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Қ. И. Сәтпаев атындағы Қазақ ұлттық техникалық зерттеу университеті

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ИЗВЕСТИЯ

НАЦИОНАЛЬНОЙ АКАДЕМИИ НАУК
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Қазақстан Республикасы Ұлттық ғылым академиясы "ҚР ҰҒА Хабарлары. Геология және техникалық ғылымдар сериясы" ғылыми журналының Web of Science-тің жаңаланған нұсқасы Emerging Sources Citation Index-те индекстелуге қабылданғанын хабарлайды. Бұл индекстелу барысында Clarivate Analytics компаниясы журналды одан әрі the Science Citation Index Expanded, the Social Sciences Citation Index және the Arts & Humanities Citation Index-ке қабылдау мәселесін қарастыруда. Webof Science зерттеушілер, авторлар, баспашылар мен мекемелерге контент тереңдігі мен сапасын ұсынады. ҚР ҰҒА Хабарлары. Геология және техникалық ғылымдар сериясы Emerging Sources Citation Index-ке енуі біздің қоғамдастық үшін ең өзекті және беделді геология және техникалық ғылымдар бойынша контентке адалдығымызды білдіреді.

НАН РК сообщает, что научный журнал «Известия НАН РК. Серия геологии и технических наук» был принят для индексирования в Emerging Sources Citation Index, обновленной версии Web of Science. Содержание в этом индексировании находится в стадии рассмотрения компанией Clarivate Analytics для дальнейшего принятия журнала в the Science Citation Index Expanded, the Social Sciences Citation Index и the Arts & Humanities Citation Index. Web of Science предлагает качество и глубину контента для исследователей, авторов, издателей и учреждений. Включение Известия НАН РК. Серия геологии и технических наук в Emerging Sources Citation Index демонстрирует нашу приверженность к наиболее актуальному и влиятельному контенту по геологии и техническим наукам для нашего сообщества.

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ABOUT THE CRITERIA OF ESTIMATION OF SURFACE WATER QUALITY OF KAZAKHSTAN ON THE BASIS OF ACCOUNTING OF ITS NATURAL FEATURES

Abstract. A literature review of the evaluation issues of existed methods and standards regulating the surface waters quality from the scientific and applied points of view is given. The problem of an objective and reliable assessment of the level of influence of anthropogenic factors on the quality of water resources has special relevance in the countries of the Commonwealth of Independent States (CIS). According to the number of leading scientists, mainly from the Russian Federation (RF), one of the significant insufficiency in the assessing of surface waters quality is the applying of uniform values of maximum permissible concentration (MPC) MPC_{sh} and MPC_{fish} established for the entire territory of the former USSR without taking into account the specifics of regional natural conditions and characteristics of water bodies. Within the territory of Kazakhstan the distortion of the actual state of surface water quality is becoming due to the use of the natural concentrations of the main ions and heavy metals in the calculation of the complex water pollution index (CWPI) by the Kazhydromet and not taking into account the wide distribution in the water bodies with brackish waters and ore-bearing areas. The validity of these statements is confirmed by examples from official publications.

According to a common opinion of scientists, it is necessary to proceed the development of regional MPC because some methodological approaches have already appeared. It is recommended to develop a Temporary Methodological Guide for Surface Water Quality Assessment (prior to the establishment of regional water quality indicators) in Kazakhstan, excluding the main water ions from the calculated CWPI indicators, because they are not pollutants but natural components of the water composition.

Key words: surface water quality assessment, standards, regional MPC indicators.

Introduction. Water shortages have long become an acute global problem especially in arid low-water areas. It is no coincidence that in the last century 1981-1990 was proclaimed a decade of drinking water by the United Nations with the slogan "Pure water and acceptable sanitation for all". Considering the further aggravation of water problems in the world the UN proclaimed 2005-2015 as the international decade of action "Water for Life". UN Secretary-General Ban Ki-moon, in his Message on the occasion of World Water Day, noted that water is the key to sustainable development. He also announced the current assessment that by 2030 almost half of the world's population could face water shortages when demand exceeds supply by 40%. The International Year of Cooperation on Water Resources (2013) and World Water Day (22 March) are dedicated to enhancing cooperation and building partnerships at local, national and transboundary levels, to address freshwater issues.

