



NORWEGIAN JOURNAL OF DEVELOPMENT OF THE INTERNATIONAL SCIENCE

№82/2022

Norwegian Journal of development of the International Science

ISSN 3453-9875

It was established in November 2016 with support from the Norwegian Academy of Science.

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AGRICULTURAL SCIENCES

MORPHOLOGICAL CHARACTERISTICS AND PRODUCTIVITY OF INDETERMINANT TOMATO HYBRIDS

Sievidov V

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Abstract

The article describes a study of fourteen hybrids of an indeterminate tomato type. The morphological characteristics of tomato plants and fruits were studied on adult plants during the period of mass fruit ripening (more than 80%). The length of the main stem was measured with a ruler from the base of the stem to the point of growth of the top of the stem. The number of lateral shoots was counted on the main stem, taking into account those that formed flowers or fruit clusters. The number of fruits was determined on all clusters of the plant, including the lateral shoots. When growing tomatoes in protected ground conditions, the climatic features of the growing area cannot be ruled out. In our opinion, a more favorable growth from a biological point of view and greater productivity from an economic and economic point of view may be associated with the geographical location of the experimental site, which ultimately affects the intensity of the action of climatic factors for cultivated crops, including tomatoes. A five-year study to assess the quantitative traits of tomato plants in the Kharkiv region revealed an increase in the values of the studied indicators in 2021 compared to 2017-2020, which is expressed in a significant increase in the length of the main stem of plants; there is a tendency to an increase in the number of side shoots and internodes, and it has also been established that the severity of the values of quantitative varying traits depends on the grown hybrid. On average, over the period of research, the yield of Zulfiia and Ronda hybrids was formed below the control by 0.5 and 0.4 kg/m², respectively. On average, over the period of research, the yield of Zulfiia and Ronda hybrids was formed below the control by 0.5 and 0.4 kg/m², respectively. The best in terms of yield when growing tomatoes in a spring film greenhouse were the hybrid Syhnora - 16.9 kg/m² (by 9% more than the control). Thus, analyzing the data obtained, it can be concluded that the characteristics of tomatoes vary depending on the grown hybrid. Moreover, this applies to both growth vegetative organs and the intensity of fruiting which exceed those of the tomato hybrids F1 Syhnora, Matias and Panekra in comparison with the other hybrids.

Keywords: variability, internode length of the main stem, the generative organs, tomato, side shoots, fruits, quantitative traits

JEL Classification O13, Q16

1. INTRODUCTION

Tomato is one of the leading vegetable crops for the production of high-quality plant products in the open field and the most promising for future agrotechnology of the noospheric level [1-4]. In our country, this crop is in second place after cucumber, although in terms of nutritional value, tomato fruits significantly surpass it [5]. Tomato fruits are a medicinal raw material. They are recommended for patients with various types of metabolic disorders, diseases of the cardiovascular system and gastrointestinal tract [6].

Today, most scientists and specialists understand that the processes of intensification of agricultural production, its large-scale concentration and specialization put forward a number of fundamentally new scientific and socio-economic problems. These include: the ever-increasing energy "price" of each additional food calorie, the increased danger of disturbing the ecological balance and environmental pollution, the need to ensure greater independence of agriculture from the vagaries of nature [7-12]. The questions of more efficient use of "artificial", especially natural energy resources, on the basis of scientifically grounded design of highly productive and environmentally stable agrobiocenoses, op-

timal climatic placement of cultivated species and varieties of plants, development of energy-efficient technologies for their cultivation [13; 14].

Analyzing current trends in the regulation of plant growth and development, the most important problems and tasks of intensive vegetable growing were formulated, the solution of which requires a purposeful study.

The decisive importance in the practical implementation of these tasks belongs to the further increase in the adaptive potential of the agricultural production system as a whole, to increase the general and specific adaptability of cultivated plants and, above all, the correct climatic zoning of crops and varieties hybrids [3; 15].

Tomato quality depends on a combination of the interactions among different single quality attributes. It includes appearance (color, size, shape, lack of defects), flavor (total soluble solids, sugar, organic acid), nutritional value (lycopene, vitamin C, minerals) and storage qualities. With the development of the social economy and the improvement of people's living conditions in Ukraine, consumer demand is gradually shifting to higher quality tomatoes instead of quantity and, therefore, fruit quality should be considered in addition to yield.

In this regard, the purpose of our study was to study the quantitative traits in tomato hybrids of indeterminate type Panekra F1 and Matthias F1, depending on the climatic conditions of growing.

2. MATERIALS AND RESEARCH METHODS

The research was carried out in the conditions in the eastern part of the left-bank Forest-Steppe of Ukraine, on the territory of Kharkiv district of Kharkiv region. Field experiments were performed according to approved methods [16, 17]. The soil at the experimental site is characterized by the following pronounced features: high content of humus and nutrients, lack of differentiation of the profile of clay components, shallow carbonates, close to neutral, the reaction of the soil solution. It is characterized by agronomically valuable granular-lumpy structure, high physical-mechanical and chemical properties, high humus content. The arable layer of the soil contains: gross nitrogen - 0.29%, phosphorus - 0.2%, hydrolyzed nitrogen - 71.8 mg / kg of soil, mobile phosphorus - 109.0 mg / kg of soil, and mobile nitrogen 271.9 mg / kg of soil. The humus content in the layer 0-40 cm - 3.9%, the pH of the aqueous extract - 5.2. The mechanical composition of the soil is medium loamy silty-sandy with a fraction content with a particle diameter of more than 0.25 mm 6%. The lowest moisture content in the layer of 0-40 cm is equal to 22.18% by weight of absolutely dry soil, in the layer of 0-60 cm - 21.37%. The bulk density of the soil is 1.18 g / cm³.

Weather conditions over the years of research differed significantly from the long-term average in terms of precipitation, while the temperature did not change significantly. During the study period, the average monthly temperature was average higher than normal by 1.6 degrees.

The morphological characteristics of tomato plants and fruits were studied on adult plants during the period of mass fruit ripening (more than 80%). The length of the main stem was measured with a ruler from the base of the stem to the point of growth of the top of the stem. The number of internodes was counted on the main stem. The number of lateral shoots was counted on the main stem, taking into account those that formed flowers or fruit clusters. The number of fruits was determined on all clusters of the plant, including the lateral shoots [18].

The growth of lateral shoots in the indeterminate cultivars can be extended by pinching (shoot removal) from the results of the previous reports. In some tomato cultivars, the numbers and weights of fruits that grew on double-stemmed plants created by pinching treatments were greater than those that grew on single-stemmed plants. Pinching at the seedling stage can increase the number of double clusters and flowers on lateral shoots of tomato. Pinching is often performed to increase initial tomato yield, but there are differences among cultivars as to the effects of pinching. In addition, the lengths of the lateral shoots at each node do differ depending on the pinching position. As the number of remaining true leaves is increased by pinching, there is a difference among the lateral shoot lengths. Since a relationship among the lengths of lateral shoots, the number of flowers per plant, and per lateral shoot is expected to be changed by pinching in determinate processing tomatoes, growth of the lateral shoot would be influenced by the uptake and distribution of mineral nutrients in each organ. Furthermore, because pinching can enhance the uniformity of fruit maturity, pinching could shorten the harvest term while also, due to this shorter flowering period, leading to harvest periods with more than 80% total fruit yield.

In the experiment, fourteen tomato hybrids were evaluated, compared with the Berberana F1 hybrid in the control. Observations of the emergence of seedlings during the cultivation of seedlings showed that all the tested samples had a high field germination of seeds and did not differ from each other at the beginning of emergence. The conducted phenological observations made it possible to conclude that the period of seedlings - flowering in all samples came almost at the same time (48-50 days). And the period of passage of the flowering-ripening phase was shorter and equaled 45-49 days, but in total the period of germination - the beginning of ripening was 95-99 days, which is typical for early ripening samples. The period of fruiting in the experiment was extended - 48-54 days. On September 1, the largest number of ripe fruits was in the control of Matias F1 - 61%, while Panekra F1 had the smallest - 43%. Biometric observations were carried out on the phases of growth and development of plants with an interval of 20-25 days. 10 typical plants were measured by two incompatible repetitions (Table 1).

Table 1 - The value of morphological characteristics of tomato plants, 2017-2021.

Hybrid F1	Stem length, cm	Quantity of leaves, pcs.	Quantity of branches, pcs.	Average weight of one fruit, g	Quantity of brushes and fruits, pcs.
Berberana	295	26	11	125	5
Panekra	285	25	10	140	4
Matias	293	26	11	130	4
Belfort	312	27	12	120	4
Zulfiia	280	25	10	100	5
Syhnora	325	28	12	145	4
Ronda	290	25	11	102	4
Makhitos	270	24	10	110	5
Bostina	310	27	12	125	4
Alamina	325	28	12	105	5
Toivo	275	24	10	130	4

Hybrid F1	Stem length, cm	Quantity of leaves, pcs.	Quantity of branches, pcs.	Average weight of one fruit, g	Quantity of brushes and fruits, pcs.
The value of Student's t-test	7,4	3,7	2,1	5,3	3,1
p	< 0,001	< 0,001	< 0,01	< 0,001	< 0,01

Differences were also found in other indicators. The maximum they were for the Syhnora F1 hybrid, the average value of the stem length was 10.2% higher, the quantity of leaves on the main stem - by 7.7%, the weight of one fruit - by 35.8% compared to the Berberana F1 hybrid (control), this difference was significant ($p < 0.001$). As you can notice, the greatest differences affected the vegetative organs most important from a productive point of view, the generative organs.

There were no pronounced differences in the values of the studied parameters in 2021 in comparison with 2017. However, a slight excess of a number of indicators should be noted in recent observations.

We carried out observations for the cultivation of these hybrids in 2017-2021. The yield of the studied hybrids was determined not only by the number of fruits per plant, but also by their weight (Table 2).

Table 2 - The value of the yield of tomato plants, 2017-2021.

Hybrid F1	Year					Average	Yield increase	
	2017	2018	2019	2020	2021		kg/m ²	%
Berberana	16,5	14,1	14,5	14,4	18,0	15,5	0,0	0,0
Panekra	16,0	15,2	15,9	15,5	17,1	15,9	0,4	2,8
Matias	16,8	15,5	16,2	16,0	17,6	16,4	0,9	5,9
Belfort	15,7	14,6	15,2	15,0	16,0	15,3	-0,2	-1,3
Zulfiia	15,2	13,6	14,0	14,0	17,4	14,8	-0,7	-4,3
Syhnora	17,4	16,0	16,6	16,1	18,4	16,9	1,4	9,0
Ronda	14,0	13,2	13,8	13,3	13,7	13,6	-1,9	-12,3
Makhi-tos	14,2	13,0	12,9	13,0	13,5	13,3	-2,2	-14,1
Bostina	16,1	15,0	15,4	15,8	16,4	15,7	0,2	1,5
Alamina	14,3	13,2	12,0	12,6	13,8	13,2	-2,3	-15,0
Toivo	13,7	13,0	12,5	12,8	13,4	13,1	-2,4	-15,6

We have determined that the level of overall yield depends much more on the genotype of the hybrid under study than on the climatic conditions that developed during the years of research. Thus, in 2017-2020, the highest yield at the level of 16.0-17.4 kg/m² was observed in the Syhnora hybrid, which is 5.5-14.5% higher than the control variant. Hybrids Matias and Panekra also exceeded the control by 1.8-11.7% in yield, respectively. The Bostina hybrid exceeded the control variant, but this excess was not significant. Therefore, when growing tomatoes in the spring-summer crop change in a film greenhouse in 2017-2021, the hybrids of Syhnora, Matias and Panekra turned out to be the best. The yield hybrids of Belfort and Zulfiia were almost at the level of the standard. The lowest yield was shown by the hybrids Alamina and Toivo - on average 14.8% less than in the control.

At the same time, although in 2021 the Syhnora hybrid showed the highest fruit yield - 18.4 kg/m², which is 2.2% more than the control, in the same year the Berberana hybrid (control) recorded the maximum yield over the years of the study, at the level of 18.0 kg/m². The Matias hybrid also showed itself well, the yield of which was 17.6 kg/m², although it was less than the control variant by 2.2%.

On average, over the period of research, the yield of Zulfiia and Ronda hybrids was formed below the control by 0.5 and 0.4 kg/m², respectively. The good

indicators differed in terms of yield when growing tomatoes in a spring film greenhouse were the hybrids Matias and Panekra - 16.4 and 15.9 kg/m² (by 5.9 and 2.8% more than the control, respectively). The best in terms of yield were the hybrid Syhnora - 16.9 kg/m² (by 9% more than the control, respectively).

Thus, analyzing the data obtained, it can be concluded that the characteristics of tomatoes vary depending on the grown hybrid. Moreover, this applies to both growth vegetative organs and the intensity of fruiting which exceed those of the tomato hybrids F1 Syhnora, Matias and Panekra in comparison with the other hybrids.

4. CONCLUSIONS

When growing tomatoes in greenhouses, the climatic features of the growing area cannot be ruled out. In our opinion, a more favorable growth from a biological point of view and greater productivity from an economic and economic point of view may be associated with the geographical location of the research field, which ultimately affects the intensity of the action of climatic factors for cultivated crops, including tomatoes. A five-year study to assess the quantitative traits of tomato plants in the Kharkiv region revealed an increase in the values of the studied indicators in 2021 compared to 2017-2020, which is expressed in a significant increase in the length of the main stem of plants; there is a tendency to an increase in the number of side

shoots and internodes, and it has also been established that the severity of the values of quantitative varying traits depends on the grown hybrid.

The greatest variability depending on the hybrid is shown in relation to the intensity of fruiting. Thus, according to the results of the research, from all the studied hybrids of the indeterminate type, samples were distinguished that were distinguished by increased biometric indicators and productivity. In order to obtain high yields of tomato products in protected ground, it is advisable to recommend the use of the following F1 tomato hybrids of indeterminate type: Syhnora, Matias and Panekra.

REFERENCES:

1. Duhiienko, N.O., Symonenko, O.O. Competitiveness of the agro-industrial complex of Ukraine in the conditions of European integration. *Visnyk mykolaivs'koho natsional'noho universytetu im. V.O. Sukhomlyns'koho*, vol. 5, 2015 pp. 81-84.
2. Sievidova I. O. The factors that impact the functioning of wholesale markets of vegetable products. *Ahrosvit*. 2018. № 2. pp. 28-32.
3. Oliynyk T. I., Sevidova I. O. Vegetable growing of protected soil context of food security of Ukraine: monograph. Kharkiv.: Maidan, 2012. 232 p.
4. Tween, L. (2004). Economic instability in Agriculture. The Contribute of Prices, Government Programs and Export, *American Jorنال of Agriculture Economics*, vol. 65, 5, December. 2004.
5. Leshchenko L. O., Sievidov V. P. Current state and development trends of vegetable growing in Ukraine. *Visnyk KhNAU. Serii: ekonomichni nauky*. 2005. T. 3. pp. 317-326.
6. Yarovy G. I., Sievidov V. P. Peculiarities of cucumber cultivation in protected soil. *Bulletin of KhNAU. Ser.: Crop production, selection and seed production, fruit and vegetable growing and storage*. 2016. № 1. pp. 172-177.
7. Sievidov V. Innovative components of sustainable development of the vegetable industry in Kharkiv region. *Bulletin of LNAU. Agronomy*. 2016. №20. pp. 82-86.
8. Sievidova I., Plyhun S. Features of the organizational and economic mechanism for ensuring the competitiveness of marketing activities of agricultural enterprises. *Bulletin of KhNTUSG: economic sciences*. 2020. № 202. pp. 149-158.
9. Yarovy G. I., Sievidov I. V. Current state and prospects of tomato production in protected soil. *Bulletin of KhNAU. Series: Crop production, selection and seed production, fruit and vegetable growing and storage*. 2018. № 2. pp. 37-42.
10. Havrys' I.L. (2014). Selection of Edible Tomato (*Lycopersicon esculentum* Mill.) Hybrids for Growing in Extension Culture. *Sortovychennya ta sortoznavstvo*. № 3 (20). pp. 23-25.
11. Sevidova I.A. Development of foreign trade prospects for the wholesale market of agricultural products in the context of European integration. *Bulletin of Kharkiv National Agrarian University. V.V. Dokuchaev. Ser.: Economic sciences*. No. 8, 2013. pp. 143-148.
12. Hnatyuk A., Dubovaya A. Promising heterotic tomato hybrids for winter hydroponic greenhouses. *Ovochivnytstvo i bashtannytstvo*. № 51. 2005. pp.240-246.
13. Kondrat'eva, I. Ju., Kandoba E.E. (2006). Creation of tomato varieties with a high level of plasticity and resistance to adverse environmental factors. *Sbornik nauchnyh trudov KNIIOKH*, Krasnodar, 134-138.
14. Fahad, S., Bajwa, A. A., Nazir, U., Anjum, S. A., Farooq, A., Zohaib, A., et al. (2017). Crop production under drought and heat stress: plant responses and management options. *Front. in Plant Sci.* 8, 1147. doi: 10.3389/fpls.2017.01147
15. Theodoropoulou A, Giotis C, Hunt J, Gilroy J, Toufexi E, Liopa-Tsakalidis A, Markellou A, Lueck L, Seal C, Leifert C (2007) Effect of variety choice and use of resistant rootstock on crop yield and quality parameters of tomato plants grown in organic, low input and conventional production systems/growth media. In: Niggli U, Liefert C, Alfoldi T, Luck L, Willer H (eds) Improving sustainability in organic and low input food production systems. *Proceedings of the 3rd International Congress of the European Integrated Project Quality Low Input Food (QLIF)*, University of Hohenheim, (Germany, 20-23 March, 2007). Research Institute of Organic Agriculture, Frick, Switzerland, 177-180.
16. Trybel S. O., Siharova D. D., Sekun M. P., Ivashchenko O. O. ta in. Methods of testing and application of pesticides / [Za red. prof. S. O. Trybelya]. Kyiv: Svit, 2001. 448 s.
17. Methods of research in vegetable growing and melon growing / [Za red. G. L. Bondarenka, K. I. Yakovenka]. Xarkiv: Osnova, 2001. 369 s.
18. Ohta, K. and Ikeda, D. (2016). The development of secondary lateral shoots generated from lateral shoots in tomato plants. *Acta Hort.* 1123, 221-226.

BIOLOGICAL SCIENCES

HALOTOLERANT BACTERIA THAT STIMULATE PLANT GROWTH

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Abstract

The article presents an analysis of scientific sources on the mechanisms of stimulation of agricultural growth of rhizo- and endobacteria. These data determine the relevance of the study of endophytic microorganisms.

Keywords: plant, microorganism, rhizobacteria, endobacteria, stimulation, growth, mechanism

Halotolerant bacteria can grow in media with a wide range of salinity, from 1 to 33% NaCl, as well as in the absence of NaCl [14]. Therefore, they are well suited for cultivation in the halophyte rhizosphere, where there is often a low water potential due to salt stress in a dry climate [26]. Interestingly, PGPR and endophytic bacteria isolated from extreme environmental conditions retain their Plant Growth-Promoting (PGP) traits (even in the presence of high salt concentrations). For example, Zhu et al. (2011) isolated halotolerant PGPR *Kushneria sp.* YCWA18, from the Daqiao Salt Flats on the east coast of China, are highly phosphate soluble and can grow on solid media containing 20% (w/v) sodium chloride [27]. Tiwari et al. (2011) also isolated PGPRs that were halotolerant based on their ability to tolerate 2–25% NaCl, these include *Bacillus pumilus*, *Pseudomonas mendocina*, *Arthrobacter sp.*, *Halomonas sp.*, and *Nitrincola laciaponensis* with plant growth promoting traits such as phosphorus (P) solubilization and the ability to produce IAA, siderophores; phosphorus, stimulate plant growth by functioning as a phytohormone (IAA), provide the plant with iron through chelation and uptake (siderophores), and reduce the plant stress hormone precursor ethylene (ACA deaminase). Individual genera of halotolerant bacteria were isolated from various halophyte plants, such as *Rosa rugosa* [4], *Salicornia bigelovii* [18], *Salicornia brachiata* [13], and *Halocnemum strobilaceum* [1], *Acacia spp.* [5] *Sesuvium portulacastrum* [2] and *Avicennia marina* [9], as well as from a wide variety of habitats such as extreme alkaline saline soils, desert soils and saline soils [19]. Many of these halotolerant bacteria have shown the ability to stimulate plant growth.

Numerous studies have shown that halotolerant endophytic bacteria and PGPR effectively improve the growth of various crops under saline conditions [22]. The mechanisms by which they improve growth have been shown to include: (1) activating the plant's antioxidant defense mechanism by increasing the activity of key enzymes such as superoxide dismutase, peroxidase, and catalase, which scavenge excess reactive oxygen species and protect plants from salt toxicity. [12]; (2) improving plant nutrition by fixing atmospheric nitrogen (N_2), dissolving P or K, producing siderophores to absorb Fe [8]; (3) increasing the efficiency of inoculated plants in uptake of selected ions to maintain a high K^+/Na^+ ratio; it can directly reduce the accumulation of

toxic ions such as Na^+ and Cl^- and improve the nutritional status of both macronutrients and micronutrients by regulating the expression and/or activity of ion transporters [12]; (4) reduction of Na^+ accumulation by plants due to the release of EPS to bind cations (especially Na^+) in roots and prevent their transfer to leaves; this helps create a physical barrier called a rhizome around the roots [8]. PGPR and exopolysaccharide-producing endophytic bacteria improve soil structure by promoting soil aggregation, which leads to water retention and increased plant nutrient supply. Exopolysaccharides can also alleviate plant salt stress by binding Na^+ . This binding is due to the presence of hydroxyl, sulfhydryl, carboxyl, and phosphoryl functional groups characteristic of bacterial EPS [15]. *Aeromonas hydrophila/caviae*, *Bacillus sp.*, *Planococcus rifietoensis*, *Halomonas variabilis*, *Burkholderia*, *Enterobacter*, *Microbacterium*, and *Paenibacillus* are among the halotolerant PGPR and endophytic bacteria that produce EPS and promote biofilm formation [14]; (5) synthesis of the ACC deaminase enzyme, which converts the plant ethylene precursor ACC to ammonia and α -ketobutyrate [10], thereby reducing plant ethylene accumulation and avoiding ethylene-mediated growth inhibition in response to abiotic stresses such as increased salinity [22]; (6) changes in root architecture and morphology, hydraulic conductivity, and hormonal status [3]. These root changes, which may result from an increase in IAA, may facilitate the uptake of more nutrients and provide access to a larger soil water network [11]; (7) the release of stress-related volatile compounds that increase plant biomass and their survival under severe drought conditions [23]; (8) accumulation of osmolytes such as amino acids and their derivatives (eg glutamate, proline, peptides and N-acetylated amino acids), quaternary amines (eg glycine-betaine and carnitine) and sugars (eg sucrose and trehalose) [6]; (9) maintaining higher stomatal conductance and photosynthetic activity [7], which can reduce the accumulation of toxic ions (Na^+ and Cl^-) and improve the $K^+:Na^+$ ratio in the leaf [17]; (10) induction of expression of stress-sensitive genes. In particular, halotolerant PGPR and endophytic bacteria induce the activation of stress resistance genes such as RAB18 (LEA), ABA-responsive elements (ABRE) and dehydration-sensitive elements (DRE) regulons RD29A and RD29B, as well as transcription factor DREB2b DRE-binding protein. They can also induce genes encoding proteins associated with energy metabolism and cell division, in

particular with amino acid metabolism and the tricarboxylic acid cycle.

Inoculation of agricultural crops with halotolerant PGPR and endophytic bacteria isolated from halophytes successfully improved the growth and resistance of crops under salt stress conditions [20]. Halotolerant PGPR and endophytic bacteria can provide many benefits to plants, including helping halophytes and glycophytes overcome salt stress. For example, salt-tolerant PGPRs isolated from the rhizosphere soil of *Haloxylon salicornicum*, *Lespedeza bicolor*, *Atriplex leucoclada*, *Suaeda fruticosa*, and *Salicornia virginica* halophytes also enhanced the growth of maize exposed to salinity [25]. These plants showed accumulation of osmolytes (eg sugar and proline) and increased activity of antioxidant enzymes (eg superoxide dismutase, peroxidase, catalase and ascorbate peroxidase) compared to uninoculated plants. Similarly, studies by Siddikee et al. (2010) showed that after inoculation of canola seedlings with halotolerant bacterial isolates isolated from halophyte plants under salt stress under gnotobiotic conditions, the plants showed a significant increase in growth, as evidenced by a 35–43% increase in dry weight. % and an increase in root length by 29–47% [21].

REFERENCES:

1. Al-Mailem, D. M., Sorkhoh, N. A., Marafie, M., Al-Awadhi, H., Eliyas, M., and Radwan, S. S. (2010). Oil phytoremediation potential of hypersaline coasts of the Arabian Gulf using rhizosphere technology. *Bioresour. Technol.* 101, 5786–5792. doi: 10.1016/j.biortech.2010.02.082
2. Anburaj, R., Nabeel, M. A., Sivakumar, T., and Kathiresan, K. (2012). The role of rhizobacteria in salinity effects on biochemical constituents of the halophyte *Sesuvium portulacastrum*. *Russ. J. Plant Physiol.* 59, 115–119. doi: 10.1134/S1021443712010025
3. Arora, N. K., Tewari, S., Singh, S., Lal, N., and Maheshwari, D. K. (2012). “PGPR for protection of plant health under saline conditions,” in *Bacteria in Agrobiotechnology: Stress Management*, ed D. K. Maheshwari (Berlin; Heidelberg: Springer-Verlag), 239–258.
4. Bibi, F., Chung, E. J., Yoon, H. S., Song, G. C., Jeon, C. O., and Chung, Y. R. (2011). *Haloferula luteola* sp. nov., an endophytic bacterium isolated from the root of a halophyte, *Rosa rugosa*, and emended description of the genus *Haloferula*. *Int. J. Syst. Evol. Microbiol.* 61, 1837–1841. doi: 10.1099/ijs.0.022772-0
5. Boukhatem, Z. F., Domergue, O., Bekki, A., Merabet, C., Sekkour, S., Bouazza, F. (2012). Symbiotic characterization and diversity of rhizobia associated with native and introduced acacias in arid and semi-arid regions in Algeria. *FEMS Microbiol. Ecol.* 80, 534–547. doi: 10.1111/j.1574-6941.2012.01315.x
6. Creus, C. M., Sueldo, R. J., and Barassi, C. A. (2004). Water relations and yield in *Azospirillum*-inoculated wheat exposed to drought in the field. *Can. J. Bot.* 82, 273–281. doi: 10.1139/b03-119
7. del Amor, F. M., and Cuadra-Crespo, P. (2012). Plant growth-promoting bacteria as a tool to improve salinity tolerance in sweet pepper. *Funct. Plant Biol.* 39, 82–90. doi: 10.1071/FP11173
8. Dodd, I. C., and Pérez-Alfocea, F. (2012). Microbial amelioration of crop salinity stress. *J. Exp. Bot.* 63, 3415–3428. doi: 10.1093/jxb/ers033
9. El-Tarabily, K. A., and Youssef, T. (2010). Enhancement of morphological, anatomical and physiological characteristics of seedlings of the mangrove *Avicennia marina* inoculated with a native phosphate-solubilizing isolate of *Oceanobacillus picturae* under greenhouse conditions. *Plant Soil* 332, 147–162. doi: 10.1007/s11104-010-0280-y
10. Etesami, H., and Beattie, G. A. (2017). “Plant-microbe interactions in adaptation of agricultural crops to abiotic stress conditions,” in *Probiotics and Plant Health*, eds V. Kumar, M. Kumar, S. Sharma, and R. Prasad (Singapore: Springer), 163–200.
11. Goswami, D., Dhandhukia, P., Patel, P., and Thakker, J. N. (2014). Screening of PGPR from saline desert of Kutch: growth promotion in *Arachis hypogaea* by *Bacillus licheniformis* A2. *Microbiol. Res.* 169, 66–75. doi: 10.1016/j.micres.2013.07.004
12. Islam, F., Yasmeen, T., Arif, M. S., Ali, S., Ali, B., Hameed, S. (2016). Plant growth promoting bacteria confer salt tolerance in *Vigna radiata* by up-regulating antioxidant defense and biological soil fertility. *Plant Growth Regul.* 80, 23–36. doi: 10.1007/s10725-015-0142-y
13. Jha, B., Gontia, I., and Hartmann, A. (2012). The roots of the halophyte *Salicornia brachiata* are a source of new halotolerant diazotrophic bacteria with plant growth-promoting potential. *Plant Soil* 356, 265–277. doi: 10.1007/s11104-011-0877-9
14. Khan, M. A., Boër, B., Öztürk, M., Clüsener-Godt, M., Gul, B., and Breckle, S.-W. (2016). *Sabkha Ecosystems: Vol. V: The Americas*. Springer.
15. Nunkaew, T., Kantachote, D., Nitoda, T., Kanzaki, H., Ritchie, R. J. (2015). Characterization of exopolymeric substances from selected *Rhodospirillum rubrum* strains and their ability to adsorb sodium ions. *Carbohydr. Polym.* 115, 334–341. doi: 10.1016/j.carbpol.2014.08.099
16. Pérez-Alfocea, F., Albacete, A., Ghanem, M. E., and Dodd, I. C. (2010). Hormonal regulation of source-sink relations to maintain crop productivity under salinity: a case study of root-to-shoot signalling in tomato. *Funct. Plant Biol.* 37, 592–603. doi: 10.1071/FP10012
17. Pérez-Alfocea, F., Albacete, A., Ghanem, M. E., and Dodd, I. C. (2010). Hormonal regulation of source-sink relations to maintain crop productivity under salinity: a case study of root-to-shoot signalling in tomato. *Funct. Plant Biol.* 37, 592–603. doi: 10.1071/FP10012
18. Rueda-Puente, E. O., Castellanos-Cervantes, T., Díaz de León-Álvarez, J. L., Preciado-Rangel, P., and Almaguer-Vargas, G. (2010). Bacterial community of rhizosphere associated to the annual halophyte *Salicornia bigelovii* (Torr.). *Terra Latinoamericana* 28, 345–353.

19. Ruppel, S., Franken, P., and Witzel, K. (2013). Properties of the halophyte microbiome and their implications for plant salt tolerance. *Funct. Plant Biol.* 40, 940–951. doi: 10.1071/FP12355
20. Shukla, P. S., Agarwal, P. K., and Jha, B. (2012). Improved salinity tolerance of *Arachis hypogaea* (L.) by the interaction of halotolerant plant-growth-promoting rhizobacteria. *J. Plant Growth Regul.* 31, 195–206. doi: 10.1007/s00344-011-9231-y
21. Siddikee, M. A., Chauhan, P. S., Anandham, R., Han, G.-H., and Sa, T. (2010). Isolation, characterization, and use for plant growth promotion under salt stress, of ACC deaminase-producing halotolerant bacteria derived from coastal soil. *J. Microbiol. Biotechnol.* 20, 1577–1584. doi: 10.4014/jmb.1007.07011
22. Singh, R. P., and Jha, P. N. (2016). A halotolerant bacterium *Bacillus licheniformis* HSW-16 augments induced systemic tolerance to salt stress in wheat plant (*Triticum aestivum*). *Front. Plant Sci.* 7:1890. doi: 10.3389/fpls.2016.01890
23. Timmusk, S., El-Daim, I. A. A., Copolovici, L., Tanilas, T., Kännaste, A., Behers, L., et al. (2014). Drought-tolerance of wheat improved by rhizosphere bacteria from harsh environments: enhanced biomass production and reduced emissions of stress volatiles. *PLoS ONE* 9:e96086. doi: 10.1371/journal.pone.0096086
24. Tiwari, S., Singh, P., Tiwari, R., Meena, K. K., Yandigeri, M., Singh, D. P. (2011). Salt-tolerant rhizobacteria-mediated induced tolerance in wheat (*Triticum aestivum*) and chemical diversity in rhizosphere enhance plant growth. *Biol. Fertil. Soils* 47:907. doi: 10.1007/s00374-011-0598-5
25. Ullah, S., and Bano, A. (2015). Isolation of plant-growth-promoting rhizobacteria from rhizospheric soil of halophytes and their impact on maize (*Zea mays* L.) under induced soil salinity. *Can. J. Microbiol.* 61, 307–313. doi: 10.1139/cjm-2014-0668
26. Upadhyay, S. K., Singh, D. P., and Saikia, R. (2009). Genetic diversity of plant growth promoting rhizobacteria isolated from rhizospheric soil of wheat under saline condition. *Curr. Microbiol.* 59, 489–496. doi: 10.1007/s00284-009-9464-1
27. Zhu, F., Qu, L., Hong, X., and Sun, X. (2011). Isolation and characterization of a phosphate-solubilizing halophilic bacterium *Kushneria* sp. YCWA18 from Daqiao Saltern on the coast of Yellow Sea of China. *Evid. Based Complement. Altern. Med.* 2011:615032. doi: 10.1155/2011/615032

CHEMICAL SCIENCES

INVESTIGATION OF THE CHARACTER OF INTERACTION IN THE SYSTEM $\text{As}_2\text{Se}_3 - \text{Cu}_2\text{Cr}_4\text{Te}_7$ AND THE PROPERTIES OF THE OBTAINED PHASES

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ИССЛЕДОВАНИЕ ХАРАКТЕРА ВЗАИМОДЕЙСТВИЯ В СИСТЕМЕ $\text{As}_2\text{Se}_3 - \text{Cu}_2\text{Cr}_4\text{Te}_7$ И СВОЙСТВ ПОЛУЧЕННЫХ ФАЗ

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Abstract

The character of the interaction in the $\text{As}_2\text{Se}_3 - \text{Cu}_2\text{Cr}_4\text{Te}_7$ system was studied by the methods differential thermal (DTA), X-ray phase (XRF), microstructural (MSA) analyzes, as well as by measuring microhardness and density, and built a phase diagram. It is established that the state diagram of the system is a quasi-binary section of the quasi-ternary system $\text{As}_2\text{Se}_3\text{-Cu}_2\text{Te-Cr}_2\text{Te}_6$. In the $\text{As}_2\text{Se}_3\text{-Cu}_2\text{Cr}_4\text{Te}_7$ system, the process of eutectic equilibrium and peritectic transformation takes place. Regions of solid solutions were found in the system, which, based on As_2Se_3 , extend up to 2 mol %, and based on $\text{Cu}_2\text{Cr}_4\text{Te}_7$ up to 13 mol %. Eutectic equilibrium and peritectic transformation occur in the system. In the system, under normal conditions, the region of glass formation based on As_2Se_3 extends up to 10 mol %, and when cooled in ice water - 20 mol %.

