole life? What am I with my desires?" [7, vol.20 pp. 111-113].

The conclusion reached by him answers the question about the teacher's tasks: "to awaken a free interest of a free person to a rational knowledge about oneself, about the lives of others, about society, about the world" (ibid.).

So, the modern field of education has grown on historical grounds. But it should be recognized that the historical excursion cannot be perceived unequivocally. It requires a special study of different points of view on education in general as a sphere (taking into account the past) "production of a human resource for the labor market" [3] or as a wide field of interaction culture where "the ability to live" in the world of modern technologies and different social systems is formed.

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多语言时代的外语多语教学
**MULTILINGUAL TEACHING OF FOREIGN LANGUAGES
IN THE ERA OF PLURILINGUISM**

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注解。 本文讨论了当前世界各国的语言状况和关系。 得出结论：利用多种外语教学方法优化学生外语交际能力的形成。

关键词：西化，多语言，形式化方法，多语言教学

Annotation. *The article discusses the current state and the relationship of languages in the world. The conclusion is made about the possibility of using the methodology of teaching several foreign languages to optimize the formation of foreign language communicative competence of students.*

Keywords: *westernization, plurilingualism, formalized method, multi-language teaching*

Globalization, which has become synonymous with Westernization, together with the hegemony of the English language, has reached the apogee of its spread and influence. The dynamics of the development of intercultural contacts is reaching a higher level. French philosopher J.-F. Lyotard stated that “the merit of post-modern theory is its substantiation of sociocultural pluralism, which is acutely expressed in the era of global processes. There is a rejection of Western priorities and the rehabilitation of many forgotten traditions of the past, learning from the experience of other cultures” [4, p. 40]. Being a carrier and a mirror of the culture of the people, the language gives access to different world views, knowledge about “others”, which serves as a guarantee of mutual understanding, since translation is never exhaustive and perfect [5, p. 26]. The Charter on Plurilingualism in Europe, adopted in the EU back in 2005, defines this phenomenon as “the use of several languages by one person” [1]. The Council of Ministers of the EU and the Department of Education, Culture, Youth” in 2011 adopted the conclusion that “a wider choice of languages, among which there are less common languages and the languages of neighboring countries, should be, to the extent possible, offered at all levels of education in the perspective of education and lifelong learning” [7].

At Voronezh University in recent years, there has been an interest in learning French from scratch by those who have previously studied English. This choice is due to the desire to learn something new, since the level of English is quite high.

This state of affairs is connected, in our opinion, with two factors. First, despite the fact that now English, as the lingua franca is spoken all over the world, it is often not enough for all areas of human activity, especially such as tourism and international trade. Secondly, in recent years, the spread of English has had all the signs of language expansion, when there was “aggressive promotion of the language, export of language pedagogy”, [6, p. 143-151] and, as a result, the language has gone beyond the functional areas reserved for foreign languages.

All this led to some “satiety” of English and a natural defensive reaction. Obviously, the English language will remain a "sublanguage" of science and technology. First of all information technologies, i.e. the area to which it turned out to be most successfully adapted, like the Latin that existed as a language of science until the 19th century. The next leader is still not obvious. The popularity of the Spanish language is growing. But the number of speakers is not enough for a qualitative breakthrough to the leaders, because Many factors are needed: geopolitical, economic, strategic, psychological. In recent years, there has been an intensification of the protection of native languages and a simultaneous expansion of the “practice of awakening to languages”, which allows pupils to see their native language from a distance with several living languages, which improves knowledge of it and favors the study of other languages [1]. This is evidence that, most likely, we have already entered the era of plurilingualism. And it will require a revision of curricula, encouragement of interdisciplinary work and special optimization of teaching a second, third foreign language, or several languages at once. In Europe, which unites 28 states, there are important tendencies that make language learning a success factor, empower people, i.e. create conditions for personal development. Innovative techniques funded by the European Union are being developed, including the Galatea language project: EuRom4, EuroComRom, and Understanding Romance Languages [8]. All these methods were initially aimed at learning to read on the basis of texts simultaneously in several Romance languages, based on their similarities [9]. In 2003, the Galanet Internet platform began to work, its goal is to connect all those who study Romance languages.

For Russia, plurilingualism is no less relevant, and the study of a multitude of languages is an urgent need. To strengthen cooperation, better mutual understanding and as a sign of respect, it is important to study Slavic languages. Close contacts with Europe and the rest of the world require the expansion of the study of languages, for example, Germanic or Romance groups. And here the English language, with which the younger generation is familiar to some extent, should play a positive role. Since the lexical composition of English and French is 60%

common, and there are no deep discrepancies in the field of morphology and syntax, the second choice of French and the third language, for example, Spanish and Italian, can be very effective, interesting and motivating students. event. Classes can be more dynamic and encouraging the creativity and personal discoveries of students and teachers. Since “young teachers practically all are now“ bilinguals, ”and the hegemony of English is not terrible for them,” according to L. Muradova [2], they will be able to improve this experience by teaching French and at the same time, for example Spanish or / and Italian. B. A. Lapidus noted that if the study of the first FL is proceeding against the background of the native language, then the first FL is the main background for mastering the second and third FL. It is also the main resource of interlingual interference, and the source of the transfer of methods of working on the language [3, p. 40]. Of course, it is easier to rely on the knowledge of a language that you know, than to start from scratch; the more you experience the use of a single language, the more accelerated the study of the subsequent one [3]. To study the second, third, etc. language, you need to change the approach, which can be called, for example, as formalized. Starting, for example, with the phonetics of the French language, in which it is the most complex of all Romance languages, it is necessary to focus on the general alphabet of Romano-Germanic languages and pay attention to the differences with English: strict reading rules, lack of diphthongs, nasal sounds, continuity of words speech stream, etc. To designate then that usually Italian and Spanish phonetics and spelling are not a difficult problem. Focusing on the sounds and rules of reading the French language in detail, the rules of reading and the phonetic transcription of Spanish and Italian can be given in the form of tables for visual comparison. Students suggest sites for their independent listening and working with sounds, as a task - to find differences. In the next lesson, compare the sounds, their transmission in writing, examples and rules of reading. Such work arouses research interest in the typological comparison of languages, leads to small discoveries. Similarly, the study of grammatical phenomena is possible. The grammar of Romance languages has approximately the same level of complexity as French, but differs from English (lack of gender, etc.). The generalization and the formalized representation of the system of parts of speech in these languages, including the clarity of this knowledge in English, where from experience, students have very vague ideas about its structure. For the teachers themselves, who, as a rule, specialize in French and have a third language in their passive, one of the Romance languages, such formalized teaching of several languages from one group will not be burdensome and too time consuming. The Internet provides tremendous opportunities in choosing the most convenient algorithm, and freedom for independent work of students, in search of sites and methods. A form of control can be organized in the form of presentations that students will present as they study various topics and aspects in

the form of a generalization of typologically close languages. The teacher identifies the goals and aspects of research for students, based on existing knowledge; awareness of the proximity of languages; identifying similarities; comparative analysis of language pairs. At the senior courses it is possible to offer students the independent development of their teaching methods in teaching reading, writing and oral communication in several languages.

Events show that people will be more and more aware of the limitations of their existence in comparison with those who speak several languages, those who can better feel globalization and enjoy more opportunities. For young people who are currently studying, living and working in an open world, important conditions are created for creating an ambitious career. In addition, by expanding our own cultural and linguistic environment, we can improve our understanding of each other and pass on these values to children.

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高中化学教学中的系统活动方法
**SYSTEM-ACTIVITY APPROACH IN TEACHING CHEMISTRY
IN HIGH SCHOOL**

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注解。 本文讨论了系统活动学习方法的标准和原则。 关于“碳水化合物”主题的拟议模型类。 单糖“对于高中学生而言”化学“不仅可以获得知识，还可以在集体工作的条件下表现出独立性。

关键词：系统活动方法，教育技术，教育网络任务。

Annotation. *The article discusses the criteria and principles of the system-activity approach to learning. The proposed model classes on the topic "Carbohydrates. Monosaccharides" for students in high school in the discipline "Chemistry" allows not only to acquire knowledge, but also to show independence in the conditions of collective work.*

Keywords: *system-activity approach, pedagogical technology, educational web quest.*

The use of methods and techniques in teaching, which form the ability to independently acquire new knowledge, gather the necessary information, put forward hypotheses, draw conclusions and conclusions in the conditions of excess information, becomes increasingly relevant in the educational process [2].

Today, the center of attention is the student, his personality, and a unique inner world. The methods and forms of organization of general educational activities of students, which rationally correspond to certain conditions and goals of developing a harmonious personality, come to the first place for a modern teacher. Combining various aspects of learning activities, it allows both students and teachers to achieve positive results in mastering knowledge and the ability to design a process for obtaining this knowledge.

What is the essence of this method? Many teachers [2, 3, 5] in modeling the educational process use the considered approach based on the following criteria [3]:

1. Training and development of personality traits that meet the requirements of a progressive society, the conditions for building a civil society based on tolerance, dialogue of cultures and respect for a multi-ethnic, multicultural and multi-religious Russian society, a dynamically changing economy.

2. Orientation on the results of education as a system-forming component of the standard, where the student's personal growth based on universal learning activities, comprehension and mastering the world is the goal and the main result of education.

3. The leading role of individual age, psychological and physiological characteristics of students, the importance of activities and forms of communication, as well as taking into account the continuity of preschool, primary general, basic and secondary (full) general education to determine the goals of education, upbringing and their achievement.

4. The variability of individual educational routes and the individual development of each student allows for personal growth of creative potential. This can be realized with the condition of the necessary transition to a constructive solution of social problems based on the development of the content and methodology of education.

5. The way to achieve the result that determines the possibility of increasing the socially desirable level of personal and cognitive development of students.

6. The role of educational content and ways of organizing in tandem with educational activities and the educational process in achieving the goals of personal and social development of students.

The system-activity approach identifies the main results of training and education in the content of the main tasks and general learning activities that students should learn [4]. It is necessary to understand that self-organization plays the leading role in the assimilation of knowledge. The ability to organize their work in the educational process, one way or another, leads to the successful self-realization of the student.

Independent mastery of new knowledge, skills, and skills for self-organization in the educational process allows students to achieve success in personal growth. This possibility is ensured by the fact that universal learning activities are a synthesis of actions that generate a multifaceted orientation of students in various subject areas of knowledge and motivation to learn.

An example of the application of the activity approach can serve as a lesson on the topic "Carbohydrates. Monosaccharides" [1]. This class also uses web quest.

Purpose of the lesson:

- study the structure of monosaccharides;
- study the isomerism of monosaccharides;
- predict the chemical properties of simple carbohydrates based on the structural features of their molecules.

Table 1
Working process

Stages of work	Methods	Tasks
1. Organizational stage		
2. Verification of homework, reproduction and correction of knowledge, skills and abilities of students necessary for the creative solution of the tasks.	Frontal survey	- Web quest on the topic "Carbohydrates. Monosaccharides "(see tab.2)
1. Updating existing knowledge		- Expand the essence of the term "aldehyde-alcohol". - Qualitative reactions of polyhydric alcohols, aldehydes ". - What is isomerism? Name the types of isomerism.
4. Primary learning new knowledge.	Work in pairs	- Write projection formulas for tautomers of glucose and fructose. Call them. - On the example of glucose to show enantiomers, diastereomers, epimers.
5. Primary check of understanding	1. Frontal work (spoken) 2. Group work 3. Frontal work (written) 4. Independent work	- Perform test "Carbohydrates. Monosaccharides". - Performing laboratory work "Chemical properties of monosaccharides." - Write the equations of qualitative reactions on the aldehyde group, on the alcohol group. - Formalization of laboratory work.
6. Primary consolidation.	Independent work	- Examination "The structure and properties of monosaccharides"
7. Information about homework, instructions for its implementation		
8. Reflection (summarizing classes)		

The content of the web quest (for short-term work) on the topic "Carbohydrates. Monosaccharides"

Information text

Carbohydrates are part of the cells and tissues of all plant cells and animal organisms and by weight constitute the bulk of organic matter on Earth. One of the representatives of carbohydrates is monosaccharides. Free in nature, glucose is found. Derivative monosaccharides include compounds having a monosaccharide nature and containing instead of one or several hydroxyl groups (and also in addition to them) a hydrogen atom or other functional groups, most often an amino group or a carboxyl group.

Internet resources:

databases, information and reference and search engines - Internet resources that correspond to the subject of discipline:

1. <http://studopedia.org18-151884.html>
2. <http://worldofscience.rulbiologija16617-proizvodnye-monosaharidov.html>
3. <http://megaobuchalka.rul3/16806.html>

The task. Fill in the table "Structure and properties of derivatives of aminosugars" using Internet resources.

Table 2

Structure and properties of derivatives of monosaccharides

Name of monosaccharide derivatives	Structure	Biological role	Application / Use
Deoxy sugar			
Aminosugar			
Neuramic acid			
N-acetyl neuraminic acid			

The completed web quest is discussed and supplemented in the group, students can offer their online resources on the topic being studied.

Thus, the system-activity approach creates such conditions under which students should be able to plan, take notes, correctly conduct observations, clearly record and describe their results, summarize and draw conclusions, and also master the scientific methods of cognition.

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解决文本问题
SOLVING TEXT PROBLEMS

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注解。 本文讨论了俄罗斯联邦数学主要国家考试中包含的单词问题的类型。 作者描述了学龄儿童在解决文本问题时遇到的困难，并提出了解决每种问题的方法指南。

关键词：文本任务，标准任务，解决方法，学龄儿童。

Annotation. *The article discusses the types of word problems included in the main state exam in mathematics in the Russian Federation. The authors describe the difficulties encountered by schoolchildren in solving textual problems, and offer methodological guidelines for solving problems of each type.*

Keywords: *text task, standard task, solution method, schoolchildren.*

Text tasks are the traditional section of the math exam. The main difficulty in solving a textual task is to translate its conditions into the mathematical language of equations. For text tasks, there is no single solution algorithm - this is their complexity.

Pupils in primary schools are poorly assimilated to solve text-based tasks even at the basic level, as shown by the results of the Basic State Exam (BSE). This is due to the lack of general ideas among schoolchildren about the processes considered in tasks, phenomena, the lack of a figurative representation, the inability to establish what is given in the task, what needs to be found, to identify the interrelationships of the values considered in the problem. The important point is the lack of proper skills and abilities: lack of knowledge of the stages of solving the task, lack of understanding of the content and purpose of their own activities in each of them, inability to solve equations or inequalities (or their system) of a certain type, inability to select roots of an equation or inequality solutions condition of the task. Lack of possession of the necessary techniques of reasoning, ignorance of common methods for solving tasks do not allow many students to successfully work on a specific textual task.

The relevance of the work is connected with the need to teach schoolchildren to distinguish between the main types of tasks and solve the simplest of them in order to successfully complete the BSE in mathematics.

Textual tasks for which the ready-made rules exist in the school course of mathematics or these rules directly follow from any definitions or theorems that define the program for solving these tasks in the form of a sequence of steps are called standard [1]. It is assumed that for the implementation of individual steps of solving standard tasks in the course of mathematics there are also well-defined methods.

There are various methods for solving textual tasks: arithmetic, algebraic, graphic, geometric. It should be noted that almost every task within the chosen method allows solving in various ways, i.e. solution using different models [3].

The textual task in test and measurement materials is presented in the first part - task no. 16, in which it is necessary to perform simple practical calculations using percentages, fractions, relations, and in the second part, task no. 22, which is associated with the formulation of the equation with one or two unknowns.

Consider the types of text tasks included in the BSE in mathematics, and describe the features of their solution.

The tasks on the movement include tasks that talk about three quantities: the path, speed and time; the basic formula is $S = V \cdot t$. These tasks are of the following types:

- tasks on the movement of objects towards each other (approach speed) or the movement of objects in opposite directions (removal speed);
- tasks for movement after, in which objects move in one direction, but leave from different points at some distance from each other; when moving in pursuit of objects, they can both come closer and move away;
- tasks on the movement of an object along a river, in which they distinguish their own speed of an object, the speed of an object along a stream of the river, object speed against the river;
- tasks on the motion of extended bodies, the length of which is measured with the distance that they travel;
- tasks for driving on ring roads, for example, let two bodies start moving from one point in one direction with speeds $v_1 > v_2$, then if l – circle length, t_1 – the time after which they will be at one point for the first time, then $l = (v_1 - v_2) \cdot t_1$, where t_1 – is the time during which the first body will travel a distance l greater than the second body.

Tasks for work include tasks that speak of three quantities: work, time during which work is performed, productivity — work done per unit of time. Collaboration tasks link work time, labor productivity and work time by the ratio:

$$\text{work time} \times \text{labor productivity} = \text{workload}$$

As a rule, time is taken as x , and labor productivity is expressed in $1/x$.

In addition, tasks related to work include tasks related to filling and emptying tanks with the help of pipes, pumps and other devices. In this case, the volume of pumped water is considered as the work done.

Tasks on mixtures, alloys and concentration are tasks in which it is a question of mixing various substances in certain proportions. The main condition is the fusion of various metals, the dissolution of various substances into each other, or the transfusion of liquids consisting of several components. In most cases, tasks for mixtures and alloys become clearer if, when solving them, schemes, figures, tables are used.

Table 1

Name of substances, solutions, mixtures, alloys	% substance content (proportion of substance content)	Mass of solution (mixture, alloy)	Mass of substance
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Tasks for mixtures and alloys are of two main types:

1. Two mixtures of a certain mass with a certain concentration of the substance are poured together. It is necessary to determine the mass and concentration of this substance in the new mixture.

2. In some solution, with a certain concentration of the substance, add, for example, pure water (with a zero concentration of this substance). It is necessary to determine what the concentration of a substance has become.

The tasks on the progression include tasks for arithmetic and geometric progression for which it is necessary to: set the type of progression, select known and desired values, write formulas for the corresponding type of progression, make calculations for the quantities describing the situation of the problem, formulate a conclusion.

When teaching schoolchildren how to solve text problems, the following conditions should be considered: age characteristics of students; the level of rigor of presentation of the material corresponding to the level of development (learning) of students; a clear definition of the volume (depth) of the material under study, depending on the learning tasks to be solved (basic education, mathematical specialization, various types of profile differentiation, etc.) [2].

So, in order to learn how to solve tasks, it is necessary to solve various tasks and different methods, to be able to analyze solutions, compare, find advantages and disadvantages in each particular case. However, the ability to solve tasks is not directly dependent on the number of solved tasks, therefore, in psychological, pedagogical and methodical research, preference is given to methods of forming common approaches to the task as an object of study, its analysis and the search for its solutions.

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Ferdowsi在上海合作组织国家文化和语言的共同学习研究中对Shahname新波斯连续统的地名表示

TOPONYMIC REPRESENTATIONS OF THE NEW PERSIAN CONTINUUM IN SHAHNAME BY FERDOWSI IN THE CONTEXT OF CO-LEARNING STUDY OF THE CULTURES AND LANGUAGES OF THE SCO COUNTRIES

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注解。 本文讨论了Firdousi对Shahname的新波斯连续统的地名表示。从“Shahnameh”文本中提取地理知识的技巧成为新波斯语连续体语言文化学生之前已知和获得的地理知识和心理地图相关的基础。 通过地名学对新波斯语连续统一体的文化介绍是在研究语言和文化的方法的基础上进行的，旨在将现实的语言概念融入语言世界，并获得所研究的新波斯语所反映的世界的另一种视角。

关键词：地名，塔吉克语，Shahnameh，Ferdowsi，Novopersid连续体，语言和文化研究方法，地理知识，特殊认知。

Annotation. *The article discusses the toponymic representations of the New Persian continuum in Shahname by Firdousi. Skills of extracting geographical knowledge from texts of “Shahnameh” become the basis for the correlation of previously known and acquired geographical knowledge and mental maps for the language culture student of the New Persian continuum. Cultural introduction to the New Persian continuum through toponymy is carried out on the basis of the methods of studying languages and cultures aimed at incorporating language concepts of reality into the verbal world and acquiring another vision of the world reflected in the New Persian language studied.*

Key words: *toponymy, Tajik language, Shahnameh, Ferdowsi, Novopersid continuum, methods of studying languages and cultures, geographical knowledge, special cognition.*

A distinctive feature of the new millennium is the resumption of migratory

flows of the population, which are caused by global economic transformations of humanity, which makes a multi-faceted study of the phenomenon of cross-border territories, including in terms of the integration of linguistic cultures and semantic worlds of communicating ethnic groups.

Recently, the method of learning foreign languages and cultures, or the method of cross-cultural learning of languages, has become important in the methodology of teaching foreign languages [1]. The study of the cultures and languages of the SCO countries, which include Tajikistan, is becoming relevant for the cross-border territory of Altai. The emergence of its own dialect in Tajikistan was the result of the policy of creating national identities: the formation of a cultural identity that is different from the Persian-speaking residents of Afghanistan and Iranians predetermined the creation of an independent language with its own writing and vocabulary features. The total number of people who speak Tajik is estimated by experts at 8.5 million.

In 3 vols. work "Languages of the world. Iranian Languages" [2] Tajik language is characterized as the language of the main population of the Republic of Tajikistan, with variations of its name: *taj. забони тоҷикӣ* English *Tajik*; *rus таджикский язык*. Tajik language belongs to the southwest group of Iranian languages. Its distribution area is Tajikistan, Uzbekistan, partly distributed in Kyrgyzstan, as well as in Northern Afghanistan.

Tajik has a common history with Persian and Dari, which dates back to Middle Persian and Ancient Persian. At present, researchers are talking about the existence of a New Persian continuum on the territory of Central Asia, which spread from Iran to the Afghan-Pakistan border. It is accepted to call all peoples of the continuum, capable of understanding each other and speaking the language of one family. Persian-speaking residents of Afghanistan and Iran and Tajiks still have not lost the ability to understand each other.

In the history of the formation and development of the New Persian continuum, it is possible to speak of the existence of three periods: 1) ancient - the functioning of the ancient Persian language is witnessed in the ancient Persian cuneiform monuments of the 6th — 3rd centuries BC; 2) medium - the functioning of the Middle Persian language is represented by a variety of written records from the IV century BC till VIII-IX centuries AD 3) the new - the functioning of the New Persian language (classical Persian / Persian-Tajik) and the modern languages formed on its basis - Persian, Tajik and Dari [2].

We believe that cultural introduction to the New Persian continuum should be based on the methods of studying languages and cultures, which allows us to assimilate not only new forms of words, a new code for expressing content, but also a new system of concepts inherent in the studied languages and reflecting the characteristics of cultures [3]. Such a technique helps to incorporate the culture of

the New Persian continuum into the verbal world of linguistic ideas about reality, about culture, while simultaneously acquiring another vision of the world reflected in the language.

E. D. Karandasova [3] develops an algorithm for learning languages and cultures, which is a step-by-step technology and is based on the transition from a facilitation strategy (working with the entire group of language learners) through the use of cooperation strategies (working in subgroups) to coaching (individual tasks).

Acquaintance with the culture of the New Persian continuum, we propose to start with working with “Shahname” Firdousi. As noted by Omid Shiva [4], Orientalists carried out a colossal effort to study written sources on the history of Iranian peoples, among which “Shahname” Firdousi, a written source covering various aspects of the life of the peoples of Iran and Central Asia, stands out: ethno-geography, historical geography, ethnic history, political, socio-economic relations, material and spiritual culture and the relationship of these peoples.

As for ethnography, G.V. Ptitsyn drew attention to the fact that the geographical information of “Shahnameh” within the limits of the Central Asian and East Iranian complex is quite real [5]. The researcher connects the impossibility of associating a particular name that appears in a poem with a particular place with either the distortions of the poem scribes or the insufficiency of the research work done. A special part of ethno-geography and linguistic-cognitive culture of an ethnos is ethnotoponymy.

T.V. Davydova considers ethnotoponymy as part of the cultural heritage [6]. The data of toponymy reflects information about ethnogenesis, the time of the initial settlement of territories, ways of movement, migration flows, social welfare, especially the economic structure, economic activity. O.V. Kravchenko [7] also believes that the study of toponyms acts as a tool for the formation of linguocultural competence, which should correspond to the current state of intercultural relations and deepen knowledge of the world of the culture of the language being studied.

We believe that the study of ethno-names forms not only linguocultural, but also geographical competence, which is based on the mastering of knowledge of the geographical world of the New Persian continuum. D.Mark, K.Freks, S.Hirtle, R.Lloyd and B.Tversky [8] believe that people's knowledge of the geographical world differs from the actual geographical world. B. Tversky believes that mental representations are built for specific purposes, first of all, the schematization of the geographical world and the integration of information about it [9].

The study of the mental representations of the geographical world of the New Persian continuum in Shahnameh allows you to create its cognitive model (see Figure 1) and, based on this model, form an idea of the integration strategies of the representatives of the New Persian continuum.

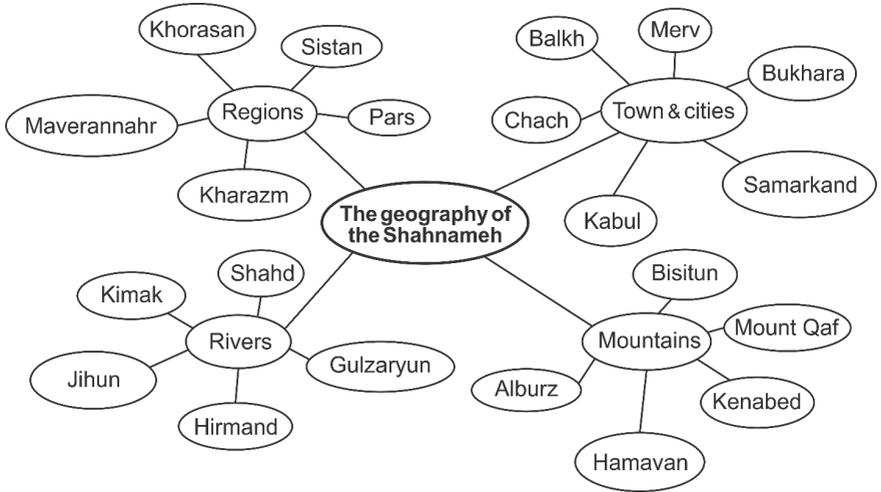


Fig.1. The cognitive model of the geographical world of the New Persian continuum in *Shahname* by Ferdowsi, or “The geography of the *Shahnameh*”

The integrative nodes of the network of the New Persian model are, ‘regions’, ‘town & cities’, ‘rivers’, ‘mountains’, harmoniously coordinating the ancient Chinese ideographic principle of classification of objects of the geographical world and the antique version of the feeling of the geographical world formed through polis and rhetorical models.

The “regional” component most likely demonstrates the operation of the laws of deontic logic (or normative logic): the law of deontic consistency, the law of deontic completeness.

The construction of a cognitive model of the geographical world in the method of studying languages and cultures should be attributed to the coaching faction, which is mediated through the use of cooperation strategies preceded by facilitation. In this methodological and methodological faction, attention should be paid to the gradual transition from a facilitation strategy (working with the entire group of language learners) through the use of a collaboration strategy (working in sub-groups) to coaching (performing individual tasks).

The implementation of the facilitation strategy is to identify in the text of “Shahname” toponyms that correspond to the topics of ‘regions’, ‘town & cities’, ‘rivers’, ‘mountains’, highlighting the contexts of their functioning - ‘performative contents’ that contain information about geographical “inference” of the New Persian continuum, built on the basis of the special logic of the territory.

Table 1.
*Samples of performative contexts
in English and Russian translations of “Shahname”:*

Regions	
Kharazm (Khwarazm or Chorasmia)	Хорезм
<p><i>Vol. 4, p. 173 – How Kai Khusrau fought with Shida the Son of Afrasiyab [10]:</i> They made this compact: “None shall fight in aid From either side, and for our standard-bearers Day shall not darken with calamity.” The twain departed from the hosts afar, Like merry-makers going to a feast, And reached a barren spot and waterless, Untrod by lion and pard, a waste within The marches of Kharazm and fit for fight; The soaring eagle flew not over it; Part was hard, arid earth and part mirage. There those two warriors like ravening wolves Made for themselves an ample battlefield. The cavaliers, as lions full of rage Leap from the covert on a hunting-day...</p>	<p><i>T.3, C. 383 – Битва Кей-Хосрова с Шиде - Пешенгом [11]:</i> «...За помощью мы не прибегнем к бойцам, И тот, кто осилит врага своего, Пусть жизнь сохранит знаменосцу его». Вот оба несутся, как будто летят На праздник; две рати вослед им глядят. Равнина для битвы пригодна была, Граница Хорезма по ней пролетгла. Бесплодная степь — ни воды, ни травы, Ее обходили и тигры, и львы, Добычи там даже орел не искал — Пустыня меж серыми глыбами скал. Избрали поляну широкую там, И начали битву жестокою там С неистовством изголодавшихся львов, Что, логова бросив, выходят на лов.</p>
Town & cities	
Chach (Tashkent)	Чач (Ташкент)
<p><i>Vol. 3, p. 227 – How the Khan was taken Prisoner [10]:</i> They sent a very grievous rain of arrows As when the winds of autumn blast a tree; The air was clothed with eagles’ plumes: no warrior E’en dreameth of such strife! Gudarz, beholding That shower of steel, alarmed for Rustam’s safety, Said to Ruhham: “O laggard! tarry not, But with two hundred horsemen ply the reins, And with your bows of Chach and poplar shafts Guard in the battle peerless Rustam’s back.”</p>	<p><i>T.3, C.48 – Гибель хакана [11]:</i> И стрел раздается пронзительный свист; Летят, словно осенью с дерева лист. И стало от перьев орлиных темно — Такое увидеть и в снах не дано. Ростему грозящий губительный дождь Увидел Гудерз, многоопытный вождь. Зовет он Роххама: «О славный герой! Ты лучников лучших две сотни построй, С чачийскими луками в бой поведи, К Ростему-вождю на подмогу иди».</p>
Rivers	
Kimak (Irtysh)	Кимак (Иртыш)

Regions	
Kharazm (Khwarazm or Chorasnia)	Хорезм
<p><i>Vol. 4, p. 203 – How Jahn came to Kai Khusrau with Embassy from Afrasiyab [10]:</i> The grandson am I of Zadsham the king, Descended from Jamshid and Faridun, My knowledge and my Grace are both from God, And I possess a pinion like Surush. When destiny oppressteth me my heart Requireth not a teacher; I will go At slumber-time, as God commandeth me, Like stars before the sun, cross the Kimak, And yield thee realm and crown.</p>	<p><i>T.3, C. 417 – Джемхен прибывает к Кей-Хосрову с посланием от Афрасиаба [11]:</i> Величьем был дед мой Задшем знаменит, А предки мои — Феридун и Джемшид. Мне знанье дано, мне дана благодать И, словно Сорушу, дано мне летать. Коль в этом бою не достигну побед, Я знаю, что делать, не нужен совет. По воле Йездановой скроюсь в ночи меж звезд, проливающих с неба лучи. Отдам тебе край и венец мой, и стяг, А сам устремлюсь я за реку Кимак.</p>
Mountains	
Alburz (Alborz)	Эльборз (Эльбурз)
<p><i>Vol. 1, p. 168-169 – How Faridun bound Zahhak [10]:</i> And offered up his prayers and thanks to God, Then said: “The realm is mine, your fortune's star Is bright, for me alone did God send forth From Mount Alburz by Grace, and for your sakes, To set the world free from the Dragon's bane. Blest as we are by Him who giveth good We ought to walk toward good upon His paths. As king I may not tarry in one place, Else would I pass with you a length of days.”</p>	<p><i>T.1, C. 79 – Феридун заключает Зохака в оковы [11]:</i> Изрек он: «Пристал мне престол золотой; Отныне вам жить под счастливой звездой. Я избран всевышним, создавшим миры, Им послан на подвиг с Эльборза-горы. Я землю, исполнив йезданов наказа, От чудища злого очистил для вас. Нам ныне дарована милость творца, Пойдем же благою стезей до конца! Повсюду я властвую в мире земном, Нельзя мне в краю оставаться одним. И рад бы я с вами еще отдохнуть, Но долг призывает немедленно в путь».</p>

Acquaintance with the toponymy of the New Persian continuum in the translation of “Shahname” by Firdowsi allows the student to start learning the Tajik language as a New Persian language and get acquainted with the basics of the geographical competence of a representative of this linguistic culture, which undoubtedly determine the peculiarities of linguistic consciousness, cognitive strategies and communicative positioning in various communication circumstances. Obtained skills of thorough reading of “Shahnameh” in the focus of geographic knowledge using the methods of studying languages and cultures allow us at the personal level to link the area of geographic knowledge, mental maps and related topics. In addition, immersion in the semantics of the toponym "Shahnameh" contributes to understanding how knowledge of the geographical space is organized in the mind of a representative of the New Persian language, how it is remembered and reproduced when necessary. Of particular importance is the understanding of how people reason in order to gain new knowledge, what is the role of various sources of geographic information in their lives and how they build their relationships with the outside world, trying to keep the universe in themselves.