The problem of water is actual in Kazakhstan. Although on its territory there are about 40 thousand rivers, 41 thousand lakes, 210 reservoirs in which about 100 km^3 of water are concentrated, and the total surface water resources in the country are 91,3 km^3 per year. According to data [1-3], due to economic activities, resources of the river flow of the Republic of Kazakhstan decreased by 23,8 km^3/year (by 21%), including transboundary flow - by 15,9 km^3/year (by 26%), local runoff - at 7.9 km^3/year.

The president of Kazakhstan N.A. Nazarbayev has big concern regarding the water supply problem in Kazakhstan. In his Address, he stressed that by 2050 year Kazakhstan should once and for all solve the water supply problem. Among the ten main challenges of the 21st century, allocated to them for our country, the problem of water shortage is included. He committed to the Government to develop a new water resources policy of the country, study the international best practices in solving water supply problems and change society's way of thinking in the issues of economical usage of water. He also pointed out the need of developing a long-term state program on water in order to solve the problem of providing the drinking water to population by 2020 and irrigation problem by 2040.

The problem of clean water has now become so urgent in many countries that it has already become global and many experts call it "problem number one" for any industrially developed country including ours. Thus, the problem of water can be solved only if its normative quality is ensured.

The toxicological situation is a very tense in the republic. According to available information, improvement of the ecological state of the republic's water bodies should not be expected in the coming years. The revival of industry and agriculture will lead to further intensification of anthropogenic pollution of water bodies. The number of new generation pesticides used in agriculture is increasing year by year. Their impact on the environment remains outside of environmental authority's control.

The continuing anthropogenic pollution of the republic's water basins, both as a transboundary runoff and as a result of the dumping of industrial, agricultural and domestic wastewater in the territory of the republic become the particular concern. Air emissions from industrial and municipal enterprises are also significant sources of pollution not only in the land area, but also in water bodies. All this causes damage to the ecology and economy of Kazakhstan.

Hence, the level of influence of diverse anthropogenic factors on the quality of environment, including water resources, should be assessed objectively and reliably on the basis of perfect methods and criteria developed in accordance with the specific of climatic and other conditions of operating of the country's water bodies. This problem has now become particularly relevant, especially in the CIS countries, due to the fact that on their territory the criterion and standards for assessing the quality of surface waters, developed in the period of the USSR, are used up to now.

The purpose of this work is to show the imperfection of the existed methods for assessing the quality of surface waters in terms of their adaptation to regional conditions and the unreasonableness of the results obtained when using them on the basis of a brief literature review and some results of our own research. The other purpose is to draw the attention of scientists and specialists in the field of control and protection of water resources to the emerging new scientific results in the field of theory and practical approaches to optimize methods for rationing and assessing the quality of surface waters.

Review of scientific literature. According to [4] the control over the content of chemicals in the environment started in 1925 when the first values of the MPC for the air environment of the working area were determined. In 1949 for the first time, some MPCs were set for atmospheric air, and in 1950 for water [4]. I.V. Lukyanenko [5] considers the current understanding of the fishery MPCs and the first-time MPCs for fishery water bodies formed in the 1950s which becomes significant practical achievement of fishery toxicology. They, as it known, were formally approved in 1961 in the "Rules for the protection of surface waters from pollution by sewage".

Currently, the regulation of chemical pollution entry to the surface waters is carried out by two MPC systems: sanitary and hygienic ($MPC_{s.h.}$ - standards for water bodies for domestic and drinking and cultural and public water usage) and fishery (MPC_{fish}) - standards for fishery water reservoirs for the same substances. For a long time these complex experimental works are conducted by medical scientists and biologists disconnected.

According to [6, 7], in the middle 1970s there was an attempt to unify the two active MPC systems, but the opinion of the researchers was divided. Some scientists appeal for merging of two existing MPC systems into one universal one, while others considered it advisable, along with the existing ones, to create another third MPC system aimed at protecting the ecosystems of the reservoir as a whole. It was about the "environmental MPC", i.e. normalization of foreign substances in order to ensure the ecological well-being of the reservoir [8] or, in other words, the "ecological" regulation of pollution or the "environmentally" neutral concentration of pollutants.