Аннотация

Характер взаимодействия в системе $\text{As}_2\text{Se}_3\text{-Cu}_2\text{Cr}_4\text{Te}_7$ исследован методами дифференциально-термического (ДТА), рентгенофазового (РФА), микроструктурного (МСА) анализов, а также измерением микротвердости и плотности и построена фазовая диаграмма.

Установлено, что диаграмма состояния системы является квазибинарным сечением квазитройной системы $\text{As}_2\text{Se}_3\text{-Cu}_2\text{Te-Cr}_2\text{Te}_6$. В системе $\text{As}_2\text{Se}_3\text{-Cu}_2\text{Cr}_4\text{Te}_7$ происходит процесс эвтектического равновесия и перитектического превращения. В системе обнаружены области твердых растворов, которые на основе As_2Se_3 простираются до 2 мол. %, а на основе до 13 мол. %. В системе при нормальных условиях область стеклообразования на основе As_2Se_3 простирается до 10 мол. %, а при охлаждении в ледяной воде - 20 мол. %.

Keywords: system, microhardness, quasi-binary, liquidus, syngony.

Ключевые слова: система, микротвердость, квазибинарный, ликвидус, сингония.

Введение

Данные о взаимодействии между халькогенидами мышьяка и халькомедихрома не имеются данные по четверным системам в литературе. Система $\text{As}_2\text{Se}_3 - \text{Cu}_2\text{Cr}_4\text{Te}_7$ исследуется впервые. Исходные компоненты системы являются полупроводниками с комплексными физическими свойствами. Халькогениды As_2Se_3 и полученные на его основе тройные и более сложные сплавы обладают фотоэлектрическими и люминесцентными свойствами [1-7]. Халькогенидное волокно изготовленной на основе халькогенидов As_2S_3 и As_2Se_3 мышьяка нашло применение как компактная нелинейная среда, обеспечивающая эффективное романовское усиление и генерацию, сжатие импульсов, оптическую регенерацию, преобразование длины волны [8-12]. Халькогениды хрома и полученные тройные соединения на его основе обладают магнитными свойствами [13-15]. Поэтому исследование взаимодействия между соединениями As_2Se_3 и CuCr_2Te_4 весьма актуально.

Целью настоящей работы является исследование взаимодействия в системе $\text{As}_2\text{Se}_3\text{-Cu}_2\text{Cr}_4\text{Te}_7$ с построением фазовой диаграммы и поиска области твердых растворов.

Соединение As_2Se_3 плавится с открытым максимумом при 380°C и кристаллизуется в моноклинной сингонии с параметрами решетки: $a = 12,053$; $b = 9,890$; $c = 4,277$ Å, $\beta = 90^\circ 28'$, пр. гр. $P2_1/n$ [16]. Плотность и микротвердость стеклообразного соединения As_2Se_3 соответственно равны $\rho = 4,618$ г/см³ и $H_v = 1280\text{-}1400$ МПа.

Соединение $\text{Cu}_2\text{Cr}_4\text{Te}_7$ плавится incongruently при 1000°C и вблизи имеются большой области гомогенности [17].

Экспериментальная часть

Синтез сплавов системы $\text{As}_2\text{Se}_3\text{-Cu}_2\text{Cr}_4\text{Te}_7$ синтезированы из компонентов As_2Se_3 и $\text{Cu}_2\text{Cr}_4\text{Te}_7$ в вакуированных до 0,133Па кварцевых ампулах при $600\text{-}1200^\circ\text{C}$. Для кристаллизации стеклообразных сплавов применяли отжиг. Окончательный вариант отжига был, применен после термографической записи не полностью равновесных сплавов.

Охлаждение сплавов вели со скоростью 50-60 град/ч.

Равновесные сплавы системы исследовали методами дифференциально-термического (ДТА), рентгенографического (РФА), микроструктурного (МСА) анализов, измерением микротвердости и определением плотности.

Термический анализ образцов осуществляли на низкочастотном термографе марки НТР-73 с хромель-алюмелевыми термопарами. Скорость нагрева составляла 10 град/мин.

РФА проводили на рентгеновском приборе D2-PHASER в SiK_α -излучении с Ni-фильтром. МСА полированных, протравленных (травитель: $\text{KOH}_{\text{конц}} + \text{H}_2\text{O} = 1:1$ и $\text{HNO}_3 + \text{H}_2\text{O}_2 = 2:1$) шлифов изучали на микроскопе МИМ-8. Микротвердость образцов измеряли на микротвердомере ПМТ-3 при нагрузках, выбранных в результате изучения измерения микротвердости для каждой фазы от нагрузки. Плотность сплавов определяли пикнометрическим взвешиванием: наполнителем служил толуол.

Результаты и их обсуждение

Сплавы системы $\text{As}_2\text{Se}_3\text{-Cu}_2\text{Cr}_4\text{Te}_7$ получались компактными в стеклообразном состоянии, черного цвета. Сплавы богатые, As_2Se_3 устойчивы по

отношению к воздуху, воде и органическим растворителям, плохо растворяются даже в минеральных кислотах. Сплавы богатые $\text{Cu}_2\text{Cr}_4\text{Te}_7$ хорошо растворяются в концентрированных минеральных кислотах HNO_3 и H_2SO_4 . Сплавы из области стекол растворяются в HNO_3 и в щелочах (NaOH , KOH).

С целью кристаллизации стеклообразных сплавов их длительно отжигали в области температуры кристаллизации в течение 720 ч. Сплавы системы $\text{As}_2\text{Se}_3\text{-Cu}_2\text{Cr}_4\text{Te}_7$ исследовали до и после отжига.

ДТА сплавов системы перед отжигом показал, что на термограммах сплавов присутствует температура размягчения $T_g = 180^\circ\text{C}$. После длительного отжига (720 ч) на термограммах сплавов температура размягчения исчезает, а эффекты, связанные с солидусом и ликвидусом, сохраняются (табл. 1 и 2).

Микроструктура сплавов системы $\text{As}_2\text{Se}_3\text{-Cu}_2\text{Cr}_4\text{Te}_7$ до отжига представляет собой одну мутную фазу. Поэтому было трудно определить точные границы твердых растворов. После кристаллизации стеклообразных образцов в структуре отчетливо видны отдельные фазы.

Таблица 1. Состав, результаты ДТА, измерения микротвердости и определения плотности сплавов системы $\text{As}_2\text{Se}_3\text{-Cu}_2\text{Cr}_4\text{Te}_7$ до отжига

Состав, мол %		Термические эф- фекты, °С	Плотность, 10 ³ кг/м ³	Микротвердость фаз, МПа	
As ₂ Se ₃	Cu ₂ Cr ₄ Te ₇			α	β
100	0	180,380	4,62	1400	-
95	5,0	180,380	4,74	1400	-
90	10	185,380,400	4,87	1430	-
85	15	190,280,410,475	4,99	1480	
80	20	190,410,570	5,12	1480	-
70	30	195,410,720	5,36	1480	-
60	40	410,500,840	5,62	1480	2000
50	50	410,600,945	5,86	-	2000
40	60	410,700,1030	6,11	-	2000
30	70	410,790,1100	6,36	-	2000
20	80	410,880	6,60	-	2000
10	90	580,950	6,85	-	2000
5,0	95	775,980	6,97	-	1980
0,0	100	1000,1210	7,10	-	1970

Таблица 2. Состав, результаты ДТА, измерения микротвердости и определения плотности сплавов системы $As_2Se_3-Cu_2Cr_4Te_7$ после отжига

Состав, мол %		Термические эф- фекты, °С	Плотность, 10 ³ кг/м ³	Микротвердость фаз, МПа	
As ₂ Se ₃	Cu ₂ Cr ₄ Te ₇			α	β
100	0	380	5,21	780	-
95	5,0	380	5,30	820	-
90	10	380,400	5,40	880	-
85	15	380,410,475	5,49	880	-
80	20	410,570	5,59	900	-
70	30	410,720	5,78	900	-
60	40	410,500,840	5,97	900	-
50	50	410,600,945	6,16	900	2000
40	60	410,700,1030	6,34	-	2000
30	70	410,790,1100	6,53	-	2000
20	80	410,880	6,72	-	2000
10	90	580,950	6,91	-	1990
5,0	95	775,980	6,97	-	1980
0.0	100	1000,1210	7,10	-	1970

Рентгенофазовый анализ проводили на сплавах системы $As_2Se_3-Cu_2Cr_4Te_7$ с содержанием 10, 20, 30 и 87 мол. % $Cu_2Cr_4Te_7$ (рис. 1).

На дифрактограммах сплавов, содержащих 10, 20 мол. % $Cu_2Cr_4Te_7$ дифракционных пиков не наблюдается, данный образец относится к области

стекол, а образец 30 мол. % $Cu_2Cr_4Te_7$ к стекло-кристаллической области (рис.1). Остальные сплавы являются кристаллическими. Образец состава 87 мол. % $Cu_2Cr_4Te_7$ относится к области твердых растворов на основе соединения $Cu_2Cr_4Te_7$.

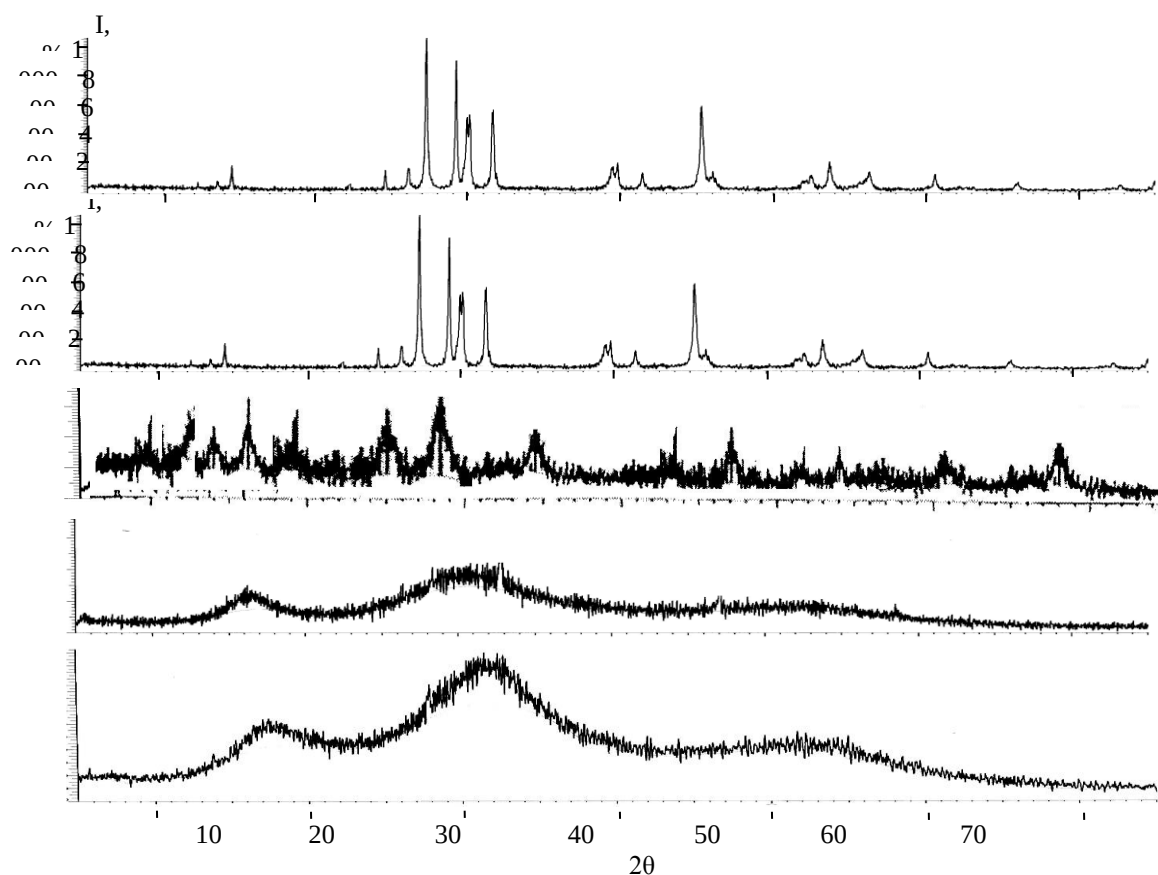


Рис. 1. Дифрактограммы сплавов системы $As_2Se_3-Cu_2Cr_4Te_7$ содержащих 10 (1), 20 (2), 30 (3), 87 (4) и 100 мол. % $Cu_2Cr_4Te_7$ (5).

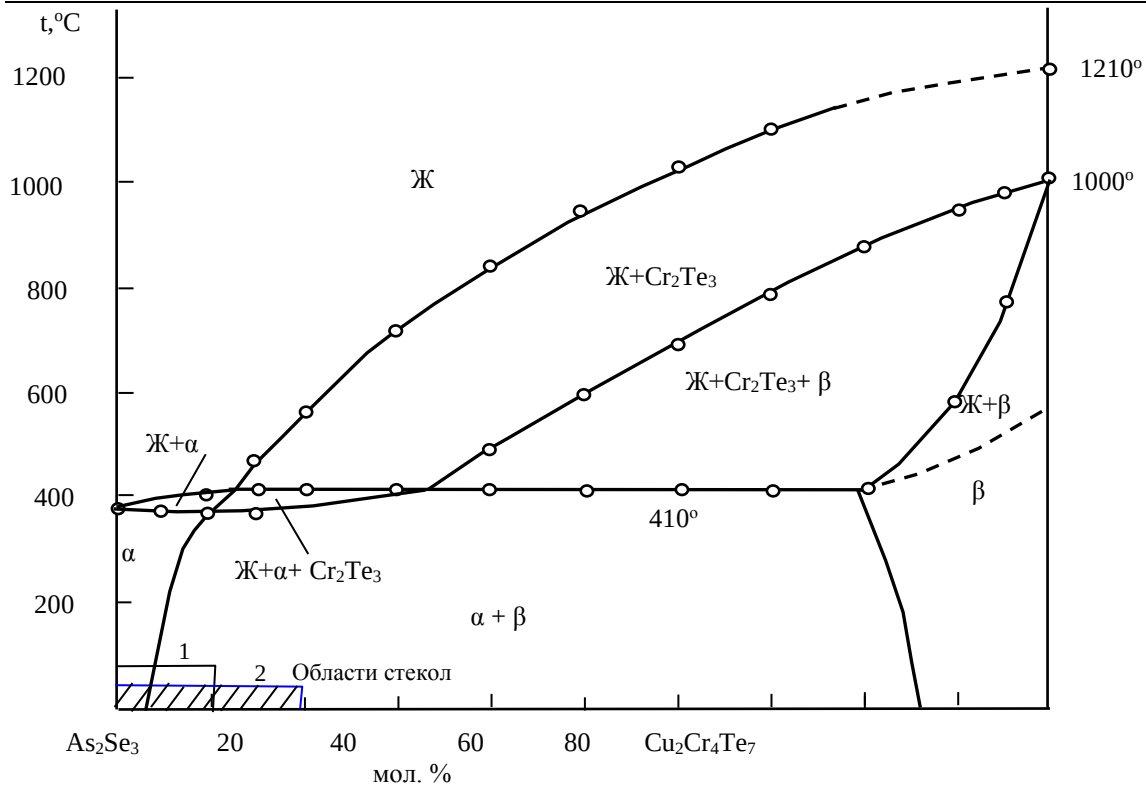


Рис.2. Фазовая диаграмма системы As_2Se_3 - $\text{Cu}_2\text{Cr}_4\text{Te}_7$.
Области стекол: 1- медленное охлаждение, 2-закалка в ледяной воде.

По результатам физико-химического анализа построена фазовая диаграмма системы As_2Se_3 - $\text{Cu}_2\text{Cr}_4\text{Te}_7$ (рис. 2). Как видно из рис. 2, диаграмма состояния системы As_2Se_3 - $\text{Cu}_2\text{Cr}_4\text{Te}_7$ является частично квазибинарной. В системе происходят эвтектическое равновесие и перитектическое превращение.

Ликвидус системы As_2Se_3 - $\text{Cu}_2\text{Cr}_4\text{Te}_7$ состоит из трех ветвей первичной кристаллизации: α -фазы, твердые растворы на основе As_2Se_3 , Cr_2Te_3 и β -фазы, твердые растворы на основе $\text{Cu}_2\text{Cr}_4\text{Te}_7$. Ликвидус α -фазы и Cr_2Te_3 пересекаются в интервале концентраций 0-12 мол. % $\text{Cu}_2\text{Cr}_4\text{Te}_7$ и температуре 405°C . Выделяются первичные кристаллы и жидкости в пределах 5-100 мол. % $\text{Cu}_2\text{Cr}_4\text{Te}_7$. В области концентрации 5-25 мол. % $\text{Cu}_2\text{Cr}_4\text{Te}_7$ существуют трехфазные сплавы ($\text{Ж}+\alpha+\text{Cr}_2\text{Te}_3$).

В системе область гомогенности на основе As_2Se_3 при комнатной температуре достигает 2 мол. %, а на основе $\text{Cu}_2\text{Cr}_4\text{Te}_7$ - до 12 мол. %. Ниже линии солидуса в диапазоне концентраций 2-85 мол. % $\text{Cu}_2\text{Cr}_4\text{Te}_7$ имеются двухфазные области ($\beta+\alpha$), а в пределах 85-100 мол. % $\text{Cu}_2\text{Cr}_4\text{Te}_7$ образуются однофазные α -фазы.

При измерении микротвердости литых сплавов системы As_2Se_3 - $\text{Cu}_2\text{Cr}_4\text{Te}_7$ были обнаружены два ряда значений (табл. 1 и 2). Из них первой соответствует микротвердость α -фазы твердых растворов на основе As_2Se_3 $H_m = (1400-1480)$ МПа, а второй β -фазы твердых растворов на основе $\text{Cu}_2\text{Cr}_4\text{Te}_7$ $H_m = (1970-2000)$ МПа. После отжига микротвердость сплавов из области стекла для α -фазы составляет (780-900) МПа, а для β -фазы $H_m = (1970-2000)$ МПа.

Полученные данные показывают, что значения микротвердости стекол выше микротвердости соответствующих кристаллов. Значения плотности стекла, наоборот, ниже текущих значений для соответствующих кристаллов. Для определения области стеклообразования в системе был проведен РФА до и после отжига.

Заключение

По результатам физико-химических методов анализа изучен характер химического взаимодействия в системе As_2Se_3 - $\text{Cu}_2\text{Cr}_4\text{Te}_7$ и построена Т-х фазовая диаграмма. Установлено, что фазовая диаграмма системы является частично квазибинарной и проявляется в виде устойчивого участка. Установлено, что диаграмма состояния системы является квазибинарным сечением квазитройной системы As_2Se_3 - Cu_2Te - Cr_2Te_6 . В системе As_2Se_3 - $\text{Cu}_2\text{Cr}_4\text{Te}_7$ происходит процесс эвтектического равновесия и перитектического превращения. Растворимость при комнатной температуре на основе As_2Se_3 доходит до 2 мол. %, а на основе $\text{Cu}_2\text{Cr}_4\text{Te}_7$ до-13 мол. %. В системе при нормальных условиях область стеклообразования на основе As_2Se_3 простирается до 10 мол. % $\text{Cu}_2\text{Cr}_4\text{Te}_7$, а при охлаждении в ледяной воде - 20 мол. % $\text{Cu}_2\text{Cr}_4\text{Te}_7$.

СПИСОК ЛИТЕРАТУРЫ:

1. Dinesh Chandra SATI1, Rajendra KUMAR, Ram Mohan MEHRA Influence of Thickness Oil Optical Properties of a: As_2Se_3 Thin Films // Turk J Phys. 2006. V.30. P.519- 527.
2. Lovu M., Shutov S., Rebeja S., Colomeyco E., Popescu M. Effect of metal additives on photodarkening kinetics in amorphous As_2Se_3 films // Journal of

Optoelectronics and Advanced Materials 2000. V. 2. Issue: 1. P 53-58/

3. Jun J. Li Drabold. D. A. Atomistic comparison between stoichiometric and nonstoichiometric glasses: The cases of As_2Se_3 and As_4Se_4 // Phys. Rev. 2001. V. 64. P. 104206-104213.

4. Hineva T., Petkova T., Popov C., Pektov P., Reithmaier J. P., Funrmann-Lieker T., Axente E., Sima F., Mihailescu C. N., Socol G., Mihailescu I. N. Optical study of thin $(\text{As}_2\text{Se}_3)_{1-x}(\text{AgI})_x$ films // Journal of optoelectronics and Advanced Materials. 2007. Vol. 9. No. 2. February. P. 326-329.

5. Seema Kandpal, Kushwaha R. P. S. Photoacoustic spectroscopy of thin films of As_2S_3 , As_2Se_3 and GeSe_2 // Indian Academy of Sciences. PRAM ANA journal of physics. 2007. Vol. 69. No. 3 P. 481-484.

6. Littler I. C. M., Fu L. B., Mägi E. C., Pudo D., Eggleton B. J.. Widely tunable, acoustooptic resonances in Chalcogenide As_2Se_3 fiber // Optics Express. 2006. V. 14. Issue 18. P. 8088- 8095.

7. Бабаев А. А., Мурадов Р., Султанов С. Б., Асхабов А. М. Влияние условий получения на оптические и Фотолюминесцентные свойства стеклообразных As_2S_3 // Неорган. материалы. 2008. Т. 44. № 11. С. 1187-1201.

8. Kim B.Y., Blake J.N., Engan H.E., Shaw H.J. All-fiber acousto-optic frequency shifter // Opt. Lett. 1986. V. 11. P. 389-391.

9. Lee S.S., Kim H.S., Hwang I.K., Yun S.H. Highly-efficient broadband acoustic transducer for all-fiber acousto-optic devices // Electron. Lett. 2003. V. 39. P. 1309-1310.

10. Engan H.E. Acousto-optic coupling in optical Fibers // IEEE Ultrasonics Symposium. 2000. V.1. P. 625- 629.

11. Diez A., Birks T.A., Reeves W.H., Mangan B.J., St P. Russell J. Excitation of cladding modes in photonic crystal fibers by flexural acoustic waves // Optics Lett. 2000. V. 25. P. 1499-1501.

12. 20. Claytor T.N., Sladek R.J. Ultrasonic velocities in amorphous As_2S_3 and As_2Se_3 between 1.5 and 296 K. // Phys. Rev. 1978. B. 18. P. 5842-5850.

13. Белов К.П., Третьяков Ю.Д., Гордеев И.В., Королева Л.И., Педько А.В., Багорова С.Д., Алфёров В.А., Саксонов Ю.Г., Шалимова М.А. Магнитные свойства халькогенидных шпинелей $\text{Cd}_x\text{Cu}_x\text{Cr}_2\text{S}_4$, $\text{CdCr}_2\text{Se}_{4-y}$ $\text{FeCr}_2\text{S}_{4-y}$ // ФТТ 1973. Т.15, № 10. С.3106-108.

14. Север Г.Н. Аномальный фотомангнетический эффект в ферримангнитном полупроводнике CdCr_2Se_4 // ФТП. 1983. Т. 17. № 8. С.1505-507.

15. Шумилкин Н. С. Взаимодействие в системах Cu-In-Cr-Se(Te) в области существования магнитных фаз с высокими температурами магнитного упорядочения (Tc). Дис. на соиск. канд. хим. наук. РАН ИОНХ им. Н.С.Курнакова. 2002. 121 с.

16. Хворостенко А.С. Халькогениды мышьяка. Обзор из серии "Физические и химические свойства твердого тела". - М., 1972. 92 с.

17. Алиев И.И., Исмаилова С. Ш., Гусейнова Ш.А., Ахмедова Дж.А. Фазовые равновесие в системе $\text{As}_2\text{Te}_3\text{-Cu}_2\text{Cr}_4\text{Te}_7$ Евразийский Союз Ученых 2021. 6/67. №1. С. 14-17. DOI: 10.31618/ESU.2413-9335.2021.1.87.1389

PHASE EQUILIBRIUM IN THE SYSTEM InAs_2Se_4 - $\text{In}_6\text{As}_4\text{S}_3\text{Se}_9$ AND PROPERTIES OF THE FORMING PHASES

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ФАЗОВЫЕ РАВНОВЕСИЯ В СИСТЕМЕ InAs_2Se_4 - $\text{In}_6\text{As}_4\text{S}_3\text{Se}_9$ И СВОЙСТВА ОБРАЗУЮЩИХСЯ ФАЗ

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Abstract

The phase equilibria in the InAs_2Se_4 - $\text{In}_6\text{As}_4\text{S}_3\text{Se}_9$ system were studied by the methods of complex physico-chemical analysis (DTA, XRF, MSA, microhardness measurement and density determination) and its state diagram was constructed. It is established that the system is a quasi-binary section of the $\text{As}_2\text{S}_3\text{-InSe-As}_2\text{Se}_3$ quasi-ternary system. In the InAs_2Se_4 - $\text{In}_6\text{As}_4\text{S}_3\text{Se}_9$ system, the solubility based on InAs_2Se_4 at room temperature reaches 9 mol. %, and on the basis of $\text{In}_6\text{As}_4\text{S}_3\text{Se}_9$ up to 15 mol. %. The compound InAs_2Se_4 and $\text{In}_6\text{As}_4\text{S}_3\text{Se}_9$ form a eutectic with the composition 40 15 mol. % $\text{In}_6\text{As}_4\text{S}_3\text{Se}_9$.

Аннотация

Методами комплексного физико-химического анализа (ДТА, РФА, МСА, микротвердость и определение плотности) изучены фазовые равновесия в системе InAs_2Se_4 - $\text{In}_6\text{As}_4\text{S}_3\text{Se}_9$ и построена диаграмма ее состояния. Установлено, что система является квазибинарным сечением квазитройной системы $\text{As}_2\text{S}_3\text{-InSe-As}_2\text{Se}_3$. В системе InAs_2Se_4 - $\text{In}_6\text{As}_4\text{S}_3\text{Se}_9$ растворимость на основе InAs_2Se_4 при комнатной температуре доходит до 9 мол. %, а на основе $\text{In}_6\text{As}_4\text{S}_3\text{Se}_9$ до 15 мол. %. Соединение InAs_2Se_4 и $\text{In}_6\text{As}_4\text{S}_3\text{Se}_9$ образуют эвтектику состава 40 15 мол. % $\text{In}_6\text{As}_4\text{S}_3\text{Se}_9$.

Keywords: system, phase, solid solution, solidus, microhardness.

Ключевые слова: система, фаза, твердый раствор, солидус, микротвердость.

ВВЕДЕНИЕ

Известно, что бинарные халькогениды элементов подгруппы мышьяка, особенно полупроводниковые сульфиды и селениды мышьяка привлекают внимание как перспективные материалы для применения в фотоэлектрических элементах и т.д. [1-4], акустооптике [5-12]. Слоистые моноселениды индия InSe также являются полупроводниками и обладают фотоэлектрическими свойствами. [13,14].

Ранее нами были изучены квазитройная система As_2S_3 - As_2Se_3 - InSe и некоторые квазибинарные разрезы [15,16].

Целью данной работы является исследование фазовых равновесий в системе InAs_2Se_4 - $\text{In}_6\text{As}_4\text{S}_3\text{Se}_9$, а также поиск новых полупроводниковых фаз.

ЭКСПЕРИМЕНТАЛЬНАЯ ЧАСТЬ

Сплавы системы InAs_2Se_4 - $\text{In}_6\text{As}_4\text{S}_3\text{Se}_9$ были синтезированы из соответствующих лигатур InAs_2Se_4 и $\text{In}_6\text{As}_4\text{S}_3\text{Se}_9$ при температуре 800-900°C. Для достижения равновесного состояния литые сплавы отжигались при 570-600°C в течение 450 ч.

Исследование сплавов системы проводили методами дифференциального термического (ДТА),

рентгенографического (РФА), микроструктурного (МСА) анализов, измерением микротвердости и определением плотности.

ДТА образцов осуществляли на низкочастотном терморегистраторе НТР-73 с Pt/Pt-Rh-термопарой. Скорость нагрева составляла 9 град/мн. РФА проводили на рентгеновском приборе модели Д2 PHASER на CuK-излучении с Ni-фильтром.

МСА полированных протравленных (травитель: $\text{HNO}_3 + \text{H}_2\text{O}_2 = 1:1$) шлифов изучали на микроскопе МИМ-8. Микротвердость образцов системы измеряли на микротвердомере ПМТ-3. Плотность сплавов определяли пикнометрическим взвешиванием: наполнителем служил толуол.

РЕЗУЛЬТАТЫ И ИХ ОБСУЖДЕНИЕ

Для более детального исследования диаграммы состояния InAs_2Se_4 - $\text{In}_6\text{As}_4\text{S}_3\text{Se}_9$ использовали сплавы с разным интервалом концентраций, включая исходные компоненты.

Диаграмма состояния системы InAs_2Se_4 - $\text{In}_6\text{As}_4\text{S}_3\text{Se}_9$, исследованы методами ДТА, РФА и МСА, а также определением микротвердости и плотности.



Рис.1. Микроструктуры сплавов системы InAs_2Se_4 - $\text{In}_6\text{As}_4\text{S}_3\text{Se}_9$.
1-5 мол. %, 2-40 мол. % и 3- 60 мол. % $\text{In}_6\text{As}_4\text{S}_3\text{Se}_9$.

Следуя правилам количественной термографии эвтектических эффектов, были построены треугольники Таммана, результаты которых согласуются с данными микроструктурного анализа.

Для уточнения границы области твердых растворов на основе $\text{In}_6\text{As}_4\text{S}_3\text{Se}_9$ синтезировали дополнительные сплавы 80;83; 85; 90 мол. % $\text{In}_6\text{As}_4\text{S}_3\text{Se}_9$ и были отожжены при температурах 500, 400 и 200°C в течении 120 ч.; 240 и 320°C, соответственно. Затем были закалены в ледяной воде.

Результаты изучения микроструктуры закаленных сплавов отмечались в диаграмме состояния системы InAs_2Se_4 - $\text{In}_6\text{As}_4\text{S}_3\text{Se}_9$ соответствующими знаками. Линии солидуса были проведены одно- и двухфазными полями. Микроструктуры некоторых сплавов системы InAs_2Se_4 - $\text{In}_6\text{As}_4\text{S}_3\text{Se}_9$ приведены

на рис.1. Как видно из рис. 1 сплавы состава 5 мол. % $\text{In}_6\text{As}_4\text{S}_3\text{Se}_9$ является однофазными и представляет собой твердый раствор на основе InAs_2Se_4 (1). Образец состава 40 мол. % $\text{In}_6\text{As}_4\text{S}_3\text{Se}_9$ под номером (2) указывает на эвтектический состав. Состав образца 60 мол. % $\text{In}_6\text{As}_4\text{S}_3\text{Se}_9$ (3) двухфазный.

Диаграмма состояния системы InAs_2Se_4 - $\text{In}_6\text{As}_4\text{S}_3\text{Se}_9$, построенная в результате физико-химического анализа, представлена на рис. 2. Как видно из рис. 2, при комнатной температуре растворимость на основе исходных компонентов составляет: 9 мол. % на основе InAs_2Se_4 и 15 мол. % на основе $\text{In}_6\text{As}_4\text{S}_3\text{Se}_9$. При эвтектической температуре (620°C) оно имеет значения 15 и 20 мол. %, соответственно.

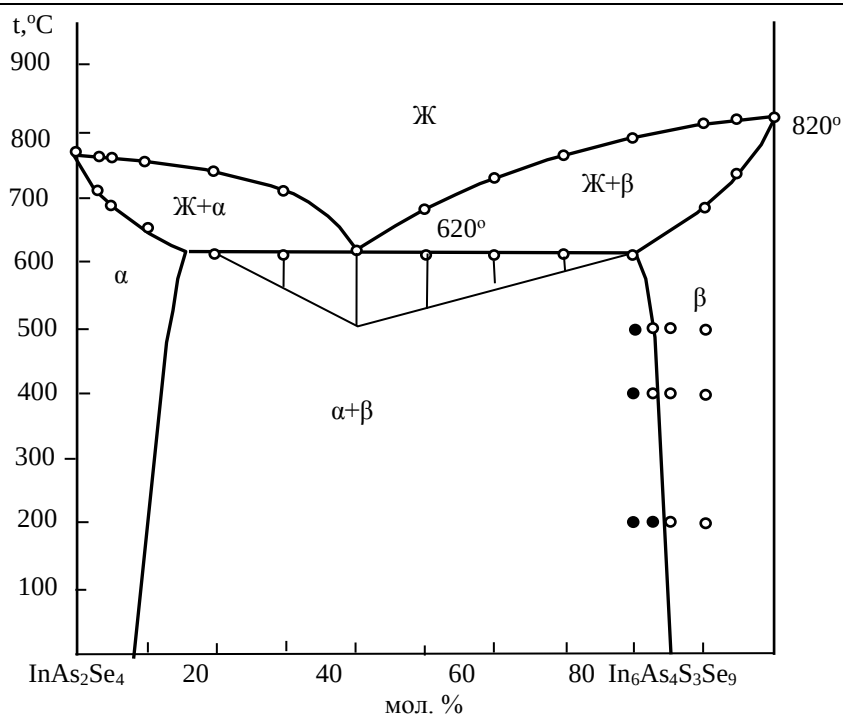


Рис. 2. Т-х фазовая диаграмма системы InAs_2Se_4 - $\text{In}_6\text{As}_4\text{S}_3\text{Se}_9$.

