ЖАРАТЫЛЫСТАНУ ЖӘНЕ ГЕОГРАФИЯ ҒЫЛЫМДАРЫНЫҢ ӨЗЕКТІ МӘСЕЛЕЛЕРІ

АКТУАЛЬНЫЕ ПРОБЛЕМЫ ЕСТЕСТВЕННЫХ И ГЕОГРАФИЧЕСКИХ НАУК

ACTUAL PROBLEMS OF NATURAL AND GEOGRAPHICAL SCIENCES

https://doi.org/10.51889/3005-6217.2026.87.1.006

Azamatkyzy A., [1*] Samatova S.,[1] Kunasheva Z.[1]

[1]Makhambet Utemisov West Kazakhstan University, Uralsk, Kazakhstan
[*]e-mail: ayaulym.azamatqyzy@mail.ru

ANALYSIS OF THE ZHAIYK RIVER WATER QUALITY BASED ON HYDROCHEMICAL INDICATORS

Abstract

This study is devoted to the assessment of the ecological condition of the Zhaiyk River and provides a comprehensive analysis of the chemical composition of its natural waters. As one of the largest transboundary rivers in Eurasia, the Zhaiyk River has strategic importance for maintaining regional biodiversity and ensuring the sustainable development of adjacent territories. It serves as a crucial source of water for agriculture, industry, and domestic needs of the population in Kazakhstan and neighboring countries. The river's aquatic ecosystems provide habitats for numerous species of flora and fauna, including valuable commercial fish species.

In recent decades, the ecological state of the Zhaiyk River has raised serious concerns due to increasing anthropogenic pressure. The main sources of pollution include industrial discharges, agricultural runoff containing mineral fertilizers and pesticides, as well as urbanization and the growing volume of domestic wastewater. These factors negatively affect surface water quality and the overall condition of the river ecosystem.

The study is based on water sampling conducted at various sections along the river, followed by laboratory analysis of key physicochemical parameters. The analyzed indicators include pH levels, concentrations of major ions (calcium, magnesium, sodium, and chlorides), as well as the content of biogenic elements such as nitrates and phosphates. The results indicate an increase in pollution levels, particularly in areas located near industrial and agricultural zones. The study also examines potential ecological risks to aquatic organisms and human health. Based on the findings, recommendations are proposed to improve monitoring systems, promote rational water resource management, and preserve the ecological sustainability of the Zhaiyk River basin.

Keywords: Zhaiyk River, water quality, chemical composition, sodium, potassium, nitrate, ammonium nitrogen.

А.Азаматқызы,[1*] С.Т. Саматова,[1] З.Х. Кунашева[1]

[1]Махамбет Өтемісов атындағы Батыс Қазақстан университеті,
Орал қ., Қазақстан Республикасы
[*]e-mail: ayaulym.azamatqyzy@mail.ru

ЖАЙЫҚ ӨЗЕНІНІҢ СУ САПАСЫНЫҢ ГИДРОХИМИЯЛЫҚ КӨРСЕТКІШТЕРІНЕ НЕГІЗДЕЛГЕН ТАЛДАУ

Аңдатпа

Бұл зерттеу Жайық өзенінің экологиялық жағдайын бағалауға арналған және оның табиғи суларының химиялық құрамына жан-жақты талдау жасайды. Еуразиядағы ең ірі трансшекаралық өзендердің бірі ретінде Жайық өзені өңірлік биоалуантүрлілікті сақтау мен оған іргелес аумақтардың тұрақты дамуын қамтамасыз етуде стратегиялық маңызға ие. Өзен Қазақстан мен көршілес мемлекеттердің ауыл шаруашылығы, өнеркәсібі және халықтың тұрмыстық қажеттіліктері үшін маңызды су көзі болып табылады. Сонымен қатар, Жайық өзенінің су экожүйелері өсімдіктер мен жануарлардың көптеген түрлеріне, оның ішінде бағалы кәсіптік балық түрлеріне тіршілік ету ортасын қамтамасыз етеді.