That is why there was a need to formulate the problem of ecological water quality criteria and to justify a new view of environmental MPC as the maximum permissible variability of abiotic factors in the aquatic environment [7,9]. This source also emphasizes that the idea of a physiological norm and physiological and biological indicators of the status of hydrobionts, the threshold and critical levels of a particular factor, is highly important during the developing of environmental MPC. Only experiment can evaluate the toxicity of a particular substance or group of substances for fish and other hydrobionts, establish the dependence of the degree of toxicity on concentration and time of action on hydrobionts, establish threshold and maximum permissible concentrations and regulate the supply of these substances to the reservoir. It is impossible to establish the maximum permissible concentration limit for the results of environmental-toxicological studies directly on fishery reservoirs or experimental reservoirs, without taking into account the whole variety of emerging chain changes.

Officially, the current MPC, as a criterion for assessing the degree of contamination of surface waters, is officially defined on the basis of sanitary rules and norms (SanPiN), part "Protection of surface waters from pollution; No. 4630-88, approved in 1988 by the Ministry of Health of the USSR ". They also valid in the territory of the Republic of Kazakhstan in accordance with the order of the head of the Department of sanitary and epidemiological service of the ministry of Health of the Republic of Kazakhstan No. 408 of August 18, 1997. At the same time, there is also a List of MPC_{fish} for water in fishery reservoirs [10].

Both, the sanitary and hygienic rationing system with the use of $MPC_{s,h.}$ and the system of fisheries management $MPC_{fish,}$ have for a long time been subjected to justified and fair criticism. In general, similar remarks are stated in the works [11-15] and indicate that the level of accumulation in the reservoir of the substance and products of its biotransformation along the trophic chain, the processes of accumulation of substances in biological objects and bottom sediments is often not taken into account during the establishing process of MPC, t.e. the concentration of substances in the water does not reflect the toxicological load on the ecosystem of the reservoir. The necessity of taking into account the effect on hydrobionts, both the starting compounds and the products of their transformation, is confirmed on the basis of experiments [14], which showed that the interaction of malathion and each of its two hydrolyses was more additive.

According to [16], the existing MPC, especially for sanitary purposes, contain insufficient environmental information. The need to pay special attention to the issue of migration of chemicals on the trophic chains of the aquatic ecosystem and the role of aquatic organisms in the process of self-purification of the reservoir and the formation of water quality was noted. This approach can exclude cases of "false self-purification", when there is no chemical substance in the water (or below the MPC), and a considerable amount of them has been accumulated in hydrobionts.

An analysis of the existing list of MPCs (roughly safe levels of exposure (RSLE)) has shown that more than half of the standardized substances refer to technical products, intermediate products, wastes from various industries, often of undefined composition, various liquid, semi-liquid mixtures that interact with water, connections, and it is practically impossible to verify the compliance of their concentration with the established standards [17]. Hence, the effectiveness of MPC application remains unknown.

The important question is also raised that the normalization of inorganic substances of natural components of the water composition in the MPC_{fish} was performed without taking into account the natural range of concentrations of these substances caused by biogeochemical and climatic factors. For example, the MPC of nitrates is more than 10 times greater than their maximum concentration in unpolluted water bodies and the maximum permissible concentrations of the main ions for low-mineralized water are several times higher while for mineralized waters of steppe and semi desert landscapes it is much lower than the natural concentrations of these ions.

According to [18] ecological water quality standards should be based on ecological criteria for assessing the functioning of aquatic ecosystems and, consequently, should be established on the basis of an analysis of the ecosystem response to external disturbances. As an example, there are significant differences between the content of mineral forms of nitrogen in natural waters, acceptable from hygienic and fishery positions, and those concentrations of these compounds in which "flowering" of water bodies is observed.

The paper [19] draws attention to the fact that the development of standards regulating of levels of water pollution (MPC, RSLE) and maximum permissible level (MPL) of food fish products does not take

into account the possibility of mutagenic and genotoxic action of pollutants and their derivatives. In this regard, the use of a set of simple and reliable methods for testing the genetic hazard of individual representatives of pollutants, their complex mixtures and metabolites in natural waters and fish tissues is recommended for the determination of MPC and MPL.

According to a number of researchers [20-22], the compliance of fishery MPC does not ensure a reduction in the negative impact of pollutants on water bodies and the conservation of natural aquatic ecosystems and the genetic fund of aquatic organisms. It is proposed to include in the normative document of biological indicators in terms of their informativeness and practical applicability, including characterizing the state of groups and communities of aquatic organisms with the identification of basic and additional normalized indicators, as well as methods for their determination for various types of water bodies.