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里海虾虎鱼 (Gobiidae) 家族代表的形态生物学特征
**MORPHOBIOLOGICAL CHARACTERISTICS OF
REPRESENTATIVES OF THE GOBY (GOBIIDAE) FAMILY
OF THE CASPIAN SEA**

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注解。 虾虎鱼科 (Gobiidae) 是里海地区最大和最未开发的鱼群之一, 这是由于分析外部形态特征的巨大差异和难度。 本文讨论了居住在里海北部中部地区以及伏尔加河和乌拉尔河口的虾虎鱼的生物和形态特征问题。 研究表明, 虾虎鱼属于众多鱼类种群, 在食物链中起着重要作用, 可作为鲟鱼, 半通道, 海涵涵鲱鱼和里海海豹的饲料。

关键词: 虾虎鱼家族, 里海, 交配装, 雌性, 雄性, 产卵, 腹吸盘, 绝对数, 喂养对象。

Annotation. *The goby family (Gobiidae) is one of the largest and most unexplored group of fish in the Caspian region, this is due to the great variability and difficulty of analyzing external morphological characters. The article deals with the issues of biological and morphological features of goby fish living in the central region of the northern Caspian and the mouth of the Volga and the Urals. It is shown that goby species belong to numerous fish populations and play an important role in food chains, acting as forage objects for sturgeon, semi-passage, sea migratory herring, and Caspian seals.*

Keywords: *goby family, Caspian Sea, mating outfit, females, males, spawning, abdominal sucker, absolute numbers, feeding objects.*

The goby family (*Gobiidae*) is one of the largest and most complex, in taxonomic terms, a group of fish of the Ponto-Caspian region. In taxonomic terms, representatives of this family are not well understood and are the subject of discussion. This is mainly due to the large variability and in some cases with the difficulty of analyzing the external morphological features used in the goby systematics. The greatest difficulties are usually encountered in determining the species, with

many groups and genera contain a large number of close and difficult forms. One of the numerous groups are the Black Sea-Caspian gobies belonging to the genus (*Neogobius* Iljin, 1927), of the four species three live in the Caspian Sea. Representatives of this family, as a rule, occupy the coastal strip of the sea and keep, mainly in the central region of the Northern Caspian Sea, as well as in the mouth of the Volga and the Urals.

Biological features. The gobies are near-bottom, sedentary fishes that do not perform large migrations, their spawning and feeding grounds are close to each other in the sea. The composition of goby fish largely depends on the nature of the soil, temperature and salinity of water, depth of the place. Skin respiration is well developed in them, as indicated, for example, by the long-term survival of gobies in air with an almost complete absence of gill respiration.

By the nature of feeding, gobies are benthophagous, but the composition of food may vary depending on the species, age of gobies, as well as the season of the year, the sea area and the state of the food supply, their diets mainly include crustaceans, mollusks and small fish. many species is 3-4 years old. Females of some species of goby become sexually mature in the second, males in the third year of life. Spawning stretched, runs from April to September, spawning portion. Eggs are small polyplasmic or large oligoplasmic. During the spawning period, fish migrate to shallow water (0.5-3.0 m) to well warmed up areas. A distinctive feature in the biology of gobies is the spawning and protection of offspring. Males of all kinds take care of the offspring, guard the nest. Gobies build nests under stones or casements of mollusk shells for laying caviar. For some types of characteristic marriage dress. There is a pronounced sexual dimorphism, males are larger than females of the same age and perform the function of protecting offspring.

Morphological features. The gobies are characterized by small sizes, have a relatively large and wide head, a peculiar structure of the skeleton of the head and shoulder girdle, there is no swim bladder, an elongated body, compressed at the back and covered with medium-sized scales [3]. The mouth is of moderate length, does not go behind the eyes, the cheeks and gill covers are bare or they are covered with scales only in the upper quarter or third, the back of the head is covered with scales. The front nasal openings are in the form of short tubes, the rear ones are located close to the eye. The teeth are usually small conical in several rows on both jaws ..

There are sensitive channels and pores on the head, they play an auxiliary role in systematics in determining genera and species. There is a special terminology of pores and rows of superficial neuromasts, taking into account the specifics of Ponto-Caspian goby fish (Figure 1) [1].

Conclusion. Due to their abundance, gobies play a large role in the overall productivity of the Caspian Sea, are an important component of the reservoir ecosystem and are of significant economic importance. In the northern, desalinated, part of the Caspian Sea, goby species belong to numerous fish populations and play an important role in trophic chains, acting as forage objects for sturgeon, semi-migratory fish species, marine migratory herring, and the Caspian seal [2]. For example, young sturgeon in the Middle and Southern Caspian, especially in the winter, consumes mainly fish food, up to 80% consisting of gobies. The fishery of these fish in the Caspian is not conducted, they have no economic value.

The absolute number of gobies in the Northern Caspian is unstable, there are years when their number is reduced to the minimum values, for example, in 1997 it was only 634.7 million pieces, and in this century there is an increase - in 2010 the number of gobies in the sea increased to 2632 million copies.

And although gobies are not commercial species, they are also subject to rational use and protection. These species may be associated with commercial species through trophic and topical interspecific relationships. They participate in the formation of habitat quality, can affect the biosphere balance as a whole, ensuring a stable existence of the ecosystem.

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牙釉质中甲硝唑和叶绿素分析方法的研究进展
**DEVELOPMENT OF METHODS FOR THE ANALYSIS
OF METRONIDAZOLE AND CHLOROPHYLLIPT
IN DENTAL TABLETS**

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注解。作者开发了一种片剂组合物，包括甲硝唑固体分散体的微胶囊，以及叶绿素，薄荷精油，茶树和丁香，用于预防和治疗口腔疾病。

Annotation. *The authors have developed a composition of tablets, including microcapsules of the solid dispersion of metronidazole, as well as chlorophyllipt, essential oils of mint, tea tree and cloves, intended for the prevention and treatment of oral diseases.*

The purpose of the study *is to develop methods for the quantitative analysis of tablets for the content of the main components: metronidazole and chlorophyllipt.*

Materials and methods. *Quantitative determination of metronidazole and chlorophyll was performed by spectrophotometric method according to the methods developed by the authors.*

Results. *The conditions for the determination of metronidazole and chlorophyllipt with the joint presence in the developed tablets are substantiated. Established the validity of these methods for indicators - specificity, linearity, precision and accuracy.*

Conclusion. *As a result of the work, it was established that the determination error for metronidazole was $\pm 1.52\%$, for chlorophyll it does not exceed $\pm 3.00\%$. This allows the use of these methods for the quantitative determination of both metronidazole and chlorophyll in gel-forming tablets.*

关键词：甲硝唑，叶绿素，凝胶形成片，分析方法，分光光度法。

Keywords: *metronidazole, chlorophyllipt, gel-forming tablets, methods of analysis, spectrophotometry.*

Introduction

The total prevalence of periodontal disease is due to the complexity and duration of treatment of this disease. Therefore, the development of schemes, methods and drugs for the integrated treatment of this disease is a relevant and promising area of pharmaceutical and dental practice [1]. For the treatment and prevention of periodontal disease are widely used gels, lozenges and films, including antimicrobial and antiseptic preparations. Promising are gel-forming tablets that can form a gel in the place of use, enveloping the basal pockets, which may include a combination of antibiotics, vegetable antiseptics and essential oils. In the complex treatment of periodontal disease and oral diseases, antimicrobial drugs such as doxycycline, metronidazole, chlorophyllipt alcohol solution 1%, as well as essential oils of tea tree and cloves, have been well recommended. The authors have developed the composition and technology of gel-forming tablets, which include these components [2]. The problem of the bitter taste of metronidazole and the short duration of its therapeutic effect in the oral cavity has been solved by microencapsulating the solid dispersion of metronidazole [3].

The purpose of the study is to develop methods for the quantitative analysis of tablets for the content of the main components: metronidazole and chlorophyllipt with joint presence.

Materials and methods

We used metronidazole (ФЦ 2.1.01365.18), chlorophyllipt thick extract (ФЦП 42-8556-07) [4], polyethylene glycol 6000 (TY 2483-165-0575758787-2005), tea tree essential oil (TY 9151-001-77499056-2005), essential oil of cloves (TY 9156-001-77344782-2007). Microcapsules of metronidazole were obtained according to the method [3]. Standardization of the obtained tablets was carried out according to the content of metronidazole and chlorophyll. Previously, in accordance with the requirements of the Russian and foreign pharmacopoeias [5, 6, 7], a method for the quantitative determination of metronidazole by a spectrophotometric method was developed and validated. The specific absorption rate for metronidazole was also calculated. We used the spectrophotometer CФ-104 of the company Aquilon with software UVWin.

Method of quantitative determination of metronidazole: about 1.0 g (exact weight) of powdered tablets, placed in a volumetric flask with a capacity of 100 ml, dissolved in 50 ml of 0.1 M solution of hydrochloric acid and bring the volume of the solution to the mark with the same solvent, filtered through a red tape filter, discarding the first 15 ml of solution. 1.0 ml of the filtrate is placed in a volumetric flask with a capacity of 100 ml and the volume of the solution is adjusted to a mark with 0.1 M hydrochloric acid solution.

Reference solution. 0.1 M solution of hydrochloric acid.

Measure the optical density of the subject on a spectrophotometer at the maximum absorption at a wavelength of 277 nm in a cuvette with a layer thickness of 10 mm.

$$X = \frac{A_x \cdot 100 \cdot 100 \cdot P}{A_{1\text{cm}}^{1\%} \cdot a_x \cdot 1 \cdot 100} = \frac{A_x \cdot 100 \cdot P}{A_{1\text{cm}}^{1\%} \cdot a_x}$$

where A_x – optical density of the test solution;

$A_{1\text{cm}}^{1\%}$ – specific absorption rate of metronidazole at a wavelength of 277 nm, equal to 375;

a_x – a portion of the powder pounded tablets, g;

P – average weight of one tablet, g.

The statistically processed results of the quantitative determination of metronidazole (g) in tablets are shown in Table 1.

Table 1

The results of quantitative determination of metronidazole in dental tablets by spectrophotometry

№	a_x, r	A_x	Detected, g/tab	Metrological characteristics
1	1,0020	0,510	0,1249	$\bar{X}=0,1250$ $S^2=3,31 \times 10^{-6}$ $S=1,81 \times 10^{-3}$ $S_{\bar{X}} = 0,74 \times 10^{-3}$ $\varepsilon = \pm 1,52$
2	0,9860	0,522	0,1230	
3	0,9698	0,502	0,1270	
4	1,0154	0,508	0,1227	
5	1,0050	0,518	0,1265	
6	1,0322	0,530	0,1260	

Thus, the method of quantitative determination of metronidazole by the spectrophotometric method has an error of determination of $\pm 1.52\%$, which is the acceptable limit for this method.

The content of chlorophyll in the thick extract is not regulated [3]. Therefore, we have developed a method for its determination in the extract and tablets.

Method for the determination of chlorophyll in tablets: 0.5 g of powdered pounded tablets were placed in a 50 ml flask, 80% ethyl alcohol was added and stirred until complete dissolution. Then bring the volume to the mark with the same solvent and stirred. The optical density was measured on a spectrophotometer at a wavelength of 655 nm in a cuvette with a layer thickness of 10 mm. Ethyl alcohol 80% was used as a reference solution.

The content of chlorophyll tablets was determined by the formula:

$$X = \frac{A_x \times W_x \times P}{A_{1cm}^{1\%} \times a_x \times 100}$$

A_x - optical density of the test sample;

W_x - volumetric flask volume, ml

a_x - the mass of the test sample taken for analysis;

$A_{1cm}^{1\%}$ - specific absorption of chlorophyll A, equal to 944.5 at a wavelength of 655 nm;

P – average weight of one tablet, g

Statistically processed results of the quantitative determination of chlorophyll are shown in Table 2 and 3.

Table 2

The results of the quantitative determination of chlorophyll in the extract of a dense method of spectrophotometry

№	a_x, r	A_x	Detected, g/tab	Metrological characteristics
1	0,025	0,190	0,400	$\bar{X}=0,407$ $S^2=1,12 \times 10^{-4}$ $S=0,0106$ $S_{\bar{X}} = 4,3 \times 10^{-3}$ $\varepsilon = \pm 2,73$
2	0,024	0,195	0,415	
3	0,023	0,198	0,421	
4	0,025	0,186	0,398	
5	0,025	0,192	0,395	
6	0,024	0,200	0,412	

Table 3

The results of the quantitative determination of chlorophyll in dental tablets by spectrophotometry

№	a_x, r	A_x	Detected, g/tab	Metrological characteristics
1	0,500	0,140	0,0926	$\bar{X}=0,0918$ $S^2=6,83 \times 10^{-6}$ $S=2,6 \times 10^{-3}$ $S_{\bar{X}} = 1,07 \times 10^{-3}$ $\varepsilon = \pm 2,99$
2	0,493	0,143	0,0958	
3	0,543	0,147	0,0895	
4	0,531	0,145	0,0902	
5	0,499	0,141	0,0935	
6	0,516	0,139	0,0892	

CONCLUSION: As follows from these tables, the determination error for metronidazole is $\pm 1.52\%$, for chlorophyll it does not exceed $\pm 2.99\%$, which allows using these methods for quantitative determination of both metronidazole and chlorophyll in dental tablets.

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在Yangan-Tau度假村开展科学研究

THE DEVELOPMENT OF SCIENTIFIC RESEARCH IN THE RESORT YANGAN-TAU

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注解。 本文致力于在疗养院开展科学工作的成果，巴什基尔医学院内科学疾病预防部门的员工以及疗养胜地的实际医生参与了这项工作。

优化治疗措施的重要性是评估疗养院 - 度假因素对身体的影响。 在这方面，基于对基本生物反应的评估，其违反导致身体的保护和适应能力的变化以及疾病的发展的快速研究方法的开发和实施具有当前的重要性。

关键词：温泉疗法，养肝头，血液化学发光，科学研究。

Annotation. *The article is devoted to the results of scientific work carried out in a sanatorium with the participation of employees of the Department of Propaedeutics of Internal Diseases of the Bashkir Medical Institute, together with practical doctors of the health resort.*

Important to optimize therapeutic measures is the assessment of the impact on the body of sanatorium-resort factors. In this regard, the development and implementation of rapid methods of research based on the assessment of fundamental biological reactions, the violation of which lead to a change in the protective and adaptive capabilities of the body and the development of diseases, are of current importance.

Keywords: *Spa treatment, Yangan-Tau, blood chemiluminescence, scientific research.*

Seven Wonders of the World! And everyone knows them all, from memory! But there are places on the globe about which you need not only to know, but also to visit - these unique natural phenomena and terrain. Visiting such places acquires special significance - having arrived there, a person understands and realizes that what he sees is nowhere else on planet Earth. In the modern world, such a very interesting place is Yangantau - Burning Mountain (in the Southern Urals).

There were indications and contraindications for treatment at the resort. The results obtained made it possible to include patients with kidney disease among

the indications for treatment at the resort. It should be noted that the resort is of great importance for the treatment of renal patients if they have associated diseases of the musculoskeletal system, nervous system, peripheral vessels, stomach, etc. In this respect, Yangan-Tau is the only resort in the Russian Federation where opportunity to treat patients with kidney disease in the presence of concomitant diseases.

In subsequent years, research and clinical observations were conducted at the resort on the possibility of treating and rehabilitating patients with various diseases: kidney and urinary tract in winter (Akbashev R.Sh., etc.), respiratory allergies (Gantseva Kh.H., Nigmatullina A.R.), chronic nonspecific lung diseases (Zagidullin Sh.Z., Nazifullin V.L., Lukmanova R.B.), syringomyelia (Borisova N.A., Khuramshin I.Sh.), spinal osteochondrosis (Usmanova G.A., Novikova L.B.), deforming osteoarthritis (Fakhretdinov F.G., Shavaleev Z.Z. and others), gynecological diseases (Absalyamova R.K.), diseases of the upper respiratory tract (Arefieva N.A., Melnichenko S.V.); prostatitis (Yunusov M.I., Drobot B.A., Korzhavin G.V.), children with various pathologies of the kidneys and urinary tract (Gumerov A.A., Akhmetshin Z.Kh., Saitbatalov R.A., Akhmetshin R.H. and others). This has significantly expanded the indications for treatment at the resort. At the same time, studies were carried out to study the fractal structure of mineral waters, steam condensate (Gantseva Kh.Kh., Krasnogorskaya N.N., Akbashev R.Sh.), the influence of resort medical factors on free radical oxidation processes using blood and urine chemiluminescence for an objective assessment of the effectiveness of spa treatment (Farhutdinov R.R., Akbashev A.R., Gazimullina A.O.).

Let us dwell in more detail on the results of scientific work carried out in the sanatorium with the participation of employees of the Department of Internal Medicine Propedeutics of the Bashkir Medical Institute together with the practitioners of the health resort.

Important to optimize therapeutic measures is the assessment of the impact on the body of sanatorium-resort factors. In this regard, the development and implementation of rapid methods of research based on the assessment of fundamental biological reactions, the violation of which lead to a change in the protective and adaptive capabilities of the body and the development of diseases, are of current importance. According to modern concepts, many vital physiological and metabolic processes occurring in the body are closely associated with free radical oxidation.

The influence of the medical factors of the Yangan-Tau resort on free-radical oxidation processes using blood and urine chemiluminescence recordings for an objective assessment of the effectiveness of the spa treatment was studied by A.R. Akbashev. It is shown that the combined effect of therapeutic factors, gas-thermal baths and mineral water "Kurgazak" normalizes chemiluminescence associated

with the processes of free-radical oxidation in the body. The mechanism of the therapeutic action of the Yangan-Tau baths is due to the complex effect on the body of both the thermal factor and low concentrations of carbon dioxide, radon, nitrogen and other components. Organic substances, bitumens and phenols, a number of fatty and naphthenic acids, as well as active trace elements such as aluminum, silicon, iron, phosphorus, copper, etc., that can have an antioxidant and, conversely, prooxidant effect, are found in the vapor condensate. This, most likely, explains the regulatory influence of the Yangan-Tau factors on free radical oxidation processes.

Investigating the chemiluminescence of blood and urine in the course of treatment, it is possible to monitor the condition of the patients, to evaluate the effect on them of the therapeutic and preventive effects. Measurement of chemiluminescence is safe and easy for the patient, does not require special preparation of the patient, special laboratory conditions. The introduction of this method allows you to select the optimal mode of therapeutic measures, helps to increase the effectiveness of treatment.

The logical continuation of the research of Professor Teregulov G.N. was the work of the assistant GantsevaKh.Kh. (Scientific leaders: Professor R. Farkhutdinov and Professor L. Kozlova), dedicated to the determination of the therapeutic value of steam baths and their role in the pathogenetic therapy of patients with rheumatoid arthritis (RA).

Under observation at the Yangan-Tau resort, 90 patients with RA were aged 16 to 58 years old, of which 24 were men and 66 were women. Of the patients, 15.4% had an inactive phase of RA, 48.8% had a minimal degree of activity, in 35.8% - moderate, functional insufficiency of I degree occurred in 70.5% of patients, grade II - in 25.6% and grade III - in 0.5% of patients.

Observations showed that all patients tolerated well parothermal baths (PB) with a temperature of 36-37 degrees Co in combination with therapeutic mud and massage. Improving the health of patients, reducing pain in the joints, reducing stiffness in the morning, exudative manifestations in the joints, an increase in the functional activity of the musculoskeletal system was observed after taking 5-6 baths.

At the end of the course of treatment, among patients with degree I activity, 58.7% had a decrease, and 41.3% had a reduction in joint pain with a significant decrease in the articular index ($p < 0.001$), duration and intensity of morning stiffness ($p < 0.001$), an increase in the force of compression of the hand ($p < 0.001$), along with the disappearance (50.0%) or decrease (50.0%) of exudative phenomena in the joints. Improvement of the function of the musculoskeletal system due to the reduction of pain in the periarticular tissues was observed in 63.0% of patients. At stage II of RA activity, a decrease in joint pain was noted in 90.9% of patients,

of which disappearance was observed in 68.0%, the articular index significantly decreased ($p < 0.001$), the duration and intensity of stiffness in the morning ($p < 0.001$), along with with an increase in the force of compression of the hand ($p < 0.05$). Reduction of periarticular exudation was observed in 81.8% and its disappearance in 18.2% of patients. The result of favorable changes was the improvement and restoration of joint function in 31.1% of patients.

On the part of laboratory studies, certain positive changes have also been established, most pronounced in patients with grade I of RA. Thus, ESR decreased from 19.4 ± 0.52 to 14.9 ± 0.69 mm / hour ($p < 0.001$), blood viscosity - from 4.78 ± 0.13 to 4.46 ± 0.09 ($p < 0.05$); fibrinogen content - from 4.5 ± 0.08 to 4.2 ± 0.09 g / l ($p < 0.01$); CPB- from 1.27 ± 0.14 to 0.67 ± 0.12 ($p < 0.01$). At stage II of RA activity, the ESR- was significantly reduced from 31.6 ± 1.12 to 26.7 ± 1.37 mm / hour ($p < 0.01$), the content of gamma globulins - from 24.5 ± 0.70 to 21.8 ± 0.80 ($p < 0.02$), sialic acids - from 221.8 ± 9.6 to 177.0 ± 16.8 ($p < 0.05$), CPB- from 2.30 ± 0.13 to 1.76 ± 0.17 ($p < 0.02$), blood fibrinogen - from 5.2 ± 0.09 to 4.9 ± 0.08 g / l ($p < 0.05$). The activity of the inflammatory process decreased in patients with grade I RA activity from 4.8 ± 0.24 to 2.4 ± 0.21 points ($p < 0.001$), with grade II - from 8.9 ± 0.24 to 5.4 ± 0.30 ($p < 0.001$) point. The overall effectiveness of the entire group of patients was 80.0%. With the I degree of activity, positive results (significant improvement and improvement) were detected in 84.8% of cases, and with the II degree in 72.7%. Somewhat better results were obtained in patients with I Degree of activity in the warm season — 89.3%, in the cold — 77.8%; in patients with degree II of activity, the treatment efficacy was the same (75.0%), regardless of the season of the year.

Thus, the results of studies have shown that RA of I and II degrees of activity is indicated for balneo-rehabilitation with steam baths of the Yangan-Tau resort.

In the late 1990s, at the suggestion of the Ministry of Health of the Russian Federation, employees of the Department of Internal Medicine Propaedeutics conducted a special study on the effectiveness of the rehabilitation of patients with respiratory allergy (pollinosis) and chronic bronchitis and chronic obstructive pulmonary disease at the stages of rehabilitation: Yangan-Tau hospital-sanatorium polyclinic.

A comprehensive assessment of the balneological factors of the Yangan-Tau sanatorium on the body of patients with pollinosis, which is a classic allergic disease from the group of atopy caused by plant pollen and having a cyclical course, was performed in 66 patients (Assoc. Prof. GantsevaKh.Kh.).

Treatment using common parothermal baths and parothermal inhalations of temperature $37-38^{\circ}\text{C}$, daily №18 for the course and systematic ingestion of mineral water «Kurgazak» source inside the mineral water was performed in patients with pollinosis aged 18 to 52 years, in the remission period of the disease. All patients tolerated balneological treatment and completed the course.

Describing the effectiveness of this therapeutic complex in the remission of pollinosis, a significant ($p < 0.001$) improvement of the protective function of the nasal mucous membranes in terms of the rate of flicker of cilia of the epithelium and acid-base balance has been established. This creates conditions for increasing the bactericidal properties of mucus and improving the transport function of the ciliated epithelium. In parallel, significantly ($p < 0.001$) decreased hyperthermia in the area of the nose and paranasal sinuses according to thermography, which indicates the anti-inflammatory effect of thermal factors. Estimating the dynamics of respiratory function as a result of balneotherapy, a significant ($p < 0.02$) improvement in FVC, FEV, MOS25 and MOS50 parameters ($p < 0.01$) was found.

In addition, the effect of balneological treatment in Yangan-Tau on the immune status of patients in remission of pollinosis was evaluated. At the same time, a statistically significant change in the direction of the norm was observed in relation to the NST test of the spontaneous ($p < 0.02$), the activation index of the NST ($p < 0.01$), the NST test induced ($p < 0.01$) and the neutrophil activation index ($p < 0.001$). The absence of significant dynamics of cellular and humoral immunity links reflects a certain stability of the immune status in the remission of pollinosis. On the other hand, this remission, achieved due to the stability of the suppressive mechanisms of cellular immunity, and practically the lack of response of the immune status to balneal effects, from our point of view, is a positive phenomenon in the case of an immunoallergic disease. The increase in the factors of the natural resistance of the organism in patients with pollinosis is the main mechanism of the beneficial effect of Yangan-Tau balneofactors.

Assessing the effect of this medical complex on the state of the vegetative nervous system, it can be noted that it provides a normalizing effect on the vegetative tone, shifting it towards eutonia, vegetative reactivity, bringing the average data to the criteria characterized as a normal reaction, and when assessing vegetative support - reducing cases its insufficiency and increased exhaustion. In aggregate, this allows, apparently, to provide a more stable hemostasis in patients with pollinosis, as well as to increase the mechanisms of vital activity. It is probably this mechanism of influence of balneofactors through the vegetative nervous system that provides a rehabilitative effect on patients in remission of the disease.

Evaluating the obtained data on the effectiveness of complex treatment of pollinosis using balneological factors of the Yangan-Tau resort on a 5-point scale, positive results were obtained in 86.4% of patients, of which excellent in 66.8%, good in 19.6%.

Thus, balneotherapy for patients with hay fever should be more widely used by allergists. The inclusion of pollinosis in the range of indications for spa treatment in Yangan-Tau establishes the priority of the resort in the issue of balneotherapy of respiratory allergies.

The clinical efficacy of direct balneological treatment and re-treatment with the assessment of the immune status of 123 patients with chronic bronchitis (CB) in the remission phase at the sanatorium-resort stage of treatment in the conditions of the Yangan-Tau resort was studied using conventional clinical, laboratory and special instrumental diagnostic methods, as well as assessments of cellular and humoral immunity shifts.

The control group for treatment (1 gr.) Consisted of 35 patients with CB, the clinical and immunological study of which was carried out in the hospital as soon as remission was reached and 21 days after discharge to work, i.e. in terms of post-curricular examination of the main group of patients with CB (2 oz.) who underwent balneological treatment in Yangan-Tau on the referral from the in-patient department of hospital No. 21 of the city of Ufa.

Balneological treatment of patients with chronic bronchitis in the Yangan-Tau resort was carried out using natural inhalations and steam-thermal baths at a temperature of 39-41° C, daily, 18 procedures per course. Analysis of the effectiveness of spa treatment in Yangan-Tau showed by direct results that 36.9% of the treated CB patients were discharged with a "significant improvement"; 59% - with "improvement" and 4.1% - "no change". Our evaluation of the results of remote observations over 12 months indicates a high persistence of positive results. So, after 12 months, the improvement of the clinical condition was maintained in 60.4% of patients treated in Yangan-Tau. The duration of remission after sanatorium rehabilitation depended on the form of CB. So, if in patients with chronic non-obstructive bronchitis the duration of remission was on average 9.3 months, then in patients with chronic obstructive pulmonary disease - 7.4 months.

A study of the comparative effectiveness of sanatorial rehabilitation of patients with chronic bronchitis in the Yangan-Tau resort revealed the best therapeutic effect. A separate analysis of the immune status in both groups v indicates that the treatment itself at the resort with the use of natural steam-thermal baths and inhalations had an immunocorrective effect, which was also important for the final result of the treatment. In group 2 patients, the best therapeutic effect developed against the restoration of the content of T-lymphocytes, B-lymphocytes, zero cells, T-helpers. To a greater extent, there was a decrease in the number of T-suppressors (by 23.4%) with the normalization of the immunoregulatory index value. The dependence of the final result of balneotherapy from the initial state of cellular immunity is traced. Among patients with reduced levels in 6.5% of cases, there was no improvement. All cases of ineffective balneotherapy of patients in Yangan-Tau accounted for the cold period of the year. Evaluation of clinical parameters under the influence of multiple balneotherapy was performed according to the percentage of positive clinical effect, including the reduction of severity or disappearance of symptoms, indicators of automated pneumotachimetry with computer process-

ing of a spirogram and flow-volume. In patients with CB, the maximum disappearance of pathological signs with the restoration of bronchial patency in the case of “isolated” distal bronchial obstruction was observed after a course of balneological sanatorium-resort treatment, compared with patients with COPD.

Assessment of the state of immunological reactivity before the beginning of the sanatorium rehabilitation and in the course of it allows predicting and optimizing the final result of treatment at a spa resort. In order to achieve complete remission with normalization of immunological reactivity in patients with CNH, a single spa treatment in Yangan-Tau conditions is sufficient, and for patients with COPD, repeated courses of sanatorium rehabilitation are necessary.

From our point of view, the most promising areas in the development of scientific research in the Yangan-Tau resort are:

- study in the area of the field itself and in adjacent areas of the general geological situation with the use of modern geophysical methods in order to reveal the genesis of the thermal phenomena of the mountain;

- in-depth study of various aspects of the mechanism of action of natural factors, including immunological and allergological status, microcirculation, hemorheological, biochemical, biophysical and cytochemical parameters, thermography, functional state of internal organs, etc. in the process of complex differentiated use of therapeutic factors (steam conditions and the Kurgazak water source;

- study of the influence of parothermal baths on the cardiovascular, respiratory and central nervous systems of patients with various diseases of the internal organs and nervous system; development and clinical approbation of new medical and diagnostic medical technologies in the field of sanatorium-resort treatment;

- conducting research to expand and clarify the indications for treatment at a spa, develop differentiated treatment methods taking into account the stage, the degree of activity of the inflammatory process, the functional state of the organs, and the study of long-term results of treatment.