Соңғы онжылдықтарда антропогендік жүктеменің артуына байланысты Жайық өзенінің экологиялық жағдайы елеулі алаңдаушылық тудырып отыр. Ластанудың негізгі көздеріне өнеркәсіптік ағынды сулар, құрамында минералды тыңайтқыштар мен пестицидтер бар ауыл шаруашылығы шайынды сулары, сондай-ақ урбанизацияның күшеюі мен тұрмыстық ағынды сулар көлемінің ұлғаюы жатады. Бұл факторлар жер үсті суларының сапасына және өзен экожүйесінің жалпы күйіне теріс әсер етеді.

Зерттеу өзеннің әртүрлі учаскелерінде су сынамаларын іріктеуге және негізгі физика-химиялық көрсеткіштерді зертханалық талдауға негізделген. Зерттелген параметрлерге pH деңгейі, негізгі иондардың (кальций, магний, натрий және хлоридтер) концентрациялары, сондай-ақ нитраттар мен фосфаттар сияқты биогендік элементтердің мөлшері кіреді. Алынған нәтижелер, әсіресе өнеркәсіптік және ауыл шаруашылығы аймақтарына жақын орналасқан учаскелерде, ластану деңгейінің артқанын көрсетеді. Зерттеу барысында су организмдері мен адам денсаулығына төнетін ықтимал экологиялық қауіптер де қарастырылды. Нәтижелер негізінде Жайық өзені алабының экологиялық тұрақтылығын сақтау, су ресурстарын ұтымды пайдалану және мониторинг жүйесін жетілдіру бойынша ұсыныстар берілді.

Түйін сөздер: Жайық өзені, су сапасы, химиялық құрам, натрий, калий, нитрат, аммоний азоты.

Азаматкызы А.,[1*] Саматова С.Т.,[1] Кунашева З.Х. [1]

[1]Западно-Казахстанский университет имени Махамбета Утемисова,
г.Уральск, Республика Казахстан
[*]e-mail: ayaulym.azamatqyzy@mail.ru

АНАЛИЗ КАЧЕСТВА ВОДЫ РЕКИ ЖАЙЫК НА ОСНОВЕ ГИДРОХИМИЧЕСКИХ ПОКАЗАТЕЛЕЙ

Аннотация

Данное исследование посвящено оценке экологического состояния реки Жайык и содержит развернутый анализ химического состава её природных вод. Являясь одной из крупнейших трансграничных рек Евразии, река Жайык имеет стратегическое значение для

поддержания регионального биоразнообразия и устойчивого развития прилегающих территорий. Она служит важнейшим источником водоснабжения для сельского хозяйства, промышленности и бытовых нужд населения Казахстана и соседних государств. Водные экосистемы реки обеспечивают среду обитания для множества видов флоры и фауны, включая ценные промысловые виды рыб.

В последние десятилетия экологическое состояние реки Жайык вызывает серьёзную обеспокоенность в связи с усилением антропогенного воздействия. Основными источниками загрязнения являются промышленные сбросы, сельскохозяйственные стоки, содержащие минеральные удобрения и пестициды, а также рост урбанизации и увеличение объёмов бытовых сточных вод. Эти факторы негативно отражаются на качестве поверхностных вод и общем состоянии экосистемы реки.

Исследование основано на отборе проб воды в различных участках течения реки с последующим лабораторным анализом основных физико-химических показателей. К числу исследуемых параметров относятся уровень pH, концентрации основных ионов (кальция, магния, натрия, хлоридов), а также содержание биогенных элементов, включая нитраты и фосфаты. Полученные результаты свидетельствуют о повышении уровня загрязнения, особенно в районах, расположенных вблизи промышленных и сельскохозяйственных зон. В работе также рассматриваются потенциальные экологические риски для водных организмов и здоровья населения. На основе полученных данных предложены рекомендации, направленные на совершенствование системы мониторинга, рациональное использование водных ресурсов и сохранение экологической устойчивости бассейна реки Жайык.