A.G. Kocharyan and etc., in their work [23] formulated the main shortcomings of the water quality assessment system based on MPC, which are given in [24,25], as follows: the MPC ideology is based on the assessment of the effects of substances at the organism level, the transfer of the assessment to the population and ecosystem levels is incorrect. The MPC system does not take into account the entire set of factors acting on the ecosystem of synergism and antagonism of various substances. It does not allow to evaluate the effect of the duration of exposure of elevated and high concentrations of substances on the ecosystem of the reservoir. Many substances identified in wastewater do not have MPC. The MPC system is uniform for the entire territory of Russia, at the same time the vast majority of parameters characterizing both water quality and ecosystem functions have a clearly expressed zonal and regional character.

According to [9,23] the integral biological characteristics can serve as an indicator of the ecological well-being of the aquatic ecosystem – the Shannon biodiversity index and the Woodivissian biotic index, the values of which decrease with water pollution and eutrophication; and the oligochaete index, variability of biomass dynamics and productivity which are increase in the occurrence of mentioned situations. It is also noted that there are close correlation links between the hydrochemical and hydrobiological indicators under these conditions, which makes it possible to compose the regression equations estimating these relationships. The presence of linear relationship between hydrobiological and hydrochemical indicators was revealed by a number of researchers [26, 27]. The use of this approach allows to rank pollutants according to their impact on hydrobiological indicators.

Rumyantsev V.A. and Kryukov LN [28] consider that in order to identify the boundaries between the normal and regressive functioning of water bodies, it is advisable to take into account the possibility of changing from the MPC standards of toxic substances to ecologically permissible levels (EPL) of disturbing effects. The MPC standards are set without taking into account the fact that in natural ecosystems there are no isolated actions of many factors, each of which individually or collectively affects each biological characteristic. Ecological inefficiency of the MPC methodology is overcome in the framework of the biotic concept of environmental control. The work contains an important message that the relevant databases and information systems have been created in the Russian Federation also, methods for bioindication and identification of indices based on saprobity and species structure of hydrobiological communities are developing [29].

One of the important shortcomings of developing of sanitary-hygienic and fishery MPCs is not to take into account local, regional features, i.e. physical, chemical and biological parameters of local water bodies. It is known that these standards regulating water quality was developed in the USSR and recommended in the entire territory. According to the data of [30] a part of the list of substances included in the fishery MPCs was tested on the water of the Western European (Karelia, Baltic, Moscow region) and the East Siberian (Baikal) region of bionts. It was noted in [7] that a big part of work was done by the Leningrad laboratory, i.e. in the same Baltic region.

According to the authors of [31], the application of uniform values throughout the territory of the former USSR, without taking into account the local characteristics of water bodies, is the main shortcoming of the MPC concept. That study presents the results of experiments on the establishment of safe concentrations of a number of metals at various stages of development of rainbow trout with respect to Lithuanian water bodies based on LC_{50} values, the "application factor" and formulas proposed by USEPA [32] taking into account water hardness 2,5-6 (mg-eq/l) for Lithuanian reservoirs. As a result, a concentration of cadmium was 0,001-0,003 mg/l, i.e. below the current MPC (0,005 mg/l),

0,001-0, 0127 mg/l for lead was obtained and this is also below the MPC of this element (0, 1 mg/l). Only for copper values were close to the experimentally established values.

The development of environmental quality standards that take into account the state and specific features of a specific territory in the Russian Federation is carried out in accordance with the request of President in 2010. As a result of the work on the updating of MPCs and on substances of natural origin an approach of establishing MPC standards on the basis of data on the natural features of the chemical composition of water in water bodies, which is related to the regional natural heterogeneity of the chemical composition of surface waters, was proposed [20]. This approach involves the use of GIS technology to identify areas within which the quality of surface water is determined by natural factors.

Venitsianov E.V. [33] considers that one of the significant shortcomings in the regulatory and legal system of water protection in Russia is a single system for the whole country of the MPC for water objects of fishery use. The development and use of regional water quality standards are stipulated in the Russian Federation water code, however, federal water quality standards are still applying which makes water protection ineffective.

In another work Venitsianov E.V. with co-authors [34] indicate some contradiction when the concentrations of some chemical substances, under which the stability of established biocenoses are ensured, do not correspond to the maximum allowable concentrations for fishery use reservoirs (MPCs), which are the standards for regulating the quality of waters of almost all water bodies of Russia.