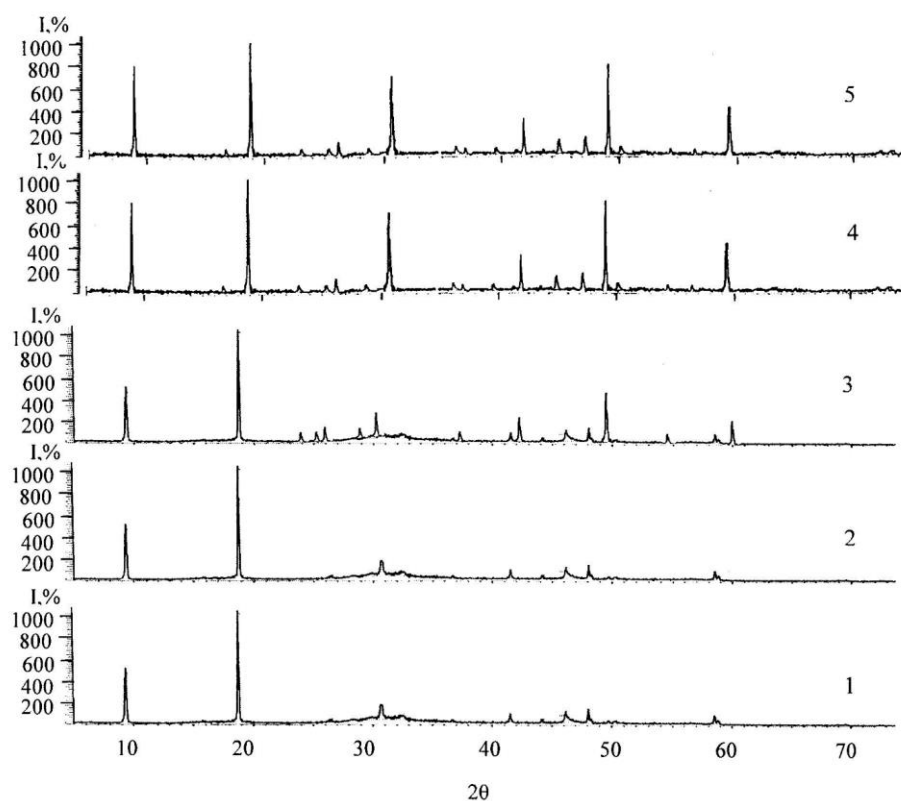


Рис. 3. Дифрактограммы сплавов системы InAs_2Se_4 - $\text{In}_6\text{As}_4\text{S}_3\text{Se}_9$:
1- InAs_2Se_4 ; 2- 9; 3- 60; 4- 85; 5- 100 мол. % $\text{In}_6\text{As}_4\text{S}_3\text{Se}_9$.

Образование в системе InAs_2Se_4 - $\text{In}_6\text{As}_4\text{S}_3\text{Se}_9$ области твердых растворов на основе исходных компонентов доказана измерением микротвердости

в зависимости от состава. Установлено, что в системе наблюдаются всего два ряда значений (1200-1070) МПа и 1050 МПа, относящиеся к α - и β -твер-

дям растворам на основе InAs_2Se_4 и $\text{In}_6\text{As}_4\text{S}_3\text{Se}_9$ соответственно. Причем с увеличением второго компонента значение микротвердости увеличивается, подтверждающая растворимость на основе InAs_2Se_4 и $\text{In}_6\text{As}_4\text{S}_3\text{Se}_9$. Результаты рентгенофазового анализа показаны на рис. 3.

Для подтверждения образования новой фазы и образования фазы переменного состава (твердых растворов) на основе исходных соединений снимались рентгенограммы исходных компонентов и сплавов, содержащих 9; 60; 85 мол. % $\text{In}_6\text{As}_4\text{S}_3\text{Se}_9$.

Как видно из рис.3, рентгенограмма сплава 9 мол. % $\text{In}_6\text{As}_4\text{S}_3\text{Se}_9$ идентична рентгенограмме соединения InAs_2Se_4 . То есть сплав относится к области твердого раствора на основе InAs_2Se_4 . Сплавы состава 85 мол. % $\text{In}_6\text{As}_4\text{S}_3\text{Se}_9$ свидетельствует о наличии твердого раствора на основе соединения $\text{In}_6\text{As}_4\text{S}_3\text{Se}_9$.

Для подтверждения образования новой фазы и образования фазы переменного состава (твердых растворов) на основе исходных соединений снимались рентгенограммы исходных компонентов и сплавов, содержащих 9; 60; 85 мол. % $\text{In}_6\text{As}_4\text{S}_3\text{Se}_9$. Результаты рентгенофазового анализа показаны на рис. 3. Как видно из рис. 3, рентгенограмма сплава 9 мол. % $\text{In}_6\text{As}_4\text{S}_3\text{Se}_9$ идентична рентгенограмме соединения InAs_2Se_4 . То есть сплав относится к области твердого раствора на основе InAs_2Se_4 . Сплав состава 85 мол. % $\text{In}_6\text{As}_4\text{S}_3\text{Se}_9$ свидетельствует о наличии твердого раствора на основе соединения $\text{In}_6\text{As}_4\text{S}_3\text{Se}_9$. На дифракционной диаграмме сплава 60 мол. % $\text{In}_6\text{As}_4\text{S}_3\text{Se}_9$ дифракционные линии представляют собой смесь дифракционных линий исходных компонентов InAs_2Se_4 и $\text{In}_6\text{As}_4\text{S}_3\text{Se}_9$, т. е. сплав двухфазный. Таким образом, анализ РФА подтверждает точность анализов ДТА и МСА. По результатам РФА в области концентрации 9-85 мол. % $\text{In}_6\text{As}_4\text{S}_3\text{Se}_9$ ниже линии солидуса совместно кристаллизуются α - и β -фазы, твердые растворы на основе InAs_2Se_4 и $\text{In}_6\text{As}_4\text{S}_3\text{Se}_9$.

Ликвидус системы состоит из двух кривых ветвей первичной кристаллизации InAs_2Se_4 и $\text{In}_6\text{As}_4\text{S}_3\text{Se}_9$ из жидкости, соприкасающейся при 40 мол. % $\text{In}_6\text{As}_4\text{S}_3\text{Se}_9$. В интервале концентрации 0-40 мол. % $\text{In}_6\text{As}_4\text{S}_3\text{Se}_9$ из жидкости выделяются первичные кристаллы α -фазы, а в пределах 40-100 мол. % $\text{In}_6\text{As}_4\text{S}_3\text{Se}_9$ кристаллизуются β -фазы (твердые растворы на основе $\text{In}_6\text{As}_4\text{S}_3\text{Se}_9$).

ЗАКЛЮЧЕНИЕ

Таким образом, построена Т-х фазовая диаграмма системы InAs_2Se_4 - $\text{In}_6\text{As}_4\text{S}_3\text{Se}_9$. Разрез InAs_2Se_4 - $\text{In}_6\text{As}_4\text{S}_3\text{Se}_9$ является квазибинарным сечением квазитройной системы As_2S_3 - InSe - As_2Se_3 . Состав двойной эвтектики, образующейся в системе, составляет 40 % $\text{In}_6\text{As}_4\text{S}_3\text{Se}_9$, а температура 620°C. Области твердого раствора, образующегося на основе первичных компонентов InAs_2Se_4 и $\text{In}_6\text{As}_4\text{S}_3\text{Se}_9$ составляют 9 и 15 мол. %, соответственно.

СПИСОК ЛИТЕРАТУРЫ:

1. Springer Handbook of Electronic and Photonic Materials. S. Kasap., Capper (Editors). Springer science + Business Media. Inc. 2006. 1406 с.

2. Handbook on Physical properties of Semiconductors. Sadao Adachi. Ed., Berlin: Springer. 2007. 246 p.

3. Анисимова И.Д., Викулин И.М., Зайтов Ф.А. Полупроводниковые фотоприемники. Ультрафиолетовый, видимый и ближний инфракрасный диапазон спектра. М.: Радио и связь. 1984. 365 с.

4. Kim B.Y., Blake J.N., Engan H.E., Shaw H.J. All-fiber acousto-optic frequency shifter // Opt. Lett. 1986. V. 11. P. 389-391.

5. Филатов А.М., Таубкин И.И., Трищенко И.А. Твердотельная фотозлектроника. Фотодиоды. М.: Физматкнига. 2011. 325 с.

6. Ewen P.J.S., Zakery A., Firth A.P., Owen A.E. Optical monitoring of photodissolution kinetics in amorphous As-S films // Philos. Mag. 1988. - Vol. - B57. - P. 1-6.

7. Hari P., Cheneya C., Luepkea G., Singha S., Tolka N., Sanghera J.S., Aggarwal D.. Wavelength selective materials modification of bulk As_2S_3 and As_2Se_3 by free electron laser irradiation // Journal of Non-Crystalline Solids. 2000. V. 270. P.265-268.

8. Dinesh Chandra SATI1, Rajendra KUMAR, Ram Mohan MEHRA Influence of Thickness Oil Optical Properties of a: As_2Se_3 Thin Films // Turk J Phys. 2006. V.30. P.519- 527.

9. Hineva T., Petkova T., Popov C., Pektov P., Reithmaier J. P., Funrmann-Lieker T., Axente E., Sima F., Mihailescu C. N., Socol G., Mihailescu I. N. Optical study of thin $(\text{As}_2\text{Se}_3)_{1-x}(\text{AgI})_x$ films // Journal of optoelectronics and Advanced Materials. 2007. V.9. No. 2. February. P. 326-329.

10. Seema Kandpal, Kushwaha R. P. S.. Photoacoustic spectroscopy of thin films of As_2S_3 , As_2Se_3 and GeSe_2 // Indian Academy of Sciences. PRAM ANA journal of physics. 2007. V. 69. No. 3. P. 481-484.

11. Burdiyan I.I., Feshchenko I.S. Photocurrent and Optical Transmission Spectra of Sn- and Pb-Doped $(\text{As}_2\text{S}_3)_{0,3}(\text{As}_2\text{Se}_3)_{0,7}$ Glass Films, Inorgan. Materials. 2005. T.41. №9. P. 1013-1016.

12. Lovu M., Shutov S., Rebeja S., Colomeyco E., Popescu M. Effect of metal additives on photodarkening kinetics in amorphous As_2Se_3 films // Journal of Optoelectronics and Advanced Materials 2000. V. 2. Issue: 1. P 53-58.

13. Кязым-заде А.Г., Агаева А.А., Салманов В.М., Мохтари А.Г. Детекторы оптического излучения на основе слоистых кристаллов и InSe // ЖТФ. 2007. Т.7. вып.4. С. 80-82.

14. Салманов В.М., Гусейнов А.Г., Оптические нелинейности в кристаллах GaSe и InSe при лазерном возбуждении // Оптика и спектроскопия. 2014. Т. 116. № 4. С.130-133.

15. Алиев И.И., Магаммедрогимова Р.С., Фарзалиев А.А., Велиев Дж.А. Фазовая диаграмма состояния системы $\text{In}_3\text{As}_2\text{Se}_6$ - $\text{In}_3\text{As}_2\text{S}_3\text{Se}_3$ // Журн. неорган. химии. 2009.т.54. № 4. с.638-640.

16. Заргарова М.И., Мамедов А.Н., Аждарова Дж.С., Ахмедова (Велиев) Дж.А., Абилов Ч.И. Справочник: Неорганические вещества, синтезированные и исследованные в Азербайджане. Баку. Изд. Элм. 2004. 462 с.

УДК 544.6.076; 544.6.018

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In the presented work, 3,6-dichloro (chlorine) of cyclohexandicarboxylic acids was obtained electrochemically, optimal process conditions were determined, and its antipyretic properties were investigated. The resulting 3,6 dichloro cyclohexandicarboxylic acids can be used in the synthesis of fire-resistant resins and additives for various polymers. Its effectiveness in reducing flammability as a flame retardant is far superior to other flame retardants.

Аннотация

В представленной работе электрохимическим способом получен 3,6-дибром циклогексен дикарбоновых кислот, определено оптимальные условия процесса, а также, исследован его антипирюющие свойства. Полученный 3,6-дибромциклогексен дикарбоновых кислот могут быть применяться в синтезе огнестойких смол и добавок для различных полимеров. Его эффективность снижения горючести в качестве антипирина намного превосходит других антипиренов.

Keywords: Electrochemical method, organohalide compounds, bicyclo dicarboxylic acids, electrolysis plant, fire resistance, gorenje retardants

Ключевые слова: Электрохимический способ, броморганические соединения, бициклодикарбоновые кислоты, электролизная установка, огнестойкость, замедлители горения

Разработка новых конструкционных полимерных композиционных материалов (ПКМ), обладающих повышенными эксплуатационными характеристиками (сочетание высоких тепло- и термостойкости, трещиностойкости и ударной прочности), представляет собой актуальную задачу современного материаловедения. Этот вопрос является особенно важным для такой динамично развивающейся отрасли, как авиационная промышленность [3]. В настоящее время одним из наиболее перспективных направлений развития авиационного материаловедения является разработка конструкционных ПКМ, предназначенных для длительной эксплуатации в условиях воздействия высоких температур. Это подразумевает создание новых видов термоустойчивых полимерных связующих, способных удовлетворять неуклонно возрастающие требования по тепло-, термо- и огнестойкости, механическим характеристикам и технологичности [4-5]. Термоустойчивые полимеры сочетают высокие деформационную устойчивость при нагреве (теплостойкость) и химическую устойчивость при нагреве (термостойкость).

К огнестойкости конструкции из этих материалов предъявляются очень жесткие требования по пожаробезопасности [6]. Наиболее распространенным и эффективным способом снижения горючести является применение замедлителей горения, т.е. антипиренов. Антипирены представляет собой неорганические и органические вещества, которые содержат в молекулах такие элементы как: фосфор, азот, бор, галогены или группировки с сочетанием этих элементов. Антипирены применяются двух видов: инертные и реакционноспособные, но это деление условное, так как антипирен может быть

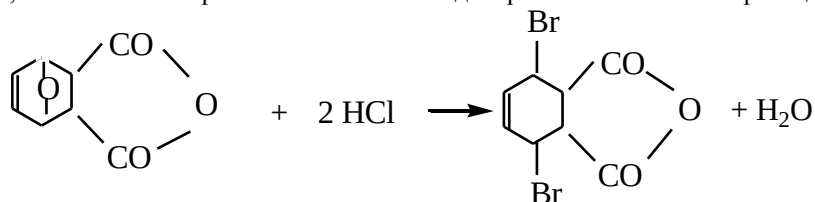
инертен к одному полимеру, но может взаимодействовать с другими и является для них реакционно-способным. Реакционноспособными являются в основном элементарноорганические и органические вещества [2].

Хорошо известно, что в качестве эффективных и потенциальных ингибиторов снижения горючести применяется в основном органические соединения, содержащие гетероатомы в молекуле с некоторыми синергическими добавками, чаще всего Sb_2O_3 [1]. В связи с этим, проблема снижения горючести полимерных материалов и создание огнестойких и термостабильных материалов с повышенными физико-механическими показателями на их основе актуальна и в настоящее время. Представленная работа является продолжением и развитием исследования по электрохимическому синтезу наиболее потенциальных и эффективных антипиренов и создание на их основе полимерных композиций с повышенными огне- и теплостойкостями, а также физико-механическими свойствами.

А также в настоящее время утилизация отходов многотоннажного производства галоид-органических соединений химической промышленности относится к одним из экологических проблем. Исходя из этого рациональное использование природных ресурсов и охрана окружающей среды от загрязнения промышленными отходами является весьма актуален.

Методика проведения электрохимического синтеза

В связи с этим нами впервые разработан электрохимический способ получения 3,6-дибромциклогексана дикарбоновых кислот на основе бициклодикарбоновых кислот по реакции:



По разработанному нами способу в раствор 3,6-эндоксо или 3,6-эндометилтен-тетрагидрофтале-вых кислот в уксусной кислоте пропускает бромистый водород при 60-95°C.

При проведение серийных электрохимических реакции обнаружено, что при бромиро-вания 3,6-эндоксометилентетрагидрофтале-вых кислот процесс протекает при 75±5°C, а в случае бромирова-ния 3,6-эндометилентетрагидрофтале-вых кислот

при 105-115°C. Опыты продолжают 1,5 часа до осаждения кристаллических продуктов.

Полученные продукты перекристаллизовали из пентана, высушивали до постоянного веса. При этом выход 3,6-дибромциклогексендикарбоновых кислот составляет 87-91%, т. пл. 197°C, при этом кислотное число 365мг КОН/г.

Реакция бромирования осуществлялась электрохимическим способом в стеклянном цилиндрическом электролизере, снабженным термостатом,

источником питания постоянного тока, графитовыми электродами, обратным холодильником, мешалкой, термометром, разделительной воронкой и сосуд с раствором NaOH. При выполнении опыта

бромистый вводили в нижнюю часть электролизёра, а выходящие газы улавливали в ловушку с щелочным раствором (см. рис).

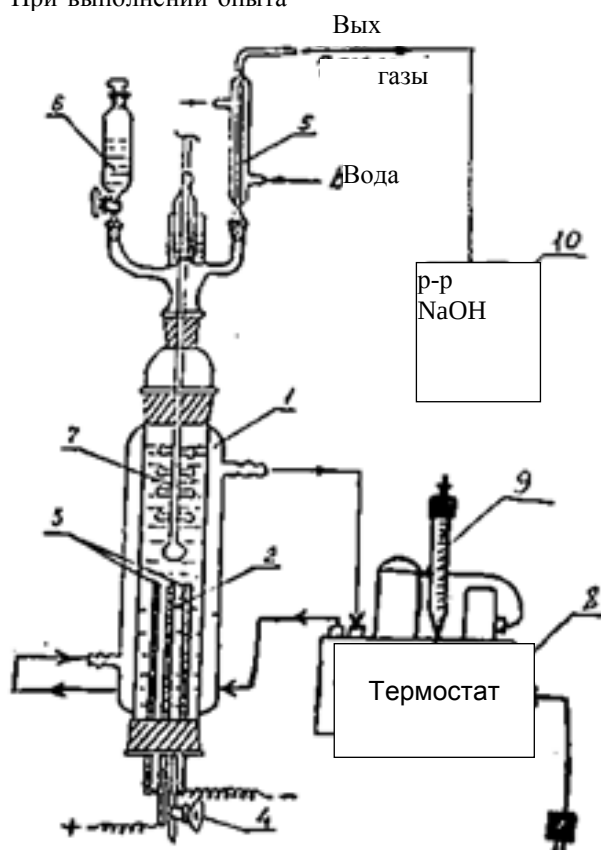


Рис. Установка для получения 3,6-дихлорциклогексен дикарбоновых кислот
1 – рубашка, 2 – анод, 3 – катод, 4- кран, 5 – холодильник, 6 – воронка, 7- мешалка,
8 - термостат, 9 – контактный, 10 – сосуд с р-ом NaOH

ВЫВОДЫ. При проведении электрохимического синтеза установлено что, реакция бромирования протекает в легких условиях, оптимальная температура для 3,6 дибромциклогексен дикарбоновой кислоты является 60-95⁰С, а для 3,6 дихлортетрагидрофталяевого ангидрида 105-115⁰С, продолжительность реакции для обеих реакции 1,5 часа, выход продукта 87-91%.

При исследовании свойств полученных соединений обнаружено , что данные соединения обладают высокими антипиреющими свойствами. На наш взгляд это очень важен для получения огнестойких композиционных материалов с целью дальнейшего расширения их ассортимента и использования их в широких областях. Известно что, галогенсодержащие антипирины в настоящее время пользуется большим спросом, в том числе хлор- и броморганические соединения. Полученный 3,6 дибромциклогексен дикарбоновых кислот могут быть применяться в синтезе огнестойких смол и добавок для различных полимеров. Его эффективность снижения горючести в качестве антипирина намного превосходит других антипиренов.

Процесс является экологически безопасным, отвечает требованиям «зеленой химии».

СПИСОК ЛИТЕРАТУРЫ:

1. Кодолов В.И. Горючесть и огнестойкость полимерных материалов. М., Химия
2. Анохин А.Г. Пожарная опасность пластмасс в строительстве, М., Стройиздат, 1969, с 9-13
3. Каблов Е.Н. Стратегические направления развития материалов и технологий их переработки на период до 2030 года // Авиационные материалы и технологии. 2012. № S. С. 7–17
4. Мухаметов Р.Р., Ахмадиева К.Р., Чурсова Л.В., Коган Д.И. Новые полимерные связующие для перспективных методов изготовления конструкционных волокнистых ПКМ // Авиационные материалы и технологии. 2011. № 2. С. 38–42.
5. Fenolun elektrokimyəvi üsulla xlorlaşması / Muradov M.M., Hüseynova İ.N., Hətəmov M.M., Nəzərova M.K., Ağayev Ə.Ə. / Elmi xəbərlər, Təbiət və texniki elmlər bölməsi. -2017. -Cild 17, -№ 2, -S. 26-28.
6. Сборник материалов III Московской международной конференции «Полимерные Листы 2008», 23 октября 2008 г., стр. 126

EARTH SCIENCES

INTEGRATION OF RADIOMETRIC AND LITHOGEOCHEMICAL METHODS FOR STUDYING URANIUM DEPOSITS

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Abstract

The advantage of this method is the efficiency in obtaining the results of measuring radioactivity directly in the field, which makes it possible to adjust the areas and directions of radiometric surveys carried out within the search areas. It is known that radiometric survey has been and continues to be the main method of searching for deposits of radioactive raw materials. With the accumulation of experience in radiometric searches, it became obvious that there was a need to improve the methodology for studying uranium deposits by developing methods for fixing from the surface not only ore bodies and deposits exposed by erosion (this problem is successfully solved by the radiometric method), but also blind ore bodies, usually passed by the radiometric method. The study of the features of uranium (radium) halos bordering blind uranium ore bodies, contoured using the radiometric method, made it possible to establish the small size of these halos, which usually do not reach the surface and, therefore, cannot be used as a reliable search indicator for blind uranium ore bodies.

Keywords: lithogeochemical halos, radiometry, uranium, uranium mineralization, chemical analysis, radioactivity.

Lithogeochemical methods of searching for blind ore bodies and the obtained results.

The limited depth of radiometric searches for blind uranium ore bodies prompted the authors, when choosing a method of prospecting for uranium within the Pkhrut ore field of Syunik region, to develop a rational complex of search methods that would be effective, first of all, when searching for blind ore bodies, which are the only real reserve increase in reserves in this ore field: geological exploration works carried out in the past for 30 years in this area have discovered only small blind ore bodies (mainly within the Okhchinskaya zone).

A detailed study of the factors controlling the size of primary halos allowed us to establish that the dimensions of halos are determined [1,p.52]:

- the concentration of the halo-forming element in the ore body (direct dependence);
- concentration gradient of the halo-forming element with distance from the ore body (inverse relationship);
- the value of the minimum anomalous content of the element (inverse relationship)

Obviously, of the listed parameters, only the value of the minimum anomalous content to some extent depends on the will of the researcher: this value is calculated statistically and can be determined with different levels of significance. Table 1 shows the parameters of the background distribution of uranium and the values of the minimum anomalous values of radioactivity in gamma ($\mu\text{R} / \text{hour}$), calculated with different levels of significance.

Table 1 Minimum anomalous values of radioactivity with different one-sided levels of significance (number of measurements - 46)

Average C, mcr / h	Distribution standard, C	Minimally abnormal contents ($\mu\text{R} / \text{h}$) with different one-sided significance levels		
		C+S=24,8 15,85% yp. 3H.	C+2S=31,2 2,3% yp. 3H.	C+3S=37,6 0,14% yp. 3H.
18,4	6,4			

As follows from Table 1, a decrease in the minimum anomalous value of radioactivity leads to a sharp increase in the number of possible errors (more than 14% at C + S) and therefore this path cannot be considered effective. Many years of experience in geochemical prospecting for ore deposits suggests that the minimum anomalous value of C + 2S is optimal. It was found that the use of phase chemical analysis of geochemical samples can significantly reduce the background content of the element of interest (in this case,

uranium) in the host rocks and, thereby, the value of its minimum anomalous content, which makes it possible to identify and outline the primary halos of mobile uranium, significantly in size. exceeding radiometric ones, significantly increasing (by almost an order of magnitude) the depth of geochemical searches for blind uranium mineralization [1,2,6 p.52,191,287]. This success was due to the prevalence of difficult-to-dissolve forms of uranium in the background areas of ore-bearing rocks: it is mainly an isomorphic impurity in the lattices

of accessory minerals. In contrast, the ores and the surrounding primary geochemical halos contain uranium mainly in the form of readily soluble oxides - pitchblende and uranium black. It was experimentally found that using phase analysis it is possible to significantly reduce the value of the minimum anomalous uranium content and, due to this, to reveal more significant primary uranium halos.

The above method of increasing the depth of prospecting for blind uranium ore bodies of hydrothermal genesis, as already noted, was developed using the example of primary geochemical halos and therefore is applicable only in areas with good outcropping of bedrock ore-hosting rocks. Within the Pkhrutsk ore field and adjacent areas, bedrock ore-hosting rocks are almost everywhere covered by eluvial-deluvial deposits of various thicknesses, which excludes the possibility of using primary halos of uranium and its satellite elements for prospecting blind ore bodies and deposits. Under such conditions, geochemical prospecting for uranium deposits and other formational types of ore deposits is carried out using secondary dispersion halos of

the corresponding associations of indicator elements. To clarify the possibility and efficiency of using secondary uranium scattering halos in the search for uranium mineralization (primarily blind) in the landscape-geochemical conditions of the Pkhrutsk ore field, in accordance with the "Instruction" [3,p.191], experimental and methodological works were carried out within the Okhchinskaya zone. In Fig.1 shows a map of sampling eluvial-deluvial deposits on the surface of the Okhchinskaya zone, within which a number of shallow blind ore bodies have been identified by previous works (Fig.2). In samples of soil-forming loose sediments on the ICP MS device in the analytical laboratory of the METTA group, the content of mobile uranium was determined by the method of phase analysis with the decomposition of the sample material with aqua regia.

To identify and delineate secondary uranium scattering halos, the parameters of the background distribution of uranium and, on this basis, the values of its minimum anomalous contents with different (one-sided) levels of significance were calculated (Table 2).

Table 2 Minimally anomalous contents of mobile uranium with different one-sided significance levels. (number of analyzes 35)

Average C, g / t	Distribution standard, C	Minimally abnormal grades (ppm) with different one-sided significance levels		
0,38	0,08	C+S=0,46 15,85% yp. зн.	C+2S=0,54 2,3% yp. зн.	C+3S=0,62 0,14% yp. зн.

Picture 3 shows the secondary scattering halos of mobile uranium, contoured by the value of the minimum anomalous content, equal to $C + 2S$. As can be seen in this figure, contrasting scattering halos of mobile uranium occupy most of the sampled area. In this case, blind mineralization (Fig. 2) is recorded by the fields of maximum concentrations of mobile uranium: in Fig. 3 fields of maximum intensity within 7.8 profiles in the area of section 10-10 (Fig. 2) and well. 532 (Fig.1). It clearly follows from the data presented that blind mineralization is reliably fixed by secondary scattering halos of mobile uranium. The situation is different with the results of the radiometric survey performed within the described area, shown in Fig. 4. In the area shown in fig. 2 blind orebody (profiles 7.8), only one anomalous value of radiometric measurement was found, which cannot be accepted as a reliable indicator of blind mineralization. The above data unambiguously indicate that the secondary scattering halos of mobile uranium, as in the case of primary halos, are characterized by a significant depth of the search for blind mineralization, while the radiometric survey does not differ in such depth. This conclusion refutes the following statement by A.B. Kazhdan and N.N. Solovyov - the authors of the well-known textbook "Search and exploration of deposits of rare and radioactive metals" [4,p.83]. "The dimensions of radioactive halos exceed the dimensions of all other halos, which makes it easier to detect them by radiometric methods". As shown above, the halos of mobile uranium are much larger than radiometric ones in size" (Fig.3, 4). Note that the cited statement is not substantiated by any factual data.

An analysis of the possibilities of comparable methods allows us to recommend the following principles for their rational integration in the search for uranium deposits. Taking into account the comparative prostate and the efficiency of radiometric surveying, one can recommend the close combination of this method with geological and geochemical, primarily lithogeochemical methods. It is recommended to carry out joint radiometric and lithogeochemical surveys, i.e. selection of lithogeochemical samples (mainly from loose deposits) at points of increased (anomalous) radioactivity. Mandatory support of radiometric survey of any scale by lithogeochemical sampling allows not only to identify and delineate radioactive anomalies, but also to determine their nature using a set of lithogeochemical criteria identified as a result of three-dimensional lithogeochemical modeling of known hydrothermal deposits of various formation types. Such an assessment of anomalies is achieved by determining, using the developed geochemical criteria, the ore-formational type and the level of the erosion cut of geochemical anomalies with preliminary "sorting" of numerous anomalies that have no industrial significance, represented by zones of scattered ore mineralization. The works of recent years have proved the high efficiency of the method described above for lithogeochemical searches for blind and weakly eroded ore bodies and deposits. Of particular note is the reliability of assessing the level of the erosion cut of lithogeochemical anomalies using the criterion of vertical geochemical zoning of primary halos.

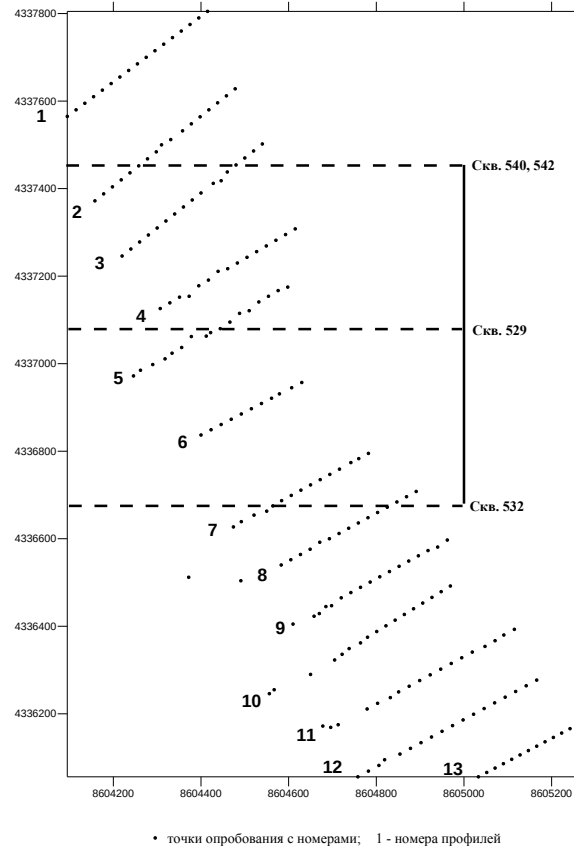


Fig.1. Map of lithogeochemical sampling of the Okhtinskaya zone of the Pkhrut ore field.M1:20000

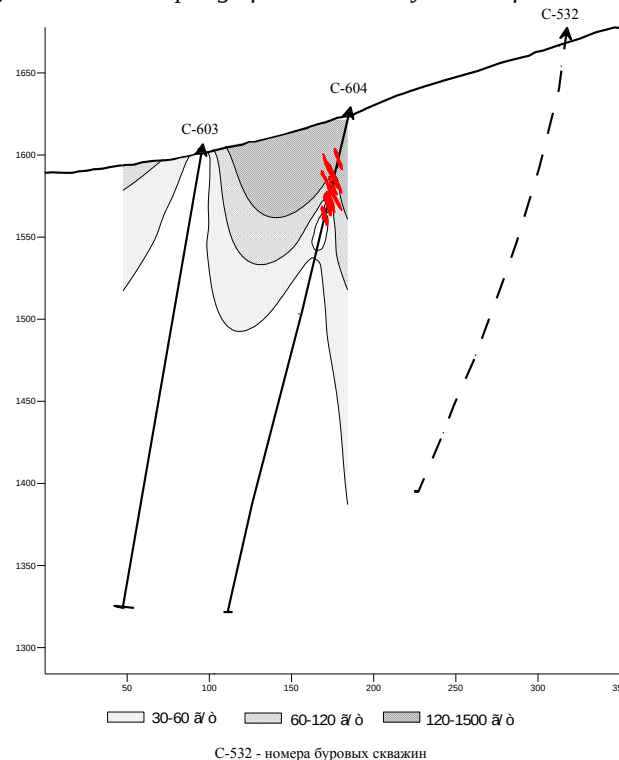


Fig. 2. Primary uranium halos (section 10-10), Southern block.M1:5000

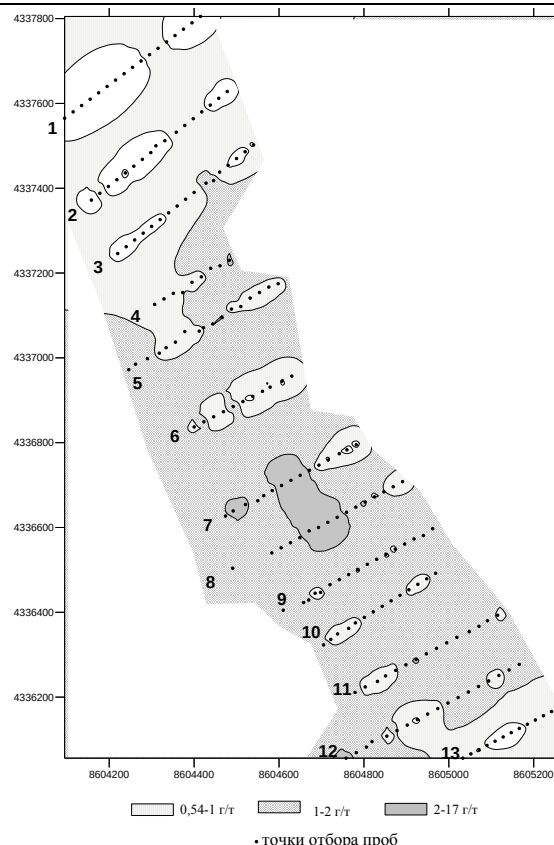


Fig.3. Secondary uranium scattering halos on the surface of the Okhchinskaya zone of the Pkhrut ore field M1:20000

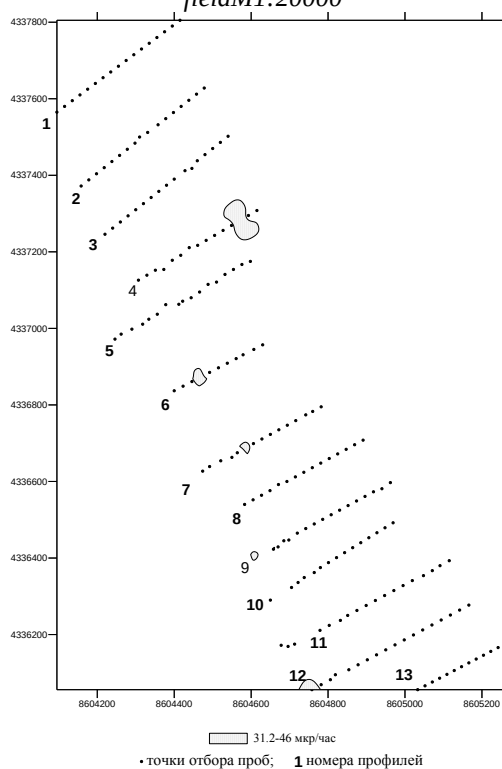


Fig.4. Secondary radiometric anomalies of the Okhta zone of the Pkhrut ore field. M1:20000

REFERENCES:

1. Grigoryan S.V. Erasing the depth of a polar hinged uranium body uranium of the first stage of maturation. Atomic Energy Vol. 18. issue. 1, M., 1965.p.52-57
2. Grigoryan S.V. Mining geochemistry. Nedra, Moscow, 1992.p.293.
3. Grigoryan S.V., Solovov A.P., Kuzin M.F. Instructions for the geochemical method: search for ore deposits. M., "Nedra", 1983.p.191.
4. Vsean A.B., Soloviev N.N. Also a divorce radioactive metals. Textbook, M., "Nedra", 1982.p.280.