- identification of the prospects for treatment and rehabilitation of people with risk factors, in a state of pre-illness, ecologically caused pathology, secondary immunodeficiency, as well as healthy people with the consequences of the impact of a chronic process in sanatorium-resort conditions for various periods of stay at the resort.

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胃食管反流病的发病和治疗方面
**PATHOGENETIC AND THERAPEUTIC ASPECTS
OF GASTROESOPHAGEAL REFLUX DISEASE**

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注解。 本文概述了胃食管反流病的相关性, 诊断和治疗的科学研究。 肥胖已被证明是治疗患者的重要加重因素。 考虑到非腐蚀性形式和Barrett食管的致病特征, 需要进一步研究GERD问题。

关键词: 胃食管反流病, 肥胖症, 质子泵抑制剂, 抗酸剂, 藻酸盐, 促动力学

Abstract. *The article provides an overview of scientific studies on the relevance, diagnosis and treatment of gastroesophageal reflux disease. Obesity has been shown to be an important aggravating factor in the treatment of patients. The need for further research on the GERD problem, taking into account the pathogenetic features of the non-erosive form and Barrett's esophagus, was emphasized.*

Keywords: *gastroesophageal reflux disease, obesity, proton pump inhibitors, antacids, alginates, prokinetics*

Gastroesophageal reflux disease (GERD) is one of the most studied diseases of the digestive tract, which is associated with its high prevalence, recurrent course

and treatment problems. GERD is a condition that develops when reflux of the stomach contents causes patient-related symptoms and/or complications to develop. [1].

Along with the typical manifestations of GERD, its atypical extra-esophageal syndromes, which complicate the diagnosis of GERD and lead to overdiagnosis of some diseases, aggravate and worsen the quality of life of patients. GERD has acquired special significance in recent years, when close attention was paid to the Barrett esophagus, a complication of GERD, which increases the risk of developing esophageal adenocarcinoma. The identification of Barrett's esophagus is a significant and sufficient basis for endoscopic examination of the upper gastrointestinal tract in all patients with chronic heartburn. The increase in the frequency of GERD and its complications requires an active study of this problem, the need to introduce modern algorithms for the diagnosis, treatment and prevention of the disease and its complications. According to some authors, the prevalence of GERD is 50% among adults. The prevalence of GERD in Moscow is 23.6%, in the cities of Russia, according to the MEGRE study, 11.3-14.3%. In Western Europe, it ranges from 10% in Spain and the UK to 17% in Sweden, and in the United States from 13% to 29%. [2].

Among those who underwent an endoscopic examination of the upper digestive tract, in 12-16% of cases, esophagitis of varying severity is detected. The development of esophageal strictures is noted in 7-23%, bleeding - in 2% of cases of erosive and ulcerative esophagitis. Barrett's esophagus develops in 15-20% of patients with esophagitis. Adenocarcinoma - in 0.5% of patients with Barrett's esophagus per year with a low degree of epithelial dysplasia, in 6% per year - with a high degree of dysplasia [3].

GERD is associated with tremendous economic damage and a significant reduction in the quality of life. In the United States alone, more than \$ 10 billion is spent annually on the direct costs associated with treating such patients, while the indirect costs associated with diminishing the working capacity of GERD patients are \$ 75 billion a year [4]. According to some authors, GERD symptoms are noted regardless of the body mass index (BMI) of patients, and according to other data, GERD symptoms are more pronounced in patients with elevated BMI and abdominal obesity is considered a risk factor for the development of erosive esophagitis [5-8].

An important risk factor for GERD is overweight or obesity. GERD and obesity are fairly new nosological forms of disease: obesity has gained an independent place in the international classification of diseases since 1947, and GERD since 1999 [9]. At the same time, the prevalence of these nosologies in the population is high. It is believed that obesity has already acquired the character of a "non-infectious epidemic," and the 21st century is called the "century of reflux disease"

[10]. Moreover, GERD and obesity can have complications that threaten the patient's life and this risk increases by 2 times if this duet is combined with arterial hypertension (AH), the prevalence and significance of which in the population cannot be overestimated [11]. At the same time, there is also a sufficient number of works characterizing the state of the cardiovascular system in individuals with GERD or obesity isolated in isolation, as well as in the case of their association with hypertension [12].

Obesity leads to changes in the anatomy and physiology of the gastrointestinal tract (for example, disorders of the motor function of the esophagus, reduction of pressure of the lower esophageal sphincter, development of hernia of the esophageal orifice and increase in intragastric pressure), which explains the connection between obesity and GERD [13]. It has been shown that with an increase in body mass index (BMI), the degree of esophagitis increases [14]. In another study, it was established that the ratio of waist circumference to hip circumference affects the development of erosive esophagitis [15]. According to Russian authors, there is a direct correlation between the intensity and frequency of heartburn (both day and night) and BMI. However, differences in the incidence of obesity among patients with different stages of erosive GERD do not reach reliable values [16].

According to D.S. Bordin, horizontal position of the body contributes to the development of gastroesophageal reflux [17]. Acid nocturnal refluxes are particularly unfavorable, since they are directly related to the development of erosive esophagitis and complications of GERD due to a decrease in esophageal clearance and prolongation of contact of hydrochloric acid with the esophageal mucosa [18].

Despite a number of works devoted to the study of the possibility of GERD comorbidity and obesity, an understanding of the mechanisms of its formation is far from complete. When considering the association of GERD and obesity, it is necessary to take into account that both diseases develop in individuals with nutritional and lifestyle problems, as well as those with a genetic predisposition according to these nosologies [16]. Currently, direct predisposing factors for the development of GERD in individuals with increased body weight, not rarely associated with the presence of hiatal hernia, are clearly marked [19]. Accumulated evidence suggests that patients with a combination of GERD and obesity often have episodes of sleep apnea; systemic inflammation associated with obesity, which occurs with an increase in the level of circulating cytokines (interleukin - 6, tumor necrosis factor alpha); oxidative stress; disturbances in the secretion of hormones: leptin, adiponectin, resistin, which leads to the aggravation of the pathogenetic mechanisms of the formation and progression of GERD [20]. Moreover, it is possible that these factors can lead to an increased risk of cardiovascular diseases in individuals with an associated course of GERD and obesity.

If the discussed nosologies in the case of their isolated course are now fully

understood through the prism of risk factors for cardiovascular events [21], then how features of the chronobiological indicators of the cardiovascular system in individuals with a combination of GERD and obesity are presented is not completely clear. Meanwhile, this trend is highly relevant from the standpoint of modern medicine in the context of comorbidity of diseases. [20].

According to recent studies, it has been demonstrated that cross-sectional epidemiological studies have a higher prevalence of GERD among obese patients compared with healthy volunteers. Small studies also confirm the link between obesity and GERD. In a study conducted by El-Serag, 453 clinic staff were interviewed, and weekly symptoms of heartburn and/or regurgitation were detected in 26% of respondents [21]. An upper endoscopy was performed in 196 patients who agreed to the study, as a result the proportion of patients with GERD symptoms was 23.3%, 26.7% and 50% for their respective groups with a BMI <25 kg/m², BMI - 25-30 kg/m² and BMI>30 kg/m², respectively. The prevalence rates of erosive esophagitis for these groups were 12.5%, 29.8% and 26.9%, respectively.

In a cohort study conducted in Japan, including 42,862 adults, 18,792 patients who underwent endoscopy of the upper digestive tract in 4355 (23.1%) were diagnosed with reflux esophagitis, in 4731 (25.1%) - a hernia of the esophageal orifice, 1492 (7.9%) - Barrett's esophagus [21]. A multivariate analysis of the research results showed that the male sex (ERR 2.02; 95% CI 1,832.23; p = 0.0001), young age (ERR 0.99; 95% CI 0.980.99; p = 0.0001), hypertriglyceridemia (ERR 1.001; 95% CI 1.0011.002, p = 0.0001), obesity (ERR 1.51; 95% CI 1,401.64, p = 0.0001), hypertension (ERR 1.11; 95% CI 1,011.21, p = 0.02) and alcohol use (ERR 1.30; 95% CI 1,171.44; p = 0.0001) were independent risk factors for developing reflux esophagitis [21].

According to international recommendations, regardless of the severity of heartburn and the endoscopic picture, all patients with GERD are subject to treatment [22]. The main therapeutic direction of GERD treatment is the use of antisecretory therapy, the gold standard of which, according to the Genvale Consensus, are proton pump inhibitors (PPIs), which reduce gastric secretion by inhibiting the activity of gastric H⁺ / K⁺ + ATPase. The clinic is widely used five main IPP - omeprazole, lansoprazole, pantoprazole, rabeprazole and esomeprazole. There is a wealth of data on the effectiveness and benefits of a drug.

It is well known that patients prefer drugs that quickly relieve the symptoms for them. Here, antacids are beyond competition. However, one should not go to the extreme, replacing the effective pathogenetic therapy of acid-related pathology with the help of PPIs, albeit with a quick, but short-term relief of the symptoms of the disease with antacids. A modern physician must rationally combine drugs, given their pharmacological features and the nature of the disease [23].

In recent years, the development of the pharmaceutical industry has resulted

in the development of new forms of antacids — alginic acid preparations (alginates). Alginic acid preparations are natural polysaccharide polymers isolated from brown algae, mainly *Laminaria hyperborea*. In the acidic environment of the stomach, alginic acids precipitate, resulting in a non-absorbable alginate gel forming within a few minutes. Carbon dioxide formed during the interaction of sodium bicarbonate and hydrochloric acid, which is part of the preparation, completes the formation of the raft (“alginate raft”), which floats on the surface of the stomach contents as a moving neutral filler and selectively enters the esophagus before or instead of stomach contents during gastroesophageal reflux episodes [24].

Given the important role of motility disorders of the esophagus and stomach in the pathogenesis of GERD, prokinetics, drugs that normalize the motor function of the gastrointestinal tract, play a significant role in the treatment of such patients. Representatives of this group of medicinal substances (metoclopramide, domperidone, cisapride) have an antireflux effect, and also increase the release of acetylcholine in the gastrointestinal tract, stimulating the motility of the stomach, small intestine and esophagus. They increase the tone of the lower esophageal sphincter (LES), accelerate the evacuation of the stomach, have a positive effect on the esophageal clearance and weaken gastroesophageal reflux [25].

Thus, GERD is a common pathology, with multifactorial pathogenesis. However, first and foremost, GERD, an acid-related disease and heartburn, is a cardinal symptom of this pathology in the vast majority of patients. Observance of a strict algorithm for the diagnosis and treatment of GERD, the correct choice of a medicinal product and a method of treatment make it possible to achieve significant success in the treatment of this common disease and the prevention of its complications. Different forms of the disease (non-erosive form, GERD and Barrett's esophagus) have their own pathogenetic features that must be considered when building a survey program and prescribing therapy.

Using PPIs can adequately control heartburn and improve the quality of life of patients. This is proved by both pathophysiological studies and excellent treatment results for patients with GERD PPIs. It should be remembered about the possibility of using in the treatment of GERD modern antacids and alginates, prokinetics. With appropriate evidence, their effectiveness can be great.

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外科医生在职业倦怠综合征框架下的焦虑和抑郁障碍的特征
**FEATURES OF ANXIETY AND DEPRESSIVE DISORDERS IN
THE FRAMEWORK OF PROFESSIONAL BURNOUT SYNDROME
AMONG SURGEONS' DOCTORS**

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注解。在专业倦怠综合征的框架内，对20名外科医生进行了检查，以诊断焦虑和抑郁障碍。所有20人都接受了初步调查和访谈，这是一个全面的心理诊断测试套件。心理诊断学显示，约三分之一的患者检查了个人和反应性焦虑，亚抑郁症的指标水平升高。随着医疗工作持续时间的增加，存在增加所识别的变化的趋势。在接受测试和访谈后，向所有受访者提供了两次与心理学家/心理治疗师的心理矫正会议，如果需要，可以选择继续他们。提供协助解决可能的心理问题，以及放松技巧的培训。20人中有14人同意并参加了基于综合心理治疗方法的课程。在倦怠综合征的发展中，可以将所获得的数据考虑在预防和精神矫正措施中。

关键词：外科医生，心理诊断学，职业和情绪倦怠，焦虑，抑郁，心理矫正。

Annotation. *20 surgeons were examined to diagnose anxiety and depressive disorders in the framework of the professional burnout syndrome. All 20 people underwent a primary survey and an interview, a comprehensive psychodiagnostics test suite. Psychodiagnostics showed about a third of the patients examined elevated levels of indicators of personal and reactive anxiety, subdepression. There is a tendency to increase the identified changes with increasing duration of medical work. After being tested and interviewed, two psychocorrectional sessions with a psychologist / psychotherapist were offered to all those surveyed, with the option, if desired, to continue them. Offered assistance in resolving possible psychological problems, as well as training in relaxation techniques. 14 out of 20 people agreed and attended classes based on an integrative psychotherapeutic approach. The data obtained can be taken into account for preventive and psychocorrectional measures in the development of burnout syndrome.*

Keywords: *surgeons, psychodiagnostics, professional and emotional burnout, anxiety, depression, psychological correction.*

For more than forty years, since the HJFreudenberger was described in 1974, burnout syndrome (BS), manifested as reactions of emotional devastation, fatigue, and loss of interest in the profession during long-term work with difficult patients, interest in this topic remains sufficient high [7]. In 1988 S.Kahill identified 5 major manifestations of emotional burnout, including somatic, emotional, behavioral, intellectual and social symptoms. [8].

At present, BS refers to a special form of professional deformation of a personality arising due to prolonged professional stresses of high intensity, which negatively affects the performance of work tasks, is accompanied by deterioration of mental and somatic health, as well as problems in the communicative sphere [2,5].

It is noted that professional activities in the field of healthcare, and, in particular, medical activities, due to frequent intense physical and psycho-emotional overloads can contribute to the development of BS [1,2, 4-6]. If there is a significant amount of work devoted to the description of BS, the specificity of its individual manifestations in different categories of doctors has not been fully understood.

The purpose of the study was to diagnose anxiety-depressive disorders within the framework of professional emotional burnout in a group of surgeons, as well as to clarify the possibilities of prevention and short-term psycho-correction of these psycho-emotional manifestations of BS in cases of their occurrence.

Characteristics of the sample and research methods:

The study sample included 20 surgeons (14 men, 6 women, aged from 24 to 60 years), working in Moscow clinics and clinics. The experience of work in the specialty of the subjects ranged from 1.5 years to 32 years.

With all 20 people. Primary interviews, questionnaires and psychodiagnostics were conducted, including testing with the A. Beck depression questionnaire (scale), Spielberger – Khanin’s scale of reactive and personal anxiety, and burnout MBI questionnaire (in N. Vodopianova’s adaptation).

In order to study the motivation of getting rid of the manifestations of emotional burnout, as well as the possibilities of short-term psychocorrectional effects on the psycho-emotional manifestations of BS, all 20 examined individuals were offered two individual psychocorrectional sessions with a psychologist / psychotherapist. At the same time, 16 out of 20 surveyed agreed to the proposed classes, and 4 people refused to attend classes for various reasons.

The results and discussion:

In our work, the focus was on studying the intensity levels of anxiety and depressive disorders in patients examined as part of BS, as well as clarifying their degree of interest in correcting these disorders in the short-term psycho-correction mode.

At the beginning of the study, the presence and development of the key signs of BS, exhaustion, detachment from patients and work, and a sense of loss of their own effectiveness or reduced self-esteem. According to the responses received, these phenomena occurred in 11 out of 20 people.

The data obtained during the survey and questioning showed the presence of psychoemotional disorders typical for BS in the examined group. The most frequently detected disorders were as follows: decrease in job satisfaction (in 4 people), appearance of indifference and fatigue at work (in 5 people), prevailing low mood (in 4 people), anxiety (in 5 people) and irritability (in 2 people)

The above complaints have been little observed by doctors with a short work experience in the specialty. At the same time, these disorders were observed in those examined after 3 or more years of work as a doctor. According to the survey, the most frequently listed complaints were found in persons with 15 or more years of medical experience.

Separate indicators of emotional burnout in the surveyed were identified using the MBI professional burnout questionnaire, which consists of three main scales - "emotional exhaustion" (EE), "depersonalization" and "reduction of personal achievements." Taking into account the objectives of the study, the most interesting for us were the indicators of the level of EE, manifested by a sense of emotional emptiness and fatigue caused by work.

More than half of the surveyed surgeons have averages and elevated rates on the MBI emotional exhaustion scale. Comparison of the results of the EE MBI test scale with data on the work experience of the examined showed an increase in the level of emotional exhaustion among those who had more medical experience.

In addition to assessing the level of emotional exhaustion in the examined, considerable interest was presented by the results of a study of the specifics of occupational stress when working as a surgeon, and the possible influence of these stresses on the psycho-emotional state of the examined doctors.

In primary conversations and questionnaires, surgeons emphasized a busy and intensive work schedule, filled with a large number of contacts with a variety of people, including communication with people who have a problematic psychoemotional state.

Working with patients and surgical patients, many of whom are emotionally labile, anxious, and sometimes capriciously demanding, requires physicians of this profile to demonstrate a benevolent, supportive interest in the state of health of patients, patience, constant readiness to answer many questions from female patients, reassure them. In addition, the specifics of the work requires the doctor to show restraint and retain his own emotions within the patient at the problem and fastidious patients. Working with this category of patients does not allow them to externally express their doubts, anxieties, bad mood, fatigue, irritability.

At the same time, during the examination of this category of doctors, they presented a significant number of complaints of an astheno-subdepressive nature. More than half of the respondents had complaints about recurring depression, dreary general mood, combined with anxiety, irritability, a feeling of weakness

and exhaustion, a decrease in working capacity, and a decrease in interest in what is happening at work and at home.

For a general assessment of the level of depressive manifestations in the sample, the A. Beck questionnaire was used. Depressive manifestations were absent in 11 people out of 20, subdepression was observed in 3 people. Indicators of severe depression were found in 6 people, and manifestations of severe depression were absent in the entire group of patients.

To find out the causes of depressive disorders, it is important to consider a combination of factors that may contribute to lower mood. These may include general health, personality and personality traits, communication style, working atmosphere and compatibility of employees, and many other parameters that may affect mood deterioration.

Testing using reactive and personal anxiety scales (Spielberger-Khanin questionnaire) allows evaluating both the level of reactive (situational) anxiety (RA), indicating readiness to respond with anxiety reactions in a specific situation, and clarifying the level of personal anxiety (PA), which is a stable characterological feature .

According to the test data, there was a clear predominance of the level of PA and RA in the group of patients surveyed, which amounted to a total of 93.5% and 86.6% of the total. The most typical of the surveyed were indicators characteristic of the average level of anxiety. Thus, the average levels of RA 7 were detected in 7 people, and PA - in 6 people. Almost one-third had indicators characteristic of an increased level of anxiety. An increased level of PA in 5 people may indicate an inherent tendency for these people to be anxious and anxious in many different situations. At 2 people. marked increases in RA, manifested by severe internal discomfort, tension, distinct situational anxiety and anxiety.

The response to the testing procedure for a part of the examined was quite peculiar. Of the 20 doctors who received the survey, 4 people. showed no interest in the results of psychodiagnostics, and refused to re-meet, saying that they were generally indifferent to the results, and they agreed to the initial testing "just out of respect for colleagues" or "at the request of the authorities."

Almost a quarter of the surveyed, commenting on the questions asked during interviews and testing, emphasized that "they themselves would not have asked for help themselves" to a psychotherapist or psychologist, considering this to be a manifestation of weakness and / or manifestation of lack of professionalism. According to them, once the medical profession has been chosen, "the doctor should be able to keep all the negative inside," independently cope with it, "... and in general, there is no need for all these conversations and tests ... we are not sick ..."

2 people out of 20 were worried about the complete confidentiality of interview data and test results, expressing fears that the data obtained was potentially

"... can be used against them, because at work and so not everything is calm and easy ..."

All 20 surveyed after testing and interviewing, regardless of the obtained indicators of psycho-emotional state, were offered two individual psychocorrection sessions with a psychologist / psychotherapist. In the anonymity mode, assistance was offered in researching and solving various kinds of psychological problems, and, if desired, learning relaxation techniques. A longer-term work with a psychologist was also envisaged in the event of a expressed desire to continue communication on topics of interest.

In this case, 4 people out of 20 refused to offer classes with a psychologist for various reasons. The main reasons for the refusal were: the denial of any problems in the somatic and psycho-emotional spheres (2 people); lack of time for the proposed activities "reluctance to discuss their lives" with a psychologist / "... and in general - with someone else" (2 people).

Among those who refused the proposed classes with a psychologist were surveyed, who during the survey and questionnaire, as well as testing the MBI showed signs of BS. Most of these "refusers" (2 out of 4 people) were in the older age group (over 50 years old), and had a long and long-term professional experience.

At the same time, young doctors with short work experience showed the greatest interest in the classes, and when testing they showed low indicators of anxiety and depression, as well as doctors over 45 years of age. having medium-high rates of depression and anxiety.

Classes with a psychologist / psychotherapist were based on an integrative psychotherapeutic approach. In each case, psychotherapeutic techniques were used, including elements of neuro-linguistic programming, Ericksonian hypnosis, art therapy, positive therapy, and psycho-muscular relaxation techniques. Most of the sessions contained a brief description of the essence of BS, personal interpretation of the obtained test results, recommendations on time management with an optimal distribution of their workloads, as well as exercises for rescuing and reducing existing stress, training for relaxation techniques individually or in small groups.

Of the 16 people who have completed short-term classes with a psychologist, 11 people. noted their usefulness for themselves, and some lifting of mood after the sessions. 8 out of 20 showed interest in periodic further studies, noting that the lessons helped them to "remember themselves more" and the need to allow themselves more rest. 4 people from this group asked to continue regular classes with a psychologist to solve their own psycho-emotional problems.

17 people out of 20 (including those doctors who themselves abandoned psychocorrectional classes), noted that regular short-term sessions with a psychologist / psychotherapist are useful for introducing into clinical practice for their patients.

According to their opinion, such work with patients and relatives can significantly ease the workload of the doctor and contribute to more productive communication with a very difficult to communicate, often conflicting and emotionally demanding category of patients.

Conclusion.

The activity of the doctor in itself implies a high psycho-emotional and physical stress, rich communication and the presence of many factors causing stress, which can potentially contribute to the development of BS. In the case of its development, an increase in the level of anxiety, subdepressive mood background, asthenic phenomena, which tend to increase with increasing work experience, are observed.

The results obtained during the examination show the need for prevention and early detection of BS in surgeons. It is advisable to carry out periodic psychological testing of this category of doctors, which is part of the annual medical examination, in order to identify signs of BS. In addition, it may be useful to teach psycho-correction methods that help to maintain your own well-being mental state. It may also be useful for psychologists / psychotherapists to conduct periodic training seminars for these physicians with the aim of teaching behavior tactics in conflict situations and working with difficult patients with various psycho-emotional problems.

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在孕早期药物终止非发育性妊娠的凝血止血
**COAGULATION HEMOSTASIS IN MEDICAMENTAL
TERMINATION OF NON-DEVELOPING PREGNANCY
IN THE FIRST TRIMESTER**

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注解。在非发育性妊娠的医疗中断背景下检查了50名妇女，最长可达63天的闭经。凝血止血指标激活的迹象显示 - 非发展性妊娠期间和服用米非司酮后血液凝固增加，随后止血剂变化逐渐恢复正常，服用米索前列醇后血液凝血总量减少。

关键词：非发展性妊娠，米非司酮，米索前列醇，药物中断，凝血止血。

Annotation. *Fifty women were examined on the background of a medical interruption of a non-developing pregnancy for up to 63 days of amenorrhea. The signs of activation of coagulation hemostasis indicators were revealed - an increase in blood coagulation during non-developing pregnancy and after taking mifepristone, followed by a gradual normalization of hemostatic changes and a decrease in total blood clotting after taking misoprostol.*

Keywords: *non-developing pregnancy, mifepristone, misoprostol, drug interruption, coagulation hemostasis.*

Relevance. The problem of non-developing pregnancy (NDP) is extremely relevant in modern obstetrics and gynecology in both clinical and social aspects. The frequency of this pathology in the structure of reproductive loss is 10-20% [3; 4]. The delay of the dead fetus in the uterus adversely affects the subsequent reproductive function of the woman. It also carries a threat not only to its health, but also to life, due to disturbances in the hemostasis system, manifested by consumption coagulopathy and hemorrhagic complications [1, 2, 5]. It was established that 2-3 weeks after the death of the fetus, subacute DIC develops [1; 2]. The traditional method of terminating a non-developing pregnancy is surgical one-stage emptying of the uterus [1; 5]. But in recent years, the medical method of abortion using mifepristone in combination with misoprostol has been increasingly introduced into obstetric and gynecological practice. This method is a safer

and more physiological way to terminate a pregnancy on an outpatient basis up to 9 weeks inclusive [3; 6; 7]. However, this method of abortion does not completely exclude the risk of complications [6]. And given the fact that the use of hormonal contraceptives after pharmacological abortion may affect the hemostasis system, the question of studying the effect of antiprogestins and prostaglandins on the coagulation link of hemostasis is significant when choosing post-abortion hormonal rehabilitation. [1; 2; 4].

Purpose of the study. To assess the condition of the coagulation link of hemostasis in women who terminate a non-developing early pregnancy using the drug method using mifepristone and misoprostol.

Materials and research methods. The material for the study was 50 cases of drug interruption of NDP with amenorrhea up to 63 days in the years 2016-2017 in the conditions of a day hospital of the obstetric-gynecological department of the University multi-disciplinary clinic of the Tyumen State Medical University of the Ministry of Health of the Russian Federation. Drug-induced abortion was performed according to the following scheme: a single oral administration of 600 mg of mifepristone followed by the use of misoprostol at a dosage of 800 µg 36-48 hours after the first drug was taken. Hemostasiological changes were evaluated in comparison with the control group — non-pregnant healthy women (n = 130, mean age 24.98 ± 5.54). Indicators of coagulation hemostasis were determined using an Olvex coagulometer (Russia), a TROMB-4 hemocoagulometer (Russia), as described by A. P. Momot et al., 2011. D-dimers were determined using the D-dimer immunoassay kit. , Axis-Shield. Soluble fibrin-monomer complexes (PFCM) were determined by a quantitative variant of the phenanthroline test. For statistical processing of the results used Statistica 6.

The results of the study. When conducting a study in coagulation hemostasis in women with NDP, the following data were obtained (Table 1).

Table 1

The state of coagulation of hemostasis in women who have interrupted the NDP medication

Indicator	Control group, n=130	Against the background of the NDP, n=50	After using Mifepristone, n=44	After using Misoprostol, n=25
ABP, с	97,02±19,97	97,00±11,76	95,88±13,30	104,38±11,69*
APTT, с	28,00±3,80	30,38±3,26*	29,44±4,05	29,68±3,17
ПО	1,07±0,09	1,09±0,08	1,10±0,10	1,05±0,04
ПТИ, %	92,78±10,49	93,35±7,97	92,59±7,81	98,11±4,51*
МНО	1,08±0,10	1,07±0,08	1,09±0,11	1,02±0,06
ТВ, с	16,00±1,77	14,99±1,19*	15,10±1,32	15,50±0,68
ФГ, г/ л	3,15±2,25	3,44±0,83	3,13±0,43	3,30±0,61
РФМК, г/л	2,09±4,71	4,92±5,75*	1,86±2,99	2,33±3,03
АТ III, %	112,70±14,09	105,86±6,69	105,75±9,41	113,00±4,54
ИРП, %	101,29±16,39	100,00±8,66	103,17±7,89	95,00±2,15
D-димер, мкг/мл	0,11±0,04	0,12±0,05	0,11±0,04	0,10±0,00
Нв, г/л	125,22±14,99	124,73±8,91	124,83±8,06	120,36±9,06

Note: Sign * significant difference in coagulation hemostasis in women who interrupted the NDP with drugs from the state of hemostasis in the control group (healthy non-pregnant women).

Elongation of a non-developing pregnancy resulted in a prolongation of the activated partially thromboplastin time (APTT) compared with the value of this indicator in individuals in the control group (30.38 ± 3.26 and 28.00 ± 3.80 , respectively). On the first day after taking mifepristone, APTT was shortened from 30.38 ± 3.26 s. up to 29.44 ± 4.05 s., and after taking misoprostol some lengthening of the APTT was recorded again to 29.68 ± 3.17 s. On the background of a non-developing pregnancy, an increase in the concentration of soluble fibrin-monomer complexes (SFMC) was determined by 2.3 times compared with the control group, which indicates the activation of continuous intravascular coagulation of blood. The thrombin time in the group of women before medical abortion was 14.99 ± 1.19 s., after taking mifepristone, the value of this indicator was extended

to 15.10 ± 1.32 s., and after misoprostol - to 15.50 ± 0.68 s., And in the control group this indicator was higher (16.00 ± 1.77 s). The concentration of fibrinogen (FG) varied within reference values, there was a decrease in FG after taking mifepristone from 3.44 ± 0.83 g/l to 3.13 ± 0.43 g/l, followed by an increase in its concentration to 3.30 ± 0.61 g/l under the action of misoprostol. It was also found to reduce the level of Antithrombin III by 6.5% before the termination of pregnancy, with a subsequent increase in its level to the values of the control group. The activation of the fibrinolytic system is noted - the maximum value of the plasminogen reserve index (RPI) is registered the next day after taking mifepristone. The value of the level of D-dimers was maximal against the background of a non-developing pregnancy, then successively decreased during pregnancy termination from 0.12 ± 0.05 μ g/ml to 0.10 ± 0.00 μ g/ml. The level of hemoglobin in the study group on the background of non-developing pregnancy was 124.73 ± 8.91 g/l, and after taking misoprostol there was a decrease in its plasma concentration to 120.36 ± 9.06 g/l, which can be explained by blood loss during an abortion.

Conclusions. Based on the findings of a study conducted on the background of a medical interruption of a non-developing pregnancy, signs of activation and dissociation of coagulation hemostasis indicators were detected. The shortening of APTT after taking Mifepristone indicates both the activation of the internal plasma-coagulation mechanism and an increase in the overall blood clotting. The thrombin time was shortened as much as possible against the background of a non-developing pregnancy, then gradually increased during the course of medical abortion, but did not reach the control group, which indicates tension in the hemostasis system. This suggests the predominance of the internal mechanism of plasma coagulation during medical abortion prior to taking misoprostol. This condition is probably associated with the activating effect of mifepristone on the internal mechanisms of blood coagulation against the background of a decrease in tissue factor entering the bloodstream as a result of mifepristone-induced detachment of a dead ovum, and a significant lengthening of ABP after administration of Misoprostol is associated with a decrease in clotting factors in the blood against the background of blood loss induced by misoprostol.

