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Д.В. Сокольский атындағы
«Жанармай, катализ және электрохимия институты» АҚ

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ИЗВЕСТИЯ

НАЦИОНАЛЬНОЙ АКАДЕМИИ НАУК
РЕСПУБЛИКИ КАЗАХСТАН
АО «Институт топлива, катализа и
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Қазақстан Республикасы Ұлттық ғылым академиясы «ҚР ҰҒА Хабарлары. Химия және технология 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. Химия және технология сериясы Emerging Sources Citation Index-ке енуі біздің қоғамдастық үшін ең өзекті және беделді химиялық ғылымдар бойынша контентке адалдығымызды білдіреді.

НАН РК сообщает, что научный журнал «Известия НАН РК. Серия химии и технологий» 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 Socia1 Sciences Citation Index и the Arts & Humanities Citation Index. Web of Science предлагает качество в глубину контента для исследователей, авторов, издателей и учреждений. Включение Известия НАН РК в Emerging Sources Citation Index демонстрирует нашу приверженность к наиболее актуальному и влиятельному контенту по химическим наукам для нашего сообщества.

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ASSESSMENT OF BORON CONTENT CHANGES IN THE SURFACE WATER OF THE ILEK RIVER VALLEY (AKTOBE, KAZAKHSTAN

Annotation. This article describe the problem of boron pollution of the surface water of the Ilek River valley (Aktobe region, Kazakhstan). The purpose of the article is to assess the dynamics of changes in the boron content in environmental objects (surface and groundwater) based on the materials of the operating in the field of monitoring systems and field research. The deterioration of the quality of surface and groundwater occurs from historical pollution, as well as from wastewater discharges from enterprises of the chemical, oil refining, machine-building industries and non-ferrous metallurgy. In Aktobe region, there is an imbalance between the ability of the natural environment to recover and anthropogenic load. Pollution of surface water is the cause of increased siltation of river, which has a harmful effect on the composition of bottom sediments, which constitute an integral part of the aquatic environment and the ecological system. In this situation, in the region, an excess of boron concentration approximately the Bestamak village by 50 times was constantly recorded in 2018, the MPC of boron in the reservoir in the area closest to the sludge collectors was exceeded by 143 times in 2017. The Ilek River pollution by boron is very acute, since boron is transported along the Ilek River and stored in the silts of the Aktobe reservoir, which is a recreational resource and a source of water supply for the Aktobe city. The high dynamism of boron leads to the fact that when it is roiled during releases from the reservoir, boron enters the lower reaches of the Ilek River, harming river organisms and the population, adversely affecting heredity. As a result of the study, exceeding the maximum permissible concentration of boron in the surface water of the Ilek River valley in unregulated flows was recorded.

Key words: boron pollution, surface water, water quality, monitoring.

Introduction. The system of public administration in the field of environmental protection includes various mechanisms of management, implementation and achievement of sustainable development goals [1, 2]. The sustainable development model relies on a constant and reliable source of fresh water. The water resources of the Republic of Kazakhstan are used in various sectors of the national economy, but the most significant consumer of fresh water is agriculture - irrigation, water supply to the rural population and animal husbandry. It accounts for about 85% of total water consumption; the remaining 15% goes to industry and water supply for the urban population. Therefore, the study of the imbalance of ecological systems in the presence of pollution presupposes a detailed knowledge of the nature of the spread of pollutants in water bodies and watercourses [3].

Aktobe region is characterized by a fairly high level of economic and industrial development. However, the problem of water security in conditions of limited and vulnerable water resources is considered as a threat to environmental safety. In this regard, the quality of surface water used for household and drinking purposes is in the constant focus of monitoring [4].

Aktobe city and adjacent district centers such as Alga are the main water users in the Ilek river basin. Man-made pollution of river runoff with boron is associated with the activities of the former Alga Chemical Factory (built in 1937), which dumped waste from boric acid production into the Ilek River without purification and preliminary purification [5].