5. Shenishevsky E.M., Grigoryan S.V. and others. Endogenous halo scattering of some: hydrothermal sites. Gosgeoltekhizdat, M., "Nedra". 1963, p.52-68.
6. Beus A.A., Grigorian S.V. Geochemical Exploration methods For Mineral Deposits, Applied Publishing Ltd, Wilmette, Illionis, USA, 1977.p.287.
7. Grigorian S.V. Primary Geochemical Halos in Prospecting and Exploration of Hydrothermal deposits. Intern. Geology Rev. v. 16, N 1, 1974.p.12-25.

HISTORICAL SCIENCES

THE IDEA OF «GOOD NEWS» IN THE OLD AND NEW TESTAMENTS

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ІДЕЯ «ДОБРОЇ ЗВІСТКИ» В СТАРОМУ ТА НОВОМУ ЗАПОВІТАХ

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Abstract

The idea of the gospel as good news has been known to Christian for more than two thousand years. However, at the same time, the authors of the biblical text have repeatedly emphasized the Decalogue as the basis of fidelity to God of every orthodox Christian. Accordingly, the question arises as to how the idea of the gospel is consistent with the requirements of the Decalogue set out in the Old Testament. As a result of the research, the author concludes that both positions, namely Old Testament and New Testament theology, do not contradict, but on the contrary harmoniously complement each other. Moreover, the key terminology used to present the idea of «good news» in the biblical text at the philological level supports the position of a harmonious combination of the Old and New Testaments, rather than a divided perception of salvation through gospel acceptance.

Анотація

Ідея Євангелія як доброї звістки відома християнському світу більше двох тисяч років. Однак, разом із тим автори біблійного тексту неодноразово наголошували на Декалозі, як основі вірності Богу кожного правдивого християнина. Відповідно виникає запитання, яким чином узгоджується ідея доброї звістки із Євангелієм із вимогами Декалогу представленими в Старому заповіті. В результаті дослідження, автор приходить до висновку, що обидві позиції, а саме старозавітне та новозавітне богослов'я не протирічать, а навпаки гармонійно доповнюють одна одну. Більше того, ключова термінологія, яка використовуються для представлення ідеї «доброї звістки» в біблійному тексті на філологічному рівні підтримує позицію гармонійного поєднання Старого та Нового заповітів, а не розділеного сприйняття ідеї спасіння через прийняття Євангелія.

Keywords: «good news», Gospel, Old Testament and New Testament, salvation of man, Christianity.

Ключові слова: «добра звістка», Євангеліє, Старий заповіт і Новий заповіт, спасіння людини, християнство.

Вступ. Ідея «Закону і Євангелія» знаходиться в самому серці християнської релігії. Хоча богослов'я і христологія є центральними християнськими вченнями, пересічні християни як правило шукають благу звістку про спасіння через Ісуса Христа саме в Євангеліях. Однак, залишається відкритим питання про те, як Декалог пов'язаний зі спасінням людини. У цій роботі ми зосередимося увагу на пошуку відповіді на це запитання. Підкреслимо, на початку дослідження, що моральний закон – це те, що Бог вклав у серце і написав у думці (згідно з Посланням до Євреїв 10:15-16). У Посланні до Римлян 8:2 він розглядається і згадується як закон, який веде нас до життя у Христі Ісусі. І знову Новий Заповіт говорить просто про «закон Христа» – закон любові. Тому знайти зв'язок між Декалогом та доброю звісткою Євангелієм є ключовим завданням цього дослідження.

Основні результати дослідження. Декалог із старозавітного підходу до життя християнина як

правило відноситься до мети любити Бога та ближнього. Десять заповідей у 20 розділі книги Вихід вказують на обов'язок людини щодо Бога і свого ближнього. В процесі спасіння людини видно любов та милосердя Бога, яке учинив Христос. Оскільки Христос не відав під суд людей із за гріха, але став нашим захисником перед Богом. Під керівництвом Святого Духа люди відчують потребу шукати Бога, визнають свою гріховність, каються у своїх провинах і виявляють віру в Ісуса як Господа і Христа, у т.ч. приймають його як замісну жертву. Така віра людини, яка отримує спасіння, приходить через Божу силу слова, і є даром Божої благодаті. Через Христа ми виправдані, усиновлені як сини та дочки Бога та звільнені від панування гріха. Через Духа ми народжуємося згори і освячуємося. Дух оновлює наш розум, пише Божий закон любові у наших серцях, і нам дається сила жити святим життям. Перебуваючи в Ньому, ми стаємо причасниками Божого єства і маємо впевненість у спасінні зараз і під час останнього суду.

Євангелія можна резюмувати так: «Євангелія – це радісне проголошення відкупної дії Бога в Христі Ісусі від імені людини, поневоленої гріхом». Як таке, воно не може бути безпосередньо знайдено у Старому Заповіті. Проте термінологія Старого Заповіту, месіанські та типологічні пророцтва, система святилищ, відкупні дії благодаті тощо, готують шлях до усвідомлення спасіння від гріха через Ісуса Христа.

Ключова термінологія доброї звістки в Старому Заповіті. Грецький корінь *euaggel*, який часто вказує на Євангелія, є перекладом давньоєврейського кореня *ḥśr*. Група етимологічно споріднених слів *ḥśr* зустрічається як іменник («добра звістка»; шість разів), як дієслово («приносити або сповіщати добру звістку», п'ятнадцять разів) і як субстантивоване причастя («вісник доброї звістки»; дев'ять разів) [1]. Цей термін часто використовується у світському значенні, особливо в якості іменника. Проте сильне богословське значення має дієслово та причастя. Проголошена добра звістка – це звістка про спасіння Яхве (Псалом 96:2), праведність (Псалом 40:9), мир (Ісаїя 52:7) і свободу (Ісаїя 61:1). У Новому заповіті є багато віршів із Старого заповіту, у яких зустрічається *ḥśr*, і використовуються по відношенню до Месії [2].

У постбіблейському юдаїзмі корінь *ḥśr* має також теологічне значення. Цей принцип є особливо важливим і майже ніколи не зустрічається у світському контексті. Вісник радості, доброї звістки – це есхатологічна фігура, що несе нову еру і добру звістку спасіння [3].

У Септуагінті іменник *beśrah* перекладено як *euaggelia* та *euaggelion*. Ці терміни не мають богословського значення. Тому вони не відповідають змісту *euaggelion*, що використовується в Новому Заповіті. За трьома винятками, *euaggelizomai* – це переклад давньоєврейського дієслова та причастя коріння *ḥśr*.

Крім того цей термін також використовується в богословському сенсі [4]. Таким чином, Септуагінта дає нам корінь *euaggel*, який стане важливим терміном у Новому заповіті, що в свою чергу наближає людину до Нового заповіту, пов'язуючи частіше, ніж у давньоєврейському тексті, проголошення доброї звістки зі спасінням (наприклад, в Ісаїя 60:6). У Новому Заповіті Ісус представлений як вісник доброї звістки про спасіння та як уособлення і зміст цієї доброї звістки – Євангелія. Коли перші християни почали проголошувати Євангелія Ісуса язичникам і використали *ḥśr*, вони ґрунтувалися на Септуагінті та її термінології, що позначає добру звістку.

Поняття доброї звістки в Старому заповіті. Як тільки що згадувалося, спасіння та визволення пов'язані з доброю звісткою у Старому заповіті. Згідно з Книгою Псалмів 40:9-10 Давид проголошує добру звістку про Божу справедливість, вірність, спасіння, істину та милість. У Старому заповіті Бог бере на себе ініціативу і втручається своїми рятівними діями. Це добра звістка, навіть якщо не завжди використовується відповідна мова. Після гріхопадіння Бог не вбиває миттєво Адама та Єву, а

починає діалог, даючи їм чудову обітницю. Він рятує Ноя та його сім'ю від потопу. Він рятує Лота від руйнування міст на рівнині. Божя любляча доброта (хесед)⁷ дозволяє Господу прощати гріхи людей, яка згрішила або оступилася (Вихід 34:6-7; Числа 14:18). Саме Господня любляча доброта принесла відкуплення (Вихід 15:13) та визволення з єгипетського рабства.

Дослідник Вос зазначає, що це визволення було «визволенням з об'єктивної сфери гріха і зла», і що «Євреї були звільнені не тільки від зовнішнього іноземного рабства, вони також були врятовані від внутрішньої духовної деградації та гріха» [2]. Відповідно до Ездри 9:8-9 Божя благодать дозволила останку вижити, і Божя любляча доброта призвела до відновлення. Хоча закон відіграє важливу роль у Старому Заповіті, він підкреслюється лише після могутнього втручання Бога, надавши спасіння та відновлення.

Термінологія доброї звістки в Новому заповіті. У Новому Заповіті група етимологічно споріднених слів *euaggel* часто використовується і вказує на Євангелія і проголошення доброї звістки. Використовуються три форми *euaggel*: іменник *euaggelion*, іменник *euaggelistēs* і саме *euaggelizomai*. Євангелія підкреслює ініціативу Бога: це Євангелія Бога (Марка 1:14) та Ісуса Христа (Римлянам 15:19), слави Божої (1 Тимофія 1:11) та недослідженого багатства Христова (Ефессянам 3:8). Це також Євангелія Царства Божого (Матвія 24:14) та Євангелія благодаті Божої (Дії апостолів 20:24) [3]. Благами Євангелія є мир (Ефессянам 6:15), спасіння (Ефессянам 1:13), спокій (Євреям 4) та надія (Колосянам 1:23). В Євангелії від Луки 4 «зміст цієї доброї звістки ... пов'язаний з проголошенням «свободи» (*aphesis*), «відновлення зору» і «року Господнього змилювання» [4]. Одержувачами послання Ісуса, що сповіщає добру звістку, є особливо бідні, страждаючі та пригнічені.

Павло використовує ці терміни найчастіше: *Euaggelion* і *euaggelizomai*, які є відмінними рисами Павлового богослов'я. Для нього Євангелія є Божою благодаттю, на яку люди відповідають вірою. Однак існувала небезпека, що ця чудова Євангелія буде спотворена і перетвориться на інше Євангеліє (Галатам 1:6-7) шляхом прийняття обрізання. А отже, повернення до закону як способу спасіння людини. Тому Павло протиставляє «інше Євангеліє» Євангелію, яке проповідував він сам (Галатам 1:11), яке за його твердженнями було Євангелієм Христа (Галатам 1:7). За словами Павла, Євангеліє має минуле, сьогодення та майбутнє. «Хоча переваги цієї Євангелії починаються тут і зараз, у момент отримання Євангелії, вони також є вічною долею віруючого» [5].

Поняття Доброї Звістки в Новому заповіті. У Посланні до Галатів Павло використовує термін *euaggelion*, а також термін *euaggelizomai* по сім разів кожен [2]. Після критики помилкового Євангелія він продовжує говорити про перебування в Христі (Галатам 1:22), виправдання вірою, а не ділами (Галатам 2:16; 3:11) [2], викуплення (Галатам 3:13;

4:5), зодягнення в Христа (Галатам 3:27), усиновлення (Галатам 4:5), визволення (Галатам 5:1) та Божу благодать (Галатам 2:21; 5:4). Можна припустити, що ці терміни, що описують реальність спасіння з різних точок зору, доповнюючи один одного, є частиною Євангелія Христа, яку проголошує Павло. Лютер зазначає: «Принаймні, у десяти інших уривках з Послань Павла «Євангелія» та «благодать» вживаються в тому самому безпосередньому контексті, сильно натякаючи на те, що єдиним рятівним каналом Божої благодаті є чиста «правда Євангелії» (Галатам 2:5, 14) [1].

Оскільки Євангеліє проголошує відкупну дію Бога через замісну смерть Христа на хресті, що забезпечує прощення гріхів і звільнення від гріха, від вічної смерті та закону як шляху до спасіння, спасіння не повинно обмежуватися лише одним аспектом, таким як виправдання вірою. Хоча це правда, що грішники «виправдуються Його благодаттю, через відкуплення, що в Ісусі Христі» (Римлянам 3:24), «виправдовуються вірою, без діл Закону» – *sola gratia i sola fide* – виправдання не повністю описує всі аспекти спасіння.

Отже, зазначмо, що не слід перетворювати Павла виключно на богослова виправдання. Найдавніше послання Павла Перше послання до Солунян не показує усвідомлення доктрини виправдання. Вирішальним мотивуючим фактором у розвитку павлівської доктрини виправдання є протистояння або дискусія з опонентами. Тільки на тлі доктрини визволення можна правильно інтерпретувати павлівську концепцію виправдання. Це набагато бі-

льше, ніж просто юридична доктрина про покарання та благодать, оскільки її судовий, юридичний характер має онтологічну основу.

Висновок. Отже, підводячи підсумки підкреслимо, що згідно біблійного вчення Христос наголошує, що Він прийшов не руйнувати закон, а виконати його (Матвія 5:17). Ісус прийшов у цей світ не для того, щоб протистояти закону, але навпаки виконати його. Христос як дорожня карта не був спрямований на те, щоб уникнути дотримання закону. Навпаки, Христос поважав, любив закон та слухався вимог Декалогу. Це саме він закликає роботи кожного із його послідовників.

СПИСОК ЛІТЕРАТУРИ:

1. Ángel M. R. Law and Law. *Biblical Research Institute*. 2019. URL: adventistbiblicalresearch.org.
2. Gane R. E. Is God's Law Part of the "New Covenant"? *Faculty Publications*. 2010. URL: <https://digitalcommons.andrews.edu/cgi/viewcontent.cgi?article=3367&context=pubs>.
3. Holmgren F. C. The Old Testament and the Significance of Jesus: Embracing Change--Maintaining Christian Identity: The Emerging Center in Biblical Scholarship. Wm. B. Eerdmans Publishing Company, 1999. 224 p.
4. Holmgren F. C. The Old Testament and the Significance of Jesus: Embracing Change--Maintaining Christian Identity: The Emerging Center in Biblical Scholarship. Wm. B. Eerdmans Publishing Company, 1999. p.86: "Heart religion' has always been at the center of Israelite faith."
5. Yancey P. The Jesus I Never Knew. Grand Rapids, Mich : Zondervan, 1995. P. 204–205.

MATHEMATICAL SCIENCES

THE VEHICLE ROUTING PROBLEM IN URBAN ROAD NETWORKS

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Abstract

The article presents an approach to solving the vehicle routing problem which is the basis of the Zig-Zag project, the purpose of which is to automate the logistics of freight transportation. The high efficiency of the proposed algorithm is due to the use of preliminary clustering of delivery points to determine geographical areas and the use of various heuristics to solve the optimization problem. Zig-Zag allows you to solve problems with time windows and restrictions on the vehicles capacity, and also takes into account the change in the speed of traffic flows depending on the time of day and road restrictions, using a heat map of the distribution of the speed coefficient obtained on the basis of statistical data.

Keywords: vehicle routing problem, time windows, vehicle capacity, genetic algorithm, k-means, speed factor heat map, freight frame of road network.

Introduction. In the modern world, the freight costs is a significant part of all logistics costs, so one of the main tasks of transport logistics is to determine the optimal route for cargo delivery in compliance with the existing restrictions and minimal costs. In the simplest case, the problem of finding the optimal route is reduced to the classic traveling salesman problem, which belongs to the class of NP-difficult problems, and even with a small number of points cannot be solved by a complete search in a reasonable time. Therefore, approximate methods and heuristics are used to solve it [1], and one of the best algorithms for solving the metric traveling salesman problem is Concorde [2, 3].

However, the classic travelling salesman problem is quite far from most of the logistical tasks encountered in practice. The generalization of the classic travelling salesman problem is vehicle routing problem [4], which refers to discrete optimization tasks and consists in determining a set of optimal routes for the existing fleet of vehicles at given delivery points and possible restrictions on the vehicle capacity, the desired delivery time (Time Windows), the presence of multiple depot, etc. [5]. Additional restrictions determine the specific type of routing task [6] and significantly complicate its solution. As the objective function of the optimization task, the length of the route, its duration or the monetary cost of delivery are selected. In any case, such a function is multi-extreme, so the direct application of gradient methods to minimize it is impossible. The most appropriate method is a genetic algorithm [6 – 8] with the appropriate implementation of genetic mutation and selection operators [9, 10]. And that's exactly what underlies the automation system of transport logistics Zig-Zag. In addition to additional restrictions specific to VRP tasks, the Zig-Zag system takes into account the change in the speed of traffic flow during the day on different sections of the road network, as well as restrictions on the movement of trucks in residential areas.

Pre-clustering. Large companies often have to solve routing problems in which there are tens to hundreds of vehicles and couriers and thousands of delivery points. With an increase in the dimension of the problem, its computational complexity increases exponentially, which is the main problem when using a genetic algorithm as an optimization method. A possible solution to this problem may be to apply the well-known "divide and conquer" principle to reduce the original task to several independent subtasks of smaller dimension. To do this, pre-clustering of delivery points is introduced into the solution of the vehicle routing problem, which makes it possible to form the traversal set of points for each individual courier and independently solve the resulting optimization problems.

The purpose of clustering is to divide some geographic area into a certain number of regions (clusters). To solve the clustering problem, the classic k-means algorithm is used, which works well and quickly with a large amount of data, but does not guarantee that the resulting clusters will be balanced by the number of points, area of the region or traversal time. Therefore, in the process of clustering, the balance of the clusters is additionally evaluated, and if the clusters are not sufficiently equal, they are adjusted by redistributing the boundary points. After that, their balance is checked again.

Clustering and assessment of its balance is carried out taking into account:

- the working schedule of couriers (start time of work, end time of work, lunch break);
- special courier skills;
- the vehicle capacity;
- the compatibility of the transported goods and special requirements for the type of transport (for example, a refrigerator is required for the transportation of frozen products);
- delivery point opening hours, weight and volume of cargo.

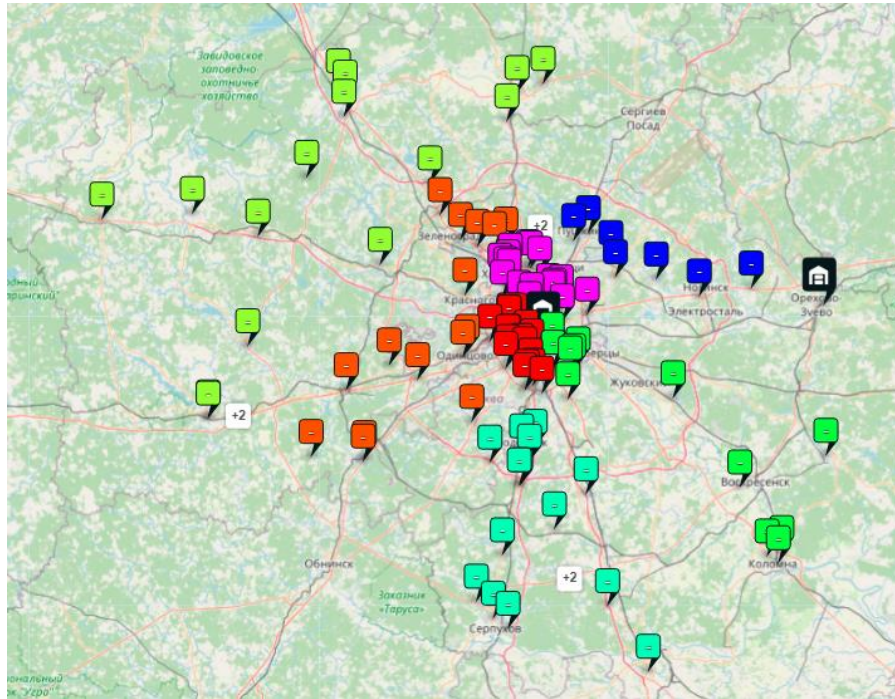


Fig. 1 Pre-clustering of delivery points

Step-by-step clustering with the assessment and adjustment of cluster balance can significantly simplify the routing vehicles problem, increasing the speed and efficiency of its solution. In Fig. 1 the result of the application of pre-clustering algorithm for the problem with 9 couriers and 106 delivery points for the road network of Moscow is presented.

Freight frame of the road network. In many cities, in order to reduce noise and air pollution, reduce the number of accidents and improve traffic in residential areas, the movement of trucks in residential areas is

limited, which must be taken into account when planning routes. In particular, a freight frame (Fig. 2) has been introduced in Moscow, consisting of roads on which free movement of freight transport is allowed. Along with it there is a residential area, the movement of trucks in which is limited, and the passage of trucks with a permissible maximum weight of more than 2.5 tons is allowed only for servicing enterprises or residents within the area, but for this it is necessary to have the appropriate permits.

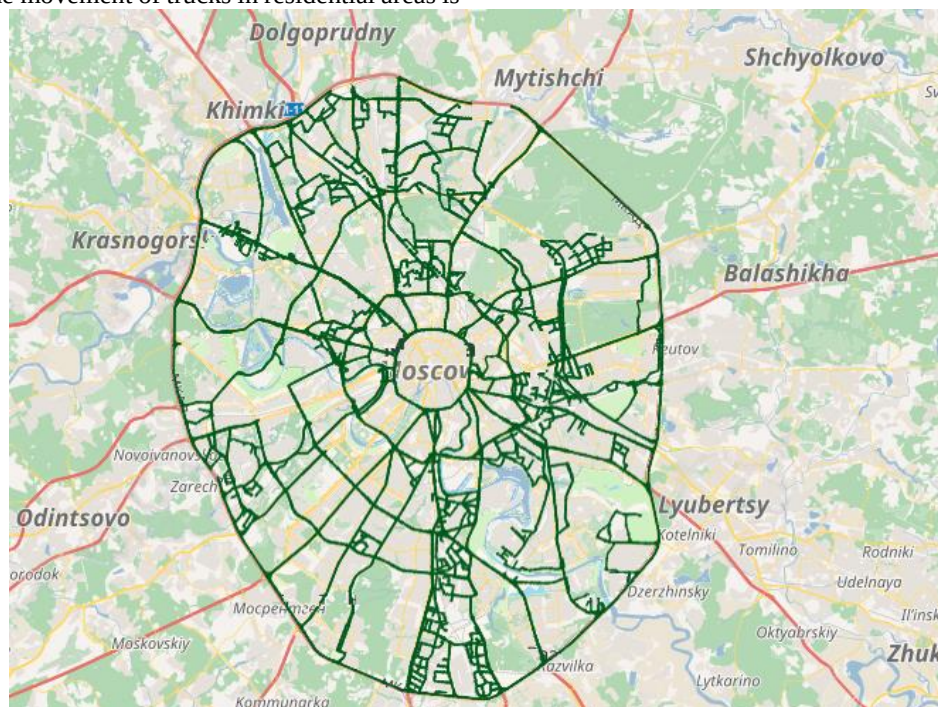


Fig. 2. The current freight frame of Moscow roads

Thus, in addition, there is the task of marking the road network of the city, so that when planning the

route, the algorithm can take into account the possibility of the movement of specific vehicles on the selected

roads. This requirement is one of the necessary conditions for ensuring the correctness of the decision, and affects not only the choice of roads when forming the route, but also the choice of the optimal type of vehicle.

The Zig-Zag project uses road network markings based on OpenStreetMap data, customer data and the requirements of regulators such as Moscow Government Traffic Management Center. Marking of the freight frame consists in entering information into the transport network data that traffic is impossible between specific nodes of the road graph. When solving the problem of optimization route duration, the condition of impossibility of movement on a certain section is mathematically equivalent to the infinite transition time between the two corresponding vertices of the road graph. Thus, the main work on the task of the freight frame is preparing input data. After that, the algorithm independently recalculates the space-time matrix, taking into account information about the possibility or impossibility of movement. Such a matrix is determined for each type of transport (cars, trucks, public) and foot couriers.

The speed factor heat map. The speed of traffic on certain sections of the road network is limited by the requirements of traffic signs and surface markings. However, the specific values of the speed and travel time are significantly affected by the roads congestion, depending on the time of day, day of the week, weather conditions, etc. These factors must be taken into account in order for the resulting decision to be as close as possible to real conditions. Otherwise, the constructed route, which seems beautiful, fast and understandable, in practice turns out to be unusable. To solve this problem, the routing algorithm uses heat maps of the speed factor, which make it possible to correct the regulated speed values on each section of the route. The speed factor is the coefficient of proportionality between the maximum permitted speed on a selected section of road and the actual speed of traffic flow in each specific time interval. For example, in Moscow, in some sections of the Third Transport Ring, the maximum permitted speed is 60 km / h, while the real traffic speed on the same sections of the road in the evening can be less than 20-30 km / h. Thus, the speed factor for this section in the evening will be equal to the ratio of the real speed to the maximum, i.e. 0.3-0.5.

A heat map can be obtained in two fundamentally different ways:

- by the expert method, when the speed factor for each section and each point in time are determined by logistical experts based on their knowledge, experience and analysis;
- as a result of statistical processing of accumulated data on traffic congestion.

Both approaches are used in the presented algorithm. Based on the results of a survey of more than 100 logisticians-experts, a geographic model of Moscow region was formed, the most probable zones of traffic jam formation were identified and the initial approximations of the speed factors were determined. At the same time, based on the peculiarities of urban traffic and its dependence on time, 4 time intervals were allocated:

- "night hours" (from 19:00 to 08:00, at this time the city roads are most free);
- "morning rush hour" (from 08:00 to 10:00, the beginning of the working day, high traffic congestion);
- "daytime hours" (from 10:00 to 17:00, average traffic congestion);
- "evening rush hour" (from 17:00 to 19:00, end of the working day, high traffic congestion).

Time zones are determined as a result of the analysis of OpenStreetMap – tracks and real tracks of the client companies of the Zig-Zag system collected on the server. Thus the space-time model of the city was built. These intervals were sufficient to calculate the optimal routes in most cases. It was found that increasing the number of time zones does not lead to an improvement in the quality of solutions to routing problems, the difference in the results of calculations was less than 5%.

For each time zone the heat map is a matrix, its elements determine the speed factors on specific sections of the roads of the transport network. In reality when moving from one time zone to another the change in the speed of the traffic flow does not occur abruptly but smoothly, so in the model the resulting value of the speed factors at each time is determined by interpolation for 4 available values.

Consider the algorithm for calculating heat maps and recalculating the vehicle speed depending on its type and time of day. Split the day on Nt discrete time intervals

$$T = \{(t_i, t_{i+1})\}_{i \in 0, Nt},$$

and the urban transport network G on the Nz geographic zones

$$Z = \{Z_i\}_{i \in 0, Nz}, \cup_i Z_j = G, \cap_j Z_i = \emptyset.$$

Let $V = \{V_i\}_{i \in 0, Nv}$ be many possible types of vehicles and $P = \{P_i\}_{i \in 0, Np}$ be the sets of delivery points for each vehicle.

Suppose you know the distance matrix between each pair of vertices of the road graph obtained for an ideal situation on the roads with no traffic jams $D_{ij} = \rho(p_i, p_j)$ and the corresponding time matrix is $\tau_{ij} = \tau(p_i, p_j)$. Then the matrix of the speed of the transport flow under ideal conditions can be obtained as:

$$S_{ij}^0 = \frac{\rho(p_i, p_j)}{\tau(p_i, p_j)}.$$

To take into account the possibility of traffic congestion and their impact on the solution to the routing problem a global coefficient C^g set by the expert method was introduced.

To determine the speed, depending on the type of transport, we introduce coefficients $C_{vt}^V, v \in \{foot, car, hgv\} = V, t \in T$ where *foot*, *car*, *hgv* denote foot, road, truck transport, respectively. We will also introduce the speed factors $C_{zizjt}^Z, z_i z_j \in Z, t \in T$ obtained by the expert

method for transitions between different geographic zones.

Then the desired real speed matrices will be calculated according to the following formula

$$\forall t \in T, v \in V \quad S_{ij}^{tv} = C^g C_{vt}^v C_{ZpiZpj}^Z S_{ij}^0, Z_{pi}, Z_{pj}$$

An interpolation algorithm is used for smoothly speed changing during the transition between time intervals, Heat maps of speed factors are matrices of $C_{zizjt}^Z, z_i z_j \in Z, t \in T$ values defined for each time interval and for each section of the roads of the transport network.

An important feature of the Zig-Zag system is the possibility of its continuous training based on accumulated statistics, as well as on the basis of open data from other systems, for example, Yandex. The speed coefficients for individual sections of roads, the boundaries of the most problematic areas and time zones are adjusted in the process of training the system.

Due to the complexity of the city's transport system, the peculiarities of the operation of delivery points and the possibility of force majeure (accidents, a sudden change in weather conditions), the error in assessing routes according to the algorithm used may be unstable. However, even taking this into account, the average error in determining the speed does not exceed

10% and in 80 percent of cases time deviations from the planned routes are less than 5 minutes.

Results. The main calculation module of the Zig-Zag system is based on the application of a genetic algorithm to solve the routing problem for each individual vehicle or foot courier at the corresponding set of delivery points obtained after preliminary clustering. The VRP is a discrete optimization problem, and each individual of the genetic algorithm is some ordered sequence of route points. The objective function of the genetic algorithm, which characterizes the fitness of individuals, determines the traversal time, taking into account possible penalties for violation of the conditions and restrictions on the time of delivery, the vehicle capacity, etc.

The algorithm implemented in the system allows you to simultaneously solve the problems of optimization of transport logistics for several customers at once with hundreds of vehicles or foot couriers and thousands of delivery points in a reasonable time. For example for 20 vehicles and 1000 delivery points the solution of the routing problem takes less than 5 minutes.

Consider the result of solving the problem presented in Fig. 1. In this task there are 7 couriers and 106 delivery points, and it is necessary to deliver the entire cargo within one working shift in the conditions of the road network in Moscow. All 7 routes built are presented in Fig. 3.

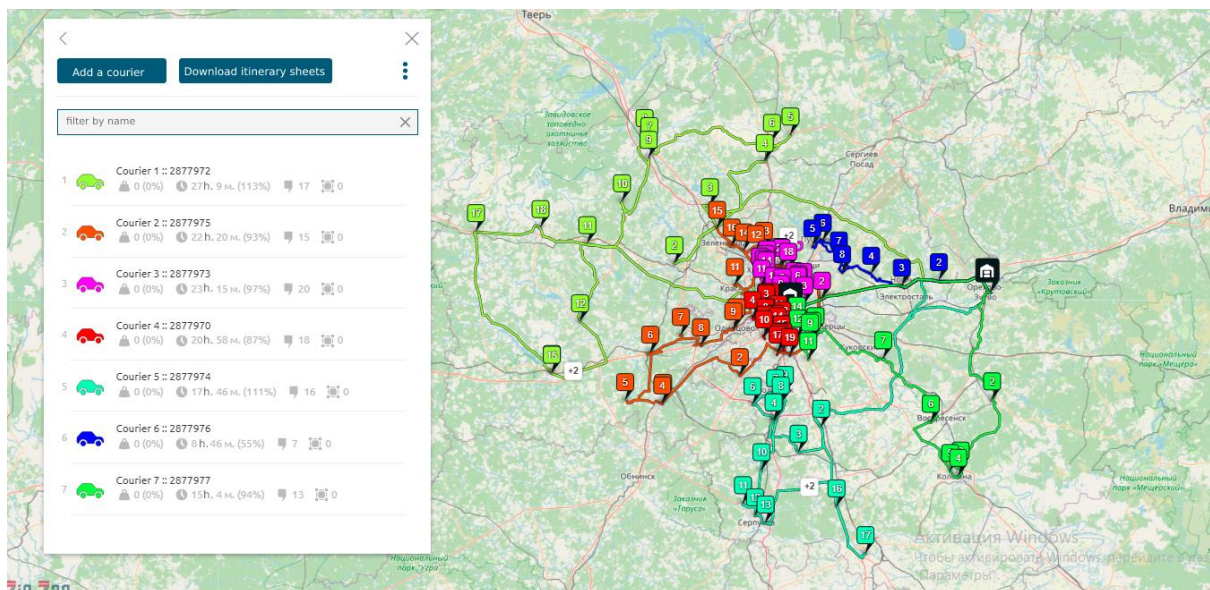


Fig. 3. The solution of the routing problem

The Zig-Zag system allows you to display the route and the corresponding route sheet with addresses,

arrival time and distances separately for each courier (Fig. 4).

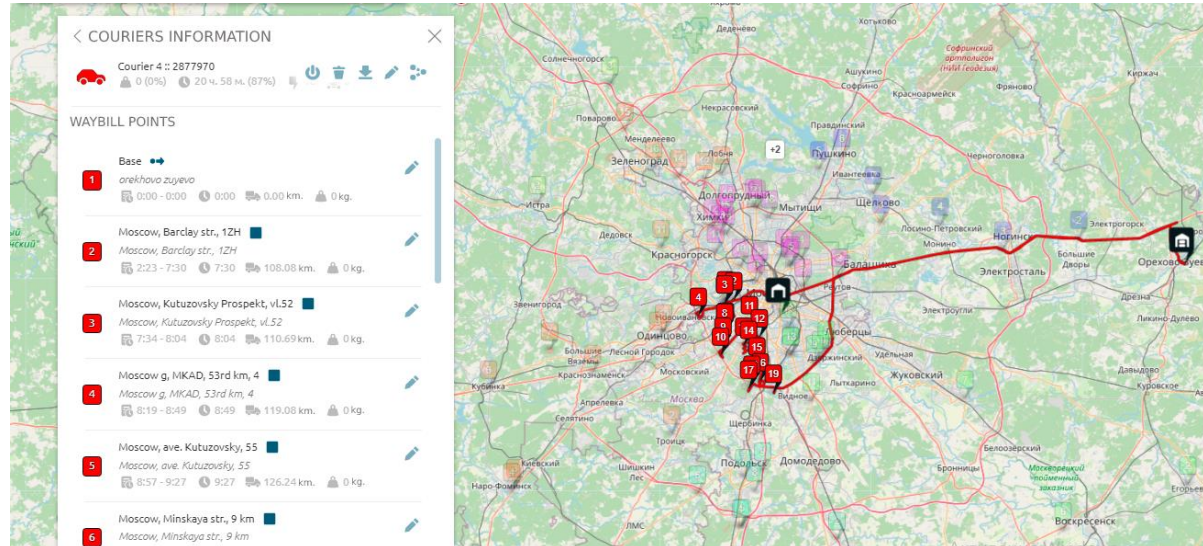


Fig. 4. The optimal route and the corresponding route sheet for one of the couriers

An example of a complete route sheet for the courier №2 shown in Table 1. According to the condition of the task, the route of each courier must begin and end at the depot, so each route is built taking into account

this condition, and the depot is the first and last point of each route. However not in all transport tasks the condition of return to the depot is mandatory, therefore if necessary the task can be solved without it.