The activation of the internal mechanism of blood coagulation against the background of a decrease in procoagulant mechanisms is also indicated by a decrease in the level of SFMC after taking Mifepristone, which is associated with the action of Hagemann factor and calcium ions, resulting in a cross-polymerization of fibrin monomers with the formation of insoluble fibrin, thereby reducing the concentration of SFMC. At the same time, abortion itself has a stress-induced effect, activating the sympathoadrenal system, which through a number of factors (kallikrein-kinin system, hyperadrenelinemia, hypercalcemia, etc.) activates the internal mechanisms of plasma-coagulation. In addition, medical interruption of

NDP is characterized by a tendency to a decrease in the activity of the antithrombin and fibrinolytic systems of the blood.

Thus, on the background of a non-developing pregnancy, an activation of the internal mechanism of blood coagulation is observed, which is directly related to the stressful effect of abortive intervention and to the activating effect of mifepristone on plasma coagulation. The subsequent decrease in total blood clotting that occurs after taking misoprostol is probably associated with emptying the uterine cavity from the ovum, accompanied by bleeding of varying intensity and volume. And, therefore, all women who have had a medical abortion for a non-developing pregnancy should be considered at risk for thrombohemorrhagic complications, despite the high efficacy of this method and its atraumatic nature.

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早期生化和超声诊断标准GONARTHRITIS
**EARLY BIOCHEMICAL AND ULTRASONIC DIAGNOSTIC
CRITERIA GONARTHRITIS**

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抽象。 本文讨论了在这种病理状态发展的早期阶段检测到的膝关节关节炎的生化和放射标准。 检查了120名21-60岁患有膝关节关节炎的患者。 在POL-AOS系统的研究中，揭示了在降低血清抗氧化活性的背景下膝关节关节炎的早期超声征象，血清和滑液产品中脂质过氧化物的增加。

关键词：膝关节炎，早期生化和放射诊断标准

Abstract. *The article deals with biochemical and radiation criteria of arthritis of the knee joint, detected in the early stages of development of this pathological condition. 120 patients aged 21-60 years with arthritis of knee joints were examined. A number of early ultrasonic signs of arthritis of the knee joint, increase in serum and synovial fluid products of lipid peroxidation on the background of reducing the antioxidant activity of serum in the study of the system of POL-AOS were revealed.*

Keywords: *knee arthritis, early biochemical and radiation diagnostic criteria*

Introduction: Rheumatic diseases occupy one of the leading places in the degree of negative impact on modern society [2], at the same time, the increase in the prevalence of rheumatic diseases is observed in all countries of the world. According to the results of international epidemiological studies, the prevalence of arthritis among the entire adult population is 115-271 cases per 100,000 persons [3]. Among the chronic autoimmune diseases of the musculoskeletal system, rheumatoid arthritis (RA) is one of the most common and undoubtedly significant.

In the Russian Federation, the prevalence of RA is on average 0.61%, and the duration of the disease in patients with newly diagnosed RA is about 7 years [3].

In 2004 in the Russian Federation diseases of the musculoskeletal system took the 2nd place in the number of cases of disability and the 3rd place in the number of days of disability [1], and in terms of the primary disability rheumatological diseases took the 3rd place after diseases of the cardiovascular system and cancer pathology.

Thus, arthritis is an urgent problem of modern rheumatology, and verification of the diagnosis in the early stages allows timely prescribe adequate therapy, including the basic means of pathogenetic orientation, which significantly changes the nature of the disease, reduces the rate of disease progression, significantly improves the prognosis of the disease and, ultimately, contributes to the achievement of recovery or clinical and laboratory remission.

Previously, there was no comparison of the results of the state of the PAP-AOS system and the ultrasound picture in patients with arthritis of the knee joints. These studies will reveal diagnostic, prognostic, radiological and biochemical signs for early diagnosis, improvement of prognosis and planning of rehabilitation of this pathology.

Research methods: scientific-methodical Department of the clinic of Professor CenterStage A. Yu., OOO "SONAR" using modern certified equipment: Samsung UGEO H-60, SamsungMedison EKO 7, XG ToshibaNemio we examined 120 patients aged 21 – 60 years with arthritis of the knee, from them with this type of lesion was predominantly in the clinic, women (98 women and 22 men). All patients were examined by rheumatologist, therapist, surgeon, ultrasound doctor. Methods of radiation diagnosis (ultrasound, MRI and MSCT, x-ray of the knee joints) were carried out in the Department of radiation diagnosis.

Clinical and biochemical study patients took place in the biochemical laboratory of GBUZ RCH№3, of the "Uralgufk", the Department of biochemistry of the "South Ural state medical University of Minzdrav of Russia," the laboratory "Invitro" and "innovative medical technology". Biochemical studies of the LPO system in the study groups were carried out by spectrophotometric method and determination of the intensity of ascorbate-induced LPO in Lviv E. I.

Statistical processing of the material with the inclusion of arithmetic mean (M), mean error (m). A measure of the significance of differences (p) using the student's value (t). Calculation of Pearson's linear correlation index (g). Processing of material using licensed programs STAT, Microsoft Excel on a personal computer.

Experimental part: Arthritis of the knee joint is inflammation of the intra- and periarticular areas of one or both knees.

It was revealed during physical examination:

Joint damage

* Asymmetric arthritis with the defeat of a small number of joints, predominantly the lower limb (mostly ankle, knee and finger joints of the feet, especially big toes).

* Always dominated by lesions of the joints of the lower extremities (in the study group of knee);

The defeat of entazisom (places of attachment of tendons and ligaments to bones near joints in these anatomical zones of the synovial bags).

*The most frequent localization anteitam — area heels.

The reason for the treatment of patients was the presence of pain, restriction of movements and swelling in the knee joint. As well as the presence of morning stiffness due to the fact that during the night in the joint develops edema, which passes through 40-60 minutes after the start of movement.

Hyperthermal reactions were observed in 35% of cases.

In arthritis, there may also be common signs characteristic of inflammation: fever, chills, sweating, General weakness. May manifest headaches, weight loss. There are also symptoms of the disease, which was the cause of inflammation: heart damage in rheumatoid arthritis, lungs and other organs in tuberculosis, etc.

In General clinical analyses, leukocytosis and formula shift were observed in the early stages in 30% of cases, ESR, CRP and rheumatoid fever samples were elevated in the early stages in 20% of cases. Their increase was noted by the second week of the disease.

The study of the PAP-AOS system revealed an increase in serum and synovial fluid lipid peroxidation products against the background of a decrease in serum antioxidant activity. Signs of damage to the knee joints on ultrasound revealed before the detailed biochemical picture of their inflammation and degeneration.

Early ultrasound signs revealed in our patients include:

- * Presence of synoviitis
- * Increasing the rigidity of the capsule of the knee joint according elastographic evaluation;
- * Changes in the spectral parameters of blood flow in the vessels of periarticular tissues;
- * Hypervascularization in the affected area;
- Usource bone plate along the line of attachment of the joint capsule;
- * Imbibition of the surface layer of hyaline cartilage of articular surfaces;
- * Somewhat later in the inflammatory process involved the muscular-ligamentous apparatus with the development of tendinitis and enthesopathies;
- * Gradually inflamed all synovial tissues of the joint.

The cruciate ligaments are subjected to gross change. The cartilage cover is destroyed. Exposed spongy tissue, which develops osteomyelitis or ostitis ("inflammation of the bone"). The changes are determined by ultrasound, MRI, MSCT and radiography.

Changes in radiographs:

- * Radiographic changes (except for signs OTK soft tissue okroplennyh joints and/or entazism) often otsutstvuyut.
- * In the case of prolonged or chronic course can be detected: periarticular osteoporosis (non-permanent sign) of the affected joints, changes in the area of the affected entheses (erosion, accompanied by subchondral sclerosis and bone

proliferation, periostitis in the case of dactylitis), sacroiliitis (usually unilateral), spondylitis (very rarely).

* In the chronic course of possible narrowing of the joint space and the development of bone erosive changes (almost exclusively in the small joints of the foot).

* A distinctive feature of the trentgenological changes in the corresponding arthritis in General and in Rea (reactive arthritis) in particular is the presence in the areas of inflammation and destruction of osteosclerosis (not osteoporosis, as in RA) and bone proliferation (in the area of marginal erosions, inflamed enthesises) and periostitis.

When using MRI and MSCT, as well as ultrasound, in the early stages it is possible to identify the characteristic signs of joint damage in arthritis. But, since these research methods are very expensive, their use is limited.

The study of the biochemical status data (indicators of the PAP - AOS system) in patients with arthritis of the knee joints of various degrees of activity and radiation diagnosis data (ultrasound diagnosis) will identify early diagnostic, prognostic and biochemical signs of the disease to improve diagnosis, rational selection of therapy and planning of the rehabilitation process.

Summary: The use of ultrasound (ultrasound) in the last 10 years has become one of the most affordable in the diagnosis of the musculoskeletal system. Simplicity, safety and noninvasiveness, high information content of new ultrasound technologies provided the ultrasound method with priority in choosing among instrumental methods of joint and soft tissue examination. Despite the impossibility of visualization of the bone tissue itself, the high informative value of the method in assessing the state of ligaments and tendons, the ability to detect changes in both periarticular and intraarticular tissues allow us to consider ASG as the method of choice for arthritis of the knee joint.

Based on the anatomy of the knee joint, the importance of assessing the state of all joint structures for the purpose of early and differential diagnosis of local inflammation is obvious, which is of great importance for the appointment of timely and adequate treatment.

Verification of the diagnosis in the early stages allows to prescribe adequate therapy in a timely manner, including basic pathogenetic agents, which significantly changes the nature of the disease, reduces the rate of disease progression, significantly improves the prognosis of the disease and, ultimately, contributes to the achievement of recovery or clinical and laboratory remission.

For the timely start of a balanced differentiated therapy of knee arthritis, evaluation of the effectiveness of therapeutic and rehabilitation measures requires further development of methods of clinical, laboratory and radiation diagnosis. The study continues.

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俄罗斯联邦消费者权益保护和人类福祉监督局 (Rospotrebnadzor) 在牙科组织检查期间披露的违规行为分析

ANALYSIS OF VIOLATIONS, DISCLOSED DURING THE EXAMINATIONS OF DENTAL ORGANIZATIONS CONDUCTED BY THE RUSSIAN FEDERAL SERVICE FOR SURVEILLANCE ON CONSUMER RIGHTS PROTECTION AND HUMAN WELLBEING (ROSPOTREBNADZOR)

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注解。对2016 - 2018年牙科组织的检查进行了分析。在克麦罗沃地区的领土上,对157个牙科机构的检查进行了分析,并在俄罗斯各地收集了另外1673个牙科组织的检查数据。最常见的违规行为如下:没有该组织的网站,在缔结关于提供有偿医疗服务的协议时限制消费者权利,未遵守国家免疫日历,X射线设备操作不规范,和消毒 - 灭菌制度。

关键词:牙科组织的验证,牙科组织的违规行为。

Annotation. *The analysis of inspections of dental organizations for 2016-2018 was carried out. On the territory of the Kemerovo region, an analysis of inspections of 157 dental institutions was carried out, and data on inspections of another 1673 dental organizations were collected throughout Russia. The most frequent violations were the following: absence of the organization's website, restriction of the consumer's rights when concluding an agreement on the provision of paid medical services, failure to comply with the National Immunization Calendar, irregularities in the operation of X-ray equipment, and disinfection-sterilization regime.*

Keywords: *Verification of dental organizations, violations in dental organizations.*

Introduction

Verification of Rospotrebnadzor is a procedure that sooner or later undergoes any medical organization in Russia. Statistics show that more than 90% of such

checks end in fines, up to the suspension of the institution for several months.

Purpose of the study

Increase the awareness of medical personnel and dental clinic managers about the most common violations detected by the Rospotrebnadzor.

Materials and research methods

The work is based on a survey of 157 dental organizations of the Kemerovo region and 1673 throughout Russia for violations identified during inspections by the CPS in the period 2016-2018.

Results and its discussion

All medical organizations are tested Rospotrebnadzor.

In the period from 2016 to 2018, the following violations were identified:

In the sphere of sanitary legislation, an insufficient number of tips for one workplace of a dentist was revealed, this violation was registered in 27% (N = 42) in the Kemerovo Region and in 31% (N = 519) in Russia as a whole. According to section 4 of paragraph 8.1.2. SanPiN 2.1.3.2630 the number of tips for each workplace of a dentist is at least 6 (two angular, straight, turbine).

In 45% (N = 71) of cases in the Kemerovo Region and in 30% (N = 502) in Russia, the rules for tip processing were violated. Processing tips is carried out in accordance with section 5, p. 8.3.5. SanPiN 2.1.3.2630-10

Violation of the requirements for sanitary maintenance of premises, equipment, inventory was registered in 65% (N = 102) of cases in the Kemerovo Region and in 51% (N = 853) in Russia. According to Section 1, Chapter 11 SanPiN 2.1.3.2630-10, containers with working solutions of disinfectants should be equipped with: 1. Tight-fitting lids 2. Have clear labels or labels indicating the means, its concentration, purpose, preparation date, expiry date solution. Cleaning equipment (buckets, basins, rags, mops) should have: 1. Clear labeling indicating the premises and types of cleaning work, be used strictly for the purpose 2. Stored in a dedicated room (outside medical offices).

Violation of the requirements of presterilization cleaning was detected in 36% (N = 57) of cases in the Kemerovo Region and in 42% (N = 703) in the Russian Federation. Quality control of presterilization cleaning is carried out daily (azopiramic or amidopyrinovy breakdown). In accordance with section 2 of paragraph 8.3.13, SanPiN 2.1.3.2630-10 are subject to control during decentralized processing - 1% of simultaneously processed products, but not less than 3 units processed at a time.

The sterilization quality control was violated in 36% (N = 57) of dental organizations in the Kemerovo Region and in 44% (N = 736) in the Russian Federation. In accordance with section 2 of paragraphs 2.35 and 2.36 SanPiN 2.13.2636-10, sterilization quality control should include bacteriological control (at least 2 times a year), chemical indicators (at each load into the sterilizer), thermal quality control of sterilization (2 times per month.).

The storage conditions for sterilized instruments were often violated, violations were recorded in 42% (N = 66) cases in the Kemerovo Region and in 54% (N = 903) in Russia. Storage of items sterilized in packaged form should be carried out in cabinets, work tables in accordance with section 2 p. 2.25 SanPiN 2.1.3.2630-10. Storage times are indicated on the package and are determined by the type of packaging material according to the instructions for its use.

Violations of the rules for the treatment of hands were recorded in 27% (N = 42) cases in the Kemerovo Region and in 37% (N = 619) in Russia. To achieve effective hand disinfection, the following conditions must be met: shortly-cut nails, the absence of artificial nails, the absence of rings, rings and other jewelry - in accordance with section 1 of clause 12.2 SanPiN 2.1.3.2630 - 10

Violation of the requirements for water supply and sanitation was recorded in 17% (N = 27) in the Kemerovo Region and in 9% (N = 151) in the Russian Federation. Rooms requiring special treatment and cleanliness of the hands of the attending medical staff should be equipped with sinks with the installation of mixers with elbow (non-contact, pedal and other non-wrist) controls and dispensers with liquid (antiseptic) soap and antiseptic solutions in accordance with Chapter 1 of Section 5.6 SanPiN 2.1.3.2630 -10).

Employees of Rospotrebnadzor registered a violation of the requirements for the working conditions of medical personnel. In 12% (N = 19) of cases in the Kemerovo Region and in 15% (N = 251) in Russia, the frequency of medical examinations was violated. Periodic medical examinations should be carried out at least once a year, medical personnel should also have data on blood tests for HbsAg and the presence of ANTI-HCV IGG in the blood, antibodies to HIV in accordance with section 1, chapter 15 of SanPiN 2.1. 3.2630 -10.

Non-compliance with the requirements for prophylactic vaccination was recorded in 52% (N = 82) of cases in the Kemerovo Region and in 33% (N = 552) in Russia. In accordance with Order No. 229 of the Ministry of Health of Russia dated June 27, 2001, employees must be vaccinated against: 1. Diphtheria 2. Tetanus 3. Viral hepatitis B 4. Influenza 5. Measles in accordance with the National Schedule of Vaccines

Violation of the requirements for the device and the operation of X-ray machines and X-ray examinations were violated in 64% (N = 100) cases in the Kemerovo Region and in 72% (N = 1204) in Russia. In accordance with SanPiN 2.6.1.1192-03, the dental organization must have an X-ray protective screen, there must be a written briefing by medical personnel on working with sources of ionizing radiation; a “do not enter” sign in front of the entrance to the room with X-ray equipment, including with a radiovisiograph.

In accordance with the order of the Ministry of Health of the Russian Federation dated May 12, 2014 No. 224n, the “requirements for a sign banning smoking

and the procedure for placing it” at the entrance to the premises of the clinic and toilet should be a sign banning smoking. Violations were recorded in 42% (N = 66) of cases in the Kemerovo Region and in 51% (N = 853) in the Russian Federation.

A violation of sanitary and epidemiological requirements for the treatment of medical waste is considered to be very rude. Violations were recorded in 30% (N = 47) of cases in the Kemerovo Region and 45% (N = 753) in Russia. In accordance with SanPiN 2.1.7.2790-10, a dental organization should be instructed in the safe handling of waste upon admission to work, thereafter once a year. There should be instructions establishing the rules for waste management and personal responsibility of employees, class B waste disposal schemes. The organization should have a storage room for used mercury-containing lamps (fluorescent and others), as well as a contract for the export and disposal of waste.

In accordance with section 1 of paragraph 11.18 of SanPiN 2.1.3.2630-10, the dental organization must have a contract for the washing of medical linen. Violations were recorded in 29% (N = 46) of cases in the Kemerovo Region and in 37% (N = 619) in Russia as a whole.

13% (N = 20) of dental organizations in the Kemerovo Region and 8% (N = 134) in Russia did not have a log of emergencies at the risk of occupational HIV infection (SP 3.1.5.2826-10 "Prevention of HIV infection").

Employees of Rospotrebnadzor registered a violation of consumer rights, namely: the Service Contracts did not specify warranty periods and other mandatory information, failure to provide benefits and benefits to the consumer established by law, the terms of the Agreement contradict the current legislation, the document does not contain a preamble with references to legislative sources confirming the legality and the need to conclude an Agreement for both parties, the Agreement does not specify the terms of payment for services and the procedure for settlements, the absence There is a site of the clinic. These violations were recorded in 19% (N = 30) cases in the Kemerovo Region and 24% (N = 402) in Russia as a whole.

Conclusions.

Any activity in Russia is regulated by legislative acts, compliance with which is controlled by the relevant authorities. Even if everything is normal and tightly controlled in your medical organization, checks are always stressful for any organization. Some points of SanPiN and FZ have a broad interpretation, in this connection it becomes practically impossible to pass the test without penalties.

Fines are one of the most loyal penalties. In the event of the discovery of serious violations, the activities of a medical organization in which non-compliance with sanitary norms and rules has been detected may be suspended. It is important to organize the work in the clinic in such a way that all the rules established by law are followed, as well as constantly monitor their changes. This will preserve the reputation and budget of the organization.

基于Ti-Ca-Mg磷酸盐的吸附材料的合成
**SYNTHESIS OF SORPTION MATERIALS BASED
ON TI-CA-MG PHOSPHATES**

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注解。显示了使用 $(\text{NH}_4)_2\text{TiO}(\text{SO}_4)_2 \cdot \text{H}_2\text{O}$ 的钛盐和热活化白云石 $\text{CaCO}_3 \cdot \text{MgO}$ 合成基于磷酸盐 Ti-Ca-Mg 的复合吸附剂的可能性。复合磷酸盐的相组成由于其各个组分的组合作用而引起材料的高吸附性质，并且可以根据工艺条件而变化，从而允许产生具有所需性质的吸附剂。

关键词：磷酸钛，磷酸钙，磷酸镁，合成，含钛废物，白云石，吸附性能，放射性核素。

Annotation. *The possibility of synthesis of composite sorbents based on phosphate Ti-Ca-Mg using the titanium salt of $(\text{NH}_4)_2\text{TiO}(\text{SO}_4)_2 \cdot \text{H}_2\text{O}$ and thermally activated dolomite $\text{CaCO}_3 \cdot \text{MgO}$ is shown. The phase composition of the composite phosphate causes the high sorption properties of the material due to the combined action of its individual components and may vary depending on the process conditions, thereby allowing the creation of sorbents with desired properties.*

Keywords: *titanium phosphates, calcium phosphates, magnesium phosphates, synthesis, titanium containing waste, dolomite, sorption properties, radionuclides.*

Introduction

Natural and synthetic Ca phosphates are promising materials and are used in the most extensive areas of technology, medicine, industry, agriculture and animal husbandry. Of high scientific and practical interest is the synthesis of Ca phosphate with specified properties and structures [1], the preparation of crystalline and amorphous phases [2] doped with various cations [3]. Despite the diversity of phosphates formed in the $\text{CaO-P}_2\text{O}_5$ system under various conditions, two are widely used - tricalcium phosphate $\text{Ca}_3(\text{PO}_4)_2$ and hydroxyapatite $\text{Ca}_5(\text{PO}_4)_3(\text{OH})$

[4], as well as their even more effective derivatives with additions of Mg [5, 6]. The study of the synthesis and properties of such materials has been given increasing attention recently. The positive effect of Mg additives on the properties of composite materials based on Ca phosphate [7] is noted, and new methods of obtaining Ca-Mg compounds are being developed. Also, compounds based on phosphates of Ca and Mg are promising sorption materials with high capacity and selectivity with respect to recoverable radionuclides ^{60}Co and ^{90}Sr [8].

One of the sources of Ca and Mg can be dolomite - $(\text{Ca}, \text{Mg}) \text{CO}_3$. Natural dolomite is characterized by low porosity and low sorption properties with respect to polyvalent metal ions. Obtaining effective sorbents based on it can be carried out by thermal and / or acid activation, with the most promising is the production of a Ca-Mg phosphate sorbent of a non-apatite structure. According to the literature, such phosphates are significantly superior to hydroxyapatite in sorption capacity.

In work [8], the options for obtaining sorbents by heat treatment and subsequent phosphating of natural dolomite are proposed, which significantly reduces the cost of the usually expensive production of synthetic phosphates. The addition of ammonium to the phosphating agent leads to the formation of additional phases, in particular, struvite, which in turn exhibits sorption properties with respect to heavy metals and is considered as an effective ameliorant [9]. The diversity of the phase composition of the resulting sorption materials based on phosphate Ca-Mg due to the conditions of the processes of their production.

There are a limited number of methods for the synthesis of calcium and magnesium phosphates: precipitation and hydrolysis in solutions, as well as solid-phase synthesis [4]. In particular, laboratory and industrial methods for the production of phosphates of Ca are described in [10]. Depending on the method, samples with different characteristics can be obtained - phase composition, specific surface, morphology, degree of crystallinity, etc., which is especially characteristic of liquid-phase synthesis, the conditions of which are dynamic and variable.

The process of sorption on such sorbents proceeds according to the mechanism of conversion (dissolution-precipitation) due to the difference in the solubility product of Ca-Mg phosphates and phosphates of the removed cations. The highest sorption activity of materials is observed in the range of $\text{pH} = 2-5$. At the same time, when removing micro-concentrations of toxic elements, the process of dissolving the sorbent prevails over the deposition process, which leads to contamination of the treated water with hardness cations. These disadvantages can be eliminated in the case of obtaining a composite material based on phosphates of Ti, Ca and Mg.

Polyvalent metal phosphates, in particular, Ti phosphates of different composition and structure, are effective sorption materials for extracting cations of various elements from water-salt solutions, for purifying both wastewater and liquid radioactive waste [11, 12].

Regarding research on the synthesis of phosphate Ti - methods for its production and properties are described in sufficient detail in the literature [13-15]. Most often, the synthesis of a titanophosphate precursor is carried out by the method of precipitation from solutions of titanium (IV) salts into which orthophosphoric acid is introduced. Another method is based on the treatment of freshly precipitated titanium (IV) hydroxide with phosphoric acid. Less commonly, the synthesis is carried out from solutions with a low concentration of reagents (sol-gel method). Subsequent processing of precursors associated with the transfer of the sorption material in a state convenient for efficient use.

Depending on the deposition conditions, it is possible to obtain amorphous or crystalline products with different P: Ti ratios. The greater this ratio, the more exchangeable protons the material contains and the more sorption capacity it has. To date, more than 30 types of Ti phosphate are known for various chemical compositions and structures.

Obviously, one of the methods for the synthesis of phosphates of Ti, Ca and Mg is the method of precipitation from solutions in the presence of a phosphorus-containing agent. It should be expected that the joint isolation of these metals from phosphate solutions will increase the sorption capacity of the material due to the synergism of the action of individual components, improve the kinetic characteristics of the sorption process and reduce the hardness cations in the purified water due to their absorption by Ti phosphate by the ion-exchange mechanism. Data on the preparation of such a composite phosphate are not available in the literature. This paper is devoted to the development of a method for the synthesis of composite phosphates using titanium-containing salt and natural dolomite as starting materials, as well as the study of the sorption properties of the obtained compositions with respect to the radionuclides included in the composition of liquid radioactive waste from nuclear power plants

Objects and research methods

Thermo-activated dolomite of composition SiO_2 0.3, Fe_2O_3 0.8, Al_2O_3 0.5, CaO_4 3.3, MgO 11.8, SO_3 0.4 (wt.%) And titanium salt $(\text{NH}_4)_2\text{TiO}(\text{SO}_4)_2 \cdot \text{H}_2\text{O}$ of composition TiO_2 19.5, NH_4^+ 9.7, SO_4^{2-} were used for work. 52.3 (wt.%). Heat treatment of dolomite was carried out at 850 °C. The final phase is a mixture of oxides of Mg and Ca carbonates (Fig. 1). As a result of the calcination of dolomite, an increase in the porosity of the material occurs due to the release of carbon dioxide and the mechanical strength of the grains slightly decreases, which is probably due to the accumulation of defects inside the crystal lattice.

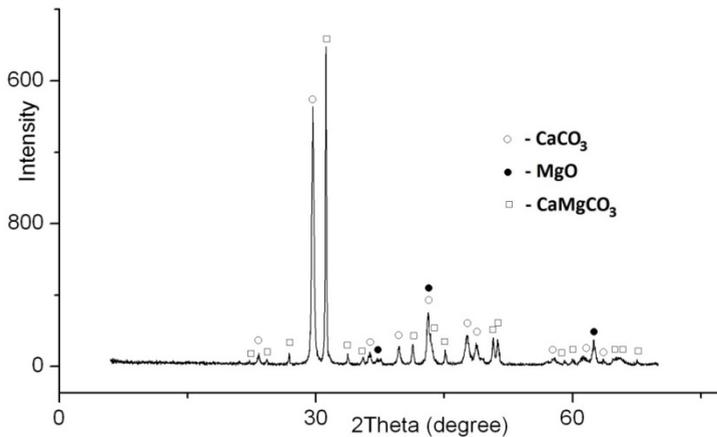


Fig. 1. Phase composition of thermally activated dolomite according to X-ray diffraction data

Synthesis of composite sorbent was carried out as follows: the specified amount of titanium salt and dolomite was loaded into a solution of phosphoric acid with constant stirring and kept for 6-8 hours at a temperature of 60 °C. As a phosphorus-containing component, orthophosphoric acid of a concentration of 10-50% H₃PO₄ was used, the flow rate of which varied 1-5 mol P with respect to the sum of Ti + Ca + Mg cations. The formed precipitate was separated by filtration, washed and dried at 60 °C. Washing was performed with 5% H₃PO₄ and then with water to remove the mother liquor. To study the sorption properties of the composition, the samples were transferred to the ammonium form by treating with 1M (NH₄)₂CO₃ solution for 24 hours. In this case, H⁺ ions in the acidic phosphates are replaced by NH₄⁺ ions to form the ammonium form of Ti phosphate and struvite (MgNH₄PO₄·6H₂O).

The sorption properties of the samples were studied under static conditions using the example of model solutions of CoSO₄ (1 g/l), SrCl₂ (1 g/l) and CsCl (1 g/l). The determination of elements in solutions was performed using atomic absorption spectrometry (Analyst 400) and atomic emission spectrometry using an inductively coupled plasma mass spectrometer (Shimadzu ICPE-9000). Phase studies in solid samples were conducted using X-ray phase analysis on a Shimadzu XRD-6000 diffractometer, as well as using IR spectroscopy, and absorption spectra were recorded on UR-20 and Specord-M 80 spectrometers in KBr tablets. Electron-microscopic (SEM) diagnostics was performed on a scanning digital electron microscope with SEMLEO-420 software. The residual concentration of the adsorbate in the solution was calculated static exchange capacity (mEq/g).

Results and discussion

According to the research results, the composition of the composite sorbent is determined by the concentrations and consumption of phosphoric acid. At the same time, with an increase in the acidity of the medium, the crystallinity of the titanium-containing phase increases and its composition changes.

According to chemical analysis and X-ray diffraction analysis using 10% H_3PO_4 with a molar ratio of phosphorus to cations $Ti + Ca + Mg = 1: 3$, the final composition contains crystalline phases of calcium hydrogen phosphate $CaHPO_4 \cdot 2H_2O$, with the structure of brushite, magnesium phosphate $MgHPO_4 \cdot 3H_2O$ with the structure bayerite, $NH_4MgPO_4 \cdot 6H_2O$ with the structure of struvite, $CaSO_4 \cdot 2H_2O$ and the amorphous phase, during heat treatment of which $(TiO)_2P_2O_7$, TiP_2O_7 phases are obtained, which are the thermal decomposition products of $TiO(OH)(H_2PO_4) - TiOP$ and $Ti(HPO_4)_2 - \alpha-TiR$ (Fig. 2). The weight ratio of titanium-containing phases is 1:1.

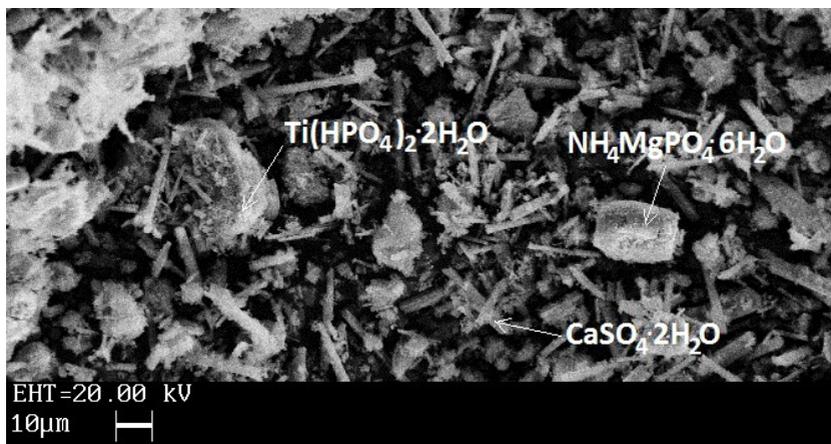


Fig.2. SEM image of composite titanium phosphate obtained by precipitation of 10% H_3PO_4

The degree of conversion to phosphates is 70% for $CaHPO_4 \cdot 2H_2O$ and 30% for $MgHPO_4 \cdot 3H_2O$. According to chemical analysis, the content of ammonium cation in the final composition does not exceed 0.8-1.0%. A further increase in the concentration and consumption of acid promotes the formation of soluble calcium and magnesium phosphates and promotes the crystallization of $\alpha-TiP$, while the proportion of $TiOP$ in the composition decreases markedly. When using 50% H_3PO_4 pure titanium phosphate α -modification is precipitated. This phase has high sorption abilities and selectivity towards the cesium cation. At the same time, an increase in the concentration and consumption of the precipitant leads to the formation of soluble forms of acidic phosphates of calcium and magnesium, and

their content in the sediment does not exceed 10%. At a sufficiently high content of calcium in the solution, the co-crystallization of sulphate and calcium phosphate proceeds, while calcium phosphate has a salivary effect on calcium sulphate. The presence of soluble magnesium phosphate expands the region of stable crystallization of gypsum to a P₂O₅ concentration of 35–37%.