Very convincing arguments about the ineffectiveness of MPC_{fish} without taking into account local and regional features of water bodies are given in the work of the Vernadsky Institute of Geochemistry and Analytical Chemistry of the Russian Academy of Sciences [35]. Official sources indicated essential pollution of significant part of the river system in Russian Federation on the basis of an assessment of surface water contamination by the specific combinatorial index of water pollution (CIWP) of Roshydromet. This was explained by the fact that natural concentrations of chemicals were used in the calculation of the CIWP, which exceed the established standards for maximum permissible water levels in the water of the water body, due to their natural content.

Further, there is an explanation about the spatial heterogeneities of the geological structure, landscape-geochemical, soil-geochemical and climatic differentiation of the territory, as well as mineral water outflows and the presence of ore deposits which determine the formation of biogeochemical and hydrogeochemical provinces within its boundaries. The last one are usually characterized by high natural concentrations of normalized chemical elements and substances in the water. The role of climatic features of the territory in the formation of water composition is well known. It defines the sources of feeding and water runoff regime, salinity of soils, composition of soil-forming minerals and other exogenous processes.

An important aspect of this work is also the systematization, analysis and generalization of territory of each of the many basin districts of Russia by the data of general conditions and the main factors for the formation of the chemical composition of surface waters, characteristic pollutants, and the chemical compounds characteristic of the surface waters of that or a different region and positions that require the adjustment of the current standards MPC_{fish}.

It was established by the generalization of the data that the distribution of many chemical compounds that are used to assess the quality of surface waters and the level of their contamination is determined by natural factors and conditions. Basin districts, which require revising of current standards of $MPC_{fish,}$ was identified; also chemical substances, which required regional water quality standard, was identified; and recommendations for special hydrochemical and hydrobiological studies were given.

This study and [17], as well as some other sources, have convincingly shown that due to the imperfection of the MPC_{fish} methodology the list of calculated surface water quality indicators includes the natural concentrations of chemicals, which exceed the MPC_{fish} standards because of the natural features of the territory. This situation is typical and widespread in assessing the quality of surface waters of steppe and semi-arid territories of Kazakhstan and Central Asian countries of the CIS because of using old MPC_{fish} established in USSR.

Discussion. In Kazakhstan the distortion of the actual state of surface water quality is occur due to the use by Kazhydromet the natural concentrations of the main ions of water and heavy metals in calculating CWPI. The increased level of concentrations of these hydrochemical parameters in surface waters

exceeding the MPC_{fish} and MPC_{sh} standards is caused by the fact that the overwhelming majority of lakes (especially large lakes) and rivers in steppe and semidesert area have brackish water. In addition, polymetallic ore deposits are widely distributed in the republic where the waters are characterized by high concentrations of metals. This important factor in the formation of heavy metals in the surface waters of the northern and central regions of Kazakhstan was stated by Konovalov G.S. [36].

It should also be noted that the increased concentration of a number of heavy metals in the water of some artificial objects in the northern regions of Kazakhstan are recorded in the absence of potential sources of pollution [37].

According to studies [38,39], in the reservoirs of the arid territories of Kazakhstan mineralization to the end products of the mass of aquatic and land plants accumulating in them can be an important source of heavy metals such as iron and others.

Below some examples for confirming the facts of distortion of the actual quality of water in some brackish reservoirs of Kazakhstan, which was published in the "Information Bulletins of Kazakhstan" (IB) produced by RSE "Kazhydromet" of the Ministry of Energy of the RK, using the current methods of calculating CWPI, are presented.

The following data are given in the IB for 2015-2017 yy. Jogargy Tobyl (Verkhnetobolskoye) and Vyacheslavskoe reservoirs, built in the upper reaches of the Tobyl and Yesil rivers, i.e. in the non-contaminated background areas, in 2016 and 2017 years was classified as "high level of pollution" due to the concentration of sulfates, magnesium and ammonium nitrogen (which are not contaminants) in water and low concentrations of iron and copper.

The waters of brackish lakes Zerenda, Sabyndykol, Alakol, Zhalanashkol and others also was classified as "highly contaminated" where such natural components of salt composition as sodium, magnesium, chlorides, sulfates are present in concentrations above their own MPC. However, these is no anthropogenic influences to this lakes, therefore, there are some recreation zones function there. And even large recreational zone was created at the Alakol lake due to the healing properties of the salt water composition.