Table 1.

Courier №2 route sheet

№	Delivery point address	Estimated arrival	Estimated departure	Total time	Total length
Depot	Moscow, Lenina, 6	00:00	00:00	00:00	0.00
1	Moscow, Troitsk, 40-km Kaluga highway.	02:41	07:30	07:30	145.75
2	Moscow region, Naro-Fominsk district, Naro-Fominsk city, 71 km of Kiev highway st.	08:20	08:50	08:50	191.32
3	Moscow region, Naro-Fominsk district, Naro-Fominsk city, 72 km of Kiev highway st.	08:52	08:52	08:52	192.32
4	Moscow region, Naro-Fominsk district, Moscow region, 44km + 300m of Kievskoe highway	09:23	09:53	09:53	211.14
5	Moscow region, Odintsovsky district, Moscow region, Minsk highway 64 km	10:41	11:11	11:11	253.24
6	Moscow region, Odintsovsky district, 64 km of the Moscow Ring Road	11:42	12:12	12:12	274.51
7	Moscow region, M-2, 31 km, left	12:41	13:11	13:11	293.30
8	Moscow region, Odintsovo district, Odintsovo city, South street,	13:29	13:59	13:59	311.32
9	Moscow region, Odintsovo district, Odintsovo city, Mozhayskoye sh.	14:05	14:35	14:35	314.28
10	Moscow region, Krasnogorsk district, Krasnogorsk city, Volokolamsk highway, 27 km	15:12	15:42	15:42	344.59
11	Moscow region, Khimki city, International highway, 1A,	16:18	16:48	16:48	372.05
12	Moscow region, Dolgoprudny city, Paveltsevo microdistrict, Novoe sh, 30B	16:55	17:25	17:25	376.22
13	Moscow region, Khimki city, 31km a / d Moscow-St. Petersburg, vl 1	17:43	18:13	18:13	387.99
14	Moscow region, Solnechnogorsk district, Moscow region, Durykino d	18:35	19:05	19:05	405.62
15	Moscow region, Zelenograd city, Pine alley, 1	19:21	19:51	19:51	417.41
Depot	Moscow, Lenina, 6	22:20	22:20	22:20	551.61

Conclusion. The algorithm for the vehicle routing problem given their carrying capacity, the time windows and the assessment of the traffic situation, presented in the paper, is the basis of the Zig-Zag transport logistics automation system. An important feature of the Zig-Zag system is the possibility of its continuous training on the basis of constantly accumulated statistics on the results of previously completed routes. Considering the features of the urban road network (and in particular the freight frame) and the use of a heat map of speed coefficients to adapt the system to real conditions allows you to successfully build logistics routes with an error in determining the speed is less than 10% and deviations in time less than 5 minutes from the predicted values. You can get acquainted with the functional features of the system and the basic methods of working with it on the website <https://zig-zag.org/>.

REFERENCES:

1. Nicos Christofides, Worst-case analysis of a new heuristic for the travelling salesman problem, Report 388, Graduate School of Industrial Administration, CMU, 1976.
2. Applegate, D.L., Bixby, R.B., Chav'atal, V., and Cook, W.J. The Traveling Salesman Problem: A Computational Study. Princeton University Press, 2006.
3. Pouya Baniassadi, Vladimir Ejov, Michael Haythorpe, and Serguei Rossomakhine. A new benchmark set for Traveling salesman problem and Hamiltonian cycle problem. 2018.
4. Dantzig G.B., Ramser J.H. The truck dispatching problem. Management Science, 1959, vol. 6, no. 1, pp. 80-91. DOI: 10.1287/mnsc.6.1.80.
5. Kubil V.N. A review of the vehicle routing problem generalizations and extensions. Vestn. RGUPS, 2018, vol. 70, no. 2, pp. 97-109.
6. Barkaoui M., Gendreau M. An adaptive evolutionary approach for real-time vehicle routing and dispatching. Computers & Operations Research, 2013, vol. 40, no. 7, pp. 1766-1776. DOI: 10.1016/j.cor.2013.01.022.
7. Xu H., Duan F.Y., Pu P. Solving dynamic vehicle routing problem using enhanced genetic algorithm with penalty factors. Int. J. of Performability Eng., 2018, vol. 14, no. 4, pp. 611-620. DOI: 10.23940/ijpe.18.04. p3.611620.
8. Sabar N.R., Bhaskar A., Chung E., Turkey A., Song A. A self-adaptive evolutionary algorithm for dynamic vehicle routing problems with traffic congestion. Swarm and Evolutionary Computation, 2019, vol. 44, pp. 1018-1027. DOI: 10.1016/j.swevo.2018.10.015.
9. Abdoun Otman, Jaafar Abouchabaka, Chakir Tajani. Analyzing the Performance of Mutation Operators to Solve the Travelling Salesman Problem. Int. J. Emerg. Sci.. 2. 2012.
10. Batishchev D. I., Neymark Ye. A., Starostin N. V. Primeneniye geneticheskikh algoritmov k resheniyu zadach diskretnoy optimizatsii [Application of genetic algorithms to solving discrete optimization problems]. Nizhny Novgorod, 2007, 88 p. (in Russ.).

MEDICAL SCIENCES

УДК 616.314

MODERN METHODS FOR THE PREVENTION OF WEDGE-SHAPED DEFECT OF TEETH

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СОВРЕМЕННЫЕ МЕТОДЫ ПРОФИЛАКТИКИ КЛИНОВИДНОГО ДЕФЕКТА ЗУБОВ

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Abstract

Non-caries dental lesions are fairly common diseases that almost every dentist encounters during his work. Among them, one should single out a disease that manifests itself in the form of a special shaped defect in dental tissue. At the initial examination, it immediately catches the eye, as the defect takes on a wedge-shaped shape. Due to its appearance, this disease was called a wedge-shaped defect [1]. According to studies, every year there are more and more patients with this pathology. Many scientists attribute this to the improper use of hygiene products, and others to the excessive consumption of products containing acids. The prevalence of this defect increases with age, most often it is found in people older than 45 years [2]. This lesion violates the aesthetic appearance of a smile, and in addition, it can lead to increased sensitivity of the teeth [3]. Scientists have not come to a consensus about the causes of the disease and the methods of its treatment [4]. However, in many cases, the disease can be prevented by applying simple methods of prevention.

Аннотация

Некариозные поражения - это довольно распространённые болезни, с которыми сталкивается практически каждый стоматолог во время своей работы. Среди них следует выделить заболевание, проявляющееся в виде дефекта зубной ткани специфической формы. При первичном осмотре оно сразу бросается в глаза, так как дефект зуба приобретает клиновидную форму. Из-за внешнего вида данное заболевание получило название клиновидный дефект [1]. Согласно исследованиям с каждым годом больных с данной патологией становится все больше. Многие ученые это связывают с неправильным использованием средств гигиены, а другие с чрезмерным употреблением продуктов, содержащих кислоты. Распространённость данного дефекта возрастает с возрастом, чаще всего его обнаруживают у лиц старше 45 лет [2]. Данное поражение нарушает эстетический вид улыбки, а кроме того, может привести к повышенной чувствительности зубов [3]. Ученые не пришли к единому мнению о причинах возникновения заболевания и о методиках его лечения [4]. Однако во многих случаях болезнь можно предотвратить, применяя простые методы профилактики.

Keywords: wedge-shaped defect, defect of teeth, causes, prevention.

Ключевые слова: клиновидный дефект, дефект зубов, причины, профилактика.

Введение. Каждый человек мечтает о красивой улыбке, однако у большинства людей имеются

различные заболевания зубов. В настоящее время значительно возросло количество пациентов с некариозными поражениями. Одно из них клиновидный дефект зубов. Данное заболевание легко можно увидеть во время улыбки, так как зубы в области шейки приобретают клинообразный вид. При данной болезни повреждаются твердые ткани зубов, прилегающие к десне [5; 6; 7].

Этот дефект достаточно распространен, его обнаруживают приблизительно у 20-34 % населения. Согласно статистике в основном это поражение диагностируется у лиц старше 45 лет предположительно из-за возможного наличия в этом возрасте заболеваний пародонта, однако проявиться оно может и у лиц молодого возраста [8; 9].

При клиновидном дефекте постепенно развивается гиперчувствительность, что в дальнейшем может привести к потере зуба и сопутствующим заболеваниям, например воспалению десны. Существуют различные методы лечения данного заболевания, однако все они имеют свои трудности [10]. Самый действенный способ борьбы с данным дефектом – предотвращение его развития, т.е. соблюдение правил профилактики.

Материалы И Методы. При написании статьи использовался теоретический анализ и обобщение данных научных трудов отечественных и зарубежных ученых о современных методах профилактики клиновидного дефекта зубов.

Результаты исследования. Можно назвать несколько причин возникновения клиновидного дефекта:

- химическая. Под воздействием кислот, содержащихся в продуктах и напитках, нарушается структура эмали;
- физико-механическая. Дефект возникает из-за неправильного прикуса, т.к. неправильно распределяется нагрузка;
- механическая. Эмаль повреждается под воздействием абразивных паст и жестких зубных щеток [11; 12].

Существует несколько способов борьбы с клиновидным дефектом. Однако следует помнить, даже при успешном лечении есть вероятность рецидива, если не соблюдать все рекомендации врача.

Среди профилактических мероприятий можно выделить следующие:

- использование правильно подобранных средств гигиены ротовой полости;
- регулярное посещение стоматолога для профилактического осмотра;
- исправление неправильного прикуса. При необходимости следует обратиться к ортодонту.
- прохождение ежегодной профессиональной гигиенической чистки зубов;
- ограничение или полный отказ от продуктов и напитков, содержащих в своем составе большое количество кислот;
- своевременное лечение сопутствующих заболеваний, например связанных с желудочно-кишечным трактом [13].

Заключение. Клиновидный дефект - это заболевание, при котором образуется дефект зуба в придесневой области [14]. Предотвратить появление данного поражения можно придерживаясь профилактических мероприятий [15]. Только их выполнение и бережное отношение к своему здоровью позволит не допустить развития не только этого заболевания, но и многих других.

СПИСОК ЛИТЕРАТУРЫ:

1. Semchenko I.M. Clinical manifestations of wedge-shaped defects of teeth // Proceedings of young scientists. Anniversary. edition, dedicated. 80th anniversary of BSMU: Sat. scientific slave. - Minsk, 2001. - S. 121-124
2. Nelovko T.V., Altynbaeva A.P., Savina E.A., Oganova K.M. A modern approach to the main aspects of the clinic and treatment of wedge-shaped defects in therapeutic dentistry // International Journal of Applied and Fundamental Research. 2015. No. 8-4. pp. 682-685. URL: <https://applied-research.ru/ru/article/view?id=7219>
3. Arutyunov S.D., Karpova V.M., Beitan A.V. Modern nanocomposites in the technology of replacement of wedge-shaped defects of teeth // Institute of Dentistry. 2006. No. 3 (32). pp. 56-57
4. Yanbulatova G.Kh. Wedge-shaped defects of hard tissues of teeth // Russian Dental Journal. 2016. No. 4. C. 221-224
5. Fedotova Yu.M., Veremeenko T.V. Causes and possible ways to eliminate wedge-shaped defects of teeth // International Student Scientific Bulletin. 2016. No. 6. URL: <https://eduherald.ru/ru/article/view?id=16650>
6. Makeeva I.M., Shevel'yuk Yu.V. The role of abfraction in the occurrence of wedge-shaped defects of the teeth. Dentistry. 2012. No. 91(1). pp. 65-70
7. Sarycheva I.N., Yanushevich O.O., Minakov D.A., Shulgin V.A. Diagnosis of wedge-shaped defects of hard dental tissues using laser-induced fluorescence and radiography. Fundamental research. 2015. No. 1-10. S. 2084-2090. URL: <https://fundamental-research.ru/ru/article/view?id=38602>
8. Wedge-shaped defect // Medical reference book of diseases. URL: https://www.krasotaimedicina.ru/diseases/zabolevanij_a_stomatology/wedge-shaped-defect
9. Andreeva Yu.V. Peculiarities of restoration of teeth in case of wedge-shaped defect // Bulletin of medical Internet conferences. 2018. No. 2. S. 44-45
10. Aleshina N.F., Radyshevskaya T.N., Rukavishnikova L.I., Piterskaya N.V. Long-term results of treatment of teeth with wedge-shaped defects // Volgograd Journal of Medical Scientific Research. 2013. No. 1. P. 42-44
11. Arutyunov S.D., Karpova V.M., Beitan A.V. Modern nanocomposites in the technology of restoration of teeth with wedge-shaped defects. Problems of Dentistry. 2007. No. 3. S. 59-60
12. Iordanishvili A.K., Pikhur O.L., Cherny D.A. Wedge-shaped defects of teeth in adults of different age groups: remarks for prevention and treatment. Dentistry. 2017. No. 96(3). pp. 14-17

13. Dunaevskaya N. V. Wedge-shaped defect - symptoms and treatment // Encyclopedia of Diseases ProDiseases. URL: <https://probolezny.ru/klinovidnyj-defekt/>

14. Bulgakova A.I., Dyumeev R.M., Islamova D.M. The use of the drug "Nanofluor" in the treatment of a wedge-shaped defect and a symptom of hyperes-

thesia of the tooth // Successes of modern natural science. 2011. No. 5. S. 129-130. URL: <https://natural-sciences.ru/ru/article/view?id=21501>

15. Yarkin R.E. Causes of wedge-shaped defects of teeth and ways to eliminate them // International Student Scientific Bulletin. 2016. No. 6. URL: <https://eduherald.ru/ru/article/view?id=16661>

PEDAGOGICAL SCIENCES

USE OF MICROSOFT TEAMS AND BLACKBOARD PROGRAMS IN HIGHER EDUCATIONAL INSTITUTIONS

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ИСПОЛЬЗОВАНИЕ ПРОГРАММ MICROSOFT TEAMS И BLACKBOARD В ВЫСШИХ ОБРАЗОВАТЕЛЬНЫХ УЧРЕЖДЕНИЯХ

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Abstract

Over the past 4 years, in connection with the transition to distance education, various educational institutions have begun to widely use online platforms for conducting online lessons. Now the most widespread programs are Microsoft Teams and Blackboard. This article is devoted to the comparison of these programs.

Аннотация

За последние 4 года, в связи с переходом на дистанционное образование, в различных учебных заведениях начали широко использовать онлайн платформы для проведения онлайн уроков. Сейчас наибольшее распространение получили программы Microsoft Teams и Blackboard. Данная статья посвящена сравнению этих программ.

Keywords: Microsoft Teams program, Blackboard program, distance education, educational institutions.

Ключевые слова: программа Microsoft Teams, программа Blackboard, дистанционное образование, учебные заведения.

Программа обладает простым и интуитивно понятным интерфейсом. В левой стороне экрана расположены основные клавиши навигации по программе. Все последние действия в программе отображаются во вкладке Activity, а команды, в которых состоит пользователь, во вкладке Teams. Звонки и чат обеспечивают связь с другими пользователями, а во вкладке Календарь отображаются все запланированные события. Режим онлайн конференции также имеет классический интерфейс, с возможностью включения демонстрации экрана и отправкой сообщений.

Возможности программы состоят из

Общение: возможность отправлять сообщения в общий канал, отправка персональных сообщений, а также аудио звонки и видео конференции Teams.

Совместная работа: создание, редактирование и внесение поправок в документы по отдельности или одновременно с другими пользователями, с возможностью объединять изменения и работа с документами Word, Excel и PowerPoint.

Meet: Возможность провести онлайн встречу. В режиме видеозвонка возможно включить демонстрацию экрана. Также программа поддерживает программы Office, их полноценное использование в самом Teams.

Общий доступ: Возможность поделиться документами, аудио файлами, изображениями, файлами одновременно со всеми членами команды.

План: Microsoft Planner полностью интегрирован с Teams. Можно создать список дел, как для себя, так и для любого участника команды, отслеживать прогресс его выполнения в виде диаграммы.

Microsoft Forms также интегрирован с Teams, что позволяет настраивать простые викторины, анкеты и опросы.

Обсуждение. Документы или элементы, созданные в тимс можно комментировать, что обеспечивает прямую связь с человеком, который загрузил материал.

Создание вики, или же страниц с информацией об изучаемой теме, которые могут изменяться или дополняться участниками команды.

Заметки: Teams также интегрируется с Microsoft OneNote, в котором можно создавать заметки.

По данным Оксфордского университета, Teams является предпочтительным инструментом для проведения онлайн занятий. Программа удовлетворяет требованиям безопасности, подходит для работы как с внутренней и конфиденциальной информацией, так и с общедоступной. Так, в начале марта 2020 года в Оксфорде насчитывалось около 1100 команд, ежедневно посещающих около 5000 пользователей; спустя месяц, число увеличилось почти до 4700 команд с примерно 17 000 пользователями в день.

The Canadian Engineering Education Association провела исследование, посвященное использованию Microsoft Teams в ходе студенческого проекта. Общая цель проекта состояла в том, чтобы “сократить выбросы углекислого газа настолько, чтобы избежать наихудших последствий изменения климата”. Студенты работали в группах, чтобы провести оценку устойчивости выбранного ими решения. Студенты выявили, что MS Teams поддерживает

различные режимы совместной работы (например, обмен сообщениями, совместное создание, обмен файлами и т.д.).

Итоговые отчеты по проектам были исключительного качества, и процесс сотрудничества был

отчетливо виден преподавателю курса. С помощью MS Teams инструктор мог отслеживать на всех этапах работы над проектом действия участников и обеспечивать соответствующую обратную связь на протяжении всего проекта.

Согласно мнению пользователей, основные преимущества и недостатки программы следующие:

Плюсы	Минусы
Интеграция всех инструментов Office	Сложная файловая структура
Удобные инструменты совместной работы и обмена информацией	Программа, за счет большого количества возможностей может показаться сложной/ без предварительной подготовки сложно разобраться
Могут использовать пользователи с учетной записью Microsoft	Могут возникнуть трудности у пользователей, не работающих с пакетом программ Microsoft
Бесплатные пользователи могут проводить конференции со 100 участниками в течении 60 минут и добавлять до 299 членов команды; Платные пользователи с учетными записями Microsoft 365 Business Basic и Standard могут проводить собрания с 300 участниками в течение 24 часов;	Высокие системные требования
Учетные записи Office 365 E3 могут приглашать до 500 000 пользователей в свои команды и проводить онлайн-мероприятия с участием до 10 000 участников.	Мобильная версия по сравнению с настольной, имеет меньше возможностей

Другой широко используемой программой является Blackboard.

Основной интерфейс программы имеет следующий вид:

Announcements – предназначено для размещения объявлений и заданий, которые необходимо выполнить;

Personal Information – страница с личными данными пользователя;

Discussion Board – пространство для обсуждений пройденных тем и обмена мыслями;

Send Email – посредством электронной почты обеспечивает связь студентов и преподавателей;

Virtual Session – предназначено для общения студентов и преподавателей в режиме реального времени;

Course content – здесь преподаватели публикуют материал курса;

Calendar – здесь отмечаются важные даты, такие как даты сдачи экзаменов, последние сроки сдачи работ на проверку и т.д.;

My courses – необходимо для получения доступа учащихся и преподавателей к курсам;

Assignments – обеспечивает обмен между преподавателями и учениками заданий и выполненных заданий;

Goals and Assessments – необходимо для прохождения онлайн тестов и квизов;

My Grades – здесь показаны оценки учащихся.

Преимущества и недостатки.

Computer Science Park University провели исследование в области пользы использования платформы Blackboard Collaborate. Результат исследования показали, что в целом программа работает без сбоев и обладает множеством полезных функций, таких как breakout room feature, recording of sessions, automated polling mechanism, chat system, presentation window и многие другие. Среди минусов, преподаватель выявил лишь то, что презентация Pover Point могла быть использованная лишь в виде изображений слайдов и при составлении презентации нужно это учесть.

В журнале *International Journal on Advances in Education Research* было отмечено, что приложение крайне удобно в ведении видеоконференций, использовании интерактивной цифровой доски, а также возможности коллективной работы, однако для работы с приложением необходима предварительная подготовка студентов и преподавателей.

Исследование об эффективности использования платформы *Blackboard Learning Management System* в изучении английского языка, проведенное в *Faculty of Science and Arts, Northern Border University, Saudi Arabia* показало, что технологии Blackboard в EFL превосходят их недостатки. Однако, даже опытные преподаватели тратили большое количество времени на поиск нужного инструмента. В большинстве случаев программу используют «не по назначению», игнорируя большинство ее возможностей.

Преимущества	Недостатки
Много возможностей для совместной работы и обмена информацией	Проблемы при интеграции программ Microsoft Office
Поддерживается на многих видах устройств	Возникают проблемы при использовании программы на смартфоне
Видео уроки и доступная инструкция по использованию	Из-за большого количества возможностей требуется предварительная тщательная подготовка студентов и преподавателей, с участием специалиста
Начиная с 9500 долларов в год, есть бесплатная пробная версия	Нет бесплатной версии

Ниже приводится сравнения программ:

I. **Blackboard** не имеет бесплатной версии; ее стоимость начинается с 9500 долларов в год.

Microsoft Teams имеет бесплатную версию, которая включает возможности:

- Собrania до 60 минут без ограничений.
- Собrania на 100 участников.
- 5 Гб в облачном хранилище на каждого пользователя.
- Неограниченный обмен сообщениями с коллегами и клиентами.
- Общий доступ к файлам, задачам и опросам.
- Шифрование данных для собраний, чатов, звонков и файлов.

Кроме того, имеется 3 дополнительных вида подписки с дополнительными возможностями.

II. **Blackboard learn** имеет возможности:

- Асинхронное Обучение.
- Отслеживание Посещаемости.
- Смешанное Обучение.
- Встроенная Разработка Курсов.
- Сертификация И Лицензирование.

- Портал Для Учащихся.
- Синхронное Обучение.
- Создание Теста/Викторины.
- В Blackboard преподаватель может ограничить доступ к выполнению домашнего задания до того времени как ученик просмотрит лекцию. Преподаватель также может делать заметки в задании ученика, так он будет знать, что необходимо исправить.
- Blackboard позволяет проводить тестирование с ограничением по времени, сохранять результаты теста и продолжать его прохождение позже. Все особенности тестирования определяет учитель при его составлении.
- При создании группы, инструктор определяет, какие возможности имеют участники группы при совместной работе. Сюда могут входить: совместная работа, виртуальный класс, ведение блога группы, обмен файлами и т.д.

Microsoft Teams также позволяет вести совместную работу над файлами, проводить онлайн семинары и конференции, проводить тестирование и опросы, а также выставлять оценки, однако в Blackboard Learn эти функции более гибкие и настраиваемые.

Сеансы и их запись в Blackboard

<i>Blackboard Collaborate</i>	<i>Microsoft Teams</i>
Запись может храниться неограниченное количество времени	Запись может храниться в зависимости от настройки администратора
Удаленные записи можно восстановить в течении 30 дней	Удаленную запись можно восстановить в течении 90 дней
Минимальное ограничение данных видеозаписи – 500 ГБ	Размер записи – 400МБ в час
Есть возможность скачивания видео	Есть возможность скачивания видео
При просмотре видео доступны перемотка, изменение скорости воспроизведения, субтитры, также можно просмотреть чат	Можно включить субтитры, доступна перемотка.
Начать запись может только модератор	Начать запись может любой участник группы

Согласному проведенному исследованию, ниже приведена таблица используемых в Азербайджане программ за 2021-2022 года:

Азербайджанская государственная академия искусств	Microsoft Teams
Азербайджанская государственная морская академия	
Азербайджанская государственная нефтяная академия	
Азербайджанский государственный аграрный университет	
Азербайджанский государственный педагогический университет	

<u>Азербайджанский государственный университет культуры и искусств</u>	
<u>Азербайджанский государственный экономический университет</u>	
<u>Азербайджанский институт туризма</u>	
<u>Азербайджанский институт учителей</u>	
<u>Азербайджанский технический университет</u>	
<u>Азербайджанский университет архитектуры и строительства</u>	
<u>Азербайджанский университет языков</u>	
<u>Азербайджанский университет кооперации</u>	
<u>Академия государственного управления при президенте Азербайджанской Республики</u>	
<u>Бакинский государственный университет</u>	Blackboard
<u>Бакинский университет для девушек</u>	
<u>Бакинский славянский университет</u>	
<u>Национальная Академия Авиации</u>	
<u>Университет Хазар</u>	

Заключение.

В рамках системы образования, независимо от уровня образовательной системы (начальная школа, средняя, высшая, дополнительное образование) программа Blackboard Learn более гибкая и при правильном использовании имеет больше возможностей, чем программа Microsoft Teams. Тем не менее, вторая программа имеет более простой интерфейс и является интуитивно более понятной для пользователей программой. Microsoft Teams удобно применять для семинаров и конференций небольших групп людей, ведения совместной работы или проектов. Для использования программы достаточно ознакомиться с ее возможностями в интернете.

Blackboard Learn является полноценной образовательной платформой. Перед ее использованием необходимо предварительное обучение как преподавателей, так и студентов. Ее можно использовать как образовательную среду для дистанционного обучения, причем проведения офлайн занятий уже не является необходимостью, так как все необходимые функции имеются в программе.

Данная работа выполнена при финансовой поддержке Фонда Развития Науки при Президенте Азербайджанской Республики – Грант № EIF-GAT-6-2021-2(39)-13/01/1-M-01

СПИСОК ЛИТЕРАТУРЫ:

1. University of Oxford. Ten things you can do with Teams 4. October 2019
2. University of Oxford. Making Teams work for everyone at Oxford, 27 April 2020
3. Proc. 2019 Canadian Engineering Education Association (CEEAA-ACEG19) Conf. CEEA19; Paper 128 University of Ottawa; June 9 – 12, 2019 – 1 of 8 – USING MICROSOFT TEAMS TO SUPPORT COLLABORATIVE KNOWLEDGE BUILDING IN THE CONTEXT OF SUSTAINABILITY ASSESSMENT Ralph Buchal¹ and Emmanuel Songso² ¹Western University, ²Wilfred Laurier University

4. Advantages and Disadvantages of Microsoft Teams, July 8, 2021 by Kristy Simon;

5. Disadvantages of Microsoft Teams: How It Could Be Slowing Down Productivity. AUTHOR: Melis-sa Abramson Sep 18, 2019

6. “A Study of the Effectiveness of Blackboard Collaborate for Conducting Synchronous Courses at Multiple Locations” Guillermo Tonsmann, PhD Associate Professor of Computer Science Park University.

7. Use of Blackboard Collaborate platform as a higher education teaching aid Arias Macías C.M., Arriazu Navarro R., Casanova Arias J.L., Fernández Arias J., Cárdenas Rebollo J.M., Rey-Stolle MF. School of Medicine CEU – San Pablo Madrid, Spain

8. International Journal on Advances in Education Research

9. Revisiting the Effectiveness of Blackboard Learning Management System in Teaching English in the Era of COVID-19 Mohammad H. Al-khreshheh¹ ¹ Department of English Language, Faculty of Science and Arts, Northern Border University, Saudi Arabia Correspondence: Mohammad H. Al-khreshheh, Department of English Language, Faculty of Science and Arts, Northern Border University, Saudi Arabia. Received: July 21, 2021 Accepted: October 6, 2021 Online Published: October 8, 2021.

10. <https://www.microsoft.com/ru-ru/microsoft-teams/free?market=ru>

11. <https://www.capterra.com/p/14500/Blackboard-LMS-for-Business/#features>

12. <https://help.blackboard.com/ru-ru/Learn/Student/Ultra/Interact/Groups>

13. <https://blackboard.secure.force.com/publickb/articleview?id=kA770000000CbqL>

14. <https://docs.microsoft.com/en-us/MicrosoftTeams/meeting-expiration#changes-to-meeting-expiration>

PHILOLOGICAL SCIENCES

LINGUISTIC ANALYSIS OF VARIABILITY IN PHRASEOLOGICAL COMBINATIONS

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Abstract

Variability is a manifestation of the instability of language, its internal dynamics in synchrony, and the stimulus of its historical change in diachrony. There are many opinions in linguistics about the trends that lead to language change. These include social and psychological factors, teleology, and freedom of speech. Phraseological combinations, like other language units, have a variety of content and expression. Variation of phraseologies exists only in the form of their expression. We have investigated variability in phraseological units and we used observation and linguistic methods in writing this article.

Keywords: phraseological units, variability, the English language

Very different terms are used to express fixed word combinations. This chaotic terminological diversity is reflected in the works of several authors. Taking into account the diversity of opinions and the plurality of terms in this field, S.I. Ojegov (1974) writes: "Different researchers have given different names to similar events: phraseological combinations, phraseological expressions, fixed structures, idioms, etc. It is necessary to prefer the term phraseological unit as the main term for naming phraseological events." [1, p. 38].

The Swedish linguist Charles Balli (1961) is considered to be the founder of the theory of phraseology in linguistics, and he divides word combinations into 4 groups: free, ordinary, phraseological group, and phraseological combinations. He also sees the existence of phraseology in its semantic features, thus contradicting idiomatic and non-idiomatic fixed word groups [2, p. 21].

V. Fleischer (1997) also understands the term "phraseology" - the field of linguistics, which deals with the study of phraseological combinations, or as a phraseological inventory of any specific language [3, p. 22].

The peculiar formative structure of phraseologies is that they are a strong union of words intertwined based on a single internal meaning. Within this union, the words that form the union lose more or less their meaning, and the whole union is established based on a single meaning.

Western linguists call phraseological units "idioms." For example, Ch. Hocket (1958) writes: "An idiom is a grammatical form consisting of a single morpheme or a complex form that cannot be determined based on the existing structure of meaning." [4, p. 172]

R. Gibb (1997) believes that idioms are formed from "dead metaphors" [5, p. 111].

U. Weinreich (1969) believes that idioms are part of polysemy because of the ambiguity of the lexical unit [6, p. 23].

U. Chafe (1968) and A. Cutler (1982), studying idiomatic, write that idioms are easily subject to structural change.

J. Katz and P. Postal's (1963) views on the description of the idiom are such that the idiom can consist of even one word [9, p. 275].

As theoretical and practical knowledge gained in twentieth-century linguistics, it was argued that language as a functional system, regardless of its complexity, differed in its degree of variability. It is as such an organic property that the variability of language makes it flexible and smooth.

Variability is a manifestation of the instability of language, its internal dynamics in synchrony, and the stimulus of its historical change in diachrony. There are many opinions in linguistics about the trends that lead to language change. These include social and psychological factors, teleology, and freedom of speech.

Recently, issues such as language variability and change of style have been raised more and more. However, this problem is quite complex, and the place of variability in the process of the historical transformation of languages is not clear enough at first glance. On the one hand, historical changes are one of the important sources of variability, on the other hand, the emergence of variant forms and structures is an important step in historical changes that often occur as a result of the replacement of some elements with others.

However, variability does not lead to changes in the language system. The parallelism of forms and constructions, as well as the variability and synonymy of lexemes, can be preserved in the language by providing its dynamics along with historical changes.

The problem of variability has been studied in both foreign and Azerbaijani linguistics. The study of the problem of variability in foreign linguistics began in the early twentieth century. The study of the concepts of "variant" and "invariant" in phonology has been associated with the phoneme and its phonetic manifestation. With the introduction of these concepts into linguistics from phonology, the scope of research on the problem in English, American, and Prague schools of linguistics has expanded. The English scientist U.L. Chaif (1975), when discussing the issue of variability, suggested that the variants at different levels appear on the outer shell of the word, which is more of a formal logic [10, p. 230].

In American linguistics, Bloomfield's theory also provided ample opportunity to study the problem of variability and invariance in the language system and had some influence on the development of linguistics in the United States. According to N. Chomsky's generative grammar, known as the third stage in American linguistics, the components of semantic variants do not exist based on grammatical relations, semantics in the internal structure of a language determines the structure of the sentence and its formation in the speech flow. In this regard, several linguists in American linguistics (Tomris, Liz, Chomsky, and others) have emphasized the importance of exploring variability in specific speech facts beyond meaning.

Research on variability showed that in the former Soviet school of linguistics L. Sherba, M. Panov, S. Ojegov, G. Torsuyev, G. Stepanov and other linguists conducted research on the general theoretical aspects of the problem of variability, studied the manifestations of variability in Russian.

The problem of variability has also been in the focus of Azerbaijani and German linguistics, and a large number of large and small research works have appeared. M. Shiraliyev, A. Demirchizade, A. Abdullayev, Z. Verdiyeva, M. Adilov, Y. Seyidov, H. Bayramov, F. Veysalli, D. Yunusov, N. Valiyeva and many linguists spoke about the issue of variability to some extent, expressed scientific views. Akhundov's research on phonemic variants has a deep scientific character.

The study of phraseological variability showed that H. Bayramov spoke in detail in this direction in Azerbaijani linguistics. N. Valiyeva classified phraseological variants in different system languages (based on materials of Azerbaijani, English, and Russian languages), explained their lexical, grammatical, and semantic features.

In Chingiz Gurbanov's research work on phraseological variants, the problem is comprehensively explained in linguistic terms: "Phraseological variants mean changes in the form and structure of the same phraseological unit resulting from fragmentation, branching from the same source, often with stylistic and emotionally-expressive shades, differing in quantity and quality of meaning and frequency of development, common content association, same valence and only partially different lexical phraseologies with distribution in specific conditions are considered." [12, p. 11]

Ch. Gurbanov concludes that phraseological variants should be defined based on structural criteria, the semantic approach does not justify itself in the actual language material. Determining the influence of both internal and external factors on language variability reveals the functionality of several terms (dialect, dialect, standard language, etc.).

The realization of the language system at all levels in the act of speech, the influence of some internal and external linguistic factors, that is, the acquisition of various changes and shades of specific language units should be assessed as a fundamental feature of language functionally.

The relationship of variability with language changes as a universal property of language is postulated in various linguistic schools, researches of linguists, and in the most diverse language materials (K. Mattayer, V.N. Yartseva, N.N. Semenyuk, D. Nerius). Variety is used as a tool for the study of historical language changes in the grammatical system, for example, in English and German materials by T.A. Rostorgueva, O.I. Brodovich, and R.P. Ebert. Variability is also a major problem in studies of historical normalization processes.