Since the acidity of the medium plays a decisive role in the synthesis of calcium and magnesium phosphates, 10% H₃PO₄ was chosen for further work. To reduce the acidity and completeness of the precipitation of calcium-magnesium phosphate, the fractional precursor administration was chosen. At the first stage, the titanium salt is introduced into the phosphoric acid solution, and 4 hours after the precipitation of titanium phosphate dolomite is introduced into the suspension. This technique allowed to reduce the acidity of the reaction system before introducing dolomite to pH ~ 2, which contributes to the complete precipitation of calcium and magnesium phosphates. At the preliminary dissolution of dolomite in H₃PO₄, the complete binding of elements to the sediment does not occur, and the formation of calcium sulfate CaSO₄·2H₂O and soluble forms of Ca-Mg phosphates occurs.

Studied the textural properties of the compositions. Depending on the composition, the specific surface area varies from 15 to 132 m²/g, the total pore volume is 0.2 cm³/g, and the average pore diameter is 17 nm. Judging by the BJH description curves (Fig. 3), there are two maxima, one of which in the 4 nm region characterizes the pore system of crystalline calcium and magnesium phosphates, and the other at 40 nm refers to the pore characteristics of the resulting titanium acid phosphates.

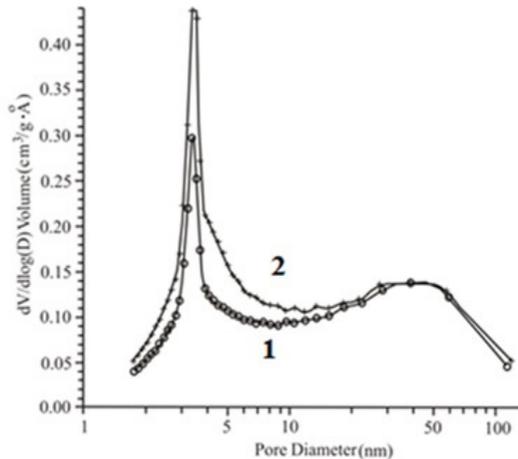


Fig.3. BJH pore distribution curve for composite phosphate, obtained by treatment with phosphoric acid concentrations of 1-20%, 2-10%.

With a decrease in the amount of calcium and magnesium phosphates in the composition of the final composition, the peak at 4 nm becomes less pronounced. In general, the precipitates obtained belong to mesoporous systems, while with an increase in the proportion of the amorphous phase of titanium phosphate, the total volume and average pore diameter increase, which should have a positive effect on the kinetics of the sorption process involving ion exchange.

Synthesized composite phosphates are a mixture of phases, in which, depending on the synthesis conditions, acidic phosphates of magnesium, calcium and titanium are presented in different ratios, as well as gypsum as a dihydrate.

It is known that calcium and magnesium phosphates of the neapatite structure show high activity in sorption processes due to the occurrence of heterogeneous chemical reactions between them and cations of recoverable metals. The driving force behind such reactions is a sufficient difference in the solubility products of phosphate sorbents and the resulting metal phosphate products. For titanium phosphate is characterized by an ion-exchange mechanism. If gypsum is present in the composition, it should effectively bind strontium to strontium sulfate. In this case, the partial dissolution of gypsum in the surface layer will contribute to the chemical reaction between sulfate ions and strontium cations with the deposition of slightly soluble SrSO_4 .

Studies of the absorption of strontium cations by reactive gypsum showed that 94% of strontium sulfate or 254 mg/g is precipitated from a solution of the chosen concentration. According to the obtained results, depending on the amount of titanium salt added to the synthesis, which includes sulfate ion, up to 15% of gypsum is present in the final composition, which can precipitate up to 35 mg of strontium / g of sorbent.

Calcium phosphate of the neapatite structure is inactive to strontium cations and its sorption capacity does not exceed 30 mg/g. Magnesium phosphate has a high solubility in neutral media and is able to effectively remove strontium. Its reactivity from solutions of a selected concentration is 150-160 mg/g. The increased activity of magnesium phosphate in the process of strontium cation extraction compared with calcium phosphate can be explained by its very high solubility. The maximum amount of magnesium acid phosphate phase in the resulting systems is 30%, which ensures that the conversion removes strontium in the amount of 50 mg/g of the composition. With a total absorptive capacity of the phosphate composition of 160-200 mg/g, it is obvious that the process of removing strontium from solution is due to the synergism of the action of both amorphous titanium phosphate to form strontium-substituted titanium phosphate, magnesium and calcium phosphates to form insoluble strontium phosphates, and precipitating strontium sulfate during partial dissolution of gypsum.

Phosphates of alkaline earth metals are not removed from solutions of cesium,

due to the high solubility of the resulting cesium phosphate, and in this case, the process proceeds only by an ion-exchange mechanism involving titanium phosphate. The greater the proportion of titanium phosphate in the composition of the final composition, the higher the sorption capacity for cesium. The maximum value of the sorption capacity for this cation - 176 mg/g was obtained for the composition in which 80% was STA, and the proportion of titanium phosphate in the composition of the final composition - 55%.

Cobalt is not precipitated by gypsum, but forms poorly soluble cobalt phosphates (PR ~ 10-35) and is sorbed by titanium phosphate by the ion-exchange mechanism. It is not yet possible to separate these processes and find out the contribution of each component, since the isotherms of sorption of cobalt with titanium phosphate belong to the H-type isotherms according to the Giles classification and are called high-affinity isotherms. The results of studies of the kinetic features of sorption of the cobalt cation showed that from dilute solutions (1 mmol/l) the process of sorption is carried out by an external diffusion mechanism and the degree of equilibrium is approaching $F = 1$ in 5 minutes of the sorption process. Cobalt phosphate precipitation from concentrated cobalt solutions is likely to precede sorption.

Conclusions

For the first time, composite phosphates based on titanium, calcium and magnesium were synthesized. It is shown that the acidity of the medium is the determining factor in obtaining the composition of a given composition. For the complete precipitation of calcium and magnesium phosphates, a two-stage introduction of mineral precursors has been proposed, which helps reduce the acidity of the medium to $\text{pH} = 2$ and ensures maximum binding of calcium and magnesium to insoluble phosphates. The use of a titanium-containing precursor in the form of a sulfate-ammonium salt leads to the release into the solid phase of a compound of calcium sulfate, which has high sorption properties with respect to the strontium cation. The sorption capacity of the resulting composition is determined by the composition of the phases and is due to the synergistic effect of the actions of the individual phases that make up the composition. At the same time, the composition of the sorbent can be varied for specific solutions to be purified by the directional synthesis of samples with a specific composition of components.

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通过组合超细粉碎组分的方法获得复合材料
**OBTAINING COMPOSITE MATERIALS BY THE METHOD OF
COMBINED ULTRA-FINE GRINDING OF COMPONENTS**

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注解。无机填料广泛用于制造油漆和清漆，建筑产品，密封化合物，吸附剂，塑料等。通常，将几种具有各种功能的填料引入这些材料的配方的组合物中。令人感兴趣的是复合材料，特别是通过对几种组分进行超细粉碎，然后进行机械活化而获得的复合材料。这种技术在行星式轧机中实施，可以在短时间内（少于1小时）实现混合物的高度均匀化，生产含有高达75-80%颗粒的细粉末1-3 μm在尺寸方面。在球磨机或振动磨机中，没有达到这种效果。在超研磨条件下，发生粉末材料颗粒表面层的电离和非晶化，这在与无机和有机物质相互作用时增加其活性。所得复合材料可用于获得复合吸附剂，以及在其热处理后，可用作航空工业，造船和电子学中使用的密封剂和粘合剂组合物中的活性成分。使用工业废物减少它将降低其成本。

关键词：矿物浓缩物，工业废物，锐钛矿，机械活化，前体，吸附剂，密封胶，胶水，比表面，油数。

Annotation. *Inorganic fillers are widely used in the manufacture of paints and varnishes, building products, sealing compounds, sorbents, plastics, etc. As a rule, several fillers with various functions are introduced into the composition of the formulations of these materials. Of interest are composite materials, in particular those obtained by ultrafine grinding of several components, followed by mechanical activation. This technique, implemented in a planetary mill, allows for a short period of time (less than 1 hour) to achieve a high degree of homogenization of mixtures with the production of fine powders containing up to 75-80% of particles 1-3 μm in size. In ball or vibratory mills, this effect is not achieved. Under ultra-grinding conditions, ionization and amorphization of the surface layer of particles of a pow-*

der material occurs, which increases its activity when interacting with inorganic and organic substances. The obtained composite material can be used to obtain a composite sorbent, as well as, after its heat treatment, be an active ingredient in the composition of sealants and adhesives used in the aviation industry, shipbuilding and electronics. Using industrial waste to reduce it will reduce its cost.

Keywords: *mineral concentrates, industrial wastes, anatase, mechanical activation, precursor, sorbent, sealant, glue, specific surface, oil number.*

Introduction

The low level of complexity of the processing of raw materials adversely affect the environment, causing significant harm to the environment. Meanwhile, many industrial wastes are an excellent base for obtaining, for example, fillers for various purposes. Inorganic fillers are widely used in the manufacture of paints and building materials, paper, plastics, composite titanium-containing sorbents, insulating and protective materials, etc. [1-4]. An important role in improving the performance properties of the materials obtained is played by the composition of the fillers and their physicochemical properties, including the degree of dispersion. The smaller the size of solid particles, the higher the degree of homogenization of the formulation and less energy costs. Consider a specific area of use of fillers - the production of adhesives and sealants. The main requirements for sealants: high elasticity, and adhesion to materials of construction, heat and cold resistance, resistance to the action of working environments [4]. In some cases, in addition to the listed properties, good electrical insulating characteristics, as well as resistance to ionizing radiation, etc. Inorganic fillers, such as titanium dioxide and silicon dioxide, and zinc oxide are important to achieve these characteristics. Each filler has its own functions, and in general, their presence improves the quality of the final product. Often, not one, but several inorganic fillers are added to the recipe; mixing them in the dispersion process with the organic component of the mixture takes more time than when working with a composite material of a homogeneous composition. In addition, such compositions possess not only the properties of their components, but also new characteristics, which often significantly increase the efficiency of their use.

The purpose of this research is to study the conditions for obtaining composite titanium-containing fillers from the products of chemical processing of man-made wastes from the Khibiny apatite-nepheline ores using solid-state super-fine grinding, the study of their composition and properties.

Experimental Technique

To obtain titanosilicate compositions, titanium dioxide, titanium hydroxide, and silicon dioxide were used in the chemical processing of waste from the processing of apatite-nepheline ore [1]. Characteristics of the materials are shown in table 1.

Table 1. Characteristics of the objects of research

Component	Characteristic
Titanium dioxide	Anatase, content TiO_2 - 96%, $S_{\text{sp}} - 3.61 \text{ cm}^3 / \text{g}$
Silica	Content SiO_2 - 92,8%, $S_{\text{sp}} - 38.9 \text{ cm}^3 / \text{g}$
Titanium hydroxide	X-ray amorphous content TiO_2 - 65.3%

As the main method that allows to homogenize the initial components, the method of mechanical activation is widely used in chemical technology [5-7]. Titanosilicate mixtures with a specified number of components (TiO_2 : SiO_2 =1:0.1-1 by weight) first crushed using a mechanical porcelain mortar, after which the samples were placed in a Pulverisette-7 planetary mill, which has 4 cups for grinding with a capacity of about 50 ml each and balls with a diameter of 10 mm. The material of the walls of the grinding glasses and the material of the balls is metallic titanium. Speed of rotation of glasses - 650 rpm. The ratio of balls: grindable material = 10: 1. The duration of the mechanical activation cycle is 1 hour [8]. Powders obtained after mechanical activation were calcined at a temperature of 850°C.

The study of samples of starting materials, intermediate and final products was carried out using chemical and physicochemical methods. Radiographs were taken on a Shimadzu instrument at a speed of 0.02 deg / s in the range $2\theta=6-180^\circ$, thermograms - using Temperature Recorder - 1000 with Pt - PtRh thermocouple at a speed of 10 deg / min. Micrometrics ASAP 2000 surface analyzer was used to characterize the surface properties of the powders. The specific surface was determined on a TriStar 3020 instrument by the BET method with nitrogen sorption-desorption. The chemical composition, including trace impurities, was determined by X-ray fluorescence analysis using a MAX-GV spectroscopy. Also determined the basic properties of the compositions in relation to their use in adhesives and sealants [9].

The discussion of the results

The compositions obtained during ultra-grinding, regardless of the nature of the titanium component, are white powders. In the composition with the initial oxide components in the process of grinding, the anatase is partially converted to rutile (Fig. 1). Moreover, an increase in the amount of silicon oxide impedes this process due to its absorption of mechanical impact energy, which leads to the deformation of the anatase structure, and to its recrystallization into rutile.

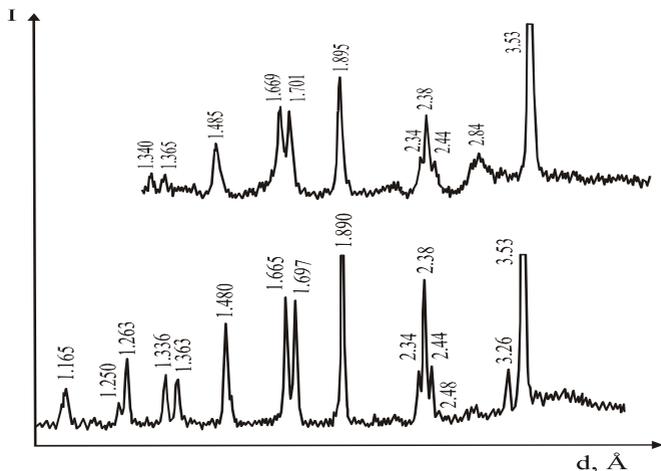


Fig.1. Radiographs of compositions obtained from oxides with the original ratio $\text{TiO}_2:\text{SiO}_2$: 1- 1:1; 2 – 1:0.1.

Analyzing the morphological properties of the surface of the particles of the compositions (Table 2), we can say that the specific surface of its particles after mechanical activation increases by 30% at the initial ratio $\text{TiO}_2:\text{SiO}_2=1:0.1$ and decreases slightly when $\text{TiO}_2:\text{SiO}_2=1:1$ (compared with the initial mixture). The total pore volume is slightly higher in the composition with a high silica content. Judging by the size of the pores, the system refers to mesoporous.

Table 2. Surface properties of compositions

$\text{TiO}_2:\text{SiO}_2$	$S_{\text{sp}}, \text{m}^2 / \text{g}$ (BET)	$V_{\text{nop}}, \text{cm}^3 / \text{g}$ (ads.)	$V_{\text{nop}}, \text{cm}^3 / \text{g}$ (dec.)	$D_{\text{nop}}, \text{nm}$
1:0.1	10.80	0.080	0.081	20.61
1:1	25.75	0.103	0.097	16.93

The fractional composition of powders of ultrafine oxides is almost identical. The size of the agglomerates combining nanoscale crystallites varies insignificantly and corresponds to the following indicators: 50% fraction of particles with a size of 1.038-1.761 microns, 75% - 1.038-2.272, the maximum particle size - 8 microns.

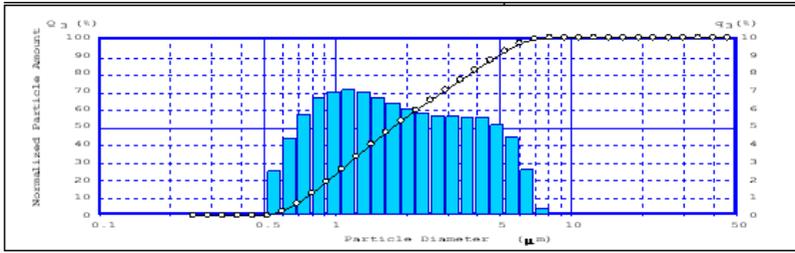


Fig. 2. Particle distribution after mechanical activation of a mixture of titanium oxide and silica.

The composition and properties of the compositions are given in table 3.

Table 3. The composition and properties of titanosilicate compositions

TiO ₂ :SiO ₂	pH	Oil absorption of powder, g/100g	TiO ₂ , %	SiO ₂ , %
1:0.1	6.61	22	92.73	7.26
1:1	5.98	31	52.93	47.06

Samples of composite products, obtained using its hydroxide instead of titanium oxide, after mechanical activation according to XRD data did not change the structure and remained X-ray amorphous, regardless of the composition of the initial mixture. After calcination, the hydroxide passes into titanium dioxide of the anatase structure (Fig. 3).

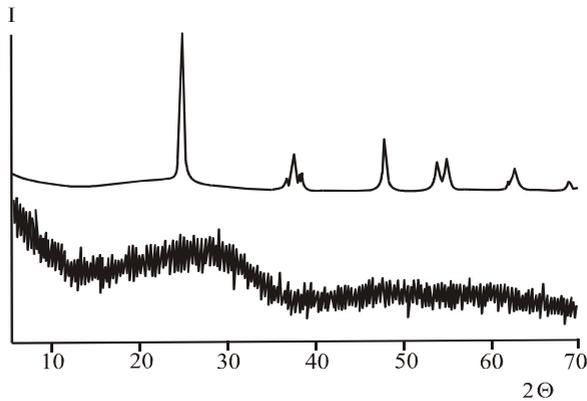


Fig. 3. Diffractograms of the composition obtained from titanium hydroxide and silicon oxide (lower), as well as calcined composition at 850 °C (upper).

Total mass loss during thermolysis of samples is about - 16%. Effects corresponding to the transformation of the structure for the samples are few. They correspond to the removal of free and bound water (52.1, 124.6) and the crystallization of titanium dioxide of the anatase structure (501.9 and 602). The process ends at a temperature of 550-600 °C. XRF of mechanically activated samples with titanium hydroxide, kept at a temperature of 800 °C for 2 h, are confirmed by the thermolysis data - figure 4.

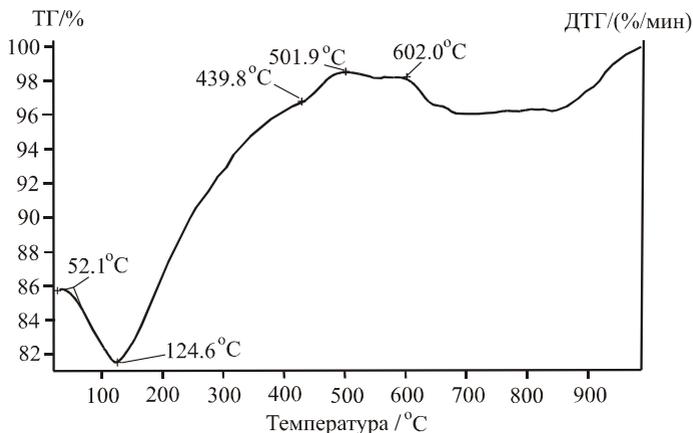


Fig. 4. Thermogram of the composite product

Table 4 shows the results of studies of the surface of the particles synthesized using titanium hydroxide compositions.

Table 4. Surface Characteristics of Particle Compositions

$\text{TiO}_2 \cdot \text{SiO}_2$	$S_{\text{ya}}, \text{m}^2 / \text{g}$ (BET)	$V_{\text{nop}}, \text{cm}^3 / \text{g}$ (ads.)	$V_{\text{nop}}, \text{cm}^3 / \text{g}$ (dec.)	$D_{\text{nop}}, \text{nm}$	Oil absorption of powder, g/100g
1:0.1	35.1565	0.1364	0.1376	14.8727	45
1:0.3	35.2215	0.1120	0.1133	13.2437	42
1:0.5	36.3943	0.1021	0.1035	12.0508	44
1:1	38.6597	0.1005	0.1015	12.3365	45

From the analysis of the morphological properties of the particles, it follows that compositions with silica are characterized by a rather high specific surface area, varying from 35 to 38 m^2 / g with an increase in its content from 10 to 50 wt.%. The total pore volume and their diameter also vary in a narrow range. The distribution of particle sizes (Figure 5): 50% is the fraction with a size of 1.422-2.385 microns, 75% - 1.422-3.975 microns, the maximum particle size is about 10 microns.

The high specific surface and significant porosity of the particles of the composition ensures their activity with respect to organic compounds, as evidenced by the indicator of oil absorption, which provides adhesion of the coating to the surface.

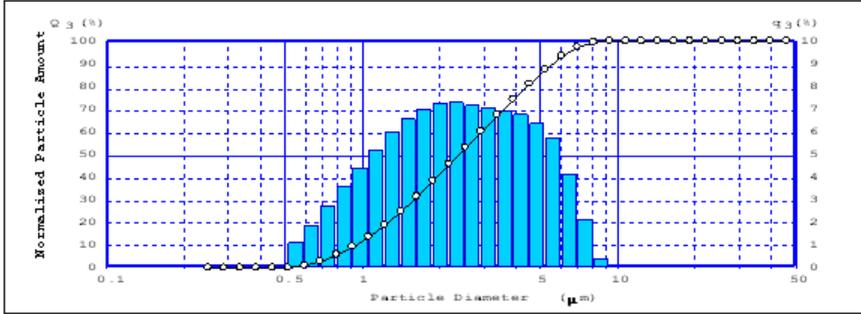


Fig. 5. Particle distribution after mechanical activation of a mixture of titanium hydroxide and silica.

Table 5 shows the composition of the titanosilicate compositions obtained using the titanium component in the form of a hydroxide. The presence of impurity components due to their presence in the original components. However, a noticeable effect on the change in the color tone of the compositions was not observed.

Table 5. The chemical composition of titanosilicate compositions, wt.%

TiO ₂ :SiO ₂ in the original mixture	TiO ₂	SiO ₂	Al ₂ O ₃	P ₂ O ₅	K ₂ O	CaO	Fe ₂ O ₃	Nb ₂ O ₅
1:0.1	91.69	6.63	0.42	0.48	0.03	0.17	0.48	0.06
1:0.3	81.31	17.29	0.36	0.47	0.03	0.13	0.38	
1:0.5	72.34	26.3	0.29	0.39	0.05	0.17	0.38	0.05
1:1	54.76	44.06	0.15	0.38	0.06	0.16	0.36	0.03

Thus, it is shown that the method of ultra-grinding powders using a planetary mill achieves a high degree of homogenization of mixtures with obtaining finely dispersed composite materials, which will ensure their effective use in the manufacture of high-quality insulating materials that can be used in extreme conditions. Moreover, the consumption of composite titanosilicate filler is lower than the total consumption of individual fillers (titanium dioxide and silica - white soot) while achieving the same effect. To obtain the compositions, sphene and nepheline are used, which are separated from man-made wastes from the Khibiny apatite-nepheline ores, which ensures their lower cost than individual fillers.

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通过现代方法估算石油储量和评估地质风险
**ESTIMATING OF OIL RESERVES BY MODERN METHODS AND
ASSESSMENT OF GEOLOGICAL RISKS**

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SOCAR

注解。油岩矿床的储量通过进化模型和蒙特卡罗方法确定。对于每种方法，估计百分比误差。研究了对每个储层参数结果的影响程度，并评估了地质风险。

关键词：矿床，克里格法，蒙特卡罗法，地质风险。

Annotation. The reserves of the Oil Rocks field were specified by means of evolutionary models and the Monte Carlo method. For each method, the percentage error was estimated. The degree of influence on the result of each of the reservoir parameters was studied and geological risks were evaluated.

Keywords: fields, kriging method, Monte-Carlo method, geological risks.

The calculation of oil reserves by the volumetric method is carried out according to the value of the following reservoir parameters: oil saturation area, effective thickness, porosity and saturation factors of oil and gas, specific gravity of oil, coefficient of calculation. These indicators, by the sectoral nature of the changes, are divided into two groups: variable and stable.

The first group includes such parameters as effective thickness, porosity and oil saturation, and the second group includes oil density, coefficient of calculation. As for the area of oil, naturally, this parameter is subject to change. In this case, to establish the distribution of reserves of any field in its area, it is necessary to use the average values of stable parameters, well data of variable parameters.

Thus, the values of the parameters are obtained for the wells, and their change over the field site is estimated using a new analysis method, kriging. This method is considered more accessible than mapping methods. The advantage of the kriging method is not only its flexibility in reflecting changes in parameters on the site, but also the possibility of presenting quantitative indicators in assessing these changes even in each part.

During mapping, the probability-free kriging seriously takes into account the weight of the parameter at all points of observation. At the same time, not only

maps of a change of the parameter of interest to us at the site of the field are compiled, but also maps reflecting errors made during the mapping. "Kriging" is actually intended to express more complex terms, such as "assessing the best linear place of a point without change" or "moving average versus better weight."

Models based on various methods of the mean value are associated with a point estimate close to the value of the variable included in the map. Here it is assumed that the influence of distant points is less than the influence of nearby points.

The most elementary procedure of kriging allows to substantiate some conclusions about the probabilistic area of the structure displayed on the map.

The study of observations is carried out as the implementation of the variance of differences, which depend only on the state between the points of observation and the mathematical expectation of the differences at any two points equals zero.

The degree of variability of a variable in space can be expressed by means of a variogram. If the form of the semivariogram is known, then it is possible to determine the value of the parameter at any point in the area under consideration. Here two maps are made: the first is based on the parameters themselves at individual points (wells) and is the best among the previously described configurations of parameters included in the map. And the second is a map error, and points to the reliability surface, which expresses the accuracy of the estimate.

Kriging in order to find the optimal set of weights, assess the surface at points different from the test points, uses information from semi-variograms. Since the semi-variogram performs the function of the distance between observations, the weights change in accordance with the geographical location of the test points.

Unlike conventional mapping methods, kriging has statistically optimal properties. Most importantly, this method provides measurements of surface errors described by contour lines. In general, the practical application of kriging for any question posed becomes possible only with the help of computer technology, because in order to characterize the change of a regionized variable at any site, it should be re-evaluated for different points. Kriging's analysis is already included in current programs.

Thus, the developed methodology is implemented on the basis of a special algorithm and program and includes the following aspects:

- the distribution of the geological oil reserves, taking into account the values of parameters for wells;
- distribution of oil production throughout the area of the exploited wells;
- maps of the distribution of residual oil reserves in the area.

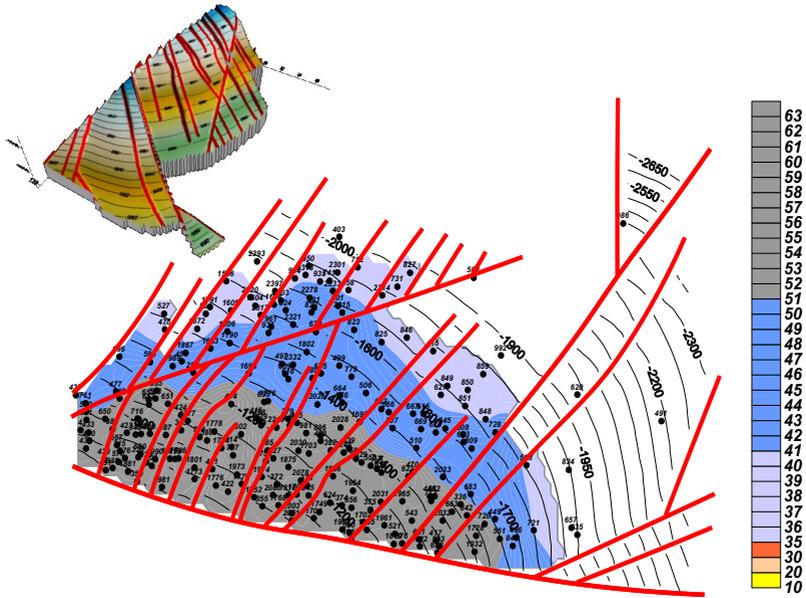


Figure 1. Distribution maps of geological reserves of the KS2 zone of the Oil Rocks field (V block).

The distribution maps of the geological reserves of the KS2 zone of the Oil Rocks field (block V) were compiled. As can be seen from the map, the main reserves are produced on the wing (Figure 1).

And recoverable oil reserves were recalculated and analyzed using evolutionary models and the Monte Carlo method (Table 1) [1, 2, 4, 5].

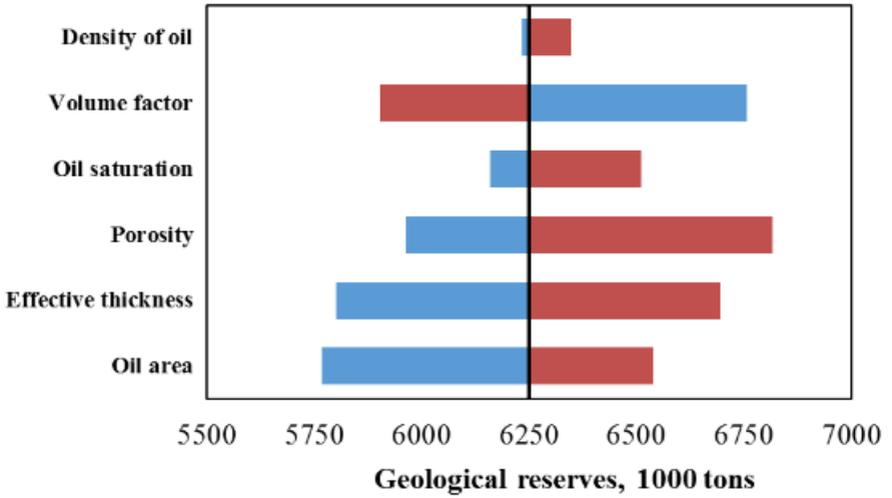
Table 1

Comparative Analysis Table for Recalculated Reserves

Zone	Category	The first recoverable reserves represented by 6GR	First recoverable reserves, calculated based on evolutionary modeling	The first recoverable reserves, calculated by the Monte Carlo method
Normalized values for the V tectonic block of the Oil Rocks field				
VI	A+C1	0,066	0,062	0,065
VII	A+B+C1	0,150	0,145	0,149
VIIa	A+C1	0,174	0,158	0,172
IX	A+B+C1	0,299	0,289	0,296
X	A	1,000	1,000	1,000
SP	A	0,699	0,672	0,697
NKP	A	0,699	0,719	0,700
KS2	A	0,157	0,146	0,156
PK1	A	0,402	0,388	0,403
Total		3,645	3,579	3,638

Above the reservoir parameters that affect the results, sensitivity analyzes were performed, which plays a large role in determining risks. By focusing the results obtained in the sample below (in the Tornado diagram), a sensitivity analysis of the parameters was carried out (Figure 2). Sensitivity analysis refers to the study of the extent to which the parameters affect the simulation results. As can be seen from the Tornado diagram, the main parameters affecting the degree of accuracy of the estimated reserves are the oil area, volume factor, porosity and effective thickness. Geological risks cannot be assessed only on the basis of the Tornado chart. The geological risk assessment was carried out based on the results from the chart (Figure 2). The matrix determined the relationship between the degree of accuracy of the estimated reservoir and fluid parameters and the geological risks, as well as the class to which the parameters relate. Geological risks were assessed at three levels (low, medium and higher) [3].

