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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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NAS RK is pleased to announce that News of NAS RK. Series of geology and technical sciences scientific journal has been accepted for indexing in the Emerging Sources Citation Index, a new edition of Web of Science. Content in this index is under consideration by Clarivate Analytics to be accepted in the Science Citation Index Expanded, the Social Sciences Citation Index, and the Arts & Humanities Citation Index. The quality and depth of content Web of Science offers to researchers, authors, publishers, and institutions sets it apart from other research databases. The inclusion of News of NAS RK. Series of geology and technical sciences in the Emerging Sources Citation Index demonstrates our dedication to providing the most relevant and influential content of geology and engineering sciences to our community.

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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ON THE CHOICE OF OPTIMAL PARAMETERS FOR THE INTEGRATED ASSESSMENT OF SURFACE WATER QUALITY

Abstract. A review of the literature on the selection of optimal indicators for the integrated assessment of surface water quality is given. The restriction of the amount of polluting ingredients analyzed in the water is indicated in the Kazhydromet system, which to a certain extent results in a water quality assessment of the results that do not correspond to the actual ecological and toxicological state of the reservoir.

The need for state monitoring of the level of accumulation and spread of persistent organic pollutants (POPs): organochlorine pesticides (CVD) and polychlorinated biphenyls (PCBs) in the water bodies of the Republic of Kazakhstan is reasonably justified on the basis of: high toxicity for living organisms and the environment, extreme stability in natural environments , active migration capacity in nature and trofical chains, existing in the RK, powerful sources of pollution of natural and water bodies, pollution the strict adherence to the Stockholm Convention on POPs, ratified by it in 2007. Contamination with these dangerous xenobiotics of some reservoirs of the Russian Federation and a number of large water objects of the Republic of Kazakhstan is shown on the basis of a generalization of the literary data, as well as the results of the author's own research into various periods. The level of contamination of water, biological resources and atmospheric precipitation of the Ile-Balkhash basin with highly toxic PCBs is graphically illustrated on the basis of the monograph on POPs published in Kazakhstan for the first time.

On the basis of irrefutable scientific data, the need to monitor the dynamics of POPs for objective assessment of water quality in the water bodies of the Republic of Kazakhstan, especially large transboundary water basins, is proved.

Key words: integrated assessment of water quality, persistent organic pollutants, sources of pollution.

Introduction. In contemporary conditions, hundreds and thousands of new chemicals created by humans enter the biosphere. They are different in composition and different in the degree of toxicity for the natural environment and living organisms. As a result of anthropogenic impact, the natural environment is transformed into a qualitatively different state [1, 2]. According to the data of L.A. Kulsky and V.V. Dal [3], up to 20000 chemical substances are present in the aquatic environment as part of the noosphere. Many of these compounds did not previously exist in nature, including in the aquatic environment and their transformation when interacting with water creates a number of negative consequences for the water body and for certain elements in the tropical chain.

Anthropogenic pollution and water bodies are exposed to Kazakhstan. An example is Lake Balkhash, the ecological state of which is significantly deteriorated under the influence of sewage and aerial emissions from industrial enterprises [4-6]. Under the influence of anthropogenic factors, the aquatic ecosystem of Lake Kopa is degraded [7], the transboundary river Zhayik (Ural) [8, 9] is subject to high man-made pollution.

The multi-component nature of the composition of surface waters and its high dynamism in time and space naturally require the use of sophisticated methods for a reliable assessment of their quality. The

urgency of these problems is well known. Optimization of water quality assessment methods is an important factor not only in solving practical problems of a local nature, but also in developing the scientific basis for forecasting the state of ecosystems of water bodies in general.

Currently, the solution of these problems is paid a lot of attention from scientists in many countries. Methods for the integrated assessment of the quality of surface waters are constantly being improved; various options have been proposed that clarify and supplement to some extent existing methods [10-12].

One of the important issues in the calculation of integral indices is the justification of the choice of the optimal parameters of water quality, on which integrated assessments should be based. On this issue in the review article V.A. Zubarev [13] presents different approaches of researchers. According to Yu.V. Novikov [14, 15], to assess the quality of water, it is necessary to use indicators with established MPCs, which can be formed as a result of chemical and biological transformations and integral indicators that have standards. Different experts recommend the most diverse number of indicators for constructing formalized assessments of water quality. C.M. Margolina et al. [16] recommended taking into account 30-40 characteristics, D. Dunnete [17] – 14, E.A. Lebedeva [18] – 6, I.V. Grib [19] – 15 indicators, etc. According to [13], most researchers base their comprehensive assessments on 9-15 water quality ingredients.