A distinctive feature of boron compounds is their high mobility in the components of the natural environment, due to increased solubility [6-11]. From this point of view, a serious problem is the purification of groundwater from boron pollution in the Ilek basin (Alga, Aktobe region) in connection with its migration from the sludge collectors of the Alga Chemical Factory, which was closed in 1997, into the groundwater, which wedges out into the Ilek River. All this determines the relevance of studies to study the dynamics of changes in boron concentrations in the surface water of the Ilek River valley in the current ecological situation of the Aktobe region. It should be noted that boron belongs to the class of biologically active substances. In the sanitary and epidemiological rules, norms, rules and regulations 2.1.4. 1074-01, according to the sanitary and toxicological sign of harmfulness, boron belongs to the second hazard class [12].

The aim of this paper is to analyze the dynamics of the processes of boron pollution of the surface water of the Ilek River valley. The authors assessed the change in the level of boron in natural environments based on the materials of observation systems operating in the region, and a selective analysis of the boron content in water samples taken in different parts of the Ilek River valley. Based on the results of the study, a conclusion was made about the quality of the surface water of the Ilek River valley.

Methods and materials. The implementation of the research includes the use of a set of scientific research methods based on international standards of good scientific practice: information and statistical, field research, laboratory analysis of surface water samples from the Ilek River valley, comparative analysis of environmental objects, the method of mathematical statistics.

According to the description of the Monitoring network [13] in the Information Bulletins on the state of the environment in the Republic of Kazakhstan, the Center for Environmental Monitoring of the Republic of Kazakhstan RSE "Kaz Hydro Met" within the Aktobe region to the border with the Russian Federation has 5 observation water points. The first three posts fall on the investigated section of the Alga-Aktobe reservoir, and even then the last of them can only conditionally be taken as a post on the Aktobe reservoir, since it is located at a distance of 0.5 km above the city of Aktobe, i.e. below the dam. The first post is a background one in relation to the old sludge collector, the second post is 0.5 km below the settlement of Bestamak. The first post is the background in relation to the old sludge collector, which is considered the main source of pollution of the river due to its close proximity. The second post is located 0.5 km below the village of Bestamak and 21 km below the old sludge collector. The distance from the village of Bestamak to the southern (opposite dam) border of the reservoir is 3.5 km from this village (5.15 km along lade). On the basis of routine observations of the RSE "Kaz Hydro Met" (Figure 1), a study of the dynamics of changes in boron concentration for the period 2011-2020 was carried out.

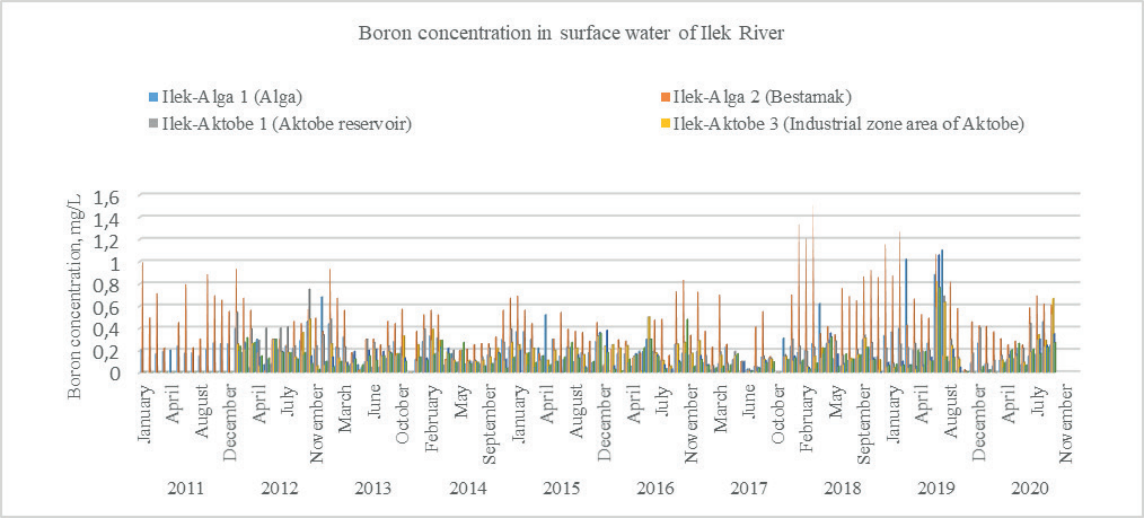

Figure 1. Dynamics of changes in boron concentration in the surface valleys of the Ilek River for the period 2011-2020