As can be seen from the matrix, the porosity in the field was poorly studied and evaluated as a parameter with an average level of risk. Therefore, it is proposed to clarify the marked parameter on the site.



■ Maximum ■ Minimum

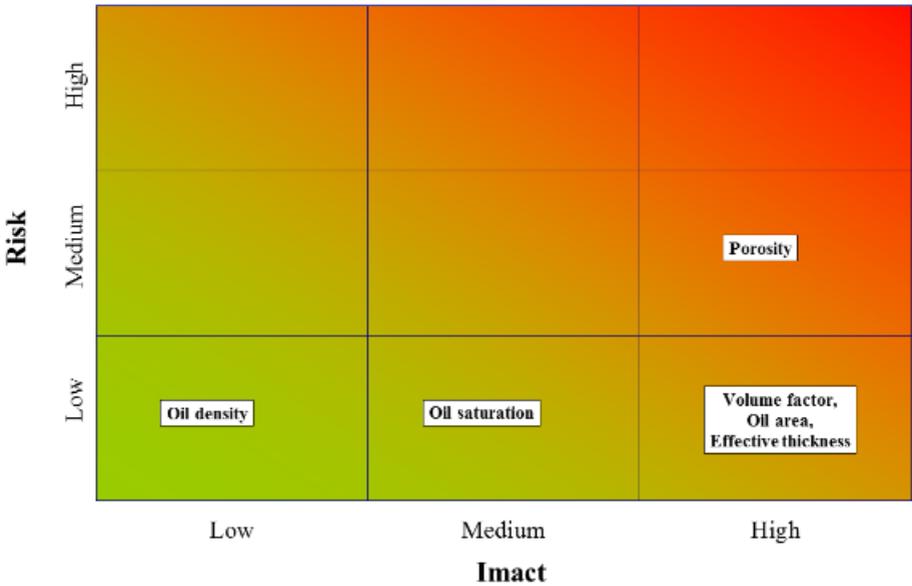


Figure 2. Tornado diagram and Risk Assessment Matrix

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改进的计算配电网电损规范值的算法
**IMPROVED ALGORITHM FOR CALCULATING
THE NORMATIVE VALUE OF ELECTRICITY LOSSES
IN DISTRIBUTION NETWORKS**

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注解。提出了一种基于组合方法确定电压为6-35kV的配电网中电能技术损耗(EP)规范值的改进算法。给出了用于计算损耗标准EP的框图。该算法的软件实现在实验POTERI V1.1:SETI,REG10PVT软件包的VES软件模块中执行。

关键词: 电力损耗, 软件模块, 标准电力损耗。

Annotation. *An improved algorithm for determining the normative value of technical losses of electrical energy (EP) in distribution electric networks with voltage of 6–35 kV, based on a combined approach, is presented. A block diagram for calculating the loss standard EP is presented. The software implementation of the algorithm is performed in the VES software module of the experimental POTERI V1.1: SETI, REG10PVT software package.*

Keywords: *electric power losses, software module, standard electric power losses.*

Introduction

Estimation of the normalized value of losses EP is an essential condition for identifying areas of the distribution electrical network (DEN) with non-electrical consumption - embezzlement EP. Accounting for and analysis of EP losses is very important for network organizations, since the level of EP losses influences the justification and establishment of regional EP tariffs. And an increase in the efficiency (accuracy and reliability) of computational methods contributes to obtaining an outcome that is acceptable for practical purposes with high reliability.

Characteristics of the algorithm for calculating the loss rate of EP and its program implementation

On the basis of the expressions given in [1], a refined or improved algorithm for calculating the normative values of EP losses in distribution electric networks is constructed and structured. This methodology is based on the combined principle of calculating the technical component of EP losses based on the optimal weight combination of deterministic and stochastic methods with a confidence level of up to 0.9975 [2].

We give an expression to determine the weighted average of the relative error of the total technical loss EP in the following form:

$$\delta_{mexh} = \delta_{cp\epsilon z} = \frac{\delta_n \Delta W_{назр} + \delta_x \Delta W_x}{\Delta W_{назр} + \Delta W_x} = \frac{\Delta W_{назр} \left(\delta_n + \frac{\delta_x}{k} \right)}{\Delta W_{назр} \left(1 + \frac{1}{k} \right)} = \frac{\left(\delta_n + \frac{\delta_x}{k} \right)}{\left(1 + \frac{1}{k} \right)}, \quad (1)$$

where $k = \Delta W_{назр} / \Delta W_x = [1 \div 10]$, than

$$\delta_{mexh} = \frac{k\delta_n + \delta_x}{k+1}, \quad \Delta W_x \neq 0. \quad (2)$$

The value of the weighted average of the relative error of technical losses is determined by the actual ratio of the load loss EP and idling loss, calculated in a deterministic or probabilistic-statistical way.

We present an algorithm for calculating the standard value of the loss of EP, taking into account losses from leakage currents.

In normal power consumption, the reported losses of EP can be represented as follows:

$$\begin{aligned} \Delta W_{отч} &= \Delta W_{yn} + \Delta W_n + |W_{н\acute{o}.м\acute{e}тp}| = \Delta W'_{yn} + \Delta W_x + \Delta W_n \pm W_{н\acute{o}.м\acute{e}тp} \\ &= \Delta W'_{yn} + \Delta W'_{м\acute{e}тp} \pm W_{н\acute{o}.м\acute{e}тp} = \Delta W'_{м\acute{e}тp} \pm \Delta W_{н\acute{o}.м\acute{e}тp}. \end{aligned} \quad (3)$$

ΔW_{yn} – semi-permanent loss of EP; ΔW_n – load loss (variable) EP; $\Delta W_{м\acute{e}тp}$

– technical loss of EP in network elements; $\Delta W_{н\acute{o}.м\acute{e}тp}$ – metrological unbalance.

In expression (1), the no-load losses of EP transformers (autotransformers) are separated from conditionally permanent losses EP, which, together with the load losses, are combined by designation of calculated technical losses with a stroke

$$(\Delta W_x + \Delta W_n) = \Delta W'_{м\acute{e}тp}.$$

Parameter of conditionally permanent losses $EP \Delta W_{\text{yn}}^/$, independent of the load, includes the following components: corona losses for lines of 110 kV and above; losses in shunt reactors, static thyristor and synchronous compensators, capacitor batteries; losses in valve arresters and surge suppressors; losses in high-frequency connection attachments; cable insulation loss; losses due to leakage currents on insulators of power lines; EP consumption for own needs, etc. [3].

As applied to networks of 6–35 kV, it should be noted that typical conditionally permanent losses of EP are mainly the no-load losses of transformers (autotransformers), as well as losses in cable insulation and losses from leakage currents on insulators of power transmission lines. In this case, the standard loss of EP will include the technical component (load and conditionally permanent losses) and losses due to inaccuracy of the measuring system and measurements. Then:

$$\Delta W_{\text{норм}} = \Delta W_{\text{техн}}^{\text{расч}} + \delta W \quad \text{или} \quad \Delta W_{\text{норм}}^{\%} = \frac{\Delta W_{\text{техн}}^{\text{расч}} + \delta W}{W} \cdot 100\% \quad (4)$$

where $\Delta W_{\text{техн}}^{\text{расч}}$ – the actual value of technical losses of EP, determined taking into account measures to reduce losses of EP; δW – the largest allowable positive value of metrological unbalance and the allowable value of commercial losses; $\Delta W_{\text{норм}}^{\%}$ – EP loss rate in%.

Further, in algorithmic expressions we take $\Delta W_{\text{техн}}^/ \text{расч}$ as the calculated value determined in a combined way based on the weight combination of the deterministic (program module REG10PVT [4]) and probabilistic-statistical (program module SETI [4]) methods

$$\Delta W_{\text{техн}}^/ \text{расч} = (\Delta W_{\text{дет}} \cdot \eta + \Delta W_{\text{вс}} \cdot \alpha) \quad (5)$$

The boundaries of the range of reliability of technical losses EP from the calculated value $\Delta W_{\text{техн}}^/ \text{расч}$ will be determined taking into account the conditionally permanent losses:

$$\Delta W_{\text{техн}}^{\text{min}} = (1 - \delta_{\text{техн}}) \cdot \Delta W_{\text{техн}}^/ \text{расч} + \Delta W_{\text{yn}}^/; \quad \Delta W_{\text{техн}}^{\text{max}} = (1 + \delta_{\text{техн}}) \cdot \Delta W_{\text{техн}}^/ \text{расч} + \Delta W_{\text{yn}}^/ \quad (6)$$

The value of the weighted average of the relative error of technical losses $\delta_{\text{техн}}$ is determined by the expression (1).

Then, taking into account the parameter μ of EP accounting error (0.3–0.5%) [5] for average conditions, assuming the allowable amount of undercounting of EP $\mu \cdot W$, the standard-permissible limits for undercounting of EP losses are written in

$$\Delta W_{\text{норм}}^{\text{min}} = \Delta W_{\text{техн}}^{\text{min}} - \Delta W_{\text{нб.мет}} = (1 - \delta_{\text{техн}}) \cdot \Delta W_{\text{техн}}^/ \text{расч} + \Delta W_{\text{yn}}^/ - \mu \cdot W; \quad (7)$$

$$\Delta W_{\text{норм}}^{\text{max}} = \Delta W_{\text{техн}}^{\text{max}} + \Delta W_{\text{нб.мет}} = (1 + \delta_{\text{техн}}) \cdot \Delta W_{\text{техн}}^/ \text{расч} + \Delta W_{\text{yn}}^/ + \mu \cdot W \quad (8)$$

Estimated allowable underreporting EP will be no more than:

$$\delta W = \Delta W_{\text{норм}}^{\max} - \Delta W_{\text{техн}}^{\min} = (1 + \delta_{\text{техн}}) \cdot \Delta W_{\text{техн}}^{\prime \text{расч}} + \Delta W_{\text{yn}}^{\prime} + \mu \cdot W -$$

$$- ((1 - \delta_{\text{техн}}) \Delta W_{\text{техн}}^{\prime \text{расч}} + \Delta W_{\text{yn}}^{\prime})$$

или

$$\delta W = 2\delta_{\text{техн}} \Delta W_{\text{техн}}^{\prime \text{расч}} + \mu \cdot W \quad (9)$$

The maximum allowable amount of undercounting of losses EP - metrological and calculated unbalance is equal to:

$$\delta W = \Delta W_{\text{норм}}^{\max} - \Delta W_{\text{техн}}^{\min} = (2\eta \cdot \delta_{\text{техн}} + \mu) \cdot W \quad (10)$$

Note that the expression for calculating the maximum allowable amount of undercounting of losses EP is identical with the expression obtained without taking into account leakage currents [1].

As a result, the calculated loss standard EP for networks with voltage of 6–35 kV is determined by the compressed expression:

$$\Delta W_{\text{норм}} = \Delta W_{\text{техн}}^{\prime \text{расч}} + \Delta W_{\text{yn}}^{\prime} + (2\eta \cdot \delta_{\text{техн}} + \mu) \cdot W \quad (11)$$

$$\Delta W_{\text{норм}} = \Delta W_{\text{техн}}^{\text{расч}} + (2\eta \cdot \delta_{\text{техн}} + \mu) \cdot W \quad (12)$$

As a result, we obtained the value of the standard loss, expressed in terms of the value of the total estimated loss EP and leave in the EP to the network. Let us give expression (12) to the form, where the value of the loss standard EP is determined through the parameter recorded in the official statements - the release of EP to the network W and the calculated variable coefficients:

$$\Delta W_{\text{норм}} = (\eta W + \Delta W_{\text{yn}}^{\prime}) + (2\eta \cdot \delta_{\text{техн}} + \mu) \cdot W = \psi + (2\eta \cdot \delta_{\text{техн}} + \mu) \cdot W \quad (13)$$

Under normal EP conditions, the following condition must be met:

$$\Delta W_{\text{отч}} \leq W_{\text{норм}} = \Delta W_{\text{техн}}^{\text{расч}} + \delta W \quad (14)$$

The presence of theft is indicated by the excess of the reported EP loss of the calculated standard value.

Figure 1 shows the block diagram of the algorithm for determining the standard value of EP losses based on a combined approach, taking into account losses from leakage currents.

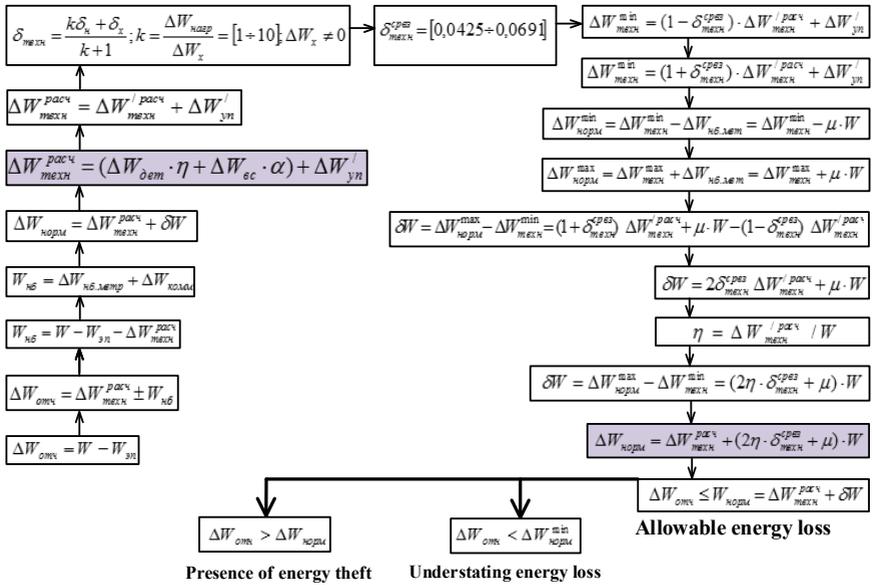


Figure 1. Block diagram of an improved algorithm for calculating the standard value of losses EP based on the combined approach, taking into account losses from leakage currents

The possibility of calculating the standard value of losses EP by the improved algorithm (except for losses from leakage currents), which is based on the calculation of the weighted average value of technical losses EP [2], is implemented in the software module VES (Figure 2).

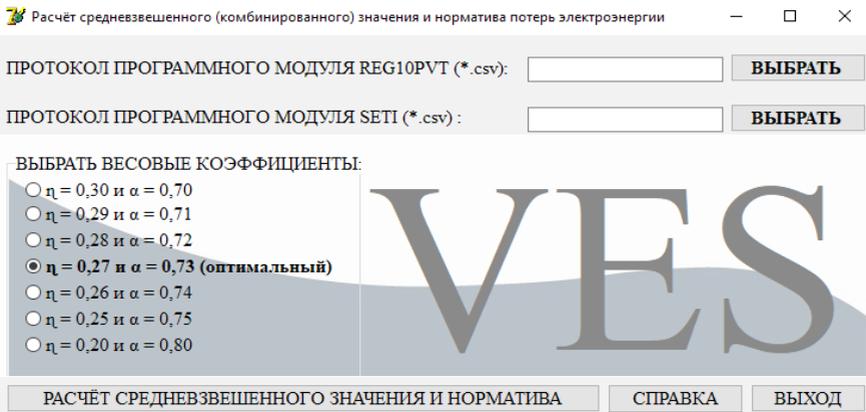


Figure 2. The working window of the VES software module

As a result of the calculations, the resulting protocol is formed, the form of which is shown in Figure 3.

----- ПРОГРАММА "POTER1" (ПРОГРАММНЫЙ МОДУЛЬ "VES")-----
(версия 2.2)

ПРОТОКОЛ

расчёта средневзвешенного (комбинированного) значения и норматива потерь электроэнергии

Отпуск ЭЭ в сеть, кВт·ч	:	381452,00
Суммарные потери ЭЭ (детерминированный метод), кВт·ч	:	7204,25
Суммарные потери ЭЭ (стохастический метод), кВт·ч	:	8028,00
Вес детерминированного метода, (1-k1)	:	0,27
Вес стохастического метода, k1	:	0,73
Средневзвешенное (комбинированное) значение потерь ЭЭ, кВт·ч	:	7805,59
Доля средневзвешенного значения потерь от отпуска ЭЭ, %	:	2,05
Средневзвешенная относительная погрешность суммарных техн. потерь ЭЭ	:	0,075
Доверительный интервал технических потерь ЭЭ, кВт·ч	:	(7220,17 - 8391,01)
Норматив отчётных потерь ЭЭ, кВт·ч	:	10883,69
Доля норматива отчётных потерь от отпуска ЭЭ, %	:	2,85
Доверительный интервал норматива отчётных потерь ЭЭ, кВт·ч	:	(5312,91 - 10298,27)

РАСЧЕТ ВЫПОЛНЕН

Figure 3. The form of the protocol for calculating the weighted average value and the standard value of technical losses of EP

In the presented algorithm (Figure 1), such conditionally permanent losses EP as losses in the insulation of power cables are taken into account depending on the nominal voltage, cross-sectional area and cable length and are determined in accordance with the tabular data (table 1) in the absence of information from the manufacturers equipment [3].

Table 1.
Specific EP loss in cable insulation

Section, mm ²	Specific loss of EP in cable insulation, thousand kWh/km per year, at rated voltage, kV			
	6	10	20	35
10	0,14	0,33	-	-
16	0,17	0,37	-	-
25	0,26	0,55	1,18	-
35	0,29	0,68	1,32	-
50	0,33	0,75	1,52	-
70	0,42	0,86	1,72	4,04
95	0,55	0,99	1,92	4,45
120	0,60	1,08	2,05	4,66
150	0,67	1,17	2,25	5,26
185	0,74	1,28	2,44	5,46
240	0,83	1,67	2,80	7,12

Note - The loss values given in the table correspond to a year with the number of days 365. When calculating losses in a leap year, the coefficient $k = 366/365$ is used.

Losses of EP from leakage currents in power line insulators are taken into account in the same way, only the value sought will no longer be determined by the cross-sectional area of the wires, but by the region of the electrical network location in accordance with Table 2 [3].

Table 2.
Specific annual losses of EP from leakage currents on insulators of power lines

Region number	Specific loss of EP from leakage currents on insulators of power transmission lines, thousand kWh/km per year, at voltage, kV			
	6	10	20	35
1	0,21	0,33	0,64	0,69
2	0,22	0,35	0,68	0,73
3	0,28	0,45	0,88	0,95
4	0,31	0,51	1,00	1,07
5	0,27	0,44	0,87	0,92
6	0,22	0,35	0,68	0,73
7	0,16	0,26	0,51	0,55

Note - The loss values given in the table correspond to a year with the number of days 365. When calculating losses in a leap year, the coefficient $k = 366/365$ is used.

Conclusions and results

The generated and refined algorithm allows with acceptable for practical purposes the accuracy and given reliability to determine the magnitude of the standard loss of EP and permissible limits by applying a combined approach, thereby compensating for the shortcomings of the use of separate deterministic or stochastic methods for calculating the loss of EP.

The method allows you to calculate the loss ratio of EP with high accuracy, taking into account the found technical losses $\Delta W_{\text{тех}}^{\text{пачу}}$ through the parameter recorded in the official reporting - EP release W .

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研究轧制对有色合金纳米结构形成的影响

**STUDYING THE EFFECT OF ROLLING ON THE FORMATION OF
NANOSTRUCTURES IN COLORED ALLOYS**

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注解。本报告介绍了一种具有纳米结构的金属板材的新技术。通过施加由螺旋辊产生的严重塑性变形获得纳米结构。在这项工作中，研究了在螺旋辊和纵向楔形轧机(LWM)中轧制过程中工件的应力 - 应变状态(SSS)。有限元方法和MSC.SuperForge程序获得了定量数据，建立了SSS分布的基本规律，螺旋轧制条带和PKS轧制过程中的温度，具有不同数量的过度和单一还原。已经在实验室条件下测试和测试了具有纳米结构的钛(VT1-0)和铝(AD31)合金的合理轧制技术。

关键词：铝合金，纳米结构，轧制，数值模拟，应力和应变强度，单一还原。

Annotation. *This report presents a new technology for sheet metal with nanostructure. The nanostructure is obtained by applying severe plastic deformation developed by a helical roller. In this work, the stress-strain state (SSS) of the workpiece during rolling in a spiral roller and a longitudinal wedge mill (LWM) was investigated. The finite element method and the MSC.SuperForge program obtained quantitative data and established the basic laws of the distribution of SSS, the temperature during the rolling of strips in helical rolls and PKS, with a different number of aisle and single reduction. A rational rolling technology for titanium (VT1-0) and aluminum (AD31) alloy with nanostructure has been tested and tested under laboratory conditions.*

Keywords: *aluminum alloys, nanostructure, rolling, numerical modeling, intensity of stresses and strains, single reduction.*

Currently, new methods of intense plastic deformation (IPD) have been developed, which allow, through deep fragmentation of grains, to obtain a new nanocrystalline structure with high strength properties. [1]. It has been established that using known IPD methods it is difficult to manufacture rolled sheets with a nanograin structure. Therefore, in this work, to obtain high-quality sheet blanks with a nanocrystalline structure without significant changes in their sizes, we propose a tool with rolls with screw-like working surfaces [2], and for rolling strips from these blanks a longitudinal wedge mill (LWM) [3].

The tool for rolling metals contains upper and lower rolls with helical working surfaces. In this case, the opposing protrusions and depressions of the upper and lower rolls are made along the left and right helix, respectively.

Longitudinal wedge mill for rolling sheets of steel and alloys contains, electric motors, gearboxes, gear stands, universal spindles, couplings, stands with work and back-up rolls. At the same time, in the first three stands there are two, and in the last two stands, four support rolls. Rotation of the work rolls decreasing in the direction of rolling is carried out through bearing stands by five gear motors with angular speed $\omega = v \cdot R$ (where v is the rolling speed in each mill stand; R is the radius of the work rolls in each mill stand). While adjusting the distance between the work rolls produce a single worm pressure mechanisms located above and below the camp frame and bearing stands.

It should be noted that the work rolls in each stand have a constant diameter, and in consecutive stands the diameter of the rolls decreases in the direction of rolling. At the exit, a thin strip is cut or rolled into rolls.

For the development of the technological process allowing to evenly distribute the accumulated strain, i.e. To obtain strips of titanium alloy VT1-0 and aluminum alloy AD31 of high quality, as well as to determine the optimal value of a single reduction, the stress-deformable state (SSS) of the workpiece was studied during rolling in a spiral roller, as well as on LWM.

To calculate the SSS, a specialized standard program MSC.Super Forge was used. A three-dimensional geometric model of the workpiece and rolls was built in the Inventor CAD program and imported into the CAE program MSC.Super-Forge. When creating a finite element model of the workpiece and the rolls, a three-dimensional CTETRA (four-node tetrahedron) volume element was used. The process calculation time was 30-40 minutes on a Pentium Duo computer with a clock frequency of 3.4 GHz and 2 GB RAM.

For the calculation, we used rectangular in cross section samples of size $6 \times 100 \times 200$ mm. From the material database, the material of the rolled stock VT1-0 or AD31 was assigned with a temperature range of deformation of, respectively, 500-1200 °C or 20 - 450 °C. To simulate the plasticity of the material, the Johnson-Cook elastoplastic model was chosen. Tool material, density and thermal

properties, which the program assigned by default, was selected as the material for the rolls. The rolling process takes place at room temperature, therefore the initial temperature of the rolls is assumed to be 20 °C. The contact between the roller and the workpiece is modeled by Coulomb friction, the friction coefficient was adopted 0.3.

Rolling titanium alloy VT1-0 carried out according to the following mode: heating to a temperature of 850 °C, rolling four passes in a spiral roller to a thickness of 5.9 mm, heated at a temperature of 950 °C, rolling on LWM to a thickness of 1.5 mm.

The rolling of the aluminum alloy AD31 was carried out according to the following mode: heating to a temperature of 380 °C, rolling four passes in a spiral roller to a thickness of 5.9 mm and rolling at a temperature of 100 °C on LWM to a thickness of 1.5 mm.

Launched the program "MSC.SuperForge". The step method was calculated components of the strain tensor and stress, the temperature distribution over the volume of the workpiece.

Under laboratory conditions, we rolled the strips of titanium (VT1-0) and aluminum (AD31) alloy in a spiral roller and LWM.

Titanium (VT1-0) and aluminum (AD31) alloy was tested after processing in a spiral roller and LWM on an Instron 5882 machine at a deformation rate of 10^{-3} s^{-1} .

Before mechanical testing, aluminum samples were subjected to heat treatment consisting of quenching and subsequent aging. The heating temperature for quenching was 450 °C, holding at this temperature for 2 hours, cooling in oil. Aging was carried out at a temperature of 120 °C for 5 h.

The metallographic analysis was performed using an energy-dispersed JNCA-ENERGY spectrometer (England) installed on a JEOL electron probe microanalyzer with an accelerating voltage of 25 kV. The range of magnifications of the device JEOL from 40 to 40000 times. The structural features of the deformed samples were also examined using a JEM-2100CX electron transmission microscope (TEM) at 200 kV accelerating voltages.

Quantitative analysis of the mechanical properties and parameters of the defective substructure was carried out by standard methods. The sections for metallographic examination were prepared according to the traditional method on grinding and polishing wheels. The grain size (D_3 , μm) was determined by the secant method (by measuring ~ 300 grains) under the assumption that the grains have a spherical shape, based on the average chord (X) according to the formula: $D_3 = 4 / \pi \cdot X$.

The process of deformation in a spiral roller, can be divided into two stages. In the first stage, the protrusion of the upper roll bends the strip towards the depression of the lower roll. In the second stage, due to the development of a torsional stress, macro-shear deformation occurs under the inclined surfaces of the protrusions or depressions of the rolls.

Based on the results of numerical simulation, it was established that:

- the seizure of the workpiece with helical rollers leads to the formation of a minimum-size tensile σ_{11} and σ_{22} in the deformation zone, as well as compressive σ_{33} stresses;

- the further rolling of the helical rolls lead to the formation of deformation in the focus area, which are mainly compressive in magnitude of normal stresses;

- at the initial moment of rolling, the intensity of stresses and strains are localized in the contact zones of the workpiece with the working surfaces of the protrusions of the rolls, with an increase in a single reduction leads to the transfer of stress and strain intensities from the contact zones to the zones of the strip and the roll bottoms;

- in the process of rolling the helical rollers, the zones of contact of the tool with the strip are cooled, while in the zones of action of the bending deformation the temperature rises slightly;

- in the second, third and fourth rolling passes in helical rolls, the magnitudes of the intensity of stresses and strains increase under the inclined sections of the protrusions and hollows of the rolls;

- the developed method of rolling the strip in a spiral roller, provides intense alternating deformation of the strip with a slight reduction;

- the maximum possible shift is realized when the ratio of the width of the protrusion to the width of the depression is 0.8 ... 0.9.

The calculation and analysis of the SSS billet during rolling of titanium (VT1-0) and aluminum (AD31) alloys on LWM shows that:

- during the seizure of the workpiece by the first, second, third, fourth, and fifth LWM stand, small in magnitude tensile σ_{11} , compressive σ_{33} and σ_{22} stresses occur in the deformation zone;

- further rolling of the billet in LWM leads to the formation of deformation in the focus mainly of compressive normal stresses;

- when rolling in the first stand of LWM, the intensity of stresses and strains are localized in the zones of metal capture by rolls, and with an increase in compression, the values of the intensity of stresses and strains increase in the center and along the edges of the deformable workpiece;

- continuous rolling of the billet in subsequent LWM stands allows you to gradually transfer the areas of concentrated deformation from the center to the zone of contact of the rolls with the rolled billet;

- gradual transfer of areas with localization of deformation from the center to the surface leads to a more uniform distribution of accumulated deformation;

- rolling in LWM leads to intensive cooling of the sections of the bands in the zone of contact of the metal with the roller;

- the most uniform distribution of the total intensity of stresses and strains over

the height and length of the rolled strip was obtained by rolling with a single compression in the first stand of 20%, in the second stand of 18%, in the third stand of 13%, in the fourth stand of 15%; in the fifth stand 12% .

It should be noted that under any conditions of rolling titanium (VT1-0) and aluminum (AD31) alloys in a spiral roller and LWM most of the plastic zone is under a comprehensive non-uniform compression. At the same time, in some conditions, tensile stresses of small size appear on a small portion of the strips, which are located under the inclined working surfaces of the protrusions and depressions of the helical rolls, as well as on the edges of the strips rolled in the LWM.

Using the obtained results on the SSS distribution over the cross section of the workpiece during rolling in a spiral roller and on LWM, we developed a technology for manufacturing bands with nanostructures. This technology was tested in the laboratory.

Rolling bands on the mill with a spiral roller and LWM carried out in the following modes. A billet with a thickness of 8 mm of titanium alloy VT1-0 or aluminum alloy AD31 was sequentially heated and heated, respectively, to a temperature of 850 or 380 ° C. After that, the heated billet rolled with four, eight and twelve passes in a spiral roller to a thickness of 7.4 - 7.8 mm. Next, the deformed billet of titanium alloy VT1-0 or aluminum alloy AD31 was heated, respectively, to a temperature of 950 or 100 ° C and rolled with optimal squeezing modes on LWM to a thickness of 1.5 mm.

In the initial state, the billet of titanium (VT1-0) and aluminum (AD31) alloy had a non-uniform microstructure. This structure consisted of large non-recrystallized grains with an average size of, respectively, ~ 56 and ~ 87 microns in the longitudinal and ~ 56 and ~ 98 microns in the transverse directions. Fine grains ~ 14–18 μm in size were located along the boundaries of these grains.

The study of the microstructure of the aluminum alloy AD31 showed that rolling in a spiral roller at a temperature of 380 °C in four passes leads to a strong fragmentation of grains into thin shear bands with a width of about 645-850 nm. Transverse boundaries form inside the bands and multiple microtwinning develops. As a result, the structure is heavily crushed. During the study, it was found that after four passes in the studied alloy an anisotropic submicrocrystalline state is formed - the sizes of grains in different directions differ by 3-4 times: 5.8 - 6.3 μm in the parallel plane and 0.94 ÷ 1.15 μm in the plane perpendicular to the directions of rolling. In our opinion, this is a consequence of the characteristic fields of deformation by bending and torsion under pressure of high anisotropy of the fields of displacements and rotations.

A different picture is observed in the alloy AD31 during the rolling of helical rolls with eight passes. It was found that rolling in eight passes at a temperature of 380 ° C leads to the division of the strip structure into deformation, intermedi-

ate and microbands consisting of subgrains separated by small and large angle boundaries. Consequently, with an increase in the number of passes, the microbands are fragmented into pieces due to the formation of shear bands, an increase in the proportion of high-angle boundaries is observed, and a mixed structure is formed. At the same time, the deformation of the workpieces at a temperature of 380 °C in spiral-shaped rollers with eight passes leads to the formation of a uniform and equiaxial structure in the longitudinal and transverse sections of the billet. From the microstructure it can be seen that further grinding of the grain-subgrain structure occurs. At the same time, in the longitudinal section of the grain billet, the substructures are definitely stretched along the bending direction, and in the transverse section - have an equiaxial shape with an average size of about 0.68 - 0.74 μm . The dislocation density is very high and it was not possible to calculate its value from the structure images.