Quite essential recommendations for choosing the optimal water quality parameters for the calculation of the Integrated water pollution indices (IWPI) are given in the work of M.Zh. Burlibaev [11]. It deals with the need to take into account, when calculating the IWPI, analytical data on the concentration of organochlorine pesticides (OCPs) in the waters of water bodies and streams.

This issue is very important for Kazakhstan due to the fact that there are powerful sources of pollution of water bodies on its territory with persistent organic pollutants (POPs), which include OCPs, which will be discussed in more detail below.

This issue is very important for Kazakhstan due to the fact that there are powerful sources of pollution of water bodies on its territory with persistent organic pollutants (POPs), which include OCPs, which will be discussed in more detail below.

The basis for this author's statement is that for carrying out a comprehensive assessment of surface water pollution in Kazakhstan, recommended for implementation in the network of RSE «Kazgidromet» «Guidelines for formalized comprehensive assessment of the quality of surface and sea water by hydrochemical indicators», published in 1988 [20]. And in the official publications in Kazakhstan (Yearbooks, Information Bulletins, etc.), compiled according to the specified «Methodological recommendations», the amount of analyzed pollutants is strictly limited, for surface waters 6 and for sea waters 4 indicators. However, data on highly toxic compounds, such as pesticides, are not taken into account. Even for such rivers as the Syrdarya and Zhaiyk (Ural) data on pesticides are not given, although pesticides for these rivers still remain priority polluters [21, 22].

Persistent organic pollutants. The validity of the recommendations for inclusion in the calculation lies primarily in the fact that OCPs (DDT, aldrin, hexachlorobenzene, HCH, etc.), as well as polychlorinated biphenyls (PCBs), which are also highly toxic for living organisms extremely low levels of concentration in natural objects. Xenobiotics are characterized by high resistance to physical, chemical and biological factors, global prevalence by air, water and migratory species, high cumulative ability in living organisms, and active migration through trophic networks. Unlike poisons that affect certain organs, these toxicants destroy the system of internal regulation, violate the human reproductive system, endocrine and immune status of a person and therefore are called endocrine disruptors. They have chronic toxicity, which is manifested in various pathological changes at the molecular-genetic, cellular-tissue and behavioral levels [23-26].

POPs are recognized by the international community as substances that pose a great danger to human health and the environment. To take measures to protect humans and the environment in 2001, a global international agreement was adopted – the Stockholm Convention on POPs [27]. It entered into force in 2004, Kazakhstan ratified it in 2007. The convention sets goals: immediate cessation of production of POPs, cessation by 2025 of their use and destruction of all wastes no later than 2028 using environmentally friendly methods.

Global and regional distribution of POPs, includes OCPs and PCBs have led to their being recorded everywhere in the most remote areas of the world, including the Arctic and Antarctica [28-30]. As we

know, by the end of the 80s there was a tendency to reduce the level of pollution of the natural environment of OCPs due to the reduction of their mass use in agriculture. However, according to the available literature data and data of official state bodies, there are quite powerful anthropogenic sources of toxic POPs into the environment in different countries at present.

Extremely high resistance of DDT and other OCPs in the soil, according to [31, 32], is determined by the exoticness of their molecules for microorganisms and as a result in the soil they undergo only partial transformation, remaining in the environment as potential sources of its pollution. According to the authors, the duration and length of the process of the release of residues of DDT and HCH into surface waters for many years is related to the fact that they are very short in leaching and leaching from the soil and are tenths of a percent per year. OCPs that have fallen into surface runoff and collector-drainage systems, make further migration in water bodies, undergoing sedimentation to bottom sediments with sediments, cumulation with aquatic flora and fauna. All this causes a long period of finding OCPs in the natural environment, includes in surface waters.

Exponential calculations showed [31,33,34] that at the junction of the forest, steppe and steppe zones, the period of almost complete disappearance of residues of DDT and HCH from soils was within 22-152 years, in the zone of dry steppes and semi-deserts – 14-142 years.

According to data [35, 36], high persistence of POPs in the environment caused the formation of their impact zones on land and in the coastal part of the seas, characterized by an abnormally high content compared to background amounts of substances in soil, water and bottom sediments. As an example, the authors cite the south-eastern region of the Azov Sea and the delta river Kuban, where according to the results of their research, high soil contamination from rice, wheat, cabbage, bottom sediments of water bodies, and a number of food products – milk, meat, potatoes, etc. – was found. Coastal parts of Yellow, Black and the Caspian Sea [37-39].