Phraseological combinations, like other language units, have a variety of content and expression. Variation of phraseologies exists only in the form of their expression. Violation of the stability of the components in phraseological combinations creates conditions for variability. Because stability is often relative, different variants of phraseological combinations arise, resulting in several variants of the same unit.

For example, *draw the curtain (over something) - 1) to be silent, to hide something; 2) not to bring something in front of the eyes, not to lift the curtain*. This phraseology is also available as *lift the curtain over something* and *raise the curtain over something*.

Variation is thus intrinsic to any natural language: it is through variation that language change takes place and some forms or uses supersede others diachronically. In the realm of phraseology, multi-word units can be varied morphologically, syntactically, semantically, and pragmatically. Recurrent and systematic variation may result in phraseological units having their entry forms altered in general dictionaries and dictionaries of idioms. The insertion of an adjective may eventually become so common and widespread that certain phraseological units can be considered as having an open slot in their lexicographic form, as is the case with *cut your teeth* which is recorded by the Cambridge Advanced Learner's Dictionary (CALD) as *Cut your political/professional, etc. teeth* and defined as "*to get your first experience of the type mentioned*". The definition itself represents a clear sign of the semantic openness of this string which is normally instantiated with the insertion of a qualifying adjective that specifies and restricts its sphere of application delimiting its referential scope.

Some lexicographers opt, in cases like this, for a solution such as "*Cut one's teeth*". In respect to this string, the Collins Cobuild Dictionary of Idioms (CCDI) includes the following information in the body of the entry 'This expression can be varied by adding an adjective before "*teeth*", which reveals to what extent lexicographers are aware of phraseological variation and how much they take into account its recurrence for matters of lemmatization, as well as for lexicographic definitions and linguistic description. The phrase in italics in the example is illustrative of the fact that variation on idiomatic expressions through adjective insertion can be a fundamental linguistic issue:

Her parents disapproved of subversive forms like rhythm & blues or rock and roll - they also forbade their four children from going to the cinema - so Doris cut her musical teeth by singing in her father's church choir. (The Guardian, February 20, 2004)

- **Types of phraseological variation**

Five distinct types of variation on phraseological units can be outlined: lexical substitution, lexical insertion, truncation, grammatical transformation, and trans-categorisation.

Lexical substitution is the most frequent and widespread type of variation on phraseological units. It is usually found in predicate phrases, schematized as VP + NP, in which either the verbal constituent or the nominal constituent (or sometimes both) is replaced by another item of the same word class with which it can bear different kinds of semantic relation. Examples such as *shed/weeping crocodile tears or right up your alley/street show how well-established*, widespread and straightforward this type of variation is.

Alternative lexical realizations do not change the holistic meaning of the unit nor do they add new semantic information or restrict its application to a certain domain but they can modify the mental scenario of the metaphor involved. Lexical insertion constitutes the second most important means of variation on phraseological units. We will be dealing with this type of variation in-depth and in detail further down this paper.

Other minor types of variation are truncation, in which part of the original unit is elided as in *scrape (the bottom of) the barrel or a weak link (in the chain)*, and grammatical transformation, which stands for a minor part of phraseological variants and does not normally attain lexicalized status.

It should be noticed that not all phraseological units can be varied from a grammatical or syntactic point of view. The classical and rather hackneyed example "*kick the bucket*" cannot be passivized as, for instance, *the bucket was kicked*.

We have found some examples of pluralization, as in "*keep a straight face – keep straight faces*" where the nominal constituent changes according to a plural subject.

Finally, trans-categorisation, also known as word-class transforms, allows certain phraseological units to be transformed into units of a different word class to adapt to the constraints of specific syntactic contexts. One of the commonest means of achieving this adaptation is represented by adjectivization by which, as in the example, a prepositional phrase with an adverbial function (off the top of one's head) becomes an adjective:

There is nothing top-of-the-head about what Mr. Hain has to say either; his pamphlet is the product of extensive online consultation and several focus-group discussions. (The Guardian, March 11, 2004)

Phraseological variants are a form of the image of units of the same distribution, where the interchangeable components have a functional, expressive style within the phraseological combinations and differ from each other in the frequency of processing. For example, the phraseological unit – *die in the harness* can be used in several ways: *die in one's boots / die in one's shoes / die with one's shoes / die with one's shoes on* - 1) die prematurely, die unexpectedly; 2) to be killed, assassinated, etc. by someone.

- **Semantic prosody and variational collocates**

Phraseological units have traditionally been regarded as fixed and non-compositional and their constituent parts as non-analyzable. More recent phraseological research has shown that there is a cline of fixedness and that therefore there are multi-word units that are more fixed than others.

Most idioms are not lexically frozen if we understand this concept as total frozenness since "at least 90% of V-NP idioms, including many usually regarded as completely frozen, appear to allow some form of (syntactically) internal modification" [15, p. 233] and are regularly lexically modified either through substitution or insertion, or both.

Syntactic flexibility, lexical substitution, and lexical insertion in phraseological units can be explained if we consider that these units are not simply long words but that their constituents have a meaning of their own. This characteristic, a sort of semantic autonomy assigned to the core constituent(s) of multi-word units, has been identified as the analyzability of idioms. The compositional view of idiom representation regards them as having a "motivated semantic structure" and states that "this structure influences their syntactic and lexical flexibility" [14, p. 15].

Words that currently collocate with other words end up establishing associations that are generally positive or negative: this extra semantic value constitutes their "semantic prosody".

S. Hunston (1995) summarises the notion of semantic prosody thus: "Briefly, a word may be said to have a particular semantic prosody if it can be shown to co-occur typically with other words that belong to a particular semantic set." [13, p. 137]

Extraneous adjectives co-occurring with the nominal constituents of predicate phraseological units make up a regular paradigm of what we have termed "variational collocates". Let us consider the following example of a variation on a phraseological unit through the insertion of an adjective:

He had an idiosyncratic ear for orchestral color, a classical composer's ability to create long, through-composed pieces from a handful of motifs, and a jazz bandleader's ability to write for specific personalities. (The Guardian, March 4, 2004)

The term "variational collocates" refers to the paradigm of adjectives that collocate inside the phraseological unit with the main nominal constituent. The adjective idiosyncratic is normally associated with nouns such as way, approach, style, factors, behavior, character, interpretation, features, views, etc., with which it commonly collocates. However, when it is inserted in a multi-word unit such as the one in, it immediately makes part of a regular paradigm of other adjectives such as acute, sympathetic, trained, or commiserative. This adjective when used as a variational collocate displays a distinct preference for co-occurring with items denoting sympathy or accuracy, which leads us to conclude that the variational semantic prosody of having an ear for is positive.

Another example of variational semantic prosody can be observed in the instantiations of the phraseological unit that *cast an eye on something*. This phrase is normally found in actual contexts of use modified by

the insertion of an adjective. A search in the BNC shows that the variational collocates of the phraseological nominal base are critical, experienced, cold, professional, shrewd, speculative, acute, cautious, and appraising to mention just the most frequently used adjectives. These collocates form a homogenous group and share the same semantic trait, that of expertise, except for the adjective speculative which deviates from the general pattern. New paradigmatic relations are then established between the core nominal constituent of a phraseological unit whenever an internal modification through the insertion of an adjective takes place.

- *Variation through the lexical insertion*

Insertion of external constituents is a very recurrent means of instantiating phraseological units, especially in media discourse. This phenomenon is overwhelmingly widespread in the press and the number of occurrences can be at times extraordinary. These insertions are either a result of the contextualization of phraseological units or the processes of quantification or qualification concerning all the lexical units of the language, including phraseological units. This significant trend has been extensively studied [15] and is gaining more and more attention in phraseological research.

The interesting thing is that we can find some regularity if we look, for example, at the adjectives that are normally used for this purpose: political, moral, judicial, domestic, academic, financial, economic, intellectual, historical, commercial, statistical, etc., which all belong to the same notional paradigm. These adjectives function as “domain delimiters” or as “viewpoint modification”, considered to be “the most widely available form of internal modification for idioms” [15, p.241].

These intrusive adjectives have lately been identified as “concern modifiers” and can be used with the majority of idioms, even with the most frozen ones which can also allow this type of modification. But other word classes can find their way into the lexicographic form of phraseological units.

Adverbs and nouns are sometimes inserted to modify the whole string or only a specific constituent part. Insertion is numerically mainly adjectival although adverbs, nouns (generally as adnominal premodifiers), and even prepositions can be inserted in the canonical forms of idioms. Apart from adverbs, which represent the second most important variation through lexical insertion, and noun modifiers, the presence of other word classes represents either minor instances or nonce variants.

Conclusion

In this article, we have investigated the variability of phraseological units. As a result of our investigation, we learned that variation is thus intrinsic to any natural language: it is through variation that language change takes place and some forms or uses supersede others diachronically. The problem of variability has been

studied in both foreign and Azerbaijani linguistics. The study of the problem of variability in foreign linguistics began in the early twentieth century.

Five distinct types of variation on phraseological units can be outlined: lexical substitution, lexical insertion, truncation, grammatical transformation, and trans-categorisation.

REFERENCES:

1. Ожегов С.И. О структуре фразеологии (в связи с проектом фразеологического словаря русского языка). Лексикографический сборник. М., 1974, вып. II., с.38
2. Балли Ш. Французская стилистика. М.: Иностр. литер., 1909, русский перевод –1961, с.21.
3. Fleischer W. Phraseologie der deutsche Gegenwartssprache. Tübingen, 1997, s.22.
4. Hockett C.F. A Course in Modern Linguistics. New York: Prentice Hall College Div., 1958, s. 172.
5. Gibb R., Josephine Jr., Bogdanovich M., Jeffrey R.Sykes, Dale J.Barr. Metaphor in Idiom Comprehension // Journal of memory and language, 1997, № 37, s. 111.
6. Weinreich U. Problems in the Analysis of Idioms. Substance and Structure of Language. Berkeley and Los Angeles: University of California Press, 1969, s. 23-25
7. Chafe W.L. Idiomaticity as an anomaly in the Chomsky paradigm //Foundations of Language, 1968, № 4, s. 109-127.
8. Cutler A. Idioms, The colder - the older // Linguistic Inquiry. London, 1982, № 13, s. 317-320.
9. Katz J., Postal P. Semantic interpretation of idioms and sentences containing them. Massachusetts: MIT Research Laboratory of Electronics, Quarterly Progress Report, vol. 70, 1963, s. 275-282.
10. Чейф Л. Уоллес. Значение и структура языка. М.: Прогресс, 1975, с. 230.
11. Vəliyeva N.Ç. Dil tipologiyasının aktual problemləri. Actual problems of language typology. Актуальные проблемы языковой типологии. Bakı: Elm və Təhsil, 2011, 512 p.
12. Курбанов Ч.Г. Диапазон лексических вариантов во фразеологии: Автореф. ...канд.филол.наук. Тбилиси, 1980, с. 11.
13. Hunston S. “A corpus study of some English verbs of attribution”, Functions of Language, 2, 1995, pp. 133-158.
14. Langlotz A. “Occasional adnominal idiom modification – a cognitive linguistic approach”, IJES, 6, 1, 2006 b, pp. 85-108.
15. Nicolas T., 1995, “Semantics of idiom modification”, in M. Everaert, E-J van der Linden, A.Schenk & R.Schreuder (eds.), Idioms: Structural and Psychological Perspectives, Lawrence Erlbaum Associates, Hillsdale, pp. 233-252.

THE PLACE OF RUSSIAN MIGRATION LITERATURE IN THE TEACHING OF "WORLD LITERATURE" (IDEOLOGICAL AND POLITICAL DIRECTIONS OF MIGRATION LITERATURE AND "WORLD LITERATURE")

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Abstract

The article discusses the presentation of Russian foreign literature, included in the concept of "world literature", as a literary work that promotes progressive ideas within this concept.

The article analyzes the formation of Russian foreign literature as a historical and cultural necessity, the factors determining its formation, the development of Russian foreign literature in the XX century, its features, the ideological and political orientation of the waves of Russian foreign literature, methods of literary struggle. Organized in emigration, continuing the traditions of Russian classical literature, they laid the foundation for a new literary phenomenon in world literature - Russian foreign literature.

Information is provided on the features of all three waves of Russian foreign literature and the methods of literary struggle. It is noted that throughout the development of Russian foreign literature, regardless of the methods of struggle, the main feature was Russian national and moral behavior, fulfilling a historical and traditional mission. Emigrant writers considered their main task in emigration to preserve national and moral values, historical memory, to prevent its destruction in generations by preserving national identity. On the other hand, they considered it their duty to acquaint the countries of the world with the achievements of Russian public opinion and culture. For the intelligentsia-emigrants, who acted as bearers and defenders of Russian culture, the main criterion at all times was the preservation of Russian national and moral values, serving the Russian idea.

It is also noted that Russian émigré literature, as a bearer of non-Soviet ideology and progressive ideas, occupies a leading place in world literature, its teaching and propaganda are of great importance.

Keywords: World literature, immigrant literature, Russian emigration, the essence of emigration, national emigration, progressive literature.

INTRODUCTION

Johann Wolfgang von Goethe was the first to introduce the concept of "world literature", which is commonly understood as the totality of the literary traditions of all peoples of the world from antiquity to the present day, and officially introduced the term "Welt-literatur" in German in 1827. The emergence of literature in each country is associated with the emergence of writing and artistic creativity in the field of the art of the word, which occurs differently in different regions, countries and states. The literature of each nation has its own national artistic identity, but at the same time it understands the achievements of the literature of other countries and develops individual elements in cooperation with them: facts, ideas, motives, images, systems, techniques, poetic forms, folk literature, and so on. Because the concept of "world literature" came about only in the 19th century, when literary ties between different countries and peoples became especially widespread and strengthened.

In the last hundred years, the teaching of world literature in general education institutions and "industry" educational institutions has been formed as a result of various approaches and concepts, in many cases based on formal geographical features or subjective expert opinion.

At the end of the 20th century and especially at the beginning of the 21st century, with the globalization of the world, a new system of values began to take shape. Samples of literature that promote "reactionary" ideas

that fall into the category of world literature disappear, and samples that promote more universal human values come into circulation. (3. p. 59)

From this point of view, it is interesting to compile a general picture of the literature of the Russian diaspora, which is widely studied by specialists in world literature, and to analyze the progressive ideas expressed in it.

The process of emigration, which began to intensify in Russia at the end of the 19th century, did not manifest itself as a strong current until the 1920s, in contrast to European countries such as Great Britain, Spain, Portugal and Germany. If those who emigrated from European countries moved more to the other side of the ocean, to new lands, then emigration from Russia also took place on the outskirts of the empire. However, immigrants from outside the empire dominated, especially to the United States. Russian emigration was an integral part of the general migration process throughout the world. Although migration was relatively weak during the First World War, by 1917 a total of about 4.5 million people had emigrated from Russia. (1, pp. 13-14). Among the emigrants, economic, religious and political interests prevailed, there were relatively few figures of literature and art, scientists and teachers.

Historically, in the ruling circles of the Russian Empire at the state level, emigration was not considered a positive phenomenon, this process was hindered in every possible way. Until 1906, the encouragement of emigration in the country was forbidden by law, and

punishment was provided for staying or moving to another country without permission and for a certain period. Therefore, those who emigrated from Russia left the country only in a secret way.

The socio-political processes that shook the vast Russian Empire at the beginning of the 20th century and, as a result, the victory of the October Revolution and the establishment of proletarian power, also changed the nature of the emigration process. Those who migrated to the other side of the ocean and emigrated to European countries in search of seasonal work were almost completely prevented. After the establishment of Soviet power, among those who secretly left the country, political figures, cultural and artistic figures began to predominate. Many intellectuals, scientists and cultural figures who did not accept the new ideology turned to emigration as the only way out.

If before the October Revolution there was a Russian emigration, then the history of Russian emigrant literature dates back to 1917. After World War I and two bourgeois revolutions in the Russian Empire, the army of poets and writers who did not reconcile themselves to the establishment of proletarian power and the demands of a new dominant ideology began a new literary event in world literature, laid the foundation for Russian foreign literature.

It is known that during the bourgeois revolutions, the majority of Russian intellectuals presented themselves as democrats, republicans and liberals, and welcomed the changes and the fall of tsarism. However, the subsequent processes, the political, economic and military crisis that engulfed the country, the outbreak of the civil war and, finally, the persecution and pressure after the October Revolution showed that the promised freedom, democracy, statehood traditions were completely destroyed, replaced by a new structure that completely contradicted their views. The civil war began with the establishment of a proletarian government with local violence and the persecution of forces and individuals who did not accept the new regime and opposed it. All this hastened the flight of the intelligentsia in various ways. Russian emigre literature abroad was created by these intellectuals, who did not reconcile themselves to the new government and went abroad.

The October Revolution radically changed Russian culture and the social and cultural life of the Russian intelligentsia. The new Soviet man, whom the proletariat wanted to see, had to separate from his past and his values, cleanse himself of the "remnants of the past" and fight for new ideals. Those who did not comply with these requirements were declared "enemies of the people" and persecuted. The famous thesis of V. I. Lenin "Whoever is not with us is against us" became the basis of a new ideological struggle. The measures taken immediately after the revolution had a decisive influence on the political, economic and cultural life of the country.

It radically changed the lives and views of millions of people from all walks of life, not only in Russia, but throughout the world. It would not be an exaggeration to say that the Russian Revolution is one of the greatest events in the history of the 20th century. Millions of his contemporaries or participants had different views on

the revolution. Some sincerely believed that humanity would be liberated from the yoke of capital, while others watched what was happening with horror and hatred. If the February Revolution was unequivocally welcomed by the majority of the intelligentsia and sympathized with it, then not everyone was in solidarity with the October Revolution. Many intellectuals - representatives of the Silver Age, writers, artists, philosophers, symbolists, who enjoy special authority in the world of culture and art - did not accept the Bolshevik revolution.

SOCIO-PSYCHOLOGICAL ANALYSIS OF THE PERIOD

In his book "Revolution and Culture: in the Perspective of Time", E.A. Popov divides the intelligentsia of that time into three groups according to their attitude to revolutionary transformations: irreconcilable opponents of the October Revolution, unconditional supporters of the revolution and living with mixed feelings, intelligentsia (8, pp. 76-77).

The intelligentsia of the second group consisted of figures of culture and art, mainly representatives of the artistic and literary avant-garde, as well as proletarian poets and writers who had little weight in the cultural elite and supported the establishment of Soviet power and the socialist system. On the whole, among the creative intelligentsia, the Bolsheviks had fewer consistent and sincere supporters than their rivals.

Among the intelligentsia belonging to the third group, there were a large number of figures of culture and art, indecisive, vacillating and confused about the revolution. Among them were many writers, poets, artists, musicians and other creative workers with outstanding abilities. These figures of literature and art, ready to cooperate with the Soviet authorities, were called "comrades" (товарищи) in the Bolshevik literary and political jargon.

Unlike the intelligentsia of the second and third groups, the first group consisted of irreconcilable opponents of the revolution. The intelligentsia of this group argues that the essence of the revolution is not to build a society in which free and just, equal people live, as promised, and that the Bolshevik policy will divide Russia, destroy national and moral values, make the new government more ruthless, with a new power and ideology. Therefore, many members of this group, who did not reconcile themselves to the proletarian ideology, were forced to leave Russia immediately or soon after the revolution and live in exile. Immigrants abroad have created a unique cultural phenomenon called "emigrant Russian culture".

Some of the emigrants later changed or corrected their attitude towards the Soviet authorities, while others remained on the same uncompromising position (even like Merezhkovsky, who supported the invasion of Nazi Germany into the USSR in the summer of 1941 and therefore was criticized by Russian emigrants). (8, p. 76).

The Red Terror that began after the October Revolution, the impact of socio-political processes on literature, moral persecution and pressure in the cultural life of the country, the death of poets and writers who did not agree with the ideology of the new government,

hunger and poverty, the devastation of the Civil War forced many intellectuals to emigrate. Almost all famous representatives of pre-revolutionary Russian literature were forced to leave the country:

I.A. Bunin, A.N. Tolstoy, A.M. Remizov, V.F. Khodasevich, G.V. Ivanov, N. Teffi, M.A. Osorgin, A.I. Kuprin, B.K. Zaisev, I.S. Shmelev, K.D. Adamovich, V.V. Nabokov, K.I. Gazdanov, M.A. Aldanov, Z.N. Gippius, D.S. Merezhkovsky, K.D. Balmont, I. Severyanin, M.I. Tsvetaeva and others. It was a well-known literary figures of the time when they left the country, not reconciled with the newly established regime.

Poets and writers who were forced to leave the country after the establishment of Bolshevik power in Russia and wrote abroad, as well as writers who began their activities after emigration (for example, Boris Poplavsky), as well as poets and writers who emigrated, but later returned to the USSR (as A. Tolstoy), their work during the years of emigration is called the "first wave" of Russian emigre literature.

It should be noted that in modern Russian literature, Russian émigré literature is grouped into three waves - the first, second and third waves - as Russian émigré literature, mainly in connection with the three émigré waves. In the works of some foreign literary critics, as well as some emigrant Russian literary critics, the number of these waves is mentioned more often, sometimes as five or six waves. N. Andreeva in the article "Features and main stages in the development of Russian emigre literature", included in the collection of articles "Russian emigre literature", which is considered one of the first significant books on Russian emigre literature, published in Germany in 1972 under the general editorship N. Poltoraski characterizes Russian foreign literature as five waves:

"... the first stage of émigré literature dates back to 1925, conditionally, of course.

The second stage lasted until 1940, when the Nazi army entered Paris ...

The third stage - from 1940 (from the fall of Paris) to 1949-1950...

The fourth stage of Russian émigré literature, in any case, lasts approximately from the 1949-1950s until the early sixties...

Around 1961, the fifth stage in the life of Russian émigré literature began (11, pp. 26-30).

Some scientists, in addition to the chronological principle, describe the chronology of the literature of the Russian diaspora, as well as each period with its own characteristics. For example, the well-known literary critic N. B. Eliseeva groups these periods as follows:

1. The period of existence of emigration as an independent political phenomenon (1917-1939);

2. The period of retrospective assessment of the phenomenon of migration, its contribution to the social and "political history" of Europe and the world by emigrant historians (1939 - mid-1950s);

3. 1960-2000 - the period of transition to the scientific study of migration as a complex multifaceted historical event (4, p.4).

However, as we have already noted, in modern literary criticism, according to the chronological principle, it is customary to conditionally distinguish three main waves of Russian immigrant literature. With regard to Russian foreign literature, this grouping is currently accepted by most foreign literary critics: the first wave of Russian foreign literature - 20-30s of the XX century, the second wave - 40-60s and the third wave - 70-90s.

In general, the formation of Russian immigration literature is associated with the first wave of Russian emigration. "Russian immigrants played a very rare and, unfortunately, underestimated role in the world civilization of the 20th century" (10, p.6). Among them are A.M. Ivanov, V. Khodasevich, M. Tsvetaeva, G. Ivanov, B. Poplavsky and others. Famous poets and writers, famous artists, philosophers and scientists in various fields of science, culture and art. Most of these poets and writers considered emigration a national tragedy. As Vladislav Khodasevich said, "Russian literature is divided into two parts. Although both parts of it suffer in different forms and for different reasons, they end up living the same way" (12, p. 466).

The second wave of Russian émigré literature emerged after World War II. This wave of people living in the occupied territories during the war, prisoners who did not return or could not return to the country after the war (more than half a million people lived this life) continued in the post-war period, which is called the "thaw". The second wave, covering the 40-60s of the 20th century, fell on Russian emigrant writers I. Elagin, O. Anstey, V. Zavalishin, N. Berner, B. Narchisov, I. Chinnov, L. Rzhevsky, A. Markov, V. Yurasov, B. Shiryaev, S. Maksimov and others. poets and writers.

The third wave of Russian foreign literature arose as a result of the dissident movement in the Soviet Union. In the 60s and 80s of the last century, part of the creative intelligentsia was forced to leave the USSR for various reasons. Whether they leave the country due to political pressure or personal or artistic problems, they change their citizenship and suffer various losses. However, unlike the first and second waves of Russian emigrants, they were able to establish relations with their homeland and even return to their homeland, like A. Solzhenitsyn. As A. Sinyavsky said, "We do not think that modern Russia is separated from us, it is completely different from us. Let's say I came here, and Daniel stayed there, and basically nothing has changed. Our relationship is similar to our common thoughts. That is why there was no such psychological wall between two different worlds - the world of emigration and the world of the metropolis" (3, p. 190). Another difference between the third wave and the first and second waves was that they were not completely isolated from literature in Russia and retained a connection with the Russian literary process.

The third wave of the 70s - early 90s of the twentieth century among Russian émigré writers includes famous poets and writers such as A. Solzhenitsyn, V. Maksimov, V. Nekrasov, G. Vladimirov, F. Goren-

stein, A. Sinyavsky, V. Voinovich, A. Gladilina, A. Zinoviev, V. Aksyonov, S. Dovlatov, I. Brodsky, S. Sokolov, Yu. Mamleev and others.

Although the second wave of Russian emigration is more numerous than the first wave, the literature of this wave is not as rich as the first wave. As is known, of the more than eight million people who remained in the West after the Second World War, more than half were forcibly returned to the USSR. Many of the prisoners, having heard Stalin's statement that "there are no prisoners, there are traitors," resorted to various means in order not to return to the USSR. Most of them are forcibly exploited in various mines and production sites. Most of those who in one way or another remained abroad and did not return did not belong to the intelligentsia. Unlike the first wave, a significant part of those who did not return with the army were ordinary people, not educated. On the other hand, the vast majority of migrants were representatives of Muslim peoples, the population of Western Ukraine, Western Belarus, the Baltic states and other republics of the USSR. People who remained abroad did not want to return to their homeland, they were afraid to return to the USSR. They do not maintain contact with other immigrants, hide, prefer to mix with the inhabitants of the country where they live, do not disclose their work, do not engage in social activities. Therefore, the literature of the second wave of emigration is not so different in history, well-known Russian émigré writers do not contribute to world literature.

The main ideological and political direction of all three waves of Russian foreign literature was the exposure of Soviet ideology, showing the importance of liberating Russia from Soviet canons. The lack of freedom of speech and thought, the lack of literature in the "homeland" they were forced to leave, had to justify the fact that this led Russia, Russian philosophy, public opinion, culture, art to crisis and bankruptcy. The main mission of Russian emigrant literature was to continue, preserve and develop the real, historical Russian culture and its rich traditions, to prevent the destruction of this rich heritage of proletarian culture. Although the methods of literary struggle of different waves are different, the main practice of each of them can be characterized as follows.

The main feature of the entire wave of "settlers" was Russian national and moral behavior, historical and traditional mission. Serving the Russian idea opened up a big picture for them. Their primary task in emigration was to preserve national and moral values, historical memory, and prevent its destruction in generations by preserving national identity. On the other hand, they considered it their duty to acquaint the countries of the world with the achievements of Russian public opinion and culture.

PROBLEM ANALYSIS

A number of literary samples are presented that have entered the world public opinion as "world literature", covering either historical periods or taking into account national or regional characteristics, the most common period was the Soviet era. The concept of "balanced world literature" was a "product" of the So-

viet era. In this case, the ideological and political essence of these works is not assessed, or the historical text is edited, shortened, and as a result becomes a propagandist of harmful ideas, manipulated by the historical mission of literature.

Russian emigrant literature, which arose and took shape at the "great historical stage" of the 20th century, created humanistic literary works that appeal both to the sociocultural environment of Russia and to universal values, and literally entered the category of world literature. As we have seen, Russian émigré literature, despite the flight from persecution and threats and activities abroad, does not promote aggressive motives, hatred and hostility, does not spread national, religious and racial discrimination, and is expressed in support of progressive ideas and free thinking.

It should be noted that Russian émigré literature should be regarded as a phenomenon in world literature. There are no other similar examples in the history of the emigration of the peoples of the world. Of course, Jews with a rich history of emigration also made a great contribution to world literature. However, it is the object of a different and independent study and differs significantly in nature, form and essence.

CONCLUSION

It is impossible to evaluate Russian foreign literature as a whole as a separate literary movement. There are works of different literary directions. These works differ from each other both in their artistic level, the social concepts represented in them, and in the load of moral values. Developing without a single line of development, in the works of individual writers a different spirit, different ways of interpretation, methods of literary struggle took shape, like a pantry, manifesting itself. Because in the absence of a unified society and literary environment, immigrants reflected in their work how they lived, how they went through spiritual "shocks" and how they received their spiritual energy. Thanks to all this, most emigrants feed on their native lands, nostalgic feelings of the past, the traditions of classical Russian literature, and live on the traditions of the past. In particular, the first wave of Russian writers does not always manage to create a work with new trends. Writers who fed on the traditions of classical Russian literature provided excellent literary examples. The continuation of these traditions in Russian literature of the 20th century not only creates the basis for the emergence of new literary masterpieces, but also connects writers with each other. It was a continuation of the same literary traditions that so closely connected I. Bunin and A. Akhmatova, B. Zaisev and B. Pasternaki, A. Remizov and M. Prishvin.

For the Russian emigrant intelligentsia, poets and writers of all walks of life, who considered themselves the bearers and defenders of Russian culture, the preservation of Russian national and spiritual values has always been the main criterion and served the Russian idea. Serving the "Russian idea", saving and developing this idea, bogged down in the "fetters" of the Soviet ideology, turned out to be their historical mission. They believed that while preserving national values, historical memory and national experience accumulated both at home and in emigration, it is necessary to maintain

the connection between time and generations, prevent its break and create the basis for the future revival of Russia. To do this, they took on the task of introducing Russian identity, thinking, philosophy and culture to the countries to which they emigrated.

Teaching Russian literature abroad in the context of world literature, on the one hand, acquaints the world community with Russian culture, on the other hand, supports the spread of progressive ideas. It is no coincidence that the emigrants themselves laid the foundation for studying and researching the literature of the Russian diaspora. Today, the science of literary criticism, relying on these studies and traditions formed in the West, expands the study of the literature of the Russian diaspora and requires that literary materials presented under the name of world literature correspond to universal human values.

REFERENCES:

1. Иванова Л.Ф. ПОНЯТИЕ «МИРОВАЯ ЛИТЕРАТУРА» В СРАВНИТЕЛЬНОМ ЛИТЕРАТУРОВЕДЕНИИ ГЕРМАНИИ. 2015. *Вестник новгородского государственного университета* №87, Ч.1 (in Russian) <https://cyberleninka.ru/article/n/ponyatie-mirovaya-literatura-v-sravnitelnom-literaturovedenii-germanii/viewer>
2. Бочарова З.С. Российское зарубежье. 1920-1930 гг. как феномен отечественной истории: Учебное пособие. М.: АИРО, 2011, 304 стр. (in Russian)
3. Глэд Дж. Беседы в изгнании. М., 1991. (in Russian)
4. Kazimi P.F. Nizami ganjavi and turan (to 880 anniversary of the great poet) *Asian Journal of Language, Literature and Culture Studies*. 2021, Volume 4 [Issue 4] p.55-60 (in English) <https://www.journalajl2c.com/index.php/AJL2C/article/view/30159>
5. Елисеева Н. В. Российская эмиграция: некоторые проблемы современной отечественной литературы // Российское зарубежье: итоги и перспективы изучения: тезисы докладов и сообщений научной конференции 17 ноября 1997 года. М., 1997. (in Russian)
6. Литературная энциклопедия русского зарубежья: 1918-1940. Писатели русского зарубежья / Гл. ред. и сост. А.Н.Николюкин. - М., 1997; Литературная энциклопедия русского зарубежья. 1918-1940. Периодика и литературные центры / Гл. ред. и сост. А.Н.Николюкин. - М., 2000; Литературная энциклопедия русского зарубежья. 1918-1940. Книги / Гл. ред. и сост. А.Н.Николюкин. - М., 2002. (in Russian)
7. Михайлов О.Н. Литература русского зарубежья. - М., 1995. (in Russian)
8. Назаров М.В. Миссия русской эмиграции. - Ставрополь : Кавказский край, 1992 - . Т. 1. - 1992. - 414 с. (in Russian)
9. Публицистика русского зарубежья (1920-1940) / Сост. И.В.Кузнецов, Е.В.Зеленина. - М., 1999. (in Russian)
10. Революция и культура: сквозь призму времени: монография / Отв. ред. Н. Б. Кириллова. - Екатеринбург : Изд-во Урал. ун-та, 2017. - 222 с. (in Russian)
11. Русское зарубежье. Золотая книга эмиграции. Первая треть XX века: Энциклопедический биографический словарь. М., 1997. (in Russian)
12. Русская литература в эмиграции: Сборник статей под ред. Н. Полторацкого. Питцбург, 1972. - 424 стр. (in Russian)
13. Ходасевич В. Литература в изгнании // Колеблемый треножник. М., 1991. (in Russian)
14. Kazimi P.F. Social and Cultural Features of Trilingual Creativity in Oriental Literature and the Work of Nizami Gandzhavi. SAS Publishers (An International Publisher for Academic and Scientific Journals) *Journal Scholars Journal of Arts, Humanities and Social Sciences*. (in English) ISSN 2347-5374. 2021, Vol.-9,Iss.-8 (Aug) p.358-362. https://saspublishers.com/media/articles/SJAHSS_98_358-362.pdf

LINGUOCULTURAL FEATURES OF EUPHEMISMS (BASED ON ENGLISH AND AZERBAIJANI MATERIALS)

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Abstract

Linguocultural aspects of taboo and euphemism as a sign of language and culture are characterized by a new approach. The non-cultural trace is in the nature of the taboo. This cultural trace, if any, is inherent like a euphemism. The contact of these natures finds its place in modern times. We have also investigated the linguocultural aspects of taboo and euphemism in the paper submitted for defense based on materials of different systems of languages. It is a controversial issue that, in contrast to the taboo, the euphemism that replaces it is a cultural and social indicator of society as a linguocultural phenomenon.

We used observation, linguistic and comparative methods in writing this paper.

Keywords: linguoculturology, euphemism, taboo, slang, classification of euphemism

Language is a means of communication between individuals, and culture is a certain level of development of society. Language is an indicator of the influence of external factors on the language consciousness of members of a single society, people, and nation. Language is also a mirror of all social and historical processes in an intercultural nature. Language is a means of influencing another language and another culture. It is because the national characteristics of the language. And the culture of each ethnic group has a direct impact on the formation of the world in a way that is specific to the perception and representation of the world for the same ethnic group or social community.