The large fish lake Maibalyk is located near Astana and on this lake there is growing fish farm functioning for more than half a century. However, the water of this brackish lake was classified in the IB Kazhydromet as "extremely highly contaminated". Most importantly in this document for 2015-2017 years, it is stated "pollution of the lake from domestic activities does not occur".

Lakes Ulken Shabakty, Kishi Shabakty, Sulukol, Karasie, Shchuchye are located on the territory of the largest in Shchuchinsk-Burabay resort area. Large financial and labor resources are invested for improvement of tourist attraction and creation of medical institutions of this area. According to the natural and climatic conditions of this territory and the nature of the water regime, some components of the salt composition (magnesium, calcium, sulfates) and zinc exceed the current MPC in the water of these lakes. That is why water quality of these lakes is characterized as “high level contamination” in IB. All of this decrease recreation condition of lakes, as well as the interest and attractiveness of tourists, especially foreign tourists to visit this resort area.

Note that the significant influence of ore zones and soil, climatic, hydro-geological conditions of the central and northern regions of Kazakhstan on the formation of surface water quality was revealed by us on the basis of the results of our own scientific research [40-42]. The methodological incorrectness of accounting for the concentration of the main ions of the salt composition during the assessing the quality of the water resources of brackish reservoirs of steppe and semi-desert regions of the republic was also noted in our previous publications [43, 44].

Thus, there is a certain paradoxical situation, caused by the imperfection of the current methodology for assessing the quality of surface waters, i.e. its inapplicability for water bodies of Kazakhstan with the high mineralization of water. This problem can be solved through the establishment of regional water quality indicators for water bodies in the arid areas of Kazakhstan, where the water with high concentration of ionic components is genetically formed depending on the specific soil, climatic conditions and water regime.

From the above brief overview, it follows that one of the significant disadvantage in assessing the quality of surface waters is the use of uniform values of MPC established for the entire territory of the former USSR without taking into account local characteristics of water bodies [17, 33, 34]. The need for

the development of regional MPC is reasonably recommended even for water bodies in Lithuania [31], the Volga, Azov-Don basins [17, 34, 35] and other regions of the European part of Russia. Although according to [7, 30] the MPC_{fish} were mainly installed on water of Karelia, Baltic, Moscow, Baikal and Leningrad region using a set of local species of hydrobionts. Therefore, of course, the need to develop regional MPCs for water bodies in Kazakhstan with taking into account the natural and climatic features of the territory was faced long ago.

The establishment of regional MPC for all controlled compounds is not an easy task because the methodological approaches to the development of MPC of harmful substances in the water of fishery reservoirs require many experimental toxicology studies on local aquatic organisms and large financial costs. According to [45] the establishment of sanitary and hygienic MPC of one compound for the air of working area takes at least 225 days with a labor intensiveness around 3000 man-days and cost 43 thousand rubles at that times.

It is practically impossible to implement these measures in Kazakhstan at present. To do this it is necessary to carry out extensive preparation of fieldwork methodology, creating an experimental base, human resources development, etc. However, unfortunately the level of development of scientific research in the water toxicology, especially experimental toxicology, is not good enough [46].

However, it must be admitted that the facts of constant biases of the existing state of the quality of water resources of a lot of large, important for the country economy and mostly uncontaminated by anthropogenic pollution water bodies that occurs in official publications of state environmental protection agencies because of wrong methods of water quality assessment of natural conditions of Kazakhstan cannot be accepted. After all, the purity of the surrounding natural environment, including water facilities, and generally favorable environmental conditions of people's living are an important indicator of the level of civilization of the country and comfort of people. Positive results are achieved by great efforts of state bodies, workers and the public. Controlling agencies have to take all possible steps of showing real quality of the reservoirs and make qualified comprehension about the reliability of the provided information.

As a result of all stated above, in our opinion, State environmental protection and control agencies have to develop the temporal methodological guidelines for assessing the quality of surface waters (till to the establishment of regional water quality indicators), with involving the representatives of specialized scientific institutions of the country. This document should specify the real pollutants of surface waters and components of natural origin in the number of controlled indicators.