The scientific literature often contains information about the discovery in the last decade of a fairly high pollution of the ecosystems of the Caspian Sea and some large water bodies of the Russian Federation and Kazakhstan. According to [40], in the bottom sediments of the northwestern part of the Caspian Sea in 2012 and 2013 the total concentration of OCPs reached 4,87 μg/kg, and the metabolites of DDT – 4,72 μg/kg, the contents of PCB and hexachlorobenzene were 10,8 and 0,30 μg/kg respectively. The highest concentrations of PCBs are recorded in the sediments of the Middle Caspian, and the OCP compounds in the sediments of the coastal waters, where they come from surface runoff. It was also noted that the POP content in marine sediments remained at about the same level as recorded in 2002, which is explained by the authors for their high environmental sustainability and the presence of local sources of pollution in the sea.

Results and discussion on organochlorine pesticides. The results of ecological and toxicological studies conducted by us also indicate pesticidal pollution of the Kazakh waters of the Caspian Sea and the mouth areas of the Zhaiyk (Ural) and Kigash rivers (eastern branches of the Volga river delta). The highest level of pesticide contamination was recorded in the water of the north-western water area of the Kazakhstan sector, which is under the influence of the Volga runoff. The total concentration of DDT and HCH in the waters of this zone varied in 2003-2005 from 6,01 to 20,02 μg/dm^3, and in 2008 and 2009 from 8,88 to 51,80 μg/dm^3. The values of this indicator were in the water river Zhaiyk within 0,21-3,02 μg/dm^3, in water river Kigash – 0,81-9,04 μg/dm^3 [22, 41]. The accumulation of pesticides in the muscles of various fish species was: DDT in sturgeon up to 40 μg/kg, in part fish species up to 20 μg/kg in carp and up to 140 μg/kg in bream muscles, and the HCH content was on average about 2,0 μg/kg.

In recent years, a number of publications have appeared in the scientific literature devoted to the study of persistent organochlorine pesticides in the ecosystem of other large water bodies of the Russian Federation [23, 42-46] and Kazakhstan [47-50]. One of the main reservoirs of the republic lake Balkash is subject to pesticide pollution. According to our unpublished data for 2012, the amount of OCPs in the water of certain parts of the lake was on average from 0,075 to 0,376 μg/dm^3. The values of this indicator in the waters of the rivers flowing into the lake reached 0,512 and 0,622 μg/dm^3. The isomers of HCCH, heptachlor, aldrin and DDT metabolites are registered in the fish of the fish inhabiting the lake; their total accumulation in the muscle tissues of fish reached 4,91 and 5,58 μg/kg by average values. All this clearly demonstrates the continuing negative impact of pesticides on water bodies. Consequently, the problem of protecting the environment from their influence still exists.

It should be noted that such a problem is quite acute for Kazakhstan. It is related to the fact that according to the latest data from the Ministry of Energy of the Republic of Kazakhstan [51], for the month of April 2014, the total number of obsolete, prohibited and unsuitable to use pesticides stored at various facilities in Kazakhstan is 1 617 638 kg (l), containers of – under them more than 169660 pieces. They are not disposed of due to insufficient capacity of processing enterprises. Large amounts of obsolete pesticides were buried at the landfill sites in the 1960s – 1980s, but there is no information about the location and the number of buried pesticides in the archives.

According to the available information [52], only within the Pavlodar region, unutilized pesticides are stored in the territories of pesticide warehouses located near settlements: Zhetekshi, 7-Aul, Kalkaman and in the Derzhavinsky agricultural complex. In this source, based on a study of the Regional Center for POPs in Brno (led by Ivan Cholubek), data are also being provided on air pollution of the vast territory of Kazakhstan by such pesticides as DDT, hexachlorobenzene and lindane.

The above materials about the continuing pesticide pollution of the republic's water bodies and non-reclaimed pesticides stored on its territory suggest that the termination of RSE «Kazhydromet» in the last decade of state monitoring of OCP compounds in Kazakhstan's water bodies is unreasonable and premature. The neglect of the concentration of these xenobiotics in assessing the quality of water resources to a certain extent leads to incorrect results, a distortion of the existing state of the quality of the aquatic environment in water bodies.