Thus, when rolling with eight passes, a further evolution of the structure occurs, namely, the number of lattice and grain-boundary dislocations is reduced, clear extinction contours appear at the grain boundaries, i.e. all signs of dynamic recovery and dynamic recrystallization by a continuous mechanism are manifested. As a result of these processes, an ultra fine-grained (UFG) structure consisting of crystallites, 0.68 - 0.74 nm in size, is formed in the material.

Consequently, the relaxation of the elastic energy during rolling in spiral-shaped rolls with eight passes in the alloy AD31 is carried out by two mechanisms — fragmentation and dynamic recrystallization.

It should be noted that with an increase in the number of rolling passes in wavy rolls, the grinding of the structure occurs not only by twinning, but also by the formation of cellular substructures as a result of the development of dislocation slip processes. At large degrees of accumulated deformation, the boundaries of the former twins and subgrains are transformed into high-angle ones.

After rolling by twelve passes in spiral-shaped rolls in an aluminum alloy AD31, an inhomogeneous grain-subgrain structure is formed. Grains and subgrains are unequal in shape and elongated along the direction of bending and torsion. The average size of the elements of the grain-subgrain structure in the transverse and longitudinal section of the workpiece is $0.125 \pm 0.04 \mu\text{m}$. The diffraction pattern shows that the nanocrystalline structure contains predominantly high-angle grain boundaries with a nonequilibrium structure, leading to an increase in the energy of grain boundaries.

The microstructural heterogeneity in the bulk of the blanks of the aluminum alloy AD31 is significantly reduced in the subsequent plastic deformation by rolling in LWM. Rolling with a total reduction to 90% leads to the formation of a microstructure with an average characteristic size of almost equiaxial elements = $95 \pm 20 \text{ nm}$, which corresponds to the nanostructured state.

Naturally, rolling on LWM at a temperature of 100 °C provides additional

strain hardening. Annealing at 200 °C for one hour practically does not change the nature of the microstructure. The nanostructured state of the aluminum alloy AD31 is preserved. Only the average size of the elements of the grain-subgrain structure increases slightly, reaching $0.125 \pm 0.03 \mu\text{m}$. Increasing the temperature to 300 °C for the same duration initiates recrystallization processes. The growth of the average size of the grain-subgrain structure becomes more noticeable and is $0.145 \pm 0.01 \mu\text{m}$. The size of the subgrain after annealing at 400 °C is $0.180 \pm 0.045 \mu\text{m}$. After annealing at 450 °C, an increase in the grain size to $0.262 \pm 0.048 \mu\text{m}$ was observed, and after annealing at 500 °C, the structure of the aluminum alloy AD31 became fine-crystalline with an average grain size of $5.3 \pm 0.3 \mu\text{m}$.

Thus, after rolling in helical rolls with twelve passes and LWM in the aluminum alloy AD31, a relatively homogeneous, equilibrium nanostructure was formed with an average characteristic grain size of a subgrain structure less than 100 nm. This structure provides high static strength (σ_T - 275 MPa, σ_B - up to 295 MPa) and good ductility of aluminum strips made of AD31 alloy.

The study of the structure of the billet titanium alloy VT1-0 rolled helical rollers at a temperature of 850 °C showed that rolling with four and eight passes lead to uneven deformation of the metal grains. As a result, an uneven elongated structure with a grain size of 3.9 - 15.9 μm is formed in the longitudinal and transverse sections of the workpiece.

Rolling in a spiral roller at a temperature of 850 °C with twelve passes causes inactive passage of dynamic recrystallization over the cross section of the workpiece, which leads to the formation of a plate structure with a cross-sectional size of the plates from 1.8 to 2.7 microns.

Further deformation in LWM at a temperature of 950 °C with optimal single reductions facilitates active dynamic recrystallization throughout the cross-section of the rolled strip, which leads to the formation of a globular fine-grained structure with a grain size of 0.2 - 0.6 μm .

Thus, the broach in spiral rollers and LWM at temperatures below and above T_{PP} allows you to get a globular fine-grained structure throughout the cross section of the workpiece.

On the basis of the conducted research, it can be concluded that the grinding of the microstructure of the titanium alloy VT1-0 is associated with the occurrence of dynamic recrystallization in the α and β phases. The driving force of spheroidization is to achieve an angle of 120 in the triple junction between the interfacial and intergranular boundary. During the deformation in the α -phase plates, the formation of transverse sub-boundaries occurs, at the same time the interphase boundaries are transformed from semi-coherent to non-coherent. At the points where the sub-boundaries reach the surface of the plates, grooves are formed, which is facilitated by the incoherence of the interfacial boundaries, since this results in the

activation of diffusion processes. With an increase in the degree of deformation, the misorientation of grain boundaries increases, and parts of the plates are able to shift relative to each other as a result of grain-boundary slippage. The process of spheroidization leads eventually to the formation of a globular structure.

Visual inspection of the surface of rolled sheets showed that the surface quality is good, there are no cracks. Deviations of the sheet thickness from the given 1.5 mm did not exceed 0.01 mm.

It is established that the mechanical properties of titanium (VT1-0) and aluminum (AD31) alloy subjected to rolling in a spiral roller and on LWM are significantly higher than the initial values. In particular, the temporary tensile strength σ_B increases by 15–20%, and the plasticity is one and a half times higher than the corresponding parameter of the initial samples. This combination of sufficient strength and good ductility opens up wide possibilities for the use of this material in practice.

Thus, our proposed method of processing titanium and aluminum alloys in a spiral roller and LWM improves the quality of the bands, reduces the labor intensity by 18–25%, increases the yield by 7–9%.

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用建模方法研究飞机机翼几何形状对气动过程的影响

**RESEARCH OF INFLUENCE OF AIRCRAFT WING GEOMETRY
ON AERODYNAMIC PROCESSES BY A MODELING METHOD**

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抽象。 在小型风洞中应用SolidWorks-2017 CAD程序复杂和物理建模来模拟建模的方法可视化并且根据平面机翼几何形状研究空气动力学轮廓的流动过程，从而提供飞机的稳定性和可控性。 物理建模的结果允许确认关于在机翼上使用主动管理界面的方便性的结论。

关键词：仿真建模，自然（物理）建模，飞机机翼，空气动力学轮廓，小翼，飞机机翼上的界面，可视化。

***Annotation.** The method of imitating modeling with application of the SolidWorks-2017 CAD program complex and physical modeling in the small-sized wind tunnel visualized and investigated the processes of flow of aerodynamic profiles depending on plane wing geometry providing stability and controllability of the aircraft. Results of physical modeling allow to confirm a conclusion about expediency of use of active management of an interface on a wing.*

***Keywords:** simulation modeling, natural (physical) modeling, aircraft wing, aerodynamic profile, winglet, interface on a plane wing, visualization.*

The problem of aviation safety is directly related to the problem of effective pilot training at the stage of training in the universities of civil aviation. The problem of vortex safety has now turned out to be particularly significant due to the intensive operation of heavy aircraft with reduced vertical separation rates.

The purpose of the work is to develop tools for simulation and physical modeling and to investigate the influence of the geometry of the wing on the operational properties of the aircraft.

The main cause of inductive resistance is the flow of air mass from the lower plane of the wing to the upper one. The wing of the classic design has a finite span, the overflow occurs at the end parts of the wing, where the end rope is formed, which also affects the lifting force. Lengthening the wing can reduce these effects. If wing lengthening in past generations of aircraft was 8-9, then in modern aircraft it was from 10 to 10.5. For the newly developed Russian medium-haul narrow-body aircraft of the new generation MC, this indicator is 11.5. For this reason, the MC-21 at cruising speeds without winglets will be more efficient than foreign analogues, since the presence of a supercritical carbon composite wing provides fuel efficiency in cruise flight [1].

In December 2017, the operation of another Russian aircraft Sukhoi Superjet 100 began, on which horizontal saberlets were installed (certification is expected in 2019). Two ends have a mass of 100 kg. They will allow reduce fuel consumption by at least 3%; improve runway performance (the presence of winglets are an obligatory requirement for London City Airport for aircraft due to the short runway); reduce fuel consumption [1].

However, a more technologically feasible and effective way is the use of aerodynamic wing tips. The tips allow you to achieve an optimal distribution of lift, increase the elongation of the wing, while its span is almost not changed. It should be noted that aerodynamic tips in flight create an additional bending moment on the power structure of the wing. This requires additional reinforcement of spars and increases the weight of the structure. Vertical tips increase the area of the side profile of the airframe, which reduces the value of the maximum side wind, at which it is possible to take off and land the aircraft. The shape of the tip affects the intensity of the end vortex, for example, on the Boeing 787, the wing tip, bent back (raked wingtip), is used. The greatest attention among all airframe units is paid to the wing, since it is the wing resource that determines the aircraft resource.

To develop an information model and conduct a simulation experiment, we used the SolidWorks-2017 CAD program complex [2,3].

3D modeling of the Boeing737-800 type aircraft and its wing (Fig. 1) has been completed. Models of three types of tips were created: blended winglet (standard ending), double feather, and Witcomb wings (Fig. 2, 3, 4).

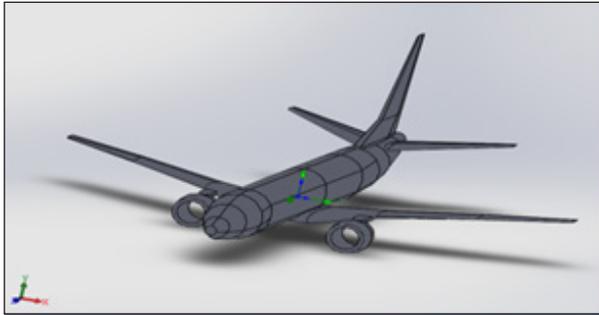


Fig.1 - 3D-model of the Boeing-737-800 without tips

An imitation experiment allowed to simulate the flow around a wing without a tip and if there are any tips. Different initial conditions varied, the geometry of the aircraft wing, the angles of attack.



Fig.2 - 3D model of the Boeing-737-800 with blended winglet tips

Boeing for aircraft B-737MAX has developed a new type of winglets - "double feather" (Split-tip)



Fig.3 - 3D-model of the Boeing-737-800 with Split-tip tips



Fig.4 - 3D-model of the Boeing-737-800 with the tips of "Witcomb wings"

When simulating the flow around a wing without a tip, the formation of a sufficiently powerful end rope (Fig.5) was revealed.

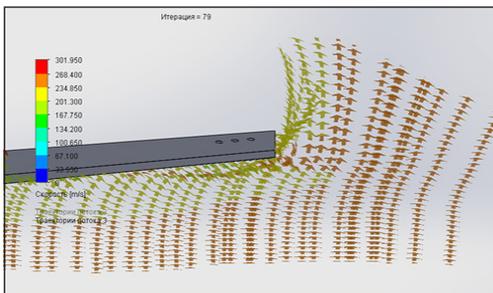


Fig.5 - Wrapping a wing model without a tip (angle of attack 4 degrees)

A significant decrease in the flow of air from the lower surface of the wing was observed during the testing of the blended winglet tip. But there is a significant deviation of air masses vertically along the tip (Fig. 6).

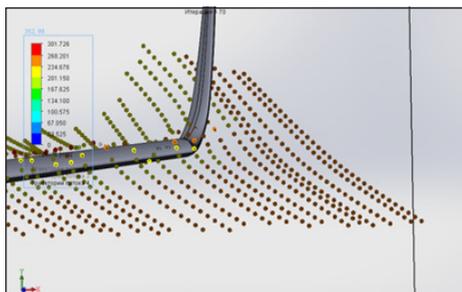


Fig.6 - Wrap around a wing model with a blended winglet tip (angle of attack 4 degrees)

The use of Whitcomb wings leads to a decrease in the vertical movement of air and overflow from the lower surface of the wing, but a harness at large angles of attack occurs outside the tip area (Fig. 7).

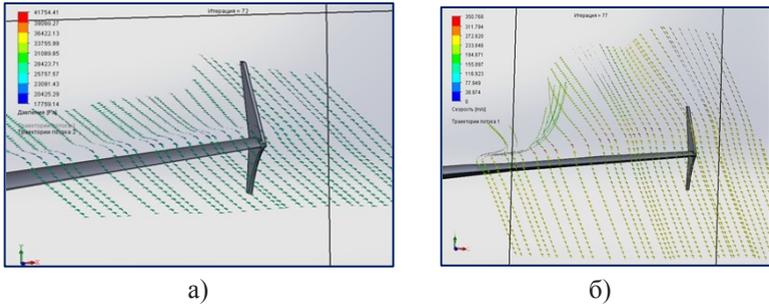


Fig. 7 - Wrap around the wing model with the tip of the “Whitcomb wings” (a - angle of attack 4 degrees; b - angle of attack 17 degrees)

A compromise is obtained using the “double feather” type ending, which combines the advantages of the above-mentioned types of ending, in particular, the flow of air and movement in the vertical direction removes the lower wing (Fig. 8).

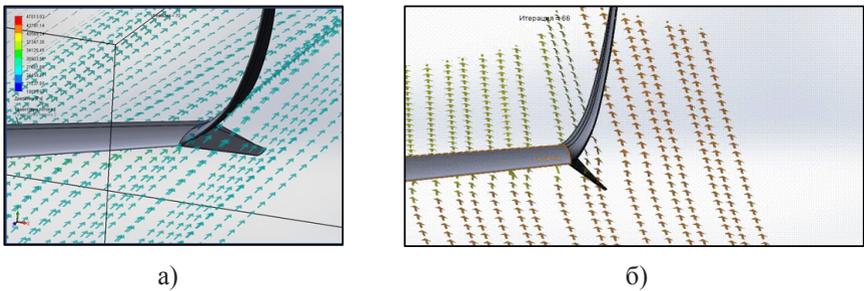


Fig.9 - Wrap around a wing model with a “double feather” tip (a - angle of attack 4 degrees; b - angle of attack 17 degrees)

The results of simulation modeling for calculating dynamic loads correspond to the theoretically expected ones: a double feather is the most advantageous at large angles of attack; The smallest friction force arises on the wings of the Whitcomb (but at the same time the lift force decreases).

Currently, the 2nd generation wing is being developed in the world, the main purpose of which is to reduce inductive resistance. In one of the options, it is proposed to use a pulsating air actuator (the air jet will be blown into the area of the air flow separation, increase the lifting force and reduce the inductive resistance). The second method is the use of active control of the air flow on the engine pylons, where the boundary layer breaks off at high angles of attack during takeoff

and landing of the aircraft. The third area is the use of adaptive wing technology, i.e. "Flexible trimming" (the aircraft is not controlled by deflecting the steering surfaces, but by bending the airfoil).

For experimental physical modeling and testing the effectiveness of the solutions proposed in the framework of the wing concept of the second generation aircraft, we created a compact wind tunnel of subsonic speeds of continuous action of an open type with a closed working part. The smoke channel method was used for visualization. Samples were models of a wing without a tip and a wing with a vertical tip.

The wingless model was used to investigate the role of the air flap. To this end, in the first case, a perforation of a plurality of holes was created on the lower edge of the wing model, and in the second case a through slot. In the course of the experiment, it was concluded that in order to obtain the expected result, the rate of purging should be comparable to the speed of the external flow and, probably, exceed it. However, in real flight practice this will require significant energy costs, and long slits in the wing can weaken its mechanical strength.

The second sample has holes for air supply to the boundary layer on the leading edge and on the upper surface of the wing behind the focus. Any air supply through the holes on the edge slowed down the flow of air, up to disruption of flow. The second hole arrangement was effective. When purging with low-pressure air flow with holes on the edge of the wing specimen with a tip, an increase in the speed of the air flow was recorded in the area where the stall was previously recorded. However, when high pressure air was applied, the effect of an air spoiler arose.

As a result of simulation using the SolidWorks-2017 CAD program complex, it was possible to visualize how the geometry of an aircraft wing affects the flow pattern of aerodynamic profiles and the flight performance to ensure the stability and controllability of the aircraft.

The results of physical modeling allow us to confirm the conclusion about the expediency of using active boundary layer control on the wing. But more promising should be considered the use of "flexible plating".

The practical significance of imitation and full-scale physical modeling, performed in accordance with the objectives of this study, is to create such information models, within which it is possible to visualize the flow processes of aerodynamic profiles by the gas flow, which, in actual aircraft flight, is impossible. The high degree of clarity of the results obtained is of great importance in the organization of the training process for the training of pilots and the retraining of aviation specialists [4]. Cognitive technologies are promising in the educational process and allow us to perceive information that is not visualized during the flight operation of an aircraft during full-scale physical experiments and simulation modeling.

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创建应用智能系统诊断神经病理学患者心理安全的基础知识
**BASICS OF CREATING AN APPLIED INTELLIGENT SYSTEM FOR
DIAGNOSING THE PSYCHOLOGICAL SAFETY OF PATIENTS WITH
NEUROLOGICAL PATHOLOGY**

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本文致力于基于模式识别，阈值和模糊逻辑的测试方法，容错非冗余无条件诊断测试，创建用于诊断神经病理学患者（IS DIPSIB）心理安全的应用智能系统的基础知识。和容错混合诊断测试。应用的IS DIPSIB是在智能工具IMSLOG和基于阈值和模糊逻辑的应用IS的基础上构建的。应用IS DIPSIB的应用将允许基于参数（特征）揭示患者的心理安全的各种规律性，所述参数（特征）确定患者的神经病理学的基本信念，做出诊断决定并使用图形证明它们，包括认知，工具。

关键词：应用智能系统，模式识别，规律性，决策，容错非冗余无条件诊断测试，混合诊断测试，阈值和模糊逻辑，认知工具，心理安全，耐力，心理健康，世界假设

Anotation. *The article is devoted to the basics of creating an applied intelligent system for diagnosing the psychological safety of patients with neurological pathology (IS DIPSIB), based on test methods of pattern recognition, threshold and fuzzy logic, fault-tolerant non-redundant unconditional diagnostic tests and fault-tolerant mixed diagnostic tests. The applied IS DIPSIB is constructed on the basis of the intelligent tool IMSLOG and the applied IS based on threshold and fuzzy logic. Application of applied IS DIPSIB will allow revealing various regularities of psychological safety of patients based on parameters (features) determining hardiness, psychological well-being, basic beliefs of patients with neurological pathology, making diagnostic decisions and justifying them using graphic, including cognitive, tools.*

Keywords: *applied intelligent system, pattern recognition, regularities, decision-making, fault-tolerant non-redundant unconditional diagnostic tests, mixed diagnostic tests, threshold and fuzzy logic, cognitive tools, psychological safety, hardiness, psychological well-being, world assumption.*

Introduction

The obviousness of the need to create intelligent systems (IS) in the field of medicine, psychology, biology, ecobiomedicine [1-13], etc. does not raise doubts. The problem to be solved is interdisciplinary, because timely qualitative diagnostics of a wide range of people requires the use of modern methods of biology, clinical psychology, psychiatry, sociology, genetics, ecology, as well as methods of discrete mathematics, mathematical logic, pattern recognition, reliability, soft computing, system analysis, statistics for the purpose of building an applied IS using new information technologies and cognitive tools.

The article is devoted to the creation of applied IS psychological safety diagnostics (DIPSIB), constructed on the basis of the IMSLOG intelligent tool (IT) [13], designed to revealing various kinds of patterns, decision making and their justification using graphical, including cognitive, tools. In addition, applied IS decision-making based on threshold and fuzzy logic in the field of medicine and psychology is used to create IS DIPSIB.

Problem Area Description

The relevance of diagnosing the psychological safety of patients, determined by a set of hardiness, psychological well-being and basic beliefs; the rapid development of information technology has intensified research on the creation of IS diagnostics based on various methods of pattern recognition [1-3, 9]. Among expert and IS diagnostics, we note a system for the selection of recruits into the army [4]; for the diagnosis of phobias FEARDEX [5]; for the preliminary diagnosis of mental disorders [6]; to diagnose and support decision making on depression [7, 8]. Very significant results were obtained by domestic scientists and presented in the publications of B. Kobrinsky. [9], Kan L.V., Kuznetsova Yu.M. and Chudova N.V. [10], Yankovskaya A.E. [12].

Our proposed approaches to the creation of an applied IS DIPSIB are certainly relevant, since they relate to the diagnosis of the most common diseases, especially in patients with neurological pathology, leading to serious psychological, social and somatic consequences for the patient and his environment; disability and disability [14]. Given the significant economic and social consequences of neurological pathology, it is necessary to develop diagnostic tools to determine the psychological consequences of the disease and adequate approaches to managing the disease. Unfortunately, in the scientific literature, we do not know analogs for the construction of an applied IS in this direction.

The prerequisite for creating an applied IS DIPSIB is the work carried out in the laboratory of the IS TSUAB to create an IS, which, based on IT IMSLOG, identifies various regularities and diagnostic, therapeutic, organizational and managerial decisions in the field of medicine, clinical psychology, military medicine, ecobiomedicine, etc. based on the matrix method of presenting data and knowledge, on test logical combinatorial methods of pattern recognition, making and substantiating decisions using graphical, including cognitive, means [2, 3], as well as on the basis of fuzzy logic and the threshold [11, 12].

Analysis of the current state of research in the field of creating IS diagnostics in this direction has shown that it is advisable to use test methods of pattern recognition and create on their basis, as well as on the basis of fuzzy and threshold logic, applied IS DIPSIB to revealing various types of patterns between the parameters (features) of psychological safety affecting multi-level, hierarchical, dynamic construct, the structural components of which include: cognitive-cognitive, emotional-volitional, motivational-need and active-activity sense.

Matrix representation of data and knowledge in IS DIPSIB

An applied IS DIPSIB consists of 2 subsystems, one of which is based on applied IS, based on threshold and fuzzy logic, and the second is constructed on the basis of IT IMSLOG [13], based on a matrix model of data representation and knowledge, including an integer matrix of descriptions \mathbf{Q} and distinction matrix \mathbf{R} [2].

The rows of the \mathbf{Q} matrix are compared to training objects (patients with different neurological pathologies in accordance with ICD-10 (Parkinson's disease (G20), multiple sclerosis (G35), spinal osteochondrosis (M42), consequences of a stroke (I69), dizziness and impaired stability (R42)); columns – characteristic features (CF) of psychological security: psychological well-being (positive relationships, autonomy, environmental management, personal growth, a purpose in life, self-acceptance, psychological well-being), world assumption (benevolence of world, meaningfulness, self-worth), hariness (commitment, control, challenge). The $q_{i,j}$ element of the \mathbf{Q} matrix sets the value of the j -th feature for the i -th object. If the value of the sign is not significant for the object, then this fact is indicated by a dash ("-") in the corresponding element of the matrix \mathbf{Q} . For each attribute z_j ($j = \{1, 2, \dots, m\}$), either the intervals of change of its values or an integer value are specified.

The rows of the matrix \mathbf{R} are assigned to the rows of the matrix \mathbf{Q} , the columns to the classification features (CIF), which divide the learning objects into equivalence classes [2]. The set of all non-repeating rows of the distinction matrix is mapped to the set of selected patterns represented by a one-column matrix \mathbf{R}' , whose elements are the numbers of the patterns.

Note that this model allows us to represent not only the data, but also the

knowledge of experts, since one row of the \mathbf{Q} matrix can be specified in an interval form (using the dash "-" symbol) a subset of objects characterized by the same final solution, given by the corresponding row of the matrix \mathbf{R} . The scope of the report does not allow an illustrative example.

According to the above matrix model, the structuring of data and knowledge in the field of clinical psychology is carried out. The rows of the \mathbf{Q} matrix are various combinations of CF values. CIF includes hardiness CIF: z1 - involvement (number of features - 18), z2 - control (number of features - 17), z3 - risk acceptance (number of features - 10); CF psychological well-being: z4 - positive relationships (number of features - 14), z5 - autonomy (number of features - 15), z6 - environmental management (number of features - 14), z7 - personal growth (number of features - 14), z8 - goals in life (the number of features - 14), z9 - self-acceptance (the number of features - 14); CF basic beliefs: z10 - the favor of the world (number of features - 4), z11 - kindness of people (number of features - 4), z12 - justice of the world (number of features - 4), z13 - controllability of the world (number of features - 4), z14 - randomness of what is happening (the number of features is 4), z15 is the value of one's own "I" (the number of features is 4), z16 is the degree of self-control (the number of features is 4), z17 is the degree of luck (the number of features is 4).

At present, we have formed the matrix \mathbf{R} of a diagnostic type, the CIF number of which is 5. The name and values of CIF are as follows: 1st CIF is the level of psychological safety (low, medium, high); 2nd CIF — signs of vulnerability (hardiness, psychological well-being, world assumption); 3rd CIF - components of hardiness (number - 3); 4th CIF - components of psychological well-being (number - 6); 5th CIF - components of the world assumption (number - 7).

The creation of a database and knowledge will be carried out on the basis of the results of a study of patients with neurological pathology who are treated in neurological clinics.

A brief description of the mathematical foundations of building applied IS DIPSIB

The applied IS DIPSIB is based on the original matrix model of data representation and knowledge (some subset of objects characterized by the same solutions, represented by one set of feature values (expert generalized knowledge), prescribed in interval form with one row of description matrix), test recognition methods patterns, fault-tolerant, non-redundant unconditional diagnostic tests (FTNRUDT) and fault-tolerant mixed diagnostic tests (FTMDT), which are the optimal combination unconditional and conditional components.

Applied IS DIPSIB is based on the revealing of various types of regularities, logical – combinatorial test methods of pattern recognition, making and substantiating decisions using cognitive tools, as well as on fuzzy and threshold

logic [13].

The regularities in knowledge will be understood as the following subsets of features [2]: constant (taking the same value for all patterns), stable (constant inside the pattern, but not constant), uninformative (not distinguishing any pair of objects of different patterns), alternative (in inclusion in diagnostic tests (DT)), dependent (in the sense of including subsets of distinguishable pairs of objects), unessential (not included in any non-redundant DT), obligatory (included in all FTNRUDT), pseudo- obligatory (not obligatory but included into all UNDTs that are involved in decision making), fault tolerant (features steady to measurement errors), as well as all the minimum and all (or part - at a large feature space) non-redundant distinguish subsets of features, which are, in fact, the minimum and FTNRUDT.

The weight coefficients are CF, too.

The block diagram of the formation of the conclusion about the psychological safety of the patient on the basis of applied IS DIPSIB will be presented in fig. 1.

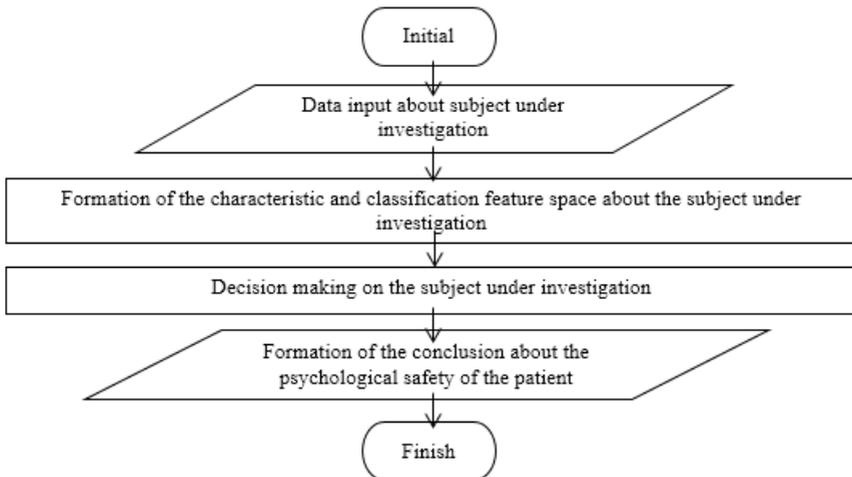


Figure 1. The block diagram of the formation of the conclusion about the psychological safety of the patient based on the applied IS DIPSIB.

Designing Application IS DIPSIB

The design of an applied IS is carried out in 5 stages (the first four of which are based on IT IMSLOG [13]): 1) systematization and structuring of data and knowledge in the field of clinical psychology, determining the functional composition of applied IS DIPSIB, its architecture and methods most suitable for revealing regularities in data and knowledge and making decisions relatively

the psychological safety of patients with neurological disorders; 2) the layout of the required configuration of the application IS DIPSIB by connecting to the core (with automatic registration) of the corresponding software modules; 3) the creation of a knowledge base module by means of a knowledge analysis module and optimization of the knowledge base, processing a knowledge module to revealing regularities by which a set of decision rules is formed, used later by the decision module and justification of decisions using cognitive tools for analyzing the psychological safety of patients with neurological pathology; 4) configure the application IS DIPSIB for transmission to the customer; 5) connect an application IS based on threshold and fuzzy logic.

Conclusion

An original IS ISP was proposed. DIPSIB was designed on the basis of IT IMSLOG and applied IS, based on threshold and fuzzy logic. The expediency of applying applied IS DIPSIB in practical healthcare is determined by the need to make diagnostic decisions efficiently, quickly and in a timely manner, to justify these decisions using graphic, including cognitive, tools.

The proposed applied IS DIPSIB will allow in a shorter time to identify various kinds of regularities of psychological safety of patients based on the features that determine hardiness, psychological well-being, world assumption. The expediency of applying the applied IS DIPSIB is connected with the need to improve the quality and reliability of diagnostic results based on brief questionnaires. There is no doubt that the constructed application IS DIPSIB is economical in terms of time and human resources; easy to use; she is able to promptly issue an opinion and supply a specialist (doctor and psychologist) with information for further work with the patient.

Thanks

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胶结作用对钢的性能的影响
**THE EFFECT OF CEMENTATION ON THE PERFORMANCE
OF STEEL**

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注解。 本文介绍了气体胶结对各种钢种产品表面硬化的影响的研究结果，以了解各种产品在运行过程中的破坏和磨损过程，因为它的使用寿命和产品的可靠性取决于表面层的状态，并且通常完全由表面层的状态决定。

关键词：气体胶结，可靠性，耐久性，化学热处理，操作特性，微观结构，胶结层，耐磨性，表面硬度，胶合钢。

Annotation. *The article presents the results of research on the effect of gas cementation on the hardening of the surface layers of products made of various steel grades, in order to understand the processes of destruction and wear of various products during their operation, because the service life and reliability of the product depend, and often are completely determined, by the state of the surface layer.*

Keywords: *gas cementation, reliability, durability, chemical heat treatment, operational characteristics, microstructure, cemented layer, wear resistance, surface hardness, cemented steel.*

Taking into account the accelerated development of technology, the issues of improving the reliability and durability of machine parts, instruments, installations, quality and efficiency of work, and, consequently, issues of saving materials, fighting corrosion and wear of machine parts, become extremely relevant. The role of these problems in the durability of machines and mechanisms has especially increased at the present time, since the development of most industries

(aerospace, aviation, power engineering, electronics, nuclear power, etc.) is associated with an increase in aggressive media, temperatures, loads in which parts and installations operate generally. One solution to these issues is to harden the surface layers of the products.