The research of water quality assessment of individual reservoirs of the republic using existing methods, as well as the analysis of data of the Information Bulletin convince us in advisability of excluding the main ions (Ca, Mg, Na, K, HCO_3, SO_4 and Cl) for majority reservoirs of the RK regardless of whether their concentration exceeds their own MPC or not. The concentration of this group of ions of the salt composition of water in the calculation of CWPI can be taken into account for those water bodies and watercourses where there are sources of pollution with these indicators. For example, the Syr Darya River and some reservoirs in its basin are contaminated by collector-drainage water from irrigated areas saturated with mineral salts.

It should be noted that the problem of establishing regional water quality indicators for Kazakhstan or for its individual territories will be in important issue in the nearest future. Eventually objective and reliable assessment of the quality of the country's water resources will require this kind of knowledge.

As it was mentioned above, this important issue has been studied deyply and systematically by Russian scientists in recent years. The work carried out by scientists from a number of leading scientific centers of the Russian Federation under the leadership of E.V. Venitsianov [34] is extremely valuable in the scientific and practical aspect. The significance of these studies for scientists and specialists of Kazakhstan is lied in the proposed new methodology for the establishing of regional water quality indicators for water bodies in the Upper Kama basin (MPC_{reg}), which is a receiver of industrial wastewater. The methodology takes into account the factors of determining the content of heavy metals in natural waters and its variability in this basin.

This method was implemented in the construction of regional water quality indicators in the Upper Kama basin. In the practical implementation, the authors consider that it is necessary to establish a range of water content of chemical substances, which remains the stability of the functioning of the existing natural hydrobiocenoses. For the Upper Kama basin, the norms of permissible impact (NPI) was developed in accordance with the guidelines [47, 48] and taking into account all mentioned conditions.

The comparison of the norms, established by the method of calculating of NPI, and regional indicators (MPC_{reg}), calculated by the proposed method, revealed a very slight difference (table).

Water quality standards for the Solikamsk-Bereznikovsky industrial complex (mg/l) [29]

Indicators	MPC_{fish}	MPC of drinking water	Calculation of MPC_{reg}	Calculation by the method of NPI, plots	
				1	2
Iron (total)	0,10	0,3	0,74	0,75	0,52
Manganese	0,01	0,10	0,09	0,10	0,06
Copper	0,001	1,0	0,002	0,002	0,002
Zinc	0,01	1,00	0,01	0,01	0,01

An important result is the fact that for the Kama river the the current standards of MPC_{fish} was smaller than MPC_{reg} for iron in 7,4 times, manganese - 9 times, copper - 2 times. In the reservoirs of Kazakhstan, the difference between the current MPC and MPC_{reg} standards (if any were calculated) would obviously be much higher. That is quite likely if the regional MPC is developed, as it was indicated in [34], based on the background indicators of chemicals composition which are characterized for the region and where ecosystem functions safely for several years. Moreover, background indicators of chemicals in water bodies and watercourses in Kazakhstan are specific in the different soil and climatic regions. For example, these indicators significantly exceed the level of their fisheries MPC for a number of heavy metals in water objects of ore-bearing territories of the republic, which was observed in our studies [40, 42, 49, 50].

Conclusion. The level of influence of anthropogenic factors on the quality of the country's water resources is evaluated not enough objectively and reliably because of using incomplete methods and criterias. According to many scientists, especially from Russian Federation, the main disadvantage of sanitary and hygienic and fishery MPCs is the usage of uniform MPC values established for the entire territory of the former USSR without taking into account regional soil, climatic, hydro-geological conditions and local characteristics of water bodies (physical, chemical and biological parameters).

In Kazakhstan, the distortion of the actual state of surface water quality is mainly caused by using in the calculation of the natural concentrations of main ions and heavy metals in the CWPI by Kazhydromet without taking into account the water salinity level of the steppe territory water bodies, as well as the prevalence of polymetallic ore deposits.

Special attention should be paid to the scientific and methodological development of specialists of the leading scientific institutions of the Russian Federation on the establishment of regional MPCs that can provide an objective assessment of the true state of water quality. The establishment of regional MPCs is extremely necessary for Kazakhstan, but this requires an important preparatory works in the methodology, the establishment of an experimental base, training of specialists, etc. Based on the results of ongoing research and analysis of materials published by Kazhydromet, it is recommended to exclude the main water ions from the calculated parameters of CWPI on the basis that they are not pollutants but the natural components of the water composition.