The need to monitor for OCPs in the water bodies of Kazakhstan and to take into account data on their concentration in assessing the quality of water resources can be quite clearly shown by the example of one of our work [53]. In it the assessment of the water quality of the lakes Alakol group was given on the basis of the results of its own research for 2004-2010, and materials on the content of OCPs (HCH and DDT) in lake waters were available for 2004-2006. In the water of the lake Alakol concentration of DDT metabolites was 0,2 μg/dm^3, isomers of HCH from 0,005 to 0,04 μg/dm^3, and in the water lake Sasykkol was present only isomers of HCH in the range of 0,01-0,03 μg/dm^3.

As we known, pesticides should not be present in the water of fishery bodies of water, i.e. Their maximum permissible concentrations are equal to 0. In our calculations for the maximum permissible concentrations of these xenobiotics, the resolution of an atomic spectrophotometer of 0,001 μg/dm^3 is conventionally taken according to recommendations [11, 12].

For clarity, the table selectively shows the calculation results for 2004-2006 only. From which it follows that the main increase in pollution of lake waters in these years was due to DDD and HCH. The range of fluctuations of the WPI values according to these toxicants (taking into account the hazard class (h.c.)) in the water of lake Alakol was in the range of 40 and 5, and for the lake Sasykkol from 10 to 30.

As can be seen from the table, the weighted average IWPI in the water of lake Alakol varied in 2004-2006 from 2,3 to 20, in the water of the lake Sasykkol – from 4,3 to 11. The maximum for both reservoirs was registered in 2005 due to elevated concentrations of pesticides and heavy metals.

In the classification of water bodies according to the results of the IWPI, taking into account the hazard class of ingredients, the following results were obtained: water lake Alakol with the joint presence of pesticides and metals in 2004 and 2005 was characterized by «extremely high levels of pollution» (IWPIa.w. – 15 and 20, respectively), and in 2006 – classified as «moderately polluted». Water lake Sasykkol in 2004 and 2006 classified as «high level of pollution», and in 2005 – «extremely high level of pollution» (IWPI – 11). In 2007-2010 the water resources of the lakes under consideration belonged to the classes of «moderate» and «high» pollution, mainly due to elevated concentrations of certain metals and nitrogen compounds.

Polychlorinated biphenyls. Above mentioned problems associated with continuing pollution of the environment, including water resources, organochlorine pesticides, used mainly in the agricultural sector. At present, environmental pollution with polychlorinated biphenyls (PCBs), which are also on the POPs list, is an even more acute environmental problem. These so-called technical POPs, have a higher level of toxicity for the natural environment and living organisms. Sources of entry of PCBs into the natural environment are leaks from transformers, condensers, heat exchangers, evaporation from various technical installations, where they are used as dielectrics, liquid industrial waste. An important role in the distribution in nature of PCBs is played by their emissions into the atmosphere from the incineration of urban garbage and various solid wastes.

Integrated water pollution indices (IWPI) lakes Alakol and Sasykkol taking into account the hazard class

Year	Indicators	Lake Alakol		Lake Sasykkol	
		with h.c.	IWPI a.w.	with h.c.	IWPI a.w.
2004	IWPI K1=∑WPI (HCH)/n	10,0	15	10	4,9
	IWPI K2=∑WPI (DDT+Pb+Cd)/n	34,5		3,8	
	IWPI K3=∑WPI (NH_4+Cu+Zn+Ni)/n	1,8		1,0	
2005	IWPI K1=∑WPI (HCH)/n	40	20	30	11
	IWPI K2=∑WPI (DDT+Pb+Cd)/n	–		0,6	
	IWPI K3=∑WPI (NH_4+Cu+Zn+Ni)/n	1,2		2,9	
2006	IWPI K1=∑WPI (HCH)/n	5,0	2,3	10	4,3
	IWPI K2=∑WPI (DDT+Pb+Cd)/n	0,6		0,9	
	IWPI K3=∑WPI (NH_4+Cu+Zn+Ni)/n	1,3		2,1	

If the problems with respect to OCPs, as briefly outlined above, are in the continued impact on aquatic ecosystems of residual accumulated in natural objects and stored (in various states) unutilized pesticide stocks, then for PCBs we are talking about the increasing rate of environmental pollution by these xenobiotics places to a critical level.