As the graphs show, large amplitudes are observed for 2011-2012 and 2017-2019. High boron content is observed in the autumn-spring periods, as well as in 2019-2020, an excess of boron MPC was recorded in Alga 1, Alga 2, Aktobe reservoir. It should be noted that the surface water of the Ilek River valley are used by the local population as a reclamation resource. Large amplitudes of fluctuations in the boron content in surface

water at these stations Ilek-Alga 2 and Ilek-Aktobe 1 (Aktobe reservoir) are evidence that the Aktobe reservoir receives groundwater diluted by the surface runoff of the Ilek River, wedging out in different places.

In order to determine the current level and predict the pollution of environmental objects with boron, in the course of field studies, samples of surface water were taken from the Ilek River. The selection of natural water is carried out in accordance with GOST 31861-2012 "Water. General requirements for sampling" [14].

The boron content in the sample was determined according to ST RK GOST R 51210-2003 [15]. The method is based on the interaction of borate ions with chromotropic acid in the presence of Trilon B (masking metal ions) with the formation of a fluorescent complex and subsequent measurement of the intensity of its fluorescence.

The results of the chemical analysis of surface water are presented in the following table 1 and in figure 2.

Table 1 – Results of chemical analysis of surface water of the Ilek river valley

№ пробы	Selection place	Coordinates	Actual data obtained, mg/dm³	Maximum permissible concentration, mg/dm³
1	Ilek River, left bank, above the factory	49° 54′ 13, 6′′ (NL) 57° 21′23, 7′′ (EL)	0,37	0,5
2	Ilek River, left bank, below the factory	49° 57′24, 7′′ (NL) 57° 22′11, 8′′ (EL)	0,43	0,5
3	Ilek river, settlement Bestamak	50° 02′19, 7′′ (NL) 57° 21′33, 6′′ (EL)	0,97	0,5
4	Aktobewaterintake	50° 17′54, 6′′ (NL) 57° 13′58, 1′′ (EL)	0,77	0,5
5	Ilekriver, Tamdyvillage	49° 43′4, 71′′ (NL) 57° 20′7, 27′′ (EL)	0,26	0,5
6	Ilek river, settlement Bestamak	50° 02′ 2, 29′′ (NL) 57° 21′ 6, 58′′ (EL)	1,50	0,5
7	Collector at the new sludge collector	49° 55′6, 25′′ (NL) 57° 19′ 9, 63′′ (EL)	0,34	0,5