Ключевые слова: река Жайык, качество воды, химический состав, натрий, калий, нитрат, аммонийный азот.

Introduction. The Zhaiyk River is an important transboundary watercourse that is extensively utilized throughout its course by industrial and agricultural sectors in both the Russian Federation and the Republic of Kazakhstan. Intensive economic activity within the river basin has resulted in contamination of the Zhaiyk ecosystem by a broad spectrum of toxic substances. The growing imbalance between anthropogenic pressure on aquatic environments and their natural capacity for self-purification and ecological recovery has contributed to the progressive degradation of water ecosystems, including the ecological condition of the Zhaiyk River[1].

The Zhaiyk-Caspian basin plays an important role in the reproduction of sturgeon and semi-anadromous fish species and holds a leading position in Kazakhstan in terms of commercial fish harvesting. To assess the state of the ecosystem of the Ural-Caspian fishery water body and to forecast its future changes, it is necessary to analyze the influence of various factors on the formation of biological resources[2].

The hydrochemical regime of the Zhaiyk River is crucial for the functioning of aquatic organisms and also plays a significant role in the secondary pollution processes of the water body [3].

The water resources of the Zhaiyk-Caspian water management basin play a critical role as a primary source of water for a wide range of users and consumers. The main watercourse of the region is the Zhaiyk River, which flows through the territories of the Russian Federation and the Republic of Kazakhstan. Within Kazakhstan, the river is fed by several tributaries, the most significant of which are the Elek, Or, Shyngyrlau , Shagan, Embulatovka, and Rubezhka Rivers. In the western part of the region, the Chizha 1st, Chizha 2nd, Karaozen, and Saryozen Rivers flow southward. The catchment areas of the latter two are located in the Saratov region . In the southern part of the basin, the Oyyl, Sagiz, and Zhem Rivers flow. These rivers do not have permanent mouths and typically lose their water through filtration and evaporation in sandy soils. Remaining within the boundaries of the basin, the Zhaiyk River and its tributaries provide essential water resources to various sectors of the economy[4].

The main consumers of water from the Zhaiyk River are industrial enterprises, municipal utilities, and irrigated agriculture. Other users include river transport, the fisheries sector, and

organizations engaged in pasture irrigation. Industry and agriculture are the leading sectors in terms of water consumption, with average annual volumes of 95 million m³ and 81 million m³ (for irrigation alone) respectively during the period 2008-2014. Water-intensive and large-scale industries are primarily concentrated in the cities of Atyrau and Kulsary, as well as in the southern and southeastern oil and gas fields[5].

The main polluters of water resources in the West Kazakhstan region are industrial enterprises, public utilities, and pipeline transport companies that discharge wastewater into the environment. A major issue in the use of water resources is the physical deterioration of wastewater treatment facilities at enterprises that discharge effluents. In many economic entities, the treatment facilities and sewage systems were built in the 20th century and now require modernization and reconstruction[6].

The quality of water in the Zhaiyk River basin is determined by two factors – natural and anthropogenic. The natural background is influenced by local physical and geographical conditions: the diverse composition of rocks, the composition and properties of soils, the presence of karst formations, variations in the degree of natural flow regulation, and other factors. The anthropogenic background is caused by direct or indirect impacts on water resources[7,8].

Figure 1 – Hydrochemical sections on the ZhaiykRiver in the territory of Kazakhstan

Materials and methods

In the Kazakh part of the Zhaiyk River basin, there are four operating hydrological observation stations: Yanvartsevo, Kushum, Makhambet, and Atyrau. The Yanvartsevo station, located on the border between Kazakhstan and Russia, was established relatively recently, in 2009. This study makes use of data from this station.

Water samples were collected monthly from September 2024 to August 2025.