The results of experimental research of the processes of destruction and wear of various products during their operation have shown that the service life and reliability of the product depend, and often are completely determined, by the state of the surface layer. The best way to solve the problem of increasing the reliability, quality and durability of products is to develop modification methods that can improve several characteristics of the surface layer, such as defectiveness, roughness, redistribution of internal stresses, remove fractured and relief layers. [1, 2].

There are various ways to change the surface properties of products. One of such methods is a change in the composition of the metal surface, in which the surface layers are subjected to diffusion chemical-thermal treatment (CTT), the result of which is the formation of a new alloy on the surface of the product. Using CTT, it is possible to obtain an alloy of practically any composition in the surface layer of a product and, therefore, to provide a complex of necessary properties — physical, chemical, mechanical, and others. One of the most common CTT methods is cementation.

Conducted research on the effect of gas cementation on the performance characteristics of the example of four steels: steel 3, 20, 20X2H4A and 12X18H9T (chemical composition is given in table 1 [3]).

Table 1
The chemical composition of steel

Steel	Element content, %						
	C	Si	Mn	Cr	Ni	S	P
3	0,14– 0,22	0,05– 0,17	0,4– 0,65	0,3	0,3	0,05	0,04
20	0,17– 0,24	0,1	0,3– 0,65	0,25	0,25	0,04	0,035
20X2H4A	0,16– 0,22	0,17– 0,37	0,3–0,6	1,25– 1,65	3,25– 3,65	0,025	0,025
12X18H9T	0,12	0,8	2,0	17,0– 19,0	8,0–9,5	0,025	0,035

When cementation alloyed steels from the cooling mode depends on the tendency to the formation of cracks. Cracks of all kinds during chemical and heat treatment arise due to internal stresses. These stresses are caused by the heteroge-

neity of the structure of different zones of the cemented layer, which is inherent in its very nature. In alloyed steels, as a result of cooling, after cementation, zones with the structure of troostite, martensite and residual austenite can form in the layer, having different specific volumes, which causes the appearance of internal stresses. The essence of all recommendations for the prevention of cracks associated with structural transformations in the cemented layer is to avoid the appearance of a streaky structure consisting of zones with different specific volumes. Each steel grade has its own “dangerous” cooling rate, which contributes to the formation of the most heterogeneous structure, which may cause cracks. To prevent cracking, cooling needs to be accelerated or slowed down depending on the steel grade, type of parts, and other conditions [4, 5].

For testing the impact bending, samples were made according to GOST 9454–78 (type 11). The shape and dimensions of the samples for testing were selected from Table 2..

Table 2
The shape and size of samples for testing

Type of hub	Hub radius R, mm	Sample type	Length L, mm	Width, mm	Height H, mm	Height of working section H1, mm
V	0,25±0,025	11	55±0,6	10±0,1	10±0,1	8±0,05
		12		7,5±0,1		
		13		5±0,05		
		14		2±0,05		

Based on the analysis of literature data, heat treatment regimes were proposed for samples (Table 3).

Table 3
Modes of cementation and heat treatment of steel

Mode №	Cementation temperature, °C	Time cementation, hour	Temperature Quenching, °C	Cooling environment	Tempering temperature °C	Cooling environment
1	910±10	5	800±10	oil	200±10	air
2	950±10	10	840±10	oil	200±10	air
3	900±10	10	780-800	oil	180±10	air

During cementation, as with other varieties of CTT, several processes simultaneously proceed:

1) formation in the environment (or in a separate reaction volume) of the diffusing element in the atomic (ionized) state (thermal dissociation);

2) adsorption ("sticking") of atoms (ions) on the metal surface with the formation of chemical bonds between the ions of the saturating element and the base metal;

3) diffusion of adsorbed atoms from the surface into the metal being treated (product). The thermodynamic driving force of diffusion is the difference in the concentration of the diffusing element. As a result of these processes, the chemical composition of the surface layer changes, a concentration gradient of the saturating element in the surface and underlying layers is formed. The concentration of the diffusing element decreases from the surface into the metal. As a consequence, the structure and properties of the steel change.

After slow cooling in the structure of the cemented layer, the following zones can be distinguished (from the surface to the core):

1) proeutectoid, consisting of perlite and secondary cementite forming a grid of the former austenite grain;

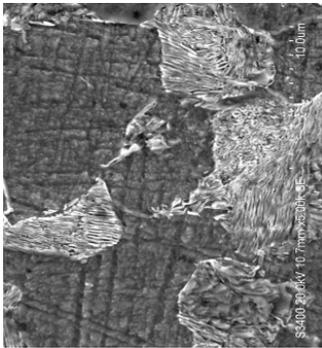
2) eutectoid, consisting of one plate perlite,

3) and 4) hypoeutectoid zone consisting of perlite and ferrite.

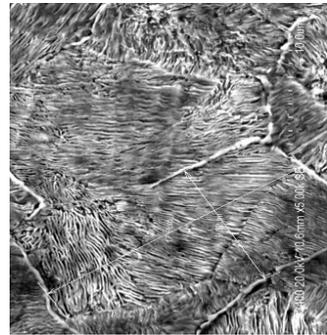
The core will have the structure of the original (before cementation) steel. Thus, by studying the structure of cemented steel after slow cooling, it is possible to determine the cementation depth. The technical depth of cementation is often taken as the distance from the surface to the zone where the carbon concentration is 0.4%, i.e. structure consists of 50% perlite and 50% ferrite. The depth of cementation, depending on the purpose of the product and the composition of the steel, is usually in the range of 0.5-2.0 mm. The concentration of carbon in the surface layer of the product is 0.8-1.0% [6].

The performance properties of cemented steels depend not only on the properties and structure of the cemented layer, but also on the properties of the core of the part. Insufficient strength of the core and the zone of residual austenite can lead to deformation of the underlayer zone under load, to the growth of internal stresses in the layer and its destruction. With a decrease in the difference in carbon content in the base and in the surface layer, the difference in changes in the specific volume of the cemented layer and core decreases, and the level of compressive stresses in the layer decreases. However, excessive hardening of the core reduces its fatigue strength, crack resistance and toughness of cemented products.

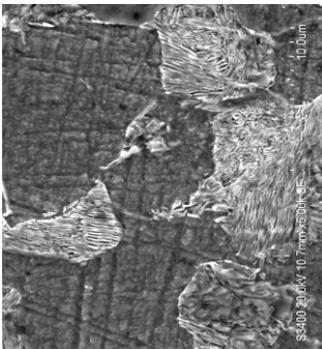
In the initial state after cementation and high tempering with air cooling, the core structure of the steel layer 20X2H4A is the trostite-type lamellar component (Figure 1). In addition, after cementation due to long exposure at high temperatures, the steel becomes coarse-grained.



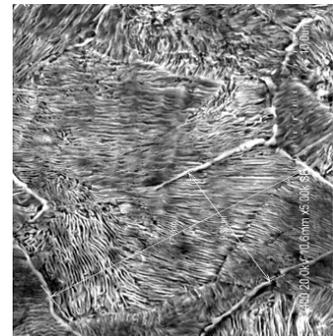
a



b



c



d

Distance from the surface, mm: a - 0.04; b - 0.12; c - 0.27; d - 1.50

Figure 1 - The microstructure of the cemented layer $\times 5000$, steel 20X2H4A

The structure of the cemented layer after final heat treatment is a martensitic-austenitic mixture strengthened by evenly distributed dispersed carbides, the amount of which decreases with increasing distance from the surface (Figure 2). The structure of the base steel is represented by packages of martensitic plates of different orientations, inherited from the orientation of the original austenite grain.

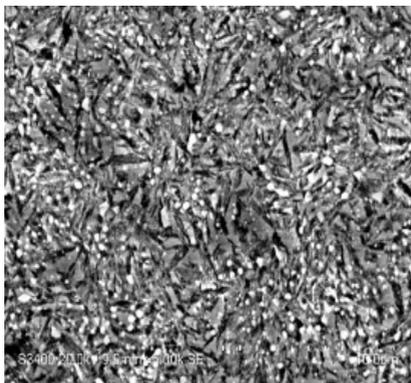


Figure 2 - The microstructure of the cemented layer of steel 20X2H4A after heat treatment $\times 5000$, the distance from the surface is 0.06 mm

The hardness on the surface of the cemented layer 20X2H4A is within HRC $\sim 58-62$ and in the core HRC $\sim 30-45$. When cementation is more often controlled, not the total, but the effective layer thickness. The effective thickness corresponds to the zone of the layer from the saturation surface to the boundary of the zone with a hardness of HRC ~ 50 . The thickness of the effective layer is 0.4-1.8 mm.

Table 4 shows the values of the surface hardness of the samples after gas carburization and full heat treatment.

Table 4
Sample surface hardness

Steel	3	20	20X2H4A	12X18H9T
Hardness, HRC	45 - 47	37 - 42	58 - 62	10 - 12

The tests performed showed the following results: the hardness of the quenched layer after cementation on samples of steel 20X2H4A has a maximum result of 58-62 HRC, the hardness of quenched samples after gas cementation from steel 12X18H9T has not changed; tensile tests showed that the samples have extremely high tensile strength (for example, after calculations, we obtained the ultimate strength of a specimen from steel 20X2H4A equal to 1267.38 N / mm², and the ultimate strength for steel 40X after quenching from 850 ° C in water and tempering

at a temperature of 200 ° C (which corresponds to a hardness of 55HRC) is 1760 N / mm²); samples made of stainless steel 12X18H9T showed that cementation does not lead to changes in performance properties for this steel grade, as they have low hardness and strength; products made from special cemented steel 20X2H4A are able to withstand considerable shock loads and provide the required strength and hardness ensuring satisfactory viscosity. due to the presence in the chemical composition of chromium and nickel, which increase the strength properties and reduce the tendency to brittle fracture.

The conducted research allows to draw conclusions that the obtained performance characteristics after gas cementation will correspond to materials that have the ability to withstand impact loads, high hardness after quenching, wear resistance and contact endurance, which solves the problems of ensuring the reliability and durability of machines and mechanisms.

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科研项目：非混合搅拌技术和设备
**SCIENTIFIC RESEARCH PROJECT: NONMIXING MIXING
TECHNOLOGIES AND EQUIPMENT**

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注解。 提出了基于在新提出的技术和技术解决方案的复杂性上确定性地形成其均匀性的用于获得大块材料的多组分混合物的预期非混合技术和设备。

关键词：散装物料，混合技术，散装介质混合设备。

Annotation. *Prospective nonmixing technologies and equipment for obtaining multicomponent mixtures of bulk materials based on the deterministic formation of their homogeneity on a complex of newly proposed technical and technological solutions are proposed.*

Keywords: *bulk materials, mixing technology, equipment for mixing bulk media.*

Location of the organization:

300600, Russia, Tula, Lenin Ave., 92, tel. (0872) 35-37-96, fax (0872) 33-13-05, contact phone of developers (0872) 73-44-93.

Type of legal entity:

Higher education institution with state accreditation.

Head of the organization:

Gryazev Mikhail Vasilyevich - Rector, Doctor of Technical Sciences, Professor.

Persons responsible for the project:

Preiss Vladimir Viktorovich - Head of the Department of the University, Doctor of Technical Sciences, Professor

Evseev Alexey Vladimirovich –Candidate of Technical Sciences, doctoral candidate.

Short story.

The project includes a series of scientific and practical works performed for the period from 1980 to 2018. for enterprises of the defense, food, feed and tool industries [1-5]. It allowed to solve the most urgent interdisciplinary problem of obtaining high-quality homogeneous mixtures with high ratios of components

from 1: 100 and above [6-14].

Within the framework of the cycle, several scientific and contractual works were carried out, the most significant of which is the project for the Kazan Scientific Research Institute of Chemical Products. Organized to obtain high-quality mixed products for special purposes, while the implementation of the results of this research allowed to obtain a significant economic effect [2].

Works are performed on the scientific and production base of the department "Technological systems of food, printing and packaging production" TSU. During the period of the project, several research grants of various levels were won, an engineering award named after S.M. Mosin, as well as carried out the defense of five Ph.D dissertations. Financing of works was carried out by the state, private companies, less often mixed. The current state of financing - from the limited fund of extrabudgetary funds of the department.

Product Description.

The proposed technology and equipment provide a higher quality mixture than all existing ones. This is ensured by the deterministic formation of the homogeneity of the mixture, increasing productivity and reducing the complexity of the entire process. At the same time, there is a reduction in the duration of the mixture preparation operation, a reduction in the production area, a reduction in energy consumption, as well as an increase in environmental and fire safety by eliminating directly the operation of mixing the components. Functional packing and packaging of mixtures without loss of quality is also possible, which is appropriate for the specific use of some mixed products [1-3].

The technology is implemented on rotary, bi-rotor, conveyor units or ortovariant combined systems, and provides the following process parameterization [4,5]:
 mixing ratio до 1:1000.
 accuracy of components in the mixture, not less ±1%.
 productivity (depending on the quality of the mixture), t/h.....0,1-2,5.
 fractions of mixed components, mm0,001-5,0.

The commercial focus of the project involves two main ways:

- licensing and selling know-how to the developed countries of Europe and Asia;
- manufacture and sale of equipment, the organization of joint production, both within Russia and abroad.

In the first case, costs are minimal, in the second, profits are maximal with a payback period of 1.33 ... 2.0 years.

Target market.

The project has a clear interdisciplinary focus and can be implemented in metallurgy, construction, industrial and household chemicals, tool manufacturing, pharmaceuticals, in food, feed and other industrial enterprises that use a mixture of

bulk materials in the production. Depending on the focus, the initial market share can be from 10 to 30%, taking into account the further crowding out of competitors due to higher quality of the finished product and lower cost.

Competitors.

Analogues of the proposed project does not exist. It is assumed that there are only competing products on the market with their subsequent displacement. When considering the pricing policy within Russia, there are fewer competitors within the country, but they are more active. Abroad, respectively, the opposite.

Intellectual property.

Patents of the Russian Federation №№ 2129911, №2271243. Several technical solutions are under consideration at Rospatent.

Project management.

It implies joint under supervision. The required resources are available in sufficient volume in the central region of the Russian Federation. The schedule of works and its main stages are planned depending on the level of financing in the range from one to two. The duration of the work depends on the complexity of the project and the level of tasks to be implemented.

Simple cash planning.

Characterized by the authors subjectively because of the need to detail the specific implementation of the project. It is assumed by the investor.

Required investment.

Also correspondingly subjective. The minimum cost of a high-tech project at the level of pilot production with an average productivity of about \$ 250,000.

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数据科学问题中的分形多样性方法
**METHOD OF FRACTAL DIVERSITY
IN DATA SCIENCE PROBLEMS**

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注解。获得参数 (SNR) 用于区分高斯函数, 在没有互相关的情况下随机变量的分布与其他函数的区别, 这使得可以描述具有强互相关的数据的集体状态。确定了一维空间中的信噪比 (SNR), 并给出了基于闭环中Cantor尘埃分形变化的计算算法。该算法对于初始数据集的线性变换是不变的, 具有重整化群不变性, 并且确定数据的互相关 (集体效应) 的强度。集体状态的描述是普遍的, 不依赖于数据相关性的性质, 也没有数据相关性时随机变量分布的普遍性。该方法适用于在信息技术中获得的大量非高斯或奇数数据。在确认Koshland的假设时, 通过计算集体效应将该方法应用于数字X射线衍射光谱的强度数据使得可以鉴定表现出生物活性的构象异构体。

关键词: 湍流状态, 集体效应, 奇异动力学, 生物活性计算机视觉。

Annotation. *The parameter (SNR) is obtained for distinguishing the Gaussian function, the distribution of random variables in the absence of cross correlation, from other functions, which makes it possible to describe collective states with strong cross-correlation of data. The signal-to-noise ratio (SNR) in one-dimensional space is determined and a calculation algorithm based on the fractal variety of the Cantor dust in a closed loop is given. The algorithm is invariant for linear transformations of the initial data set, has renormalization-group invariance, and determines the intensity of cross-correlation (collective effect) of the data. The description of the collective state is universal and does not depend on the nature of the correlation of data, nor is the universality of the distribution of random variables in the absence of data correlation. The method is applicable for large sets of non-Gaussian or strange data obtained in information technology. In confirming the hypothesis of Koshland, the application of the method to the intensity data of digital X-ray diffraction spectra with the calculation of the collective effect makes it possible to identify a conformer exhibiting biological activity.*

Key words: *turbulent state, collective effect, strange kinetics, biological activity computer vision.*

Introduction

A method based on theoretical approaches in understanding the most common patterns of behavior of complex nonlinear dynamic systems forming collective states is presented. The review [1] introduces a number of non-standard ideas of applying fractal objects to the description of nonlinear dynamic systems that detect a self-consistent desire for collective states. In the vicinity of the collective state, the number of degrees of freedom becomes minimal. In the language of space topology, this means that the fractal dimension of space decreases due to the appearance of fractional impermeable regions that model the collective state. Thus, the complexity of the nonlinear system is transferred to the complexity of space. At the same time, the universality of the geometric approach in the description of nonlinear systems from the tasks of turbulence to computer vision is manifested. In the development of these ideas, this article provides an example of constructing a fractal manifold in a one-dimensional Euclidean space, based on the Cantor dust fractal.

A computational method is proposed that transforms the original non-Gaussian data into Gaussian, which allows us to compare quantitatively the structural characteristics of large data sets.

Computational method

The transformed value of non-Gaussian data, which allows quantitative comparison, must be invariant with respect to any linear transformations of the values of the original data [2]. The problem has a solution only for ordered strange data and taking into account the neighborhood in which nonlinearity manifests itself. As shown in the paper, the transformation should have renormalization group invariance with respect to the size of the neighborhood in which a quantitative comparison of the manifestations of nonlinearity takes place.

The following are the key steps to deriving a quantitatively computed signal-to-noise ratio formula. A Cantor dust fractal or a geometric progression with an arbitrary value $0 < q < 1$ (in the classical fractal of the Cantor set $q = 2/3$) has the form:

$$F = 1 - (1 - q) - (1 - q)q - (1 - q)q^2 - (1 - q)q^3 - \dots \tag{1}$$

The following method is proposed for constructing a fractal manifold. The fractal manifold for $n = 5$ of an arbitrary set of five ordered numbers a_i is:

$$\begin{aligned} \widetilde{a_0^R}(a, 5) &= a_0 - (1 - q)a_1 - (1 - q)qa_2 - (1 - q)q^2a_3 - (1 - q)q^3a_4 - (1 - q)q^4a_0 \\ &\quad - (1 - q)q^5a_1 - (1 - q)q^6a_2 - \dots \\ \widetilde{a_1^R}(a, 5) &= a_1 - (1 - q)a_2 - (1 - q)qa_3 - (1 - q)q^2a_4 - (1 - q)q^3a_0 - (1 - q)q^4a_1 \\ &\quad - (1 - q)q^5a_2 - (1 - q)q^6a_3 - \dots \end{aligned} \tag{2}$$

With each fractal cycle m , a new number a_i appears from a sample of non-Gaussian data n and further along a closed loop. The left and right directions of the circuit traversal are different. In general:

$$\widetilde{a}_i^R(a, n) = a_i - \frac{1 - q}{1 - q^{n+1}} \left[\sum_{k=1}^n (q^k a_{\text{mod}(k+1+i, n+1)}) \right] \quad (3)$$

Similarly for $\widetilde{a}_i^L(a, n)$ it turns out:

$$\widetilde{a}_i^L(a, n) = a_i - \frac{1 - q}{1 - q^{n+1}} \left[\sum_{k=1}^n (q^{n-k} a_{\text{mod}(k+i, n+1)}) \right] \quad (4)$$

Hereinafter, the formulas in the notation Mathcad.

The sets $\{\widetilde{a}_i^R(a, n) - \widetilde{a}_i^L(a, n)\}$ and $\{\widetilde{a}_i^R(a, n) + \widetilde{a}_i^L(a, n)\}$ form fractal manifolds. The expression for the signal-to-noise ratio is determined:

$$SNR(a, n) = \frac{S(a, n)}{N(a, n)} = \frac{\sum_{k=1}^n (\widetilde{a}_i^R(a, n) - \widetilde{a}_i^L(a, n))^2}{\sum_{k=1}^n (\widetilde{a}_i^R(a, n) + \widetilde{a}_i^L(a, n))^2} \quad (5)$$

The uniqueness of the Gauss functions, the Bessel basis for the practical application of the method, is that the signal-to-noise ratio SNR in the definition (5) for these functions does not depend on the value n. In real data, there are both random effects and collective effects caused by cross-correlation. The approximation of the data by a finite series of Bessel functions (approximately three to seven members of the series) leaves only the contribution of random variations. The approximation of the data by a Fourier finite series followed by an SNR transform makes it possible to isolate a collective effect.

When modeling non-Gaussian half-wave data $a_i = \sin\left(\frac{i}{n}\right)$, which is used in calculations with preliminary approximation of data by a finite Fourier series, for sufficiently large values of n, the ratio of signal to noise ratio looks like:

$$S(n, q) \approx \frac{(1 - q)^4 (1 + q)^2}{n - 3} 2\pi^2 (1 + 4q + \dots) \quad (6)$$

$$N(n, q) \approx \frac{(1 - q)^2 (1 + q)^2}{(n - 3)^2} 2\pi^2 (1 + 4q + \dots) \quad (7)$$

$$SNR(n, q) = (1 - q(n))^2 (n - 3) \quad (8)$$

We require the condition of renormalization-group invariance $SNR(n, q)$, which brings strange data to Gaussian: as $n \rightarrow n'$ changes, $q \rightarrow q'$ transforms, leaving the value of $SNR(n, q)$ (8) unchanged in the renormalization group method [3]. Renormalization-group invariance requirement is satisfied under the condition:

$$\frac{d}{dn} SNR(n, q(n)) = 0 \quad \text{или} \quad 2(n - 3) \frac{d}{dn} q(n) = 1 - q(n) \quad (9)$$

The solution of a differential equation is:

$$q(n) = 1 - \sqrt{\frac{\mu}{n-3}} \tag{10}$$

The choice of a constant value μ sets the scale of the signal to noise ratio.

For large values of n , the asymptotics of the parameters of the length of fractal varieties $l^S(n, q) = \sqrt{S(n, q)}$ and $l^N(n, q) = \sqrt{N(n, q)}$ in the half-wave

model $a_i = \sin\left(\pi \frac{i}{n}\right)$ ((6), (7)) ((6),(7)) ((6), (7)), taking into account the renormalization-group equation for $q(n)$ (10), have the form:

$$l^S \sim n^{-\frac{3}{2}} \text{ и } l^N \sim n^{-\frac{3}{2}} \tag{11}$$

Hausdorff fractal Kolmogorov dimension [4] for fractal manifolds, constructed taking into account the direction of walking around a closed contour of n numbers:

$$D = - \lim_{n \rightarrow \infty} \left[\frac{\ln(n)}{\ln(l)} \right] = \frac{2}{3} \tag{12}$$

Average as for Gaussian numbers:

$$\lim_{n \rightarrow \infty} \left[\frac{1}{n} \sum_{i=0}^n \sin\left(\pi \frac{i}{n}\right) \right] = \frac{2}{\pi} \approx 0.64 \tag{13}$$

o differs from the average in Kolmogorov for $D = 2/3$

$$\lim_{n \rightarrow \infty} \left[\frac{1}{n} \sum_{i=0}^n \left(\sin\left(\pi \frac{i}{n}\right) \right)^D \right]^{1/D} \approx 0.60 \tag{14}$$

As an illustration of the fractal manifold method, calculations are given for binomial coefficients close to a Gaussian set, normalized to the asymptotics:

$$a_i = 2^{-n} \sqrt{\frac{\pi n}{2}} \left[\frac{n!}{i!(n-i)!} \right] \tag{15}$$

For sufficiently large values of n , the expression of the signal-to-noise ratio is:

$$S(n, q) \approx 3\pi \frac{(1-q)^4}{\sqrt{2n+1}} (1+6q+\dots) \tag{16}$$

$$N(n, q) \approx 9\pi \frac{(1-q)^2(1+q)^2}{(2n+1)^{3/2}} (1+6q+\dots) \tag{17}$$

$$SNR(n, q) = \frac{(1-q(n))^2 (2n+1)}{(1+q(n))^2 \cdot 3} \tag{18}$$

Renormalization-group equation for $q(n)$:

$$q(n) = \frac{\sqrt{2n + 1} - \sqrt{3\mu}}{\sqrt{2n + 1} + \sqrt{3\mu}} \quad (19)$$

Fractal dimension for normalized binomial coefficients $D = 4/5$.

The choice of the mean for non-Gaussian data as for Gaussian numbers often used in calculations is not unambiguous [2]. Not only the mean value itself, but also the type of formula for calculating the mean value is determined by strange data. The method of fractal manifold makes it possible to more accurately determine such a well-known characteristic of the structure as an average value, using the smaller scale $l \sim n^{-2}$ as an instrument, compared to the Euclidean scale $l^E \sim n^{-1}$ and to identify qualitatively The new structural characteristic is the degree of cross-correlation of the data or the degree of collective data state determined by the *SNR*.

Thus, the emergence of a dependence of the SNR on the number of samples n for non-Gaussian (strange) data is explained by the presence of cross-correlation of strange data. The introduction of the q parameter of the Cantor dust fractal and the application of the renormalization-group invariance method with respect to SNR allows us to proceed to the traditional analysis of Gaussian data — the degree of correlation of data in the SNR definition (5).

Preliminary calculations are performed for $q=0$ using formulas (24) - (26). At the preliminary stage of calculations, when comparing different sets of ordered data, the critical sizes of descriptors n_{kp1}, n_{kp2} are obtained that provide maximum collective states in the data sets. Then the value $\mu = \min(n_{kp1}, n_{kp2}) - 3$ is

taken in formula (10) and the value of $SNR(\max(n_{kp1}, n_{kp2}))$ is specified taking into account the renormalization group invariance (20) - (23). Comparing the SNR values of different data sets is correct when calculating on the same scale μ . The peak values of $SNR(x_i, n)$ characterize the presence of a structure in the data of the variable x , denote the neighborhood of the collective state. The concept of a critical or collective state is characteristic in the approach of strange kinetics, denoting a cluster of degrees of freedom with a strong correlation. The behavior of the system in the vicinity of the collective state is universal and does not depend on the nature of the interaction causing the correlation [1], as well as the universality of the distribution of random variables in the absence of mutual correlation.

The approximation parameters of the finite Fourier series and the size of the descriptor n when passing the ordered data with a single step are determined from the condition of the maximum of the objective function - the maximum collective state in the system.

In the matrix form, the renorm-invariant formulas for the signal-to-noise ratio are:

$$SNR(a, n) = \frac{(a * Sa)}{(a * Na)} \quad (20)$$

$$S = -(\text{matrix}(n + 1, n + 1, f) - \text{matrix}(n + 1, n + 1, f)^T)^2 \quad (21)$$

$$N = [2\text{identity}(n + 1) - (\text{matrix}(n + 1, n + 1, f) + \text{matrix}(n + 1, n + 1, f)^T)]^2 \quad (22)$$

where:

$$f(i, j) = \frac{1 - q}{1 - q^{n+1}} q^{\text{mod}(j-i+n, n+1)} \quad (23)$$

The results of calculations by formulas (11) - (14) are equivalent to the results of the original calculations by formulas (3) - (5), while allowing the development of an algorithm.

In the calculations, a symmetric vector is constructed from $K = n/2 + 1$ unique ordered spectrum data:

$$a = (a_0, a_1, a_2, \dots, a_{K-1}, a_K, a_{K-1}, \dots, a_2, a_1) \quad (24)$$

For sufficiently large K , when the condition of renormalization group invariance is satisfied, and $q = 0$, taking into account the symmetry of the matrices S and N , the formulas for the signal-to-noise ratio take the form:

$$S/2 = a_0(a_0 - a_2) + a_1(a_1 - a_3) + \sum_{i=2}^{K-2} a_i(-a_{i-2} + 2a_i - a_{i+2}) + a_{K-1}(-a_{K-3} + a_{K-1}) + a_K(-a_{K-2} + a_K) \quad (25)$$

$$N/2 = a_0(3a_0 - 4a_1 + a_2) + a_1(-4a_0 + 7a_1 - 4a_2 + a_3) + \sum_{i=2}^{K-2} a_i(a_{i-2} - 4a_{i-1} + 6a_i - 4a_{i+1} + a_{i+2}) + a_{K-1}(a_{K-3} - 4a_{K-2} + 7a_{K-1} - 4a_K) + a_K(a_{K-2} - 4a_{K-1} + 3a_K) \quad (26)$$

When comparing the SNR values with the ordering scale, the scale is shifted to the left by the size of the K descriptor. An ordered data set, with a preliminary approximation by a finite Fourier series k , is passed by a descriptor, of size K , with a single step. Calculates $\sum SNR(K, k)$ over the passage of all points in the data set. The objective function is defined as $\max(\sum SNR(K, k))$ when iterating over the parameters K and k . As already noted, a correct comparison of the structural characteristics of the SNR of different data sets should be carried out on a single scale μ , taking into account the renormalization group invariance ((20) - (23)). Similar to the comparison of measurements made in centimeters and inches.

The computational method is used for large data sets obtained in good resolu-

tion, which allows to increase the scale of comparison μ while maintaining renormalization group invariance. In order of magnitude, in a problem with conformers, the total number of data in the X-ray analysis spectrum is 2250 values, the optimal descriptor size for a given resolution is $K = 585$, the maximum harmonic of a finite Fourier series is $k = 3$.

Conclusions

The method is applicable in determining areas with a strong correlation of degrees of freedom among themselves and a quantitative comparison of the degree of correlation of large sets of ordered data. For example, when the approach of Hartree-Fock is not applicable. The interpretation of the results of data processing is based on the construction of a fractal manifold, which models a collective or critical state [2] in a one-dimensional space. The interpretation is complicated by the ambiguity of terminology describing the collective state in different tasks.

The collective state in chemistry is often called the flexibility or mobility of molecular fragments. The Koshland hypothesis of induced conformity with the manifestation of biological activity, based on the assumption of the flexibility of the active center of the enzyme, satisfactorily explains the action of the enzymes. As the substrate approaches the active center of the enzyme, a conformational rearrangement occurs synchronously in the enzyme molecule, affecting a large number of degrees of freedom. The application of the computational method to the spectra of the three conformers shows a significant increase in the collective effect of the conformer, which is distinguished by biological activity. A similar, with the manifestation of biological activity, an example of a collective effect is manifested in the method of thermomechanical curve for polymers with different molecular weight in the field of high elasticity.

The application of the universal transformation formula to large sets of non-Gaussian data, taking into account the invariance properties with respect to any linear transformation and renormalization group invariance, makes it possible to quantitatively compare collective states. The method is used in solving data science problems with a preliminary transformation of the original non-Gaussian data and comparing the degree of mutual correlation of the data, in the search for quantitative structure-property relationships.

For four points, SNR coincides with the formula for the cross operator Roberts, one of the earliest algorithms for extracting boundaries in computer vision, which makes it possible to use the method in computer vision problems and image compression algorithms.

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