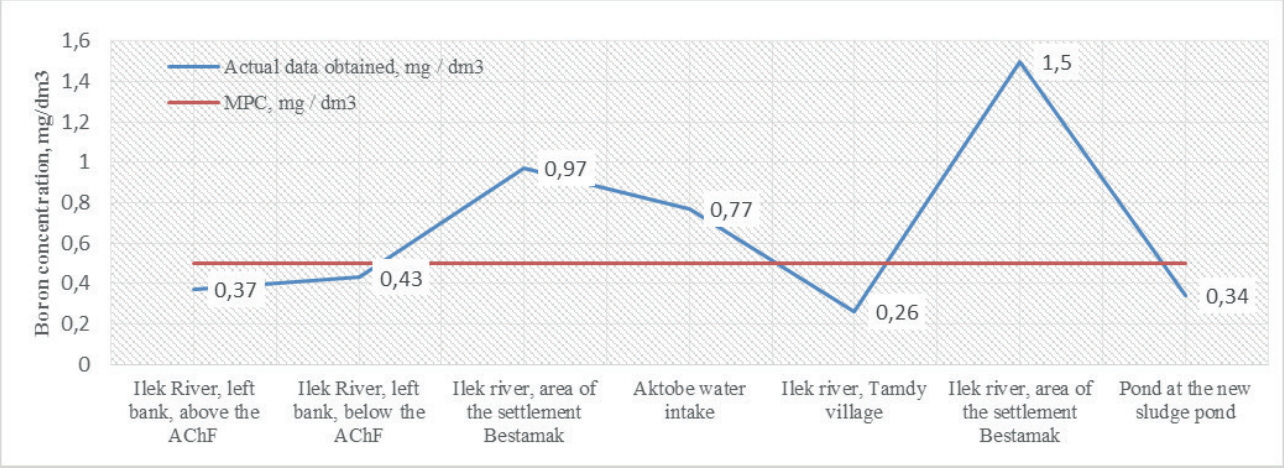

Figure 2. Boron content at observation area

As the results of chemical experiments (tests) show, high concentrations are observed in the area of the Bestamak settlement, the Aktobe water intake, which indicates the pinching out of groundwater into the Aktobe reservoir. This statement is substantiated by hydrodynamic calculations based on data from 2005-2008 and 2011-2012 to assess the pinch-out of groundwater contaminated with boron in the Ilek River. The shape of the groundwater surface depends on the permeability of the rocks, the feeding conditions of the aquifer, the configuration of the river banks to which the groundwater flows, the lowering of the water-resistant layer, the thickness of the aquifer, etc.

Results. The calculations of wedging out [16] were carried out taking into account the filtration characteristics of the Quaternary deposits of the river valley. Ilek. The average thickness of the alluvial aquifer m here is about

15 m, the calculated value of the filtration coefficient K is taken to be 35 m / day, and the hydraulic gradient is I = 0.0015. It should be noted that when calculating the flow rates, the drain imperfection coefficient was taken into account with a value of 0.3. Then the flow rate of the natural flow of groundwater per 1 m of the flow width is calculated using the following formula:

$$Q=KLmI\cdot 0{,}3, \qquad (1)$$

After substituting the numerical values, we get: Q = 15m × 1m × 35 m/day × × 0.0015 × 0.3 = 0.236 m^3/ day = 236 dm^3/ day.

When converted to m^3/h, the flow rate will be: Q=0.0098 m^3/h. This value will make it possible to calculate the value of the discharge of wedging out groundwater along the length of the Ilek river bank is in the wedging out zone. Figure 3 shows a map of hydroisohypsum and several zones can be distinguished into which contaminated groundwater is pinched out.

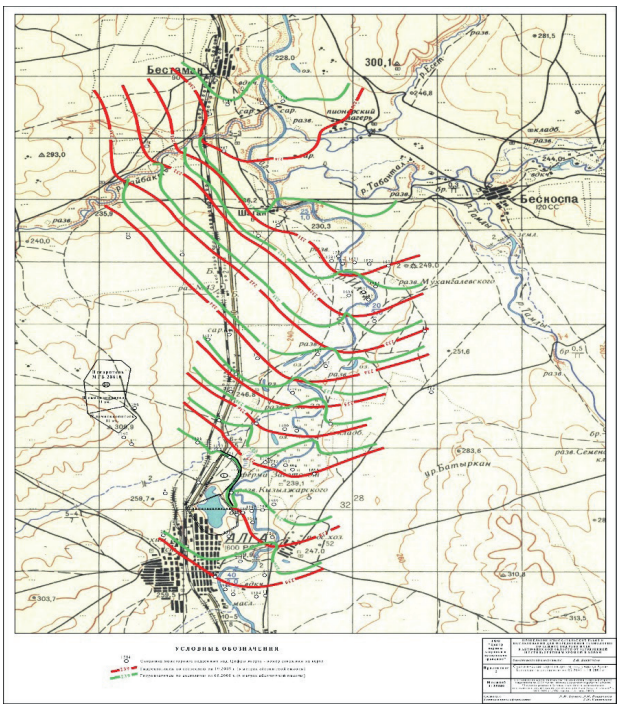

Figure 3. Map of hydroisogypsum, 2008

The old sludge collector is located very close to the river, the flow of contaminated groundwater wedging out in this zone is directed perpendicular to isohypse 238 and its length from the left bank in 2005 was 1250 m. From the right bank in this zone, wedging out with a width of about 400 m also occurred This is an area of groundwater wedging out with the highest boron concentrations in groundwater, totaling 1650 m.