Environmental problems associated with the widespread occurrence of PCBs on the planet, the increase in their negative effects on the environment, along with the insufficiency of measures taken to prevent their dangerous consequences, according to scientists and specialists, are global in scope. At present, many scientific publications, mainly foreign authors, are devoted to this problem.

Here without extending to the essence, urgency and diversity of this problem, it seems sufficient to refer to the work [54], which represents the first significant scientific generalization of literary and official information on POPs issues published in Kazakhstan, against the background of detailed studies of their contamination level aquatic ecosystem of one of the main basins of the republic. Below we only briefly note the following.

According to the results of the preliminary inventory, there are eight «hot spots» in the country contaminated with PCBs. The main polluted area is the territory of the city of Oskemen, where the waste of the Condenser Plant was buried in a storage pond. Other PCB-polluted areas are the Zhangiz-Tobinsky and Derzhavinsky polygons for the destruction of military equipment, the Saryshagan polygon, the areas of the northern and western shores of the Balkash lake, Ekibastuz and Kostanay substations, as well as substations at the Kostenko mine in Karaganda. The total area of pollution is 2500 hectares.

On the territory of the republic there are PCB-containing equipment in the amount of 116 transformers and about 50 thousand capacitors. The amount of PCB they contain is estimated at 800 tons. These equipments present a potential hazard if they are depressurized. In terms of POPs waste stocks, Kazakhstan ranks second among the countries of Central and Eastern Europe and CIS countries after Russia.

In the natural objects and the ecosystem of water bodies of Kazakhstan, targeted monitoring, in order to implement the national objectives of the Stockholm Convention on POPs, is practically not carried out. Observation of these xenobiotics is not conducted by the network of Kazhydromet and other nature protection bodies of the Republic of Kazakhstan. The «Convention on Environmental Safety of the Republic of Kazakhstan for 2004-2015» indicates the absence in Kazakhstan of an objective assessment of the environmental pollution of POPs. The need to develop a program for the control, monitoring and management of POPs was stressed during 2005-2006. However, there is no information in the scientific literature and periodicals of the Ministry of Energy about conducting any significant observations on the spread of POPs, including PCB, in the objects of the environment of the republic.

Currently some information about the levels of accumulation of PCBs are available from natural sites in the Oskemen region, which is one of 8-«hot spots » points – areas contaminated with PCBs, as well as more detailed materials obtained from the water bodies of the Ile-Balkhash basin [54]. These scientific data indicate that PCBs pollute aquatic and biological resources, snow cover and soil in some cases to a high level.

This information characterizes the toxicological state of one of eight «hot spots» – territories contaminated with PCBs. And what is the toxic atmosphere on the other «points»? Unfortunately, it is not known, there is no information on the pages of accessible scientific and operational publications due to the lack of monitoring by state environmental agencies, although there are many localities in the region of these very dangerous for human health and food resources are produced.

Some data on the level of PCB concentration in water and fish of the Shardara, Bukhtarma, Kapshagai reservoirs, the Small Aral sea and the Zhayik river were obtained by us in the last decades of the last century [21, 22, 41, 47-50].

The above information is evidence that highly toxic PCBs are widespread in ecosystem facilities of Kazakhstan's water bodies. However the State monitoring of the level of pollution and their impact on natural objects, water resources is not conducted even in the existing highly polluted areas, where there are powerful sources affecting the environment. Continuous monitoring and monitoring of the distribution of PCBs in the natural environment, as well as the establishment of systems of general public information on their results, comply with the requirements of the Stockholm Convention on POPs.

In the Russian Federation, for instance, Roshydromet conducts monitoring of environmental pollution by chemical POPs compounds. The monitoring results are published in the «Reviews» and «Yearbooks». Permanent monitoring of these substances is conducted by five specialized regional research centers. Large-scale research conducted by many scientific institutions.

Conclusion. The official data set out in the article about the huge amount of stored unutilized OCP reserves and numerous contaminated PCBs in the territory of Kazakhstan, including many in the form of used transformers and capacitors, indicate the existence of powerful sources of environmental pollution by POPs compounds. And the results of generally limited research in recent years convincingly show a fairly high level of pollution of the natural environment, including aquatic and biological resources. The lack of State monitoring and analytical data on the levels of POPs accumulation in the country's surface waters, naturally, does not allow an objective assessment of the existing state of the quality of water resources, especially in large transboundary basins.