The peculiar differences in the minds of people of different languages and cultures are the main reason for misunderstandings in intercultural and interlingual contacts. Belonging to one or another culture shapes the thinking of a particular community, and each national culture has its cultural meanings that have been fixed in the language.

Moreover, language becomes a crucial treasure trove of moral norms, beliefs, and norms of behavior in a separate social environment. Therefore, the representatives of a single nation or a definite society have common personality traits, a concrete type of thinking, and different patterns of behavior from the representatives of a certain nation.

One of the new fields of linguistics is linguoculturology. Beginning in the 1990s, researchers began to investigate the languages previously studied in the context of extralinguistic or linguistic factors from a socio-cultural point of view. Thus, they could create the conditions for the mutual study of language and culture.

Language is sociological, that is, its relationship with the environment, in particular, the existence of language, dialect, literary language, etc. The field of study by exploring various forms such as is called social linguistics. Other disciplines also study and study language and culture. However, taking into account the peculiarities of language and culture, linguoculturology, a new field of sociolinguistics, was created.

An extremely important role in the world landscape belongs to the language units of culture - linguocultures. Linguoculture is a complex, inter-level language unit, a dialectical unit of both linguistic and extralinguistic factors, a form of oral sign, a link between its semantic content and cultural meaning. Researchers have presented linguocultures in many different language forms, including words, word combinations, syntactic structures, pieces of text, and even whole text.

Different events are expressed in language. These events manifest themselves at various language levels. The phenomenon of taboo takes place at the lexical level.

Linguo-cultural analysis of taboos and euphemisms shows that while taboos are an event in the early stages of evolution and thought, euphemisms operate under the norms of high cultural society. The dimensions of the energy carried by these two nominations are also different in terms of impact.

Linguoculturology as a science was born of anthropological traditions. The directions of linguocultural research arose from the idea of the interaction of language and culture.

Linguocultural aspects of taboo and euphemism as a sign of language and culture are characterized by a new approach to it. The non-cultural trace is in the nature of the taboo. The cultural trace, if any, is inherent like a euphemism. The contact of these natures finds its place in modern times.

We have also investigated the linguocultural aspects of taboo and euphemism in the paper submitted for defense based on materials of different systems of languages. It is a controversial issue that, in contrast to the taboo, the euphemism that replaces it is a cultural and social indicator of society as a linguocultural phenomenon. The worldview of society, cultural and social development is inevitably studied in the linguocultural direction. The national-cultural specifics of civil society in the linguocultural aspect are clarified through euphemisms; the cultural sphere is reflected through language.

Euphemism is a word of Greek origin, a combination of the words "good" (ei) and "speak" (phemi), which means to speak politely. In linguistics, euphemisms are the development of more noble, culturally meaningful words instead of rude, vulgar, obscene words and expressions. It serves to soften the meaning, to express it in a more cultural form.

People try to avoid using words and expressions that are unpleasant, inappropriate, or embarrassing. They are afraid of hurting other people's feelings using such kinds of words and expressions. The consciously-avoided words and expressions are called "euphemisms". The word euphemism comes from the Greek word. Eu – good/ well + pheme – speech/speaking. Euphemism is the substitution of words or expressions for words and expressions that seem rough, unpleasant, or inconvenient to be pronounced. The people use euphemisms to get rid of the negative meaning or connotation the word or topic in question has. These include sex, death, killing, crime, disease, and different functions of the human body.

"Eupheme" refers to words and phrases that are used instead of religious concepts that are not etymologically appropriate or named, in other words, the opposite of blasphemy. Going into the depths of the etymology of this term, it seems that such words were needed at an early stage as a result of religious prohibitions. The oldest euphemisms are the names of gods whose expression is forbidden.

According to the researched sources, the following can be said about the groups of lexical-semantic meanings of euphemisms in English and Azerbaijani languages:

- a) euphemisms related to family relations;
- b) euphemisms for marriage and remarriage;
- c) euphemisms related to the news delivered to the family.

Classification of euphemisms (J.Lawrence (1973), p.15):

- semantic methods of formation (a generalization of meaning, periphrasis, and metaphorization of meaning are considered to be the most productive methods of formation of political euphemisms);

- The most common areas of political euphemisms are politics and the military;

- The most "weak" aspects of public life that English speakers need to soften and hide are economic and business activities that cause a negative reaction (attitude), negative characteristics and qualities (public people), suffocation of freedom in government, totalitarian regime.

If we look at the comparative analysis of the structure of the word "political" in English, we see that this word is often closely related to the concepts of "government" and "state". In English, political euphemism is mainly used in government and administration, social movement, and public life.

Several researchers were engaged in the study of euphemisms (D.K. Zelenin, V. Havern, Ch. Kane, A.M. Kasev, H. Nurp, A. Kurkiyev, B.A. Larin, A.A. Khaspanskaya). There are four main thematic groups in the classification of euphemisms:

- 1) euphemisms corresponding to the principle of politeness;

- 2) euphemisms based on the principle of taboo;

- 3) euphemisms that camouflage negative events in economic, political, and social life;

- 4) euphemisms that increase the social status of various specialties.

There are many definitions of "euphemism" in linguistic literature. These definitions are analyzed and divided into three major groups:

The definition of euphemisms that serve to soften the first group of rude and unpleasant expressions (Ch. Kapu, L.R. Galperin, A. Spears, and others); The second group includes the definition of euphemisms, the main function of which is the importance of other social motives (E. Patric, A. Kasev, K. Allan, E. Irina, and others); In the third group, one of the main functions is to hide reality (C. Lawrence, C. Niman, K. Silver, and others). From what has been said, it can be concluded that euphemisms perform three functions:

1. To soften a rude and harsh word for the speaker. In this case, the speaker appreciates the subject of speech, and straightforward expression is perceived by him as rudeness, harshness, and rudeness;

2. Softening a rude or unpleasant word to the other party. This situation depends on the context and the conditions of the speech;

3. Concealment of reality. Such combinations not only soften the meaning, but also choose expressions that hide the essence of the event (Allan, K., Burridge, K., & Mazal Holocaust Collection (1991), p. 26).

Some researchers, for example, E.P. Senichkina, choose several social factors in the case of euphemism. We agree with his view on the socially conditioned motives for the use of euphemisms. When talking about the social conditioning of Euphemia, there are several reasons:

- human language is a means of communication, it has a social nature;

- man himself and his inner world are social, that is, socially-oriented and socially conditioned;

- The psychological mechanism of euphemistic substitution is activated during communication;

- The choice of euphemism depends on the state of communication.

There are different opinions in linguistics about the meaning of the term "taboo". Scientists attribute the emergence of taboos to the earliest stages of human society.

Among taboo words and phrases, first of all, animal names and moral taboos have a special place. Moral taboos have manifestations in the process of movement and communication. According to the old moral norms, a man could not name his children next to his elders. This is both a moral and ethnographic taboo. Although this custom is peculiar to the Azerbaijani people, such cases are sometimes found in English.

Taboos are words that have been accepted in society, especially in ancient times, and are associated with certain actions of any member of society, and those who practice them have been severely punished by the divine forces.

In one of the chapters of Totem and Taboo, Freud divided taboos into the following types of meanings:

1. taboos related to the dead;

2. animal names;

3. plant, mineral, natural phenomena;

4. names of body parts;

5. names of death and disease.

A.S. Kurkiev divides euphemisms into five groups [6]:

- 1) euphemisms based on superstition (cold - bad);

- 2) euphemisms arising from the feeling of fear (die-fly away, go away);

- 3) mercy euphemisms (mentally retarded);

- 4) euphemisms that have arisen based on shyness (illegitimate children - a wicked child);

- 5) euphemisms based on politeness (old age).

Over time, several taboos (legal, social, religious) are created by the state. Inadmissible taboos in cultural society, words that are not acceptable to use, discussions about them are used in satire and comedies, humorous expressions:

1. A taboo on food or drink;

2. The taboo on the opening of the face.

The main meaning of taboo (religious prohibitions on certain actions to avoid the hostile manifestation of incomparable powers in primitive people are only a few sources of euphemisms and euphemisms (religious prohibitions on taboos denoting the name of God, Azrael, evil spirits, animal names). The religious and spiritual motives of euphemism have been parallel and cohesive throughout human history (J.Lawrence (1973), p.78).

Based on the findings of the study, we can say that the euphemisms gave rise to taboos. Dysphemisms are the opposite of euphemisms. Although dysphemisms are similar to taboos, they can express meaning in a harsh, rude, negative, and more effective way. In dysphemisms, stylistic modality and subjective attitude become stronger.

For example, in English to go to hell, go away, and so on. examples are dysphemism, not taboo. In the

Azerbaijani language: *vəfat etmək, əcəl yeli əsmək, axırətin sarayına getmək, can quşu uçmaq*, and so on.

Investigating the symptoms of euphemism and dysphemism allows us to distinguish them from the symptoms of other events. It is necessary to distinguish euphemisms expressed in slang words or slang itself, because sometimes, despite the negative denotation of slang, one can also come across associative melody, which is euphemism-slang.

The term slang is controversial because it refers to all informal words that fall short of modern English criteria and scope. Slang used by many speakers of the language, especially in informal communication, is extremely emotional and expressive.

Thus, slang expressions are used in the euphemistic softening function, which paraphrases negatively colored words used to neutralize the negative pragmatic effect. For example, instead of a toilet, the little house, aunt's closet. Expressions soften the expression and hide unpleasant content, but are used by the speaker to make the expression more expressive, are expressed in slang (Allan, K., Burridge, K., & Mazal Holocaust Collection (1991), p.123).

Although dysphemisms are rude, vulgarism and slang should be distinguished from dysphemism. In this case, the main difference is the communicative purpose of these units. The use of slang and vulgarisms has become a habit, and the speaker does not think about what they mean or uses them to be too informal, and some to imitate. Dysphemism, on the other hand, is deliberately used by the speaker provided that the same denotation has a more lenient name under the particular situation. Dysphemism, expressed in vulgarism, reinforces the negative pragmatic effect.

The lack of intermediate variants in the formation of synonymous forms in phraseological euphemisms leads to the emergence of the same phraseological euphemisms. For example: instead of "to kill oneself", to commit suicide, to take one's own life, and so on are different forms of the same phraseological euphemism. Only components are varied here. It transforms ideas into artistic means suitable for comprehensive, figurative, and accurate expression. Such euphemistic synonyms are often used in the language and speech of works of art.

At the same time, the connection with the living spoken language increases, and the creativity of phraseological expression is enriched. Phraseological synonyms that are semantically and stylistically compatible, are identical, but differ in meaning and stylistic diversity, and soften the expression, are called euphemistic phraseological synonyms.

For example: to combine somebody's hair, to give somebody a lecture. The synonymy in the phraseological euphemisms of the English language is found not only in the literary language but also in the colloquial language. For example, to blacken somebody's eye; to box somebody's ear; to beat somebody to feel the pinch, and so on. The government raised taxes so much that even the rich began to feel the pinch (Y.K. Kərimov (1999), p.88).

Dysphemism is a discursive-contextual phenomenon, that is, the word becomes dysphemism in certain situations of discourse, in itself, it is simply a low-level or taboo lexicon. A characteristic feature of dysphemism is the retention of the denotation: that is, the process of change occurs in the connotative component. In the case of dysphemism, the denotation can be both negative and neutral.

Thus, the processes of euphemism and dysphemism are considered to be the opposite tendency, which has a place in language and speech, that is, the softening of negative expressiveness of speech and the roughness of expression, the strengthening of negative expression.

It should be noted that the middle class uses every opportunity to improve their social status by using soft and correct expressions in their speeches. The reason for this is the social situation, which is perceived by the elite as a duty (service) and standing at the top of the hierarchy, they try not to use the hypercorrect expression to raise their status. R. Holder's euphemism gives two thematic groups: education and low intellect (E. Sheygal (1997), p. 99).

Let's look at some common examples of the use of appropriate euphemisms. To swear like a lord reflects the elite's tendency not to run out of vocabulary. Let's look at examples of the use of appropriate euphemisms: "The BBC had been offered the series and had turned it down because one of the pupils was academically sub-normal." We do have a special course for the Overactive Underachiever continued (E. Sheygal (1997), p.189).

The idea of using euphemisms in a journalistic text helps to effectively influence the recipient's emotions, so the narrative becomes more noticeable. The euphemisms used are more emotionally interesting, not only are direct (indirect) nominations, but also their meaning requires creative effort, certain associations, associated with the creation of a chain of interesting images. In this case, the softening of the direct nomination is not the main purpose of the use of euphemisms, they are used more as a function of intrigue, create another meaning, arouses interest in expression, attracts the reader, arouses interest in the reader, and draws attention to the subject (Ю.М. Скребнев (2004), p.177).

Conclusion

In this article, we have investigated linguocultural features of euphemisms based on English and Azerbaijani materials. One of the new fields of linguistics is linguoculturology. Other disciplines also study and study language and culture. However, taking into account the peculiarities of language and culture, linguoculturology, a new field of sociolinguistics, was created. In linguistics, euphemisms are the development of more noble, culturally meaningful words instead of rude, vulgar, obscene words and expressions. It serves to soften the meaning, to express it in a more cultural form.

REFERENCES:

1. Kərimov Y.K. Azərbaycan dilində evfemizmlər. Bakı, 1999, s.77
2. Allan, K., Burridge, K., & Mazal Holocaust Collection (1991). Euphemism & dysphemism: Language used as shield and weapon. New York: Oxford University Press, 1991, 350 p.
3. Həjiyeva Aziza. English Lexicology (Text-book). Bakı, "Elm və təhsil", 2011. – 248 p.
4. Lawrence J. Unmentionables and other euphemisms. London: Gentry Books, 1973, 84 p.
5. Sheygal E. Political Euphemisms in Ironical Context//Bridging Cultures: the next step. Volgograd, 1997, p.p.99-106
6. Кацев А.М. Эвфемизмы и просторечие. Семантический аспект. Актуальные проблемы семиологии. Л., 1991, с.134-141
7. Крысин Л.П. Эвфемистические способы выражения в современном русском языке //РЯШ, 1994. - №5.
8. Скребнев Ю.М. Основы стилистики английского языка. М.: АСТ, 2004, с.221

PHYSICAL SCIENCES

INVESTIGATION OF THE DYNAMICS OF THE VISCOUS FLUID MIXING APPARATUS BASED ON A CRANK MECHANISM

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ИІНДІ БАЙЛАНЫСТЫРЫЛАТЫН МЕХАНИЗМГЕ НЕГІЗДЕЛГЕН ТҮТҚЫР СҰЙЫҚТЫҚТЫ АРАЛАСТЫРАТЫН АППАРАТТЫҢ ДИНАМИКАСЫН ЗЕРТТЕУ

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Abstract

This paper presents a study of the dynamics of the viscous fluid mixing apparatus based on a crank mechanism with a limited power drive.

Dynamic and mathematical models of the viscous liquid mixing apparatus with a limited power drive are compiled. The equations of motion were solved using analytical and numerical methods and their results were compared. The characteristics of the engine motion under the load of the viscous fluid mixing apparatus are determined depending on the viscosity coefficient of the liquid and the inner diameter of the tube.

The results obtained in the course of theoretical research can be successfully used to design a viscous fluid mixing device with a limited power drive.

Аңдатпа

Бұл жұмыста шектеулі қуат жетегі бар иінді механизм негізінде тұтқыр сұйықтықты араластыру аппаратының динамикасын зерттеу келтірілген.

Тұтқыр сұйықтықты шектеулі қуат жетегімен араластыратын аппараттың динамикалық және математикалық модельдері жасалды. Қозғалыс теңдеулері аналитикалық және сандық әдістермен шешіліп, олардың нәтижелері салыстырылды. Сұйықтықтың тұтқырлық коэффициентіне және түтіктің ішкі диаметріне байланысты тұтқыр сұйықтықты араластыру аппаратының жүктемесі кезінде қозғалтқыштың қозғалыс сипаттамалары анықталды.

Теориялық зерттеулер барысында алынған нәтижелерді тұтқыр сұйықтықты шектеулі қуат жетегімен араластыру аппаратын жобалау үшін сәтті қолдануға болады.

Keywords: piston, connecting rod, rotor, hydraulic turbine, crankshaft

Түйін сөздер: поршень, шатун, ротор, гидравликалық турбина, кривошип

1 Кіріспе

Технологиялық процестер мен эксперименттік жұмыстарды ескере отырып, рычаг машиналарының динамикасын теориялық зерттеу практикаға қолайлы жақсы нәтижелер береді. Қозғалыс теңдеулерін шешудің аналитикалық әдістері тербелмелі сипаттамалар, машина мен энергия көзінің динамикалық, геометриялық және басқа параметрлері арасындағы аналитикалық байланыстарды орнатуға, әртүрлі қозғалыс режимдерін қарастыруға, жүйенің энергия көзімен өзара әрекеттесуіне және олардың тұрақтылығын

зерттеуге мүмкіндік береді. Эксперименттік зерттеулер теориялық зерттеулер нәтижелерінің сенімділігін растайды және рычаг машинасын жобалауға қажетті тербелмелі жүйенің жетіспейтін параметрлерін анықтайды.

Бұл мақалада математикалық модельдер жасалынған, айналмалы қозғалыс режимдеріндегі құрылымдық өзгерістердің әсерін және технологиялық процестің сипаттамаларын ескере отырып, идеалды емес энергия көзі бар екінші класты иінді механизмдердің негізінде жасалған суспензияны араластыру аппараттарының

кинематикасы мен динамикасы аналитикалық және сандық түрде шешілген. Қос иінді бұлғақтың ұзындығы, шатун ұзындығы, поршеньнің диаметрі мен биіктігі, шатун массасы, шток пен поршень массасы, құбыр өлшемдері, сұйық суспензияның тығыздығы мен тұтқырлығы, қозғалтқыш роторының инерция моментінің қос иінді айналу бұрыштық жылдамдығына тәуелділігі, қозғалтқыш білігінің біркелкі емес айналу коэффициенті, сұйықтықты поршеньмен араластыру күші мен қуатыны, механизмнің күшін беру коэффициенті, уақыт бойынша тұтығылатын энергия тиімділігі (немесе қозғалтқыш білігінің айналу бұрышы) зерттеледі.

2 Қозғалыс теңдеулері

Біз келесі жеңілдетулер мен болжамдарды жасаймыз: өлі көлем жоқ, сорылатын сұйықтықтар сығылмайды, сорғының механикалық түйіндерінде үйкеліс болмайды.

Иінді сорғыларда поршеньнің (плунжердің) қозғалыс заңы иінді механизмнің кинематикасына байланысты.

Егер сіз байланыстырушы шатунның соңғы ұзындығының әсерін елемейтін болсаңыз, онда поршеньмен өтетін жолды келесі тәуелділікпен иінді бұрылу бұрышымен байланыстыруға болады (сурет.1)

$$x = r(1 - \cos \varphi) \quad (1)$$

мұндағы r - кривошип радиусы.

Поршеньнің жылдамдығы уақыт бойынша жолдың туындысы, яғни,

$$u = dx/dt = r \sin \varphi d\varphi/dt = r\omega \sin \varphi \quad (2)$$

мұндағы $\omega = d\varphi/dt$ - кривошиптің айналу жылдамдығы. Поршень үдеуі

$$j = du/dt = r\omega \cos \varphi d\varphi/dt = r\omega^2 \cos \varphi \quad (3)$$

Сұйықтық іс жүзінде сығылмайтын болғандықтан, dt уақыт ішінде өткізу түтіктері арқылы өткен көлемі K болады, ал поршень dx қашықтыққа ауысқанда σdx -қа [-поршень

ауданы] тең болады; демек, түтіктер арқылы өткен көлемнің секундтық ағыны:

$$Q = \frac{\sigma dx}{dt} = \sigma \dot{x} \quad (4)$$

Екінші жағынан, бір құбыр арқылы өткен көлемнің секундтық ағыны түтіктің соңындағы қысым айырмасы Δp және сұйықтықтың динамикалық тұтқырлық коэффициентін белгілі Пуазейл формуласы арқылы білдіруге болады

$$q = \frac{\pi d^4 \Delta p}{128 \mu l} \quad (5)$$

Мұндағы d - түтіктің ішкі диаметрі, l - оның ұзындығы; СИ жүйесіндегі тұтқырлық коэффициенті μ Паскаль-секундта көрсетілген: $1 \text{ Па} \cdot \text{с} = 1 \text{ кг/м} \cdot \text{с}$. Құбырдағы тұтқыр сұйықтықтың қозғалысы квази-стационарлық және ламинарлы болады деп болжанады. Егер түтіктің ұзындығы қиманың диаметрінен бірнеше есе көп болса, бұл болжамдар дұрыс. Егер z -қайта іске қосу түтіктерінің саны болса, онда (4) және (5) салыстыру арқылы біз келесі теңдеуді аламыз

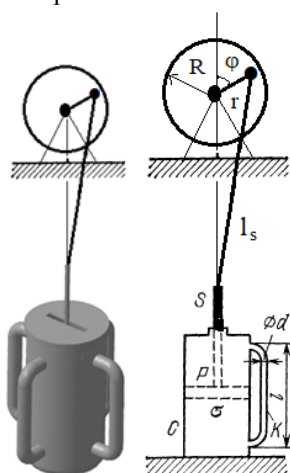
$$\Delta p = \frac{128 \mu l \sigma \dot{x}}{\pi d^4 z} \quad (6)$$

Поршеньмен бөлінген цилиндр көлемдері арасында бірдей қысым айырмашылығы болады. Поршеньге әсер ететін күшті R , поршень ауданына σ қатынасы Δp ретінде анықтаймыз. Бұл күштің бағыты поршень қозғалысының бағытына қарама-қарсы екенін ескере отырып, біз поршеньнің қозғалысына сұйықтықтың қарсылық күші проекциясының қажетті өрнегін табамыз

$$R_x = - \frac{128 \mu l \sigma^2 \dot{x}}{\pi d^4 z} \quad (7)$$

немесе

$$R_x = - \frac{128 \mu l \sigma^2 r \omega \sin \varphi}{\pi d^4 z} \quad (8)$$



Сурет. 1- Сұйықтықты араластыратын аппараттың схемасы

Екінші текті Лагранж теңдеулері түріндегі механикалық жүйе ретінде бөгетсіз гидравликалық турбинамен

қозғалатын поршеньді иінді сорғы үшін қозғалыс теңдеуін шығарайық.

Бұл жүйенің кинетикалық энергиясы:

$$T = \frac{J\dot{\varphi}^2}{2} + \frac{m\dot{u}^2}{2} + T_s \quad (7)(9)$$

мұндағы m -поршень мен өзек массаларының қосындысы, T_s - шатунның кинетикалық энергиясы, J - гидравликалық турбинаның жұмыс доңғалағының инерция моменті келесі өрнекпен анықталады

$$J = \frac{1}{2} M_0 R^2,$$

мұндағы R - жұмыс доңғалағының радиусы, M_0 - қозғалтқыштың жұмыс доңғалағының массасы.

Шатунның кинетикалық энергиясы келесі формула бойынша анықталады:

$$T_s = \frac{1}{2} M_s v_s^2 + \frac{1}{2} J_c \omega_l^2 \quad (8)(10)$$

$$T = \frac{1}{2} \left[\frac{1}{2} M_0 R^2 + m r^2 \sin^2 \varphi \right] \dot{\varphi}^2 + \frac{1}{2} M_s r^2 \dot{\varphi}^2 \left[\left(1 - \frac{r}{2l_s} \frac{\cos \varphi}{\sqrt{1 - \frac{r^2}{l_s^2} \sin^2 \varphi}} \right)^2 + \frac{1}{4} \cos^2 \varphi \right] + \frac{M_s r^2 \dot{\varphi}^2}{24} \frac{\cos^2 \varphi}{1 - \frac{r^2}{l_s^2} \sin^2 \varphi} \quad (9)(11)$$

Енді сұйықтық толтырылған цилиндр ішінде қозғалу кезінде поршеньге әсер ететін жалпыланған гидродинамикалық күштерді анықтаймыз. Поршеньді жылжыту кезінде әрекет ететін гидродинамикалық күштердің жұмысы:

$$\delta A = \Delta p \sigma r \omega \sin \varphi \delta \varphi \quad (10)(12)$$

$$\left\{ J + m r^2 \sin^2 \varphi + M_s r^2 \left[\left(1 - \frac{r}{2l_s} \frac{\cos \varphi}{\sqrt{1 - \frac{r^2}{l_s^2} \sin^2 \varphi}} \right)^2 + \frac{1}{4} \cos^2 \varphi \right] + \frac{1}{12} M_s r^2 \frac{\cos^2 \varphi}{1 - \frac{r^2}{l_s^2} \sin^2 \varphi} \right\} \ddot{\varphi} + M_s r^2 \left[\left(1 - \frac{r}{l_s} \frac{\cos \varphi}{\sqrt{1 - \frac{r^2}{l_s^2} \sin^2 \varphi}} \right) \left(\frac{r}{l_s} \frac{\sin \varphi}{\sqrt{1 - \frac{r^2}{l_s^2} \sin^2 \varphi}} - \frac{r^3}{4l_s^3} \frac{\cos \varphi \sin 2\varphi}{\left(1 - \frac{r^2}{l_s^2} \sin^2 \varphi \right)^{\frac{3}{2}}} - \frac{1}{8} \sin 2\varphi \right) \right] \dot{\varphi}^2 + \frac{128 \mu l \sigma^2}{\pi d^4 z} r^2 \dot{\varphi} \sin^2 \varphi = M_D \quad (14)$$

Жеңілдету үшін келесі шарттар бар делік

$$\frac{r}{l_s} \ll 1 \text{ и } \frac{m}{M_0} \ll 1$$

Осы шарттарға байланысты поршеньдік кривошипті насостың қозғалыс теңдеулері (12) түрге айналады:

$$\ddot{\varphi} + (\varepsilon_2 - \varepsilon_1) \sin 2\varphi \dot{\varphi}^2 + \omega \sin^2 \varphi \dot{\varphi} = \frac{M_D}{J} \quad (15)$$

мұндағы ω_l - шатунның бұрыштық жылдамдығы, J_c - орталық арқылы өтетін оське қатысты шатунның инерция моменті.

Келесі қатынастар бар

$$\omega_l = \frac{r}{l_s} \frac{\cos \varphi}{\sqrt{1 - \frac{r^2}{l_s^2} \sin^2 \varphi}} \dot{\varphi}$$

$$v_s^2 = r^2 \dot{\varphi}^2 \left[\left(1 - \frac{r}{2l_s} \frac{\cos \varphi}{\sqrt{1 - \frac{r^2}{l_s^2} \sin^2 \varphi}} \right)^2 + \frac{1}{4} \cos^2 \varphi \right],$$

мұндағы l_s - штаун ұзындығы. Демек, жалпы кинетикалық энергия

Сондықтан жалпыланған гидродинамикалық күштер келесі түрде анықталады

$$Q_B = \frac{128 \mu l \sigma^2}{\pi d^4 z} r^2 \omega \sin^2 \varphi \quad (11)(13)$$

Идеалды емес энергия көзімен поршеньдік кривошипті араластыру аппараттың қозғалыс теңдеулері:

мұндағы

$$\varepsilon_1 = \frac{M_s r^2}{6J}, \varepsilon_2 = \frac{m r^2}{2J}, \omega = \frac{128 \mu l \sigma^2}{\pi d^4 z J} r^2$$

Кейбір қозғалтқыштың білігіндегі момент, мысалы, параллель қозуы бар тұрақты ток қозғалтқышы формула бойынша анықталады

$$M_D = a - b \dot{\varphi} \quad (16)$$

мұндағы a және b - қозғалтқыш параметрлеріне байланысты тұрақты коэффициенттер.

3 Қозғалыс теңдеуін шешу

(14) және (15) теңдеулер айтарлықтай сызықты емес болып шығады, өйткені сызықты емес өрнек теңдеуге аз параметрмен енеді. Тапсырманы жеңілдету үшін $\varepsilon_1 \approx \varepsilon_2$ делік

(16) теңдеуді (14) ке ауыстыру арқылы қозғалыс теңдеуін (14) өлшемсіз пішінге түрлендіреміз

$$\frac{d^2\varphi}{d\tau^2} + \frac{b}{J\omega} \frac{d\varphi}{d\tau} + \sin^2\varphi \frac{d\varphi}{d\tau} = \frac{a}{J\omega} \quad (17)$$

(17) теңдеуді одан әрі жеңілдетуге болады, егер бір периодта бұрыштың өзгеруі 0-ден 2π болса $\omega = \frac{d\varphi}{d\tau}$ шамасы аз

өзгереді, содан кейін оның айналу бұрышындағы туынды оның орташа мәніне тең деп санауға болады. Бұрыштың айналымы φ ретінде және $d\varphi = \tilde{\omega} d\tau$, қатынасты қолдана отырып, біз (17) теңдеуді түрге түрлендіреміз:

$$\frac{d\tilde{\omega}}{d\varphi} = -\frac{\varepsilon}{2\pi} \int_0^{2\pi} d\varphi - \frac{1}{2\pi} \int_0^{2\pi} \sin^2\varphi d\varphi + \frac{B}{2\pi\tilde{\omega}} \int_0^{2\pi} d\varphi$$

мұндағы

$$\varepsilon = \frac{b}{J\omega}, B = \frac{a}{J\omega^2}.$$

Орташа операцияны орындау кезінде біз $\tilde{\omega}$ мәнін тұрақты деп санаймыз. Мынадай жағыдайды ескеріп

$$\frac{1}{2\pi} \int_0^{2\pi} \sin^2\varphi d\varphi = \frac{1}{2}, \quad \frac{1}{2\pi} \int_0^{2\pi} d\varphi = 1.$$

интегралдаудан кейін біз мынаны аламыз

$$\frac{d\tilde{\omega}}{d\varphi} = -\left(\varepsilon + \frac{1}{2}\right) + \frac{B}{\tilde{\omega}}. \quad (18)$$

(18) теңдеуді өтпелі режимдердегі айналымы анықтау үшін зерттеуге болады. Орташа теңдеуден кейін (17) теңдеу де (18) түрінде болады.

Стационарлық режимдердің болу шарты $\frac{d\tilde{\omega}}{d\varphi} = 0$.

Бұл жағдайда стационарлық қозғалыс режимдерінің теңдеулері келесідей болады:

$$\tilde{\omega}_c - \frac{B}{\left(\varepsilon + \frac{1}{2}\right)} = 0.$$

Осыдан біз стационарлық режимде қозғалтқыш білігінің айналымы қозғалысының бұрыштық жылдамдығының орташа мәнін табамыз:

$$\tilde{\omega}_c = \frac{B}{\left(\varepsilon + \frac{1}{2}\right)} = \frac{a}{b\omega} \left(1 + \frac{1}{2\varepsilon}\right). \quad (19)$$

Қатынасын ескере отырып:

$$\frac{d\varphi}{d\tau} = \frac{d\varphi}{dt \cdot \omega} = \frac{\tilde{\omega}_c}{\omega}. \quad (20)$$

(19) теңдіктен келесі өрнекті аламыз:

$$\tilde{\Omega}_c = \Omega_0 \frac{1}{\left(1 + \frac{1}{2\varepsilon}\right)},$$

мұндағы $\Omega_0 = \frac{a}{b}$ - бос жүрістегі

гидротурбинаның бұрыштық жылдамдығы

Бұдан шығатыны, араластыру аппаратының поршенінің тербеліс жиілігінің орташа мәні жұмыс істемей тұрған кезде шектеулі қуатты қозғалтқыш білігінің айналу жылдамдығына тура пропорционал.

(19) өрнегін қолдана отырып, (18) теңдеуді түрге түрлендіреміз:

$$\frac{d\tilde{\omega}}{d\tau} = -\left(\varepsilon + \frac{1}{2}\right) \left(\tilde{\omega} - \frac{\Omega_0}{\omega}\right) - \frac{\Omega_0}{2\omega} \quad (21)$$

Бастапқы шартта: $\tau = 0, \tilde{\omega} = 0$, (21)

теңдеуді интегралдау арқылы сору және айдау кезеңі үшін келесі өрнектерді аламыз

$$\tilde{\omega} = \frac{\Omega_0}{\omega} \left(1 - \frac{1}{2\varepsilon + 1}\right) \left(1 - e^{-\left(\varepsilon + \frac{1}{2}\right)\tau}\right) \quad (22)$$

Осы жерден

$$\tilde{\Omega} = \Omega_0 \left(1 - \frac{1}{2\varepsilon + 1}\right) \left(1 - e^{-\left(\varepsilon + \frac{1}{2}\right)\omega t}\right), \quad (23)$$

Шектеулі қуаттағы қозғалтқыш білігінің орташа айналу жиілігі, яғни $t \rightarrow \infty$

кезінде $\Omega_0 \left(1 - \frac{1}{2\varepsilon + 1}\right)$ болады, яғни

$$\Omega_0 \left(1 - \frac{1}{2\varepsilon + 1}\right) = \lim_{t \rightarrow \infty} \tilde{\Omega} \quad \varepsilon = \frac{b}{J\omega}, B = \frac{a}{J\omega^2}$$

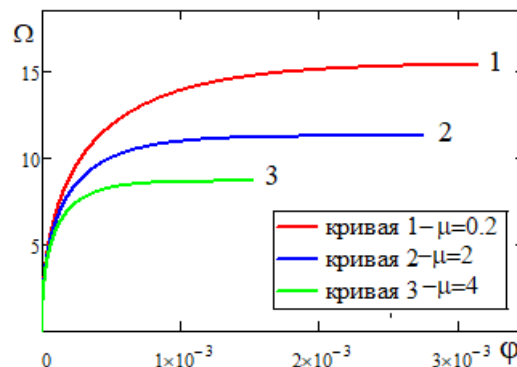
(18) теңдеудің интегралы:

$$\varphi = \frac{J\Omega_0}{b} \frac{1}{\left(1 + \frac{1}{2\varepsilon}\right)^2} \ln \frac{\Omega_0}{\Omega_0 - \left(1 + \frac{1}{2\varepsilon}\right)\tilde{\Omega}} - \frac{J}{b} \frac{1}{\left(1 + \frac{1}{2\varepsilon}\right)} \tilde{\Omega} \quad (24)$$

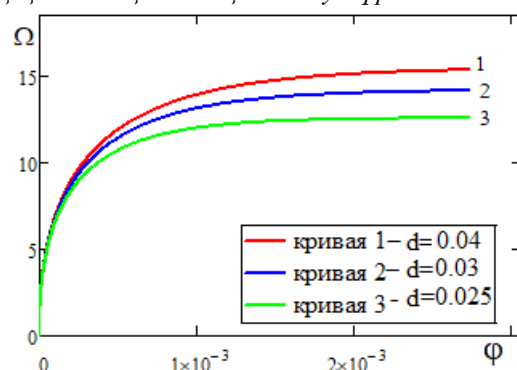
2 және 3-суреттерде (24) формулалар бойынша сұйықтың тұтқырлығының динамикалық коэффициентіне мен түтіктің ішкі диаметрінің әртүрлі мәндері үшін орташа бұрыштық жылдамдықтың қозғалтқыш білігінің айналу бұрышына, тәуелділік графиктері тұрғызылған. Стационар режимдегі қозғалтқыш білігінің айналуының орташа бұрыштық жылдамдығы бос жүріс кезіндегі айналу

жылдамдығына пропорциональ болады және қозғалтқыштың жұмыс жасау режиміне тәуелді болмайды. Орташа айналу жылдамдығы тек қана қозғалтқыштың,

араластығыш аппараттың параметрлеріне және сұйықтың тұтқырлық коэффициентіне тәуелді болады.