It can be seen from the contour of the pollution center that underground water with concentrations of more than 100 mg/dm^3 can wedge into this zone from both banks. Thus, in this zone, taking into account the drain imperfection coefficient of 0.3, 390 m^3/day wedges out. Since 1 mg/dm^3 = 1 g/m^3,the salinity of 100 mg/ dm^3correscollectors to 100 g/m^3. Thus, from this zone of wedging out per day in the river. Ilek is carried out 39 kg of boron, and during the low-water period (~ 300 days) - one year about 12000 kg, or 12 tons.

In the Ilek River, there is a dilution of boron-polluted groundwater seeping out. The scale of dilution can be estimated from the concentration of boron in surface water at section IV-IV, which is located in the zone of direct influence of the old sludge collector. In Ilek River near this section the boron concentration in 2005 was 13.44 mg/dm^3, which is 7.44 less than the concentration of escaping groundwater. However, this concentration is 27 times higher than the MPC for boron, even taking into account their changes in 2015 from 0.017 to 0.5 mg/dm^3. Of course, this amount does not reach the Aktobe reservoir, boron is precipitated by the silts of the river. Ilek, but during the flood, part of this silt, polluted by boron, is carried ashore. A decrease in concentration can be traced a little further than the fifth section, when moving to which the concentration of boron in groundwater decreased to 49.5 mg / dm3, and in the Ilek river up to 1.98 mg/dm^3.

The second zone of groundwater wedging out with a high boron content begins below the VI-VI section after 750 m, then has a gap and continues in the area of the confluence of the Suyksu brook (temporary watercourse)

for another 1130 m. Groundwater wedges out into the gap from the right bank with a small boron concentration , they were not taken into account. So, the second zone of wedging out of polluted groundwater on the left bank has a length of 1880 m. Then 444 m^3/day wedges out in this zone. Focusing on the concentration of boron in the well №1600 (82.7 mg/dm^3), we get 36.7 kg of boron per day, or 11 tons per year was 23 ton per year.

According to data from 2011-2012, to determine the amount taken out in the river. Ilek bora, it is necessary to determine the size of the pinch-out zone. Table 2 shows the results of determining the actual values of the width of the flow of groundwater for the ranges of boron concentrations, mapping the halo of wedging out of contaminated groundwater. The widths take into account the zones from both the left and right banks.

Table 2 – Zones of groundwater wedging out

№	Boron content, mg / dm3	Actual width of the zone, taking into account the scale of the map, m	
		2011	2012
1	0,5-10	5525	3050
2	10-50	8500	11750
3	50-100	3575	1550
4	>100	300	225
In total:		17900	16575

As before, the flow of contaminated groundwater with the highest boron concentration is observed near the old sludge collector; however, there have been noticeable changes in the size of the pinch-out zones with different ranges of boron concentrations. This is reflected in the fact that the zone with the maximum concentrations has greatly decreased.

In 2005, this zone was 1650 m, in 2011 - 300 m, and in 2012 - 225. Thus, over 6 years this zone has decreased by more than 5 times, averaging 18% per year. However, in 2012, compared to 2011, this zone decreased by 75 m, i.e. the decrease in the zone occurred by 25% (of course, provided that the constructions are completely reliable).

According to the analysis of climatic factors, carried out in the report on the monitoring of groundwater for 2010-2012, not only did not increase, but, on the contrary, decreased, causing a regional decrease in the groundwater level by 0.3 m. The sludge collector is the territory of the former Alga chemical plant, which ceased its activities in 1996, but has not yet been subjected to any reclamation methods. For 15-16 years of natural leaching of contaminated soil in the territory of the plant, the situation could well have changed. In addition, already in 2007, samples of sludge taken at the old sludge collector in the interval from the surface to 0.5 m showed the absence of boron in them. Drilling wells around and in the area of the sludge collector confirmed this fact, but showed that the bulk of the boron was now concentrated under the bottom of the old sludge collector at depths of up to 25 m [17].