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ЖЕР БЕТІ СУЛАРЫНЫҢ САПАСЫН КЕШЕНДІ БАҒАЛАУДА ОҢТАЙЛЫ КӨРСЕТКІШТЕРДІ ТАҢДАУ ТУРАЛЫ МӘСЕЛЕГЕ

Аннотация. Жер беті суларының сапасын кешенді бағалау үшін оңтайлы көрсеткіштерді таңдау бойынша әдеби мәліметтерге шолу келтірілген. Қазгидромет жүйесінде судағы талданатын ластаушы ингредиенттердің санының шектеулі болуынан, су сапасын бағалау кезіндегі нәтижелер су қойманың нақты экологиятоксикологиялық жағдайымен сәйкес келмейтіндігі көрсетілген.

ҚР су нысандарында тұрақты органикалық ластағыштар (ТОЛ): хлорорганикалық пестицидтер (ХОП) және полихлорлы бифенилдердің (ПХБ) таралуы мен жинақталу деңгейіне мемлекеттік мониторинг жүргізу қажеттілігі – олардың тірі организмдер мен қоршаған орта үшін жоғары улылығы мен табиғи ортадағы аса

тұрақтылығы, табиғаттағы және трофикалық тізбек бойынша белсенді миграциялық қабілеті, ҚР аумағындағы қуатты ластаушы көздерімен табиғи және су нысандарының ластануы, ластанған ошақтар және Қазақстан 2007 жылы ратификациялаған ТОЛ туралы Стокгольм конвенциясы бойынша қабылданған міндеттерді орындау үшін қажеттілігі негізді дәлелденген. ҚР ірі су нысандары мен РФ су қоймаларының осы қауіпті ксенобиотиктермен ластануы әдеби мәліметтермен, сонымен қатар авторлардың әртүрлі кезеңдерде жүргізген өз зерттеулері нәтижелері негізінде көрсетілген. Іле-Балқаш алабының су және биологиялық ресурстары мен атмосфералық жауын-шашындарының аса улы ПХБ ластану деңгейі, ТОЛ мәселесі бойынша Қазақстанда алғаш шығарылған монографияға енген мәліметтерде көрнекі суреттелген.

ҚР су қоймаларының әсіресе ірі трансшекаралық су алабтарының су сапасын шынайы бағалау үшін, ТОЛ деңгейіне мониторинг жүргізу қажеттілігі ғылыми мәліметтер негізінде дәлелденген.

Түйін сөздер: су сапасын кешенді бағалау, тұрақты органикалық ластағыштар, ластағыш көздер.

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К ВОПРОСУ ВЫБОРА ОПТИМАЛЬНЫХ ПАРАМЕТРОВ ПРИ КОМПЛЕКСНОЙ ОЦЕНКЕ КАЧЕСТВА ПОВЕРХНОСТНЫХ ВОД

Аннотация. Приводится обзор литературных сведений по вопросам выбора оптимальных показателей для комплексной оценки качества поверхностных вод. Указано на существующее в системе Казгидромет ограничение количества анализируемых в воде загрязняющих ингредиентов, что в известной мере приводит при оценке качества вод к результатам, несоответствующим действительно существующему эколого-токсикологическому состоянию водоема.

Необходимость государственного мониторинга за уровнем накопления и распространением стойких органических загрязнителей (СОЗ): хлорорганических пестицидов (ХОП) и полихлорированных бифенилов (ПХБ) в водных объектах РК аргументированно обоснована на основании: высокой их токсичности для живых организмов и окружающей среды, чрезвычайной устойчивости в природных средах, активной миграционной способности в природе и по трофическим цепям, существующих на территории РК мощных источников загрязнения ими природных и водных объектов, загрязненных очагов, строгой необходимости для Казахстана выполнение принятых обязательств по Стокгольмской конвенции о СОЗ, ратифицированной им в 2007 г. Загрязненность этими опасными ксенобиотиками некоторых водоемов РФ и ряда крупных водных объектов РК показана на основе обобщения литературных сведений, а также результатов собственных исследований авторов в разные периоды. Уровень загрязнения высокотоксичными ПХБ водных, биологических ресурсов и атмосферных осадков Иле-Балкашского бассейна наглядно иллюстрирован на материале, вошедшего в основу впервые изданной в Казахстане монографии по проблемам СОЗ.

На основе неопревержимых научных данных доказана необходимость мониторинга за динамикой СОЗ для объективной оценки качества вод водоемов РК особенно крупных трансграничных водных бассейнов.

Ключевые слова: комплексная оценка качества вод, стойкие органические загрязнители, источники загрязнения.

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