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ҚАЗАҚСТАН ЖЕР БЕТІ СУЛАРЫНЫҢ САПАСЫН ТАБИҒИ ЕРЕКШЕЛІКТЕРІН ЕСКЕРУ НЕГІЗІНДЕ БАҒАЛАУ КРИТЕРИЯЛАРЫ

Аннотация. Жер беті су сапасын бағалау сұрақтарына ғылыми және қолданбалы тұрғыдан әдістер мен нормативтер бойынша әдеби мәліметтерге шолу жасалды. Су ресурстары сапасына антропогенді факторлардың әсер ету дәрежесін объективті және нақты бағалау мәселесі қазіргі уақытта тәуелсіз мемлекеттер достастығындағы (ТМД) елдерде ерекше өзектілікке ие болды.

Бір топ жетекші ғалымдарың пікірлері бойынша су сапасын бағалаудың маңызды кемшіліктерінің бірі, әсіресе Ресей Федерациясы үшін, бұрынғы ССРО бүкіл аумағына бекітілген, аймақтық табиғи жағдайларын және су нысандарының ерекшеліктерін ескермей $ШМК_{сг}$ және $ШМК_{бш}$ бірыңғай көрсеткіштерін қолдану болып табылады. Қазақстан аумағында жер беті сулары сапасының нақты жағдайларының бұрмалануы РМК «Қазгидрометте» судың ластануының кешенді индексін (СЛКИ) негізгі иондар мен ауыр металлдардың табиғи концентрацияларын, аумақта кеңінен таралған тұзды субөгендері және рудалы телімдерді ескермей есептеуде болып табылады. Осы тұжырымдардың дәлелдігі ресми басылымдар мысалында көрсетіледі.

Ғалымдардың пікірлері бойынша аймақтық ШМК дайындау қажеттілігі туындады, ол үшін біршама әдістемелік көзқарастар пайда болды. Қазақстанда жер беті су сапасын бағалауда Уақытша әдістемелік құралын (су сапасының аумақтық көрсеткіштерін анықтағанға дейін) өңдеу ұсынылады, ол үшін СЛКИ есептеу көрсеткіштерінің ішінен судың негізгі иондарын алып тастау қажет, өйткені олар ластаушылар емес, ал су құрамының табиғи компоненттері болып табылады.

Түйін сөздер: жер беті су сапасын бағалау, нормативтер, ШМК аумақтық көрсеткіштері.

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О КРИТЕРИЯХ ОЦЕНКИ КАЧЕСТВА ПОВЕРХНОСТНЫХ ВОД КАЗАХСТАНА НА ОСНОВАНИИ УЧЕТА ЕГО ПРИРОДНЫХ ОСОБЕННОСТЕЙ

Аннотация. Приводится обзор литературных сведений по вопросам оценки с научных и прикладных точек зрении существующих методов и нормативов, регламентирующих качество поверхностных вод. Проблема объективной и достоверной оценки уровня влияния антропогенных факторов на качество водных ресурсов приобрела в настоящее время особую актуальность в странах содружества независимых государств (СНГ). Одним из существенных недостатков в оценке качества поверхностных вод, по утверждению целого ряда ведущих ученых, главным образом Российской Федерации (РФ), является применение единых величин $ПДК_{сг}$ и $ПДК_{рх}$ установленных для всей территорий бывшего СССР, без учёта специфики региональных природных условий и характеристик водных объектов. В пределах территории Казахстана искажение фактического состояния качества поверхностных вод происходит из-за использования РГП «Казгидромет» при расчётах комплексного индекса загрязнения воды (КИЗВ) природных концентрации главных ионов и тяжёлых металлов, без учёта широкого распространения на территории водоёмов с солоноватыми водами и рудоносных участков. Обоснованность этих утверждений подтверждается примерами из официальных изданий.

По единому мнению ученых необходимо приступить к разработке региональных ПДК, для реализаций которой уже появились некоторые методические подходы. В Казахстане рекомендуется разработать Временное методическое руководство по оценке качества поверхностных вод (до установления региональных показателей качества вод), исключив из расчётных показателей КИЗВ главные ионы воды, так как они не загрязнители, а природные компоненты состава воды.

Ключевые слова: оценка качества поверхностных вод, нормативы, региональные показатели ПДК.

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