The assessment of the rate of advancement of the groundwater contamination front, which became possible as a result of the analysis of the effect of the “wall in the ground” near the old sludge collector, showed the possibility of contaminated groundwater flow from the territory of the Alga chemical plant to the site of the old sludge collector. At a rate of advance of the pollution front of 300-500 m per year, this path of pollution can be quite real, because the territory of the former plant is located at a distance of 1-2 km from the sludge collector.

The same reason is the explanation for the significant, compared to 2005, expansion of the pollution halo in the northern, north-western and eastern directions of the zone with a boron concentration range of 50-100 mg / dm3.

Practical adjoining of the pollution halo with boron concentrations of 0.5-10 mg / dm3 to the western terrace of the river valley. Ilek confirms the correctness of the assumption that traces of accidental spills of sludge pipelines and filtration from a new sludge collector are isolated as sources of pollution. It should be noted that the hypsometric position of the old sludge collector allows the Ilek River to drain the flow of contaminated groundwater from the layers below the bottom of the new sludge collector.

Discussion. According to the cycles and conditions of migration of chemical elements, the Ilek River valley belongs to para- and neo-eluvial elementary ladders. The regional distribution of boron solutions is noted as industrial pollution emanating from the storage pond of a chemical plant. The water intakes of the regional center of the city of Aktobe, as well as the reservoir on the Ilek River, built between Alga and Aktobe, are polluted by man-made water. As noted in the article, pollution in a technogenic form is developed only near the Alga city, all other indications of a boron in the Ilek river valley are an aureole of exogenous dispersion of highly mineralized underground water of Permian sediments [18-20].

The set of available results of studies of the boron content in the natural environments of Aktobe showed that the main ways of boron entering the groundwater are filtration through the bottom of the old sludge pond, infiltration into the aquifer of pollution washed away by snowmelt water and storm runoff from the industrial site of the Aktobe Chemical Plant, new sludge ponds and dust sedimentation AHZ, old and new slime accumulators. Selective analysis of boron content in surface water and bottom sediments was carried out on the basis of sampling in 10 different parts of the Ilek River valley, where the frequency of exceeding the MPC was recorded in Bestamak settlement -1.94 MPC, and 3 MPC, Aktobe water intake - 1.54 MPC. In connection with the current ecological situation of boron pollution, it is necessary to conduct further studies to determine the boron risk for natural objects and public health.

Conclusions. According to the results of a long-term study of boron pollution of the investigated object, the main sources of boron pollution in the Ilek River valley are: the territory of the former Alga chemical plant, sludge collectors, sludge pipelines. The valley of the Ilek River is technogenic pollution by boron near the Alga town, and downstream its entire space further to the north is an exogenous halo of dispersion of brines of Permian rocks and boron together with them, as well as secondary technogenic pollution from sludge collectors and sludge pipelines. The main masses of pollution products accumulated in the soil and grounds of the industrial site, urban and adjacent territories as a result of atmospheric fallout during the operation of the ACP are gradually washed out during the spring flood. The dynamics of surface water pollution can be traced at 3 points of "KazHydroMet" in the Alga area. Graphs of changes in boron content in the river. Ilek in the sections above Alga (Alga 1), near Bestamak (Alga 2) and above Aktobe (Gidropost 1) for the period 2011-2020. show a consistent decrease in boron content until 2016. At the Alga1 and Aktobe Gidropost 1 stations, the downward trend continues, and at Alga 2, a sharp jump in the boron content is observed. The authors explain this course of the graphs by the manifestation of the influence of a new source of pollution, which can only be a new sludge collector, the front of which in 2019 approached the Ilek river. Since the excess of the MAC for boron in the surface water of the Ilek River valley was recorded in unregulated flows, it is advisable to analyze its impact on public health.