Сурет-2-Сұйықтың тұтқырлық коэффициентінің әртүрлі мәндердегі бұрыштық жылдамдықтың қозғалтқыштың айналу бұрышына тәуелділік графигі



Сурет-3- түтіктің ішкі диаметрінің әртүрлі мәндердегі бұрыштық жылдамдықтың қозғалтқыштың айналу бұрышына тәуелділігінің графигі

4 Жүйе қозғалысының орнықтылығы

Енді теңдеу (18) арқылы анықталатын араластыру аппаратының стационарлық режимдерінің тұрақтылығын қарастырыңыз. Ол үшін (18) теңдеуді түрге түрлендіреміз

$$\frac{d\bar{\omega}}{d\tau} = -\left(\varepsilon + \frac{1}{2}\right) \left(\bar{\omega} - \frac{B}{\left(\varepsilon + \frac{1}{2}\right)} \right), \quad (25)$$

$$\frac{d\varphi}{d\tau} = \bar{\omega}$$

Вариацияларда теңдеулер жүйесін (25) құрамыз.

$$\varphi = \varphi^* + q, \quad (26)$$

$$\bar{\omega} = \bar{\omega}^* + p,$$

(25) теңдеулер стационарлы шешімдері

$$\bar{\omega}^* = \Omega, \quad \varphi^* = \Omega\tau$$

(26) өрнегін (25) ауыстыру арқылы біз аламыз

$$\frac{dp}{d\tau} = -\left(\varepsilon + \frac{1}{2}\right)p, \quad (27)$$

$$\frac{dq}{d\tau} = p$$

(27) теңдеулер жүйесінің интегралдары $\tau \rightarrow \infty, p=0, q=0$ кезінде

$$p = Ce^{-\left(\varepsilon + \frac{1}{2}\right)\tau}, \quad (28)$$

$$q = \frac{-C}{\left(\varepsilon + \frac{1}{2}\right)} e^{-\left(\varepsilon + \frac{1}{2}\right)\tau}$$

Демек, иінді қозғалтқышы бар қозғалтқыштың стационарлық қозғалысы асимптотикалық тұрақты.

5 Қорытынды

Тұрақты режимдегі қозғалтқыштың орташа бұрыштық жылдамдығы жұмыс істемейтін қозғалтқыштың бұрыштық жылдамдығына тең және араластыру машинасының жұмыс режиміне байланысты емес. Орташа айналу жылдамдығы тек қозғалтқыштың параметрлеріне және араластырылған сұйықтықтың ағу коэффициентіне байланысты. Жетек доңғалағының радиусы жоғарылаған сайын оның орташа бұрыштық жылдамдығы төмендейді, ал ағын жылдамдығының жоғарылауымен орташа бұрыштық жылдамдық артады.

ПАЙДАЛАНЫЛГАН ӘДЕБИЕТТЕР**ТІЗІМІ:**

1. Чирнаев И.А. Поршневые кривошипные насосы. – Л: Машиностроение, Ленингр. отд-ние, 1983. – 176 с.

2. Тулешов А.К., Бисембаев К., Жаменкеев Е.К. Момент силы и мощность гидротурбины в начале погружении лопасти // Вестник Московского городского педагогического университета. Серия информатика и информатизация образования, 2008, №4(14), - С.154-161.

TECHNICAL SCIENCES

5G TECHNOLOGIES ARE CREATING A NEW WORLD ORDER

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Abstract

One of the global networks that widely uses wireless technology in modern times is the mobile phone network. Many operations are carried out via mobile communication. From this point of view, this type of communication is constantly improving and the speed of data transmission is constantly increasing. 5G technology is a more advanced technology in this area and has significantly increased the speed of data transmission, which has led to the emergence of many new areas. In this regard, the publication of the article is relevant.

Keywords: 5G technologies, Internet of Things, Conspiracy theory, polar coding.

One of the most widely used wireless global networks in the modern world is the mobile phone network. This system has already passed five generations and the sixth generation is expected. These generations are also called 1G, 2G, 3G, 4G, 5G and 6G, respectively (here G is derived from the English word generation). The first generation of mobile phones (1G) implemented only analog voice transmission. The second generation (2G) was called the digital generation, but it also carried only voice communication. The third generation (3G) was also called the digital generation and was already designed for voice and data transmission. Each of these generations had its own characteristics.

The fourth generation is a technology of mobile communication (4G) has the potential to transmit data at a speed of more than 100 Mbit / s for mobile (high-bandwidth) subscribers and at a speed of 1 Gbit / s for landline subscribers (with low mobility).

At a conference held by the International Telecommunication Union in Geneva in 2012, LTE Advanced (LTE-A) and WiMAX 2 (WMAN-Advanced, IEEE 802.16m) technologies (no SIM card required) fourth generation (4G) wireless communication standards (IMT- Advanced) has been officially adopted.

Some general information about 5G technologies

Previously, the leaders in the creation of mobile networks were mainly American and European companies. However, the United States and China are fighting for leadership in the development of this new 5G technology. According to some indicators, China is even ahead in the development of 5G networks. 5G, a new generation of mobile communications, can change people's lives again by transferring data 100 times faster than existing 4G networks. They are expected to contribute to the emergence of self-driving cars, virtual and augmented reality and the so-called Internet of Things, reduce dependence on Wi-Fi and wired Internet, and allow surgeons to perform complex remote operations.

5G provides peak data rates of up to 100 Gbps, improved, improved energy efficiency, ie sensors that can last six to eight years with a single battery,

quantitative indicators and individual energy-saving devices can be connected to the network. 5G networks support high-speed objects (up to 500 km / h), which is important, for example, for high-speed trains.

One of the main tasks of 5G is to create a base for the Internet of Things (IoT). There are differences between the ordinary Internet and the Internet of Things. On the regular Internet, a person uses and creates information, and on the Internet of Things are devices use and create information, ie sensors, quantitative indicators, industrial devices.

Fifth-generation communications heralds the arrival of platforms with minimal human involvement, in other words, the widespread implementation of "unmanned action platforms." 5G is a faster and more efficient technology. According to forecasts, only 2% of Internet traffic will be generated and used by people by 2030, thanks to "unmanned action platforms". In short, the human factor will be sufficiently removed from management. It will also revolutionize the industry.

5G is a software-defined network. In other words, the base station has become updated with software: It should be noted that the base station of mobile communication is sometimes called a "tower".

By the way, "tower" is a slang word; no one among the experts uses it. The "tower" is an iron structure where only the antennas are hung and the base stations are stopped. Therefore, it is correct to say "base station".

In addition, network virtualization takes place in 5G - many functions that were previously implemented on devices, special boards, boards are now implemented on ordinary servers.

5G can operate in higher ranges than previous generations, and more base stations need to be installed as the coverage of one base station is reduced. Therefore, the market is gradually becoming more capacious, private networks are emerging. Recently, the relevant authorities decided that in the new millimeter wave, which introduces 5G, it is possible to build a vertical network for businesses without obtaining an operator license. Some companies have even started to buy these frequencies.

The stage of creating 5G networks

The many modern capabilities of 5G networks mentioned above have prompted many IT companies around the world to conduct research in this area. In this regard, new alliances have emerged in the world that allow manufacturers of small and medium-sized IT devices to enter the market, as only giant companies such as Huawei, Ericsson, Nokia and Samsung are now operating in the market for mobile networks. In addition, one of the world's IT giants such as Facebook, Microsoft also has been actively working on this topic at, and has begun to invest in new infrastructure.

Given the strategic importance of this market in the modern world, states have also begun to participate. For example, China has invested an incredible amount of money to build a 5G network and continues to do so. Given the importance of this area, Chinese President Xi Jinping spoke for five minutes in his New Year's address to the nation about the importance of deploying 5G and new infrastructure. In China, 5G-related robots are already being actively used, with the delivery of goods becoming unmanned, requiring 5G. The integration of large video conferencing, newly built hospitals and temporary mobile posts is all done through fifth generation communications.

According to experts, the potential benefits of 5G networks can be huge. Patent companies will receive billions in royalties, and countries with the largest and most reliable networks will benefit from technological advances through faster data transfers. In addition, their intelligence and defense agencies will have a better opportunity to conduct intelligence activities in hostile countries or dismantle their networks.

China still has some advantages in the development of 5G networks. Since 2013, a government committee in China has been working with Chinese mobile operators and equipment manufacturers to develop and test 5G. It is government support that will enable Huawei and other Chinese companies to gain valuable experience and the ability to sell a wide range of equipment for 5G networks, along with a large domestic market. It is the fruits of these measures that the Chinese government has already seen in the fight against the coronavirus during the coronavirus pandemic. 5G technology has played a significant role in the fight against coronavirus in China, which will be discussed in this article.

In the United States, where the government is trying not to lead the private sector, most of the 5G issues have been handled by companies such as AT&T, Verizon, Samsung Electronics and Nokia. The country's leading mobile operators plan to launch 5G networks in some cities this year.

Regulators in the field of mobile communications and IT in general are helping both countries provide leadership. However, there is a large-scale struggle between these countries for the establishment of 5G networks. In March, the Donald Trump administration thwarted an attempt by Singapore-based Broadcom to seize \$ 117 billion from US chipmaker Qualcomm. Washington feared that Broadcom would reduce its investment in innovation, which would help Chinese companies take the lead in 5G development. In turn, Chinese regulators did not approve a \$ 44 billion deal

to buy Qualcomm's Dutch rival NXP Semiconductors in July.

Much of Washington's concern is with Huawei's growing power, especially in its ability to build 5G networks. In 2012, U.S. officials announced that the equipment of Huawei and another Chinese company, ZTE, posed a threat to national security and could be used to spy on Americans. In August, the Australian government agreed to similar US disputes and banned the use of Huawei and ZTE devices to build 5G networks. Other US allies are considering similar sanctions.

Huawei and ZTE have denied the allegations. Beijing is trying to prevent American companies from participating in Chinese networks for similar reasons.

China has made the development of the new generation 5G a priority after losing the competition to Western countries in building the previous generation of mobile networks. Europe was out of competition in the construction of 3G, and the United States helped American companies such as Apple and Qualcomm in deploying 4G networks in the late 2000s and contributed to many of the country's smartphone applications.

According to a study by Deloitte company, China has built about 350,000 mobile stations since 2015, while the United States has less than 30,000. In addition, there are 14.1 stations per 10,000 people in China and 4.7 stations in the United States. This will affect the development of 5G, as next-generation networks will need more mobile station towers than 4G.

The Chinese government also supports the development and establishment of 5G technology at the state level. Testing of 5G technology in China is carried out by a state laboratory located near the Great Wall of China, north of Beijing. According to experts who visited the laboratory, all the leading Chinese mobile operators and equipment manufacturers, as well as prototypes of mobile devices work here. The tests, conducted by companies, universities and research institutes with the support of the Ministry of Industry and Information Technology of the People's Republic of China, were scheduled to be completed by the end of 2018. After that, the Chinese state mobile operator China Mobile planned to conduct tests in 17 cities. Commercial use of 5G networks in China was expected to begin by 2020. It was during this period that the coronavirus appeared in China. Whether this is a coincidence or planned is another matter. Just as the war between China and the United States for the establishment and full ownership of 5G networks in the world (participation in this struggle in other countries is not excluded, because 5G will cause many changes in the world) is not over, the next X-virus can catch the world. To substantiate this view, we can point to the recent speech of US President Donald Trump, who said that the virus was artificially created in China.

China's success in this area will depend on its ability to persuade the rest of the world to use its own technical standards and then receive royalties for the use of its patents. Experts expect that most of the major patents will be acquired by Qualcomm and other

Western companies, although China is making significant progress in this area.

About the scientific basis of 5G technology that will change the world

It should be noted that Huawei was the first company in the world to study 5G networks. When Huawei began researching 5G networks in 2009, it hired Ton Ven, a now-defunct Nortel Networks specialist, to set up a research lab in Ottawa. One day, Ton came across the topic of "polar coding" proposed in a scientific journal to optimize the transmission of data over the network. This method was discovered by Turkish scientist Erdal Arikan. Erdal Arikan (born 1958) is a Turkish professor working in the Department of Electrical and Electronic Engineering at Bilkent University in Ankara, Turkey. Erdal Arikan received a bachelor's degree in electrical engineering from the California Institute of Technology in 1981. He also received master's and doctoral degrees at the same institute. After returning to Turkey, Erdal Arikan worked as an associate professor at the University of Illinois at Urbana-Champaign. Since 1987, he has been working as a professor at Bilkent University in Turkey. Wikipedia also has extensive information about the author of this code.

Huawei has invested heavily in the development of the technology proposed by Erdal Arikan, and the Chinese government has called on Chinese companies to vote at an industry meeting in Nevada in 2016, which sets standards, given the strategic importance of the technology. The meeting ended in a compromise, and polar codes were adopted as one of the 5G standards, which gave Huawei a very important patent. The company has already spent more than \$ 1 billion on 5G development. So far, they have seen the benefits of using 5G technologies in the fight against coronavirus. Prominent Turkish scientist Erdal Arikan's scientific discovery, "polar coding" was accepted as the main standard of the 5G network, and he was awarded many world-renowned prizes.

As American companies tend to operate on their own, the results of their research may be different. In January, a spokesman for the US National Security Council offered to compete with Beijing by setting up a state-owned 5G network, but regulators and officials rejected the idea because it was too expensive and unrealistic.

In September, the US Federal Communications Commission (FCC) announced plans to speed up the creation of 5G networks by repealing some local regulations and fees for the placement of small mobile transmitters. Official Washington has also funded some research and development that has boosted trade technology. Specifically, the US National Science Foundation (NSF) is coordinating the creation of test stands to test 5G and other next-generation wireless networks. According to the 2015 NSF report on 5G development, "the United States lags far behind Europe, South Korea, Japan and China." It should be noted that the United States has always been the cradle and leader of IT technologies in the world.

NSF is now working with government agencies, companies and universities to set up testing stations in New York. The first small tests are expected to begin in January. About 30 US, European and Asian companies have provided \$ 50 million for the project, and the US government has provided an additional \$ 50 million. NSF employee Thyaga Nandagopal, who is implementing the project, acknowledged that China's coordinated investment has given it "leadership in the beginning." However, NSF is not focusing on the development of technology after 2020, but in the early years of 5G. "We can make strategic investments and still get better results than anyone," says Nandagopal.

Huawei is also urging to moderate expectations. In a meeting with analysts in April, the chairman of the board said they saw 5G as a "digital infrastructure for everything."

Chinese IT giants Huawei and China Mobile are trying to expand their 5G networks. 5G is a very important strategic project for China, and all the resources are involved. "If China succeeds with 5G, it is expected to succeed in 6G, 7G, 8G, as 5G lays the foundation for a new generation of mobile communications.

Struggle for 5G network

The fierce struggle between China and the United States for 5G networks is taking place at various levels. One of the levels of such struggle is the use of provocative theories.

The time of the global pandemic was a perfect time for the emergence of harmful provocative theories supported by celebrities and opponents of the vaccine. And as a result of these provocative theories, at the beginning of April, at least 20 mobile towers in England were destroyed or damaged in just four days.

This theory was able to "create a direct link" between 5G equipment and the COVID-19 epidemic. Some phone companies have even been attacked for laying only fiber-optic cables. In a video watched by more than two million users, a woman talks to workers and claims that "they will kill everyone" if they finish their work. It should be noted that as a result of this vandalism, most of the collapsed towers were designed for 3G and 4G.

The "threats" associated with the damage to mobile phones and mobile operator towers have been going on for years. The question of whether they cause cancer is particularly acute, but there is currently no conclusive evidence in this area. The main thing is use nothing should be overused. Here I remember a wise saying of the genius philosopher Nizami Ganjavi: "No matter how pure the water, it gives grief when you drink too much". From this point of view, certain harms can, of course, occur when any G-network devices are used excessively. In general, there is no scientific evidence of their harm. From this point of view, even when the development of the 5G network began, all the existing "threats" re-emerged, and then the pandemic created new opportunities for provocation theories supported by certain influential people, and they were able to create the 5G-COVID19 sabotage theory. The main provisions of this theory were as follows.

There are three main theories about 5G, and two of them are related to COVID-19, but none of them is based on concrete evidence. The first theory: a 5G network causes a coronavirus, or at least its symptoms (most people who believe in this version generally doubt the existence of a coronavirus). It is this misconception that makes some people distrust the virus and do not care to fight it, and the main reason is that if they prevent the introduction of 5G, the coronavirus will be destroyed. Such a wrong approach harms the significant fight against the existing dangerous virus. They even concluded from this erroneous theory that 5G and COVID-19 were practically the same thing, biological weapons that spread from towers and cause depopulation, and that they were all controlled by the leaders of the new world order. Even a "suitable candidate" was chosen to lead the organization: Bill Gates was accepted as this candidate. This was first announced on YouTube by one of the provocateurs associated with the organization Qanon (QAnon is a widespread conspiracy theory in the United States). Conspiracy theory is the study of certain socially significant events, some historical events, or even the course of history as a whole for personal gain, ambition, or other group, clan, or other interest. It is a concept presented by a group of people who run for office as a result of a certain provocation.

The provocateur and user of the QAnon organization, which targeted Bill Gates, has tens of thousands of followers on YouTube and is also a well-known anti-vaccine. This provocative YouTube user sees a parallel between Bill Gates' work at Microsoft many years ago and his current views on the coronavirus vaccine. The rationale was that the Windows operating system and programs he created were specifically designed to attract viruses, and he could make some money from antivirus systems. And now he is fighting depopulation (population reduction campaign) and pandemic at the same time to make money in the future without compulsory vaccination. In short, Bill Gates now wants to make money from a vaccine that will help people manage, instead of stopping 5G / COVID-19-related deaths. It should be noted that there are many supporters of this erroneous theory in the world. One of the main mistakes here is that computer viruses and biological viruses are completely different concepts, and it is impossible to draw parallels between them.

A more popular theory is that 5G radiation weakens the immune system, making people more susceptible to the COVID-19 virus. Evidence for this theory was the fact that US cities with this network were the most infected. This theory, of course, did not take into account two main factors. First, 5G is only available in large cities with high populations where the virus can spread faster, and second, many countries do not have this new network at all, for example, Iran does not have a 5G network at all, but it has suffered the most from the virus. Therefore, this theory did not work.

The third provocation theory has nothing to do with the coronavirus. Here, people claim that the media has deliberately exaggerated these seemingly

erroneous, provocative theories in order to divert attention from the realities of 5G and thus discredit the competitors of the new network.

BuzzFeed, a well-known Internet news media company, wrote that videos and theories on the subject began to appear last year, when new mobile towers were installed in major cities. "A Man Working in 5G Towers Tells the Truth About Threats!" Videos titled have been shared hundreds of thousands of times. Their release dates also coincide with the announcement by the British mobile operator EE that 5G has been installed in six major cities across the country.

Since January 2020, when the coronavirus was recognized as a pandemic, users of the QAnon and r / conspiracy website have begun to spread theories linking the new disease to 5G. As a result of these theories, mobile communications began to spread in many rumors, along with the destruction of the towers. One of the users of the popular Reddit site wrote that her husband, who works for a cable company, receives more and more calls from those who want to give up the Internet due to the 5G threat.

However, there is a limit in the world of the Internet for such separate, individual saboteurs. Wired (a monthly magazine in San Francisco and London, writes about the impact of computer technology on culture, economics, and politics) shows that these ideas are recorded and disseminated through algorithms that recognize trends but do not recognize all the nonsense. This type of provocation is very common on the Internet. One of the most dangerous issues in this area is that sometimes very famous people in the world spread misconceptions about this issue on networks. Therefore, in this sensitive period, only narrow specialists are advised to comment on the relevant field.

About the real source of coronavirus

According to scientists, the coronavirus - like other respiratory viruses in recent years - has been transmitted to humans from animals. In the case of COVID-19, it is believed that it occurred in a market in the Chinese city of Wuhan, and the virus was transmitted from bats to humans. This can be confirmed by the fact that in 1918, other pandemics, such as the Spanish flu, which infected about a quarter of the world's population, appeared and flared up long before the advent of mobile communications. That is, the coronavirus has emerged as a new modification of the natural flu virus. The fact that this new flu virus came into being naturally or artificially created in a biological laboratory is another matter of discussion.

The world's struggle against the 5G-COVID-19 conspiracy theory

In recent years, a wide-ranging struggle has been launched against the 5G-COVID 19 conspiracy theory, which has spread rapidly around the world. Many scientists and doctors spoke about this theory of provocation and categorically rejected it. Dr. Simon Clark, an associate professor of microbiology at the University of Reading in Reading, England, told the BBC that such theories were "completely nonsense."

He added that the theory of 5G network damage to the immune system has not been proven in any way.

In response to the rapid spread of false information about 5G and COVID-19, YouTube began deleting videos that caused such provocations. This is part of a new regulation on coronavirus content that can mislead users. Many world-renowned publications have refused to write about such provocations.

In March of this year, the International Commission on Non-Ionizing Radiation Protection (ICNIRP) declared that 5G communication is safe for human life. The head of the organization, Eric van Rongen, also sent a message to GQ magazine confirming that there was no connection between the new network and the coronavirus. He also rejected the theory that 5G or any other G network could negatively affect human immunity.

55G is a revolution in wireless communication

Each new generation of wireless technology is faster and more reliable than previous generations. If the fourth generation communication was called high speed, then 5G will be a fast network. 5G network is sometimes called instant Internet. This new generation will increase the speed of uploading and uploading videos and photos online. For comparison, downloading an Internet movie via 4G takes about 10 minutes, and with 5G it takes a few seconds. Thanks to the new wireless connection, you can watch VR (Virtual Reality (VR), virtual reality helmets, smartphones and other digital devices is a common term for audio content played on your phone) without delay and without problems.

About the form of operation of 5G

3G and 4G helped people communicate on the planet through the network. The 5G network is not only connected to users, but also to billions of connected devices, that is, it also covers the Internet of Things. The Internet of Things (IoT) is all devices connected to the Internet. This includes devices other than computers and smartphones, such as medical equipment, unmanned aerial vehicles, home appliances, smart city infrastructure - all remotely controlled devices.

It should be noted that the Internet of Things (IT) is still working, now it works using the 4G network. However, mobile signal delays limit the transmission of data from devices to data clouds and vice versa. Applications create an array of information that is difficult to process quickly with 4G. This makes the Internet of Things ineffective:

5G technologies solve the problem of slow data transfer in the network. Companies are no longer worried about delays in transmitting information. Thanks to this, they can create devices that are completely dependent on the cloud. As a result, there will be more interconnected and remote-controlled unmanned vehicles, robots, and independent programs. According to Business Insider Intelligence, with the advent of 5G, the Internet of Things will connect 22.5 billion devices by 2021.

One of the latest achievements of modern IT technologies is the widespread use of the Internet of

Things. 5G technologies underlie the expansion of the Internet of Things. Unlike the traditional Internet, the main objects of the Internet of Things are mainly medical equipment, unmanned vehicles, etc. consists of electronic devices. It is these innovations that create certain new opportunities in the field of medicine, as well as in many areas of activity. 5G technologies create great opportunities, especially in the field of medicine. It is the direct basis for the emergence of e-medicine and allows its widespread use. For example, if 5G technology had been introduced a while ago, it could also be very effective in combating coronavirus, for example, it would be possible to test a coronavirus online remotely in a short time. The achievements of 5G technologies in the field of medicine have already been widely used in the countries where 5G technologies have already been applied. For example, in the UK, where 5G technology is used, this technology is widely used in medicine. British scientists have developed a digital bandage based on 5G technology. It can determine how wounds heal through digital dressings and inform doctors online about it. In other words, both the patient and the doctor can see how much the wound has healed on their smartphone. However, the doctor can monitor the patient's condition at any time and take appropriate steps to make the treatment more effective.

Traditional medicine remains where the doctor can see the patient and then prescribe treatment for a month or a few months, but the future medical science that will lay the foundation for 5G will consist in adapting to the patient and his lifestyle. In other words, the application of 5G technologies lays the foundation for a new era in medicine.

Sometimes we tell doctors that everything is fine for us, they say there is no need to worry, but thanks to development, the real situation will be recorded using 5G technology and transmitted to the doctor, so the doctor and patient can work together to solve health problems.

Some problems that 5G technologies will create

Clearly, 5G technologies provide high-speed data transmission over instant high-speed networks. The new 5G communication technology will transfer data many times faster, and in this regard, ordinary smartphones will not be able to cope. To connect to a 5G network, you need a smartphone that supports this standard. Some manufacturers already produce such devices. Chinese company ZTE has already promised to release the fifth generation communication phone in 2019.

It should be noted that there is no need to hurry to buy new devices to connect to the 5G network. The main reasons for this are:

- first, the mass transition to fifth-generation communications (5G) will take place over the next few years;
- Second, 5G is currently under development and may still undergo some changes in this area, so there is no need to rush to change phones.

Locations where the 5G network currently operates

China was the first to announce the 5G network test. Three Chinese network operators have received government approval to launch pilot operations in several cities, including Beijing. The launch of 5G technology took place in Chongqing in April this year. In May, Etisalat announced the launch of a new generation of communications in the United Arab Emirates.

In December 2017, 3GPP, the regulator of mobile communications, signed the specification of 5G standards. This has allowed relevant companies around the world to develop standard devices for the fifth generation of the Internet.

Local networks using 5G technology already operate in the United States, Switzerland, China and South Korea. According to the latest forecasts, over the next five years, up to 20% of mobile network traffic will pass 5G.

5G networks have been available in China, South Korea, the United States, Germany and the UK since 2019, but this network is only partially operational and does not cover the entire territory of these countries. VIAVI, which specializes in testing networks around the world, discovered in January 2020 that the new generation 5G network is available in 378 cities in 34 countries.

On the environmental impact of 5G technologies

One of the main technologies used by the instant internet created by the applications of 5G technologies is the Beamforming principle or beam formation technology. The Massive MIMO database used in 5G technologies receives all signals and calculates their arrival time and direction. It uses certain algorithms to determine where the signal is coming from and creates the best route for it to be transmitted back to the phone. Thanks to this technology, base stations can send a stream of data concentrated to a specific device, rather than transmitting a signal in all directions. This plays a significant positive role in improving the ecology of the region where the network operates. Because the towers of the base stations of the previous generation of mobile operators transmitted signals in all directions, which created enough unnecessary electromagnetic "fog" in the space of the area covered by it. Naturally, this electromagnetic "fog" had a certain negative effect on the living things and vegetation in the area. From this point of view, the application of 5G technology is expedient in terms of normalization of the ecological situation in the region. As a result of such base stations, the perfect and uninterrupted operation of the public alarm system during the war will also be ensured.

The role of 5G technology in the fight against coronavirus

Contrary to the lies of the harmful 5G-COVID 19 sabotage theory mentioned in the article, 5G networks also played a positive role in the fight against coronavirus. In China, where the coronavirus first appeared and spread, 5G technology also played a role in curbing the virus in a short time. This is evidenced

by the experience of 5G network-based technologies in China, which have become reliable assistants to doctors and effective tools to prevent epidemics.

China has managed to take control of the coronavirus epidemic - just over two months later, life in the country has returned to normal. It was not just strict government control that prevented the spread of the disease in China. In China, for the first time in human history, the fight against coronavirus infection was carried out with the widespread use of new technologies such as 5G, artificial intelligence and cloud technologies.

Evidence of this is the occasional media coverage of a field hospital in Uhan, where 5G telemedicine carts were seen. In these beds, patients' body temperatures were continuously measured with infrared thermometers that support 5G technology, and warned doctors online about patients requiring special attention. This fact was confirmed by Huawei company, which provided information on how the technology industry has helped China in the fight against the coronavirus pandemic. According to the company, 5G networks have played a major role in this. In this case, decisions on the treatment of critically ill patients were made by medical councils with the remote participation of medical staff. As a result, fewer medical personnel in China have been infected with the coronavirus. To this end, Huawei and China Telecom have set up a 5G technology-based remote diagnostic platform at Healthcare Hospital in Wuhan, which provides healthcare professionals with reliable high-precision video communication and remote patient monitoring.

In the face of a rapidly growing pandemic and a shortage of medical personnel, such technology has proven to be invaluable. This shows once again that 5G-based medical technology is necessary and important in any country that may face a large-scale epidemic and does not always provide high-quality medical services to remote areas. From this point of view, it is expedient to switch to 5G technology as soon as possible in all countries.

The role of 5G technologies in medical science

The widespread use of 5G technology in medical science has also led to the rapid development of a field in medicine called telemedicine. It should be noted that telemedicine is not a new concept. As early as the 1950s, American scientists at the University of Nebraska were the first to use two-way television communication for remote consultation, creating a new direction. Medical examinations can also be done over long distances, but this required high-speed communication. It was the speed of communication at that time that did not allow the widespread development of this field.

Although telemedicine can already partially compensate for the lack of medical supplies and play an important role in emergencies, it has many shortcomings. These shortcomings are mainly due to insufficient bandwidth of mobile networks.

The emergence of the 5G standard has given new life to telemedicine. 5G networks are characterized by high data transfer rates (1-100 Gb / s), high reliability

and low latency. All this helps to eliminate the parameters that hinder the development of remote medical care.

It should be noted that long-distance consultations can also be carried out with the help of 4G standard or traditional wired network. However, only 5G networks allow live streaming of ultra-high definition (as it is called 4K or UHD) video, which raises the quality of visual inspection to a new level. And here the almost imperceptible delay makes ultrasound examination and long-distance surgery possible. As an example of long-distance surgery, it was clearly demonstrated in August last year in Sanya when a surgeon operated on the brain of a patient 3,000 km away using manipulators and monitors connected to a 5G network. Extensive research is already being conducted in this area around the world.

Low latency and high data transfer speeds on 5G networks allow patients in other hospitals to perform operations in full. High-tech equipment connected to 5G networks and reacting immediately "extends" the surgeon's arms for thousands of kilometers, thus not wasting the valuable time spent on transporting the patient to the right specialist.

One of the most important areas in medicine is the provision of first aid. In a serious case of patients, it is important to provide qualified medical care as soon as possible, as measured in minutes. Such cases are usually necessary when the patient is taken to the hospital or isolated by inexperienced staff in a remote facility.

In these cases, 5G-based mobile video communication is invaluable, allowing the specialist to examine the patient remotely and advise less experienced colleagues. In the future, any ambulance can be connected to the 5G network. In this case, not only the video from the ambulance will be broadcast to the hospital, but also all the information received from the medical equipment connected to the patient in the ambulance will be broadcast. "Connected to the network" medical equipment will allow patients in ambulances to receive medical care under the supervision of experienced doctors in remote hospitals - as if they were in a ward or operating room.

Another application of 5G networks to medical science is related to health monitors that monitor patients remotely. Such monitors allow remote monitoring of patients' condition. Health monitors that can be worn or dressed on the human body are widely used in medical centers in some developed countries. Such monitors help to provide timely and more effective medical care to elderly and chronic patients. It should be noted that the unstable and slow mobile communication in the previous generation did not effectively monitor such a situation. For example, monitoring of pacemakers requires timely response and uninterrupted data transmission. This can be done with 5G.

A monitoring system based on devices that can be connected to 5G networks and worn on the body can provide quality medical care to patients, monitor nutrition and medication, and create an early response system for timely diagnosis and better treatment.

The widespread use of 5G technology in medicine can completely solve the problem of lack of medical staff in individual countries in the face of the coronavirus pandemic and other undesirable epidemics of this type. For example, during the coronavirus pandemic, medical staff from friendly countries who came to the aid of a country could help with coronavirus from their own countries through 5G technology, get acquainted with the condition of patients, and prescribe appropriate treatment. This would save time, save them a considerable amount of money, and, most importantly, eliminate the risk of coronavirus infection when communicating with patients in many countries. For example, during a coronavirus pandemic in China, robots helped patients deliver medicine and food, monitor their condition remotely, and disinfect the area at a "smart" hospital set up during the Uhanda epidemic. At the same time, their coordinated and uninterrupted operation was provided by the 5G network. Thanks to 5G, modern medical science will be more technological, mobile and contactless. As the Chinese experience shows, if we do not want to be vulnerable to new virus threats, we need to apply these qualities, ie to accelerate the medical application of the 5G network as much as possible.

About planning 5G network in the world

Unlike previous generations, the construction of 5G networks in the country should not be entrusted only to mobile operators in our country (Azercel, Bakcel, Nar, etc.), as it is of special strategic importance, the state should take full control over the construction and management of this network. This is because the network will carry out activities in many strategic areas, for example, the country's medical activities will expand its activities on the basis of 5G technology. In this regard, the Azerbaijani government should establish a national mobile operator under full state control. I would also like to note that there are certain resources and bases for the establishment of 5G networks in our country. Because one of the components that will operate on the basis of 5G networks is the availability of the necessary reliable IT infrastructure in the country, and especially the cloud infrastructure.

Unlike previous generations, the construction of 5G networks in the country should not be entrusted only to private mobile operators, as it is of special strategic importance, the construction and management of this network should be fully controlled by the state. Because this network will operate in many strategic areas, for example, the country's medical activities will expand based on 5G technology. In this regard, governments should create national mobile operators under full state control.

A country that fully or partially owns 5G technology will have global leadership, which is why there is a fierce struggle between the United States and China in this area around the world.

Because the creation of 5G technologies will mark the beginning of a new phase in the world. 5G will change many things in all areas of our society, lay the foundation for many developments and create a new world order in general.

№82/2022

Norwegian Journal of development of the International Science

ISSN 3453-9875

It was established in November 2016 with support from the Norwegian Academy of Science.

DESCRIPTION

The Scientific journal “Norwegian Journal of development of the International Science” is issued 24 times a year and is a scientific publication on topical problems of science.

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Norwegian Journal of development of the International Science

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