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ЕЛЕК ӨЗЕНІ АЛҚАБЫНЫҢ ЖЕР ҮСТІ СУЛАРЫНДАҒЫ БОР ҚҰРАМЫНЫҢ ӨЗГЕРІСІН БАҒАЛАУ (АҚТӨБЕ, ҚАЗАҚСТАН)

Аннотация. Бұл мақалада Елек өзені алқабының (Ақтөбе облысы, Қазақстан) жер үсті суларының бормен ластану мәселесі қарастырылды. Авторлар зерттеу міндеті ретінде мониторинг және далалық зерттеулер жүйелері саласындағы материалдар негізінде қоршаған орта нысандарындағы (жер үсті және жер асты сулары) бор құрамының өзгеру динамикасын бағалауды қойды. Жер үсті және жер асты сулары сапасының төмендеуі ластанудан, сондай-ақ химия, мұнай өңдеу, машина жасау өнеркәсібі және түсті металлургия кәсіпорындарының сарқынды суларын ағызу кезінде орын алады. Ақтөбе облысында табиғи ортаның қалпына келу қабілеті мен антропогендік жүктеме арасында теңгерімсіздік байқалады. Жер үсті суларының ластануы өзендердің сулануының жоғарылауының себебі болып табылады, бұл су ортасының, экологиялық жүйенің ажырамас бөлігін құрайтын төменгі шөгінділердің құрамына зиянды әсер етеді. Бұл жағдайда Бестамақ ауылының маңында бор концентрациясының 2018 жылы 50 есе артуы тіркеліп, шлам жинағыштарға жақын аймақтағы су қоймасындағы бордың ШРК 2017 жылы 143 есе артқаны байқалды. Елек өзенінің бормен ластауы Ақтөбе облысы үшін өте өткір мәселе, себебі бор Елек өзенімен тасымалданады және Ақтөбе қаласының рекреациялық ресурс және сумен жабдықтау көзі болып табылатын Ақтөбе су қоймасының шөгінділерінде жинақталады. Бордың үлкен динамикасы су қоймасынан су жіберу кезінде Елек өзенінің төменгі ағысына түсіп, өзен ағзаларына (тератогендік әсер) және халыққа зиян келтіріп, тұқым өндіругекедергі келтіреді. Зерттеу нәтижесінде Елек өзенінің аңғарының жер үсті суларындағы бордың ШРК-дан асып кетуі реттелмеген ағындарда тіркелді.

Түйінді сөздер: бормен ластану, жерүстісулары, су сапасы, мониторинг.

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ОЦЕНКА ИЗМЕНЕНИЙ СОДЕРЖАНИЯ БОРА В ПОВЕРХНОСТНЫХ ВОДАХ ДОЛИНЫ РЕКИ ИЛЕК (АКТОБЕ, КАЗАХСТАН)

Аннотация. В данной статье рассматривается проблема загрязнения бором поверхностных вод долины реки Илек (Актюбинская область, Казахстан). Целью статьи является оценка динамики изменения содержания бора в объектах окружающей среды (поверхностных и подземных вод) на основе материалов действующих в области систем мониторинга и полевых исследований авторов. Ухудшение качества поверхностных и подземных вод происходит от исторических загрязнений, а так же при сбросах сточных вод предприятий химической, нефтеперерабатывающей, машиностроительной промышленности цветной металлургии. В Актюбинской области наблюдается не сбалансированность между способностью природной среды к восстановлению и антропогенной нагрузкой. Загрязнение поверхностных вод является причиной повышенного заиливания рек, что оказывает вредное воздействие на состав донных отложений, которые составляют неотъемлемую часть водной среды, экологической системы. В этой ситуации в регионе постоянно регистрировалось превышение концентрации бора в окрестностях села Бестамак в 50 раз в 2018 году, ПДК бора в водохранилище в районе, ближайшем к шламонакопителям, было превышено в 143 раза в 2017 году. Проблема загрязнения реки Илек бором стоит весьма остро, так как бор переносится по реке Илек и складируется в илах Актюбинского водохранилища, которое является рекреационным ресурсом и источником водоснабжения города Актобе. Большая динамичность бора приводит к тому, что при взмучивании во время попусков из водохранилища бор попадает в нижнее течение реки Илек, нанося вред речным организмам и населению, неблагоприятно влияя на наследственность. В результате исследования зафиксированы превышения ПДК бора в поверхностных водах долины реки Илек в не зарегулированных стоках.

Ключевые слова: загрязнение бором, поверхностные воды, качество воды, мониторинг.

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90-летие академика Национальной академии наук Республики Казахстан Е.А.БЕКТУРОВА

Исполнилось 90 лет со дня рождения и 65 лет научно-педагогической и общественной деятельности известного ученого в области физической химии высокомолекулярных соединений, академика НАН РК, лауреата Государственной премии Казахстана, заслуженного деятеля науки и техники Республики Казахстан, доктора химических наук, профессора Есена Абикеновича Бектурова.

Е.А. Бектуров родился 14 декабря 1931 года в г. Ташкенте.

В 1949 году он поступил на химический факультет Казахского государственного университета, где затем обучался в аспирантуре. В 1958 г. защитил кандидатскую, а в 1972 г. – докторскую диссертации, в 1976 г. ему присвоено ученое звание профессора. С 1958 г. по 2009 г. он работал в Институте химических наук АН КазССР, где прошел путь от младшего научного сотрудника до заведующего лабораторией. С 2010 по 2021 годы Е.А. Бектуров работал профессором Казахского Национального педагогического университета. В 1983 г. Е.А. Бектуров избран в члены-корреспонденты, а в 2003 г. – в академики Национальной Академии наук Республики Казахстан.

Основное научное направление Е.А. Бектурова связано с фундаментальными исследованиями в области физической химии полимеров: водорастворимые полимеры, полиэлектролиты, полиамфолиты, комплексы полимеров, полимерные катализаторы, ионопроводящие комплексы, гидрогели, наночастицы металлов, стабилизированные полимерами. По результатам исследований в изданиях Казахстана, ближнего и дальнего зарубежья опубликовано более 800 работ, среди них 18 изобретений, 8 обзорных статей в журналах США, СССР, Энциклопедии полимерных материалов (США). Издано 32 монографии, 6 из них в ФРГ, Японии, Польше, России и 4 учебных пособия. Цикл работ Е.А. Бектурова с сотрудниками «Водорастворимые полимеры и их комплексы» в 1987 г. был удостоен Государственной премии Казахской ССР.

Исследования Е.А. Бектурова получили широкое признание в нашей стране и за рубежом. Публикации регулярно цитируются в монографиях и статьях ученых ближнего и дальнего зарубежья. Министерством науки и технической политики России Е.А. Бектуров был включён в базу данных «Лидеры науки СССР» в числе 6-ти наиболее цитируемых казахстанских ученых за период 1986-1991 гг. На монографии Е.А. Бектурова опубликовано 47 рецензий известных ученых в журналах СССР, США, ФРГ, Чехии, Румынии. Результаты исследований Е.А. Бектурова включены в ряд отечественных и зарубежных монографий, справочников и учебных пособий, а также стимулировали работы в некоторых лабораториях в нашей стране и за рубежом.

Е.А. Бектуровым внесен крупный вклад в развитие физической химии полимеров, создана широко известная в мире научная школа. Большое внимание Е.А. Бектуров уделяет подготовке высококвалифицированных кадров. Под его руководством защищено 35 кандидатских и 9 докторских диссертаций, в течение ряда лет прочитаны курсы лекций в Казахском и Вильнюсском университетах, Казахском химико-технологическом институте. Е.А. Бектуров – был членом специализированных Советов по защите докторских диссертаций, членом научно-консультативного совета журнала «Химия и технология воды» (Украина) и международного исследовательского совета Американского биографического Института (США).

Е.А. Бектуров неоднократно представлял казахстанскую науку за рубежом, выезжая для участия в качестве докладчика или члена оргкомитета в международных конференциях и симпозиумах, для чтения лекций и проведения совместных работ в ведущих научных центрах Японии, ФРГ, Чехии, Турции, Ирана, Голландии, Швейцарии, Италии, Канады.

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Е.А. Бектуров награжден медалями «За доблестный труд», «Ветеран Труда», «10 лет Конституции Республики Казахстан», «65, 70 и 75 лет Победы в Великой отечественной войне», а также грамотами Президиума АН КазССР.

Сердечно поздравляем Есена Абикеновича с юбилеем, желаем ему крепкого здоровья и дальнейших успехов.

МАЗМҰНЫ

Акурпекова А.К., Нефедов А.Н., Дәлелханұлы Ө., Тастемирова А.Т., Абильмагжанов А.З.
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