The samples were delivered to the laboratory under conditions that prevented any changes in the chemical composition of the water.

Laboratory analyses were carried out in accordance with GOST 26449.1–85 "Hydrochemistry. Water Sampling" and GOST 26449.2–85 "Hydrochemistry. Rules for Measuring Water Quality Parameters".

The concentrations of sodium, potassium, and nitrate ions were determined using the potentiometric method, while ammonium nitrogen was measured by the photocolorimetric method.

Potentiometric methods of analysis are those based on measuring the dependence of the equilibrium electrode potential on the activity of the ion being determined.

In electrochemistry, an electrode is defined as a system in which a conductor of the first kind (with electronic conductivity) is in contact with a conductor of the second kind – a solution, melt, or solid electrolyte that possesses ionic conductivity.

As a conductor of the first kind, one can use a solid metal (in the form of a plate, wire, or powder), a liquid metal (mercury, molten metals, or amalgams – mercury alloys), nonmetallic materials (such as carbon, graphite, etc.), and various compounds (such as oxides, carbides, and others)[9].

The basis of potentiometric measurements is the dependence of the equilibrium electrode potential on the activity of the ion being determined, which is described by the Nernst equation.

$$E_{Ox/Red} = E^{0}_{Ox/Red} + \frac{RT}{nF} \ln \frac{a_{Ox}}{a_{Red}} \quad (1)$$

The photocolorimetric method is based on determining the content of substances in solutions by measuring the absorption of non-monochromatic light radiation in the visible region of the spectrum.

Using this method, the concentration of the substance being analyzed in the solution can be determined from the intensity of the solution's color. The principle of the method is based on the property of colored solutions to absorb light of a certain wavelength as it passes through them. The decrease in light intensity when passing through a solution increases with the intensity of the solution's color and the thickness of the liquid layer it passes through.

These measurements are carried out using a special optical device called a photocolorimeter.

For photometric methods, it is extremely important to correctly choose the conditions for carrying out the chemical reaction that converts the analyte into a colored compound, as well as to understand the conditions under which light is absorbed by colored solutions[10].

The optical density can be determined using the Lambert–Beer law:

$$A = \lg \frac{I_0}{It} = k*l*c \quad (2)$$

Results

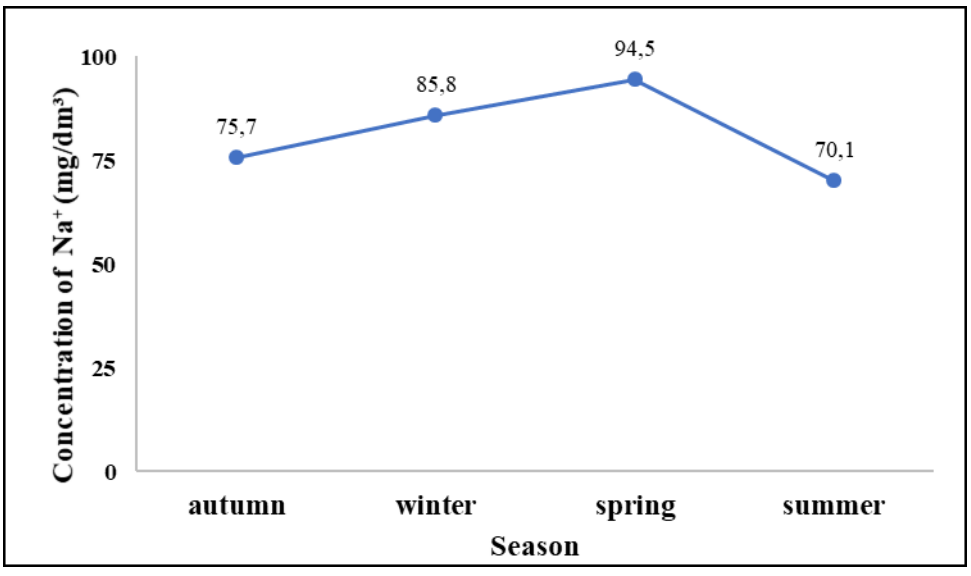

Figure 2 – Seasonal variations in sodium ion concentration

The sodium content in the water of the Zhaiyk River during 2024-2025 ranged from 66.7 to 95.8 mg/dm³, showing a distinct seasonal dynamic. The highest concentrations were observed in the winter–spring period (up to 95.8), while the lowest values occurred in summer (around 66-69). Such fluctuations are explained by both natural and anthropogenic factors. In winter and spring, the elevated sodium content is associated with reduced river discharge, weaker dilution, and the accumulation of ions in the water mass, as well as with the inflow of meltwater washing salts from the soil. In summer, the concentration decreases due to increased discharge and dilution of river water, as well as intensive biological uptake of ions during the vegetation period. Furthermore, sodium dynamics may also be influenced by human activities within the river basin, particularly the use of mineral fertilizers and wastewater discharge. Thus, the minimum values occur in summer, while the maximum concentrations are recorded in the winter–spring period, reflecting the natural seasonal characteristics of the Zhaiyk's hydrochemical regime.

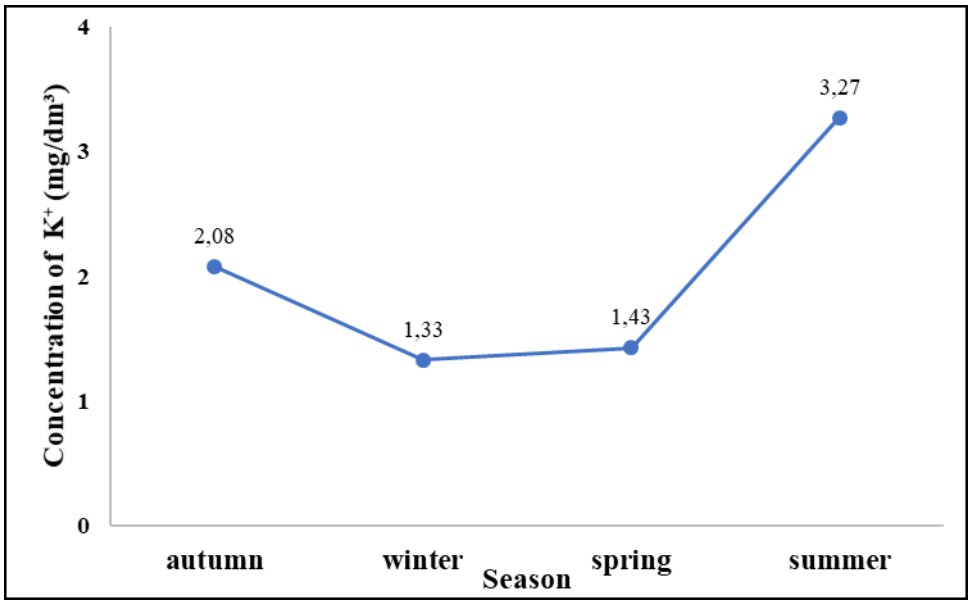

Figure 3 – Seasonal variations in potassium ion concentration

During 2024-2025, the potassium content in the water of the Zhaiyk River exhibited noticeable seasonal fluctuations. The lowest values were recorded in the winter–spring period (ranging from 1.2 to 1.5), whereas with the onset of the warm season, concentrations increased: in May there was a sharp rise to 4.4, in June – 3.7, in July – 3.2, and in August – 2.9. Thus, the minimum potassium concentrations are observed in the winter–spring period (1.2-1.5), while the maximum occurs in May (4.4). This indicates pronounced seasonal variations: a decrease during the cold season and an increase in the warm season, which is associated with rising temperatures, intensive evaporation, as well as the possible inflow of biogenic substances resulting from agricultural activities and surface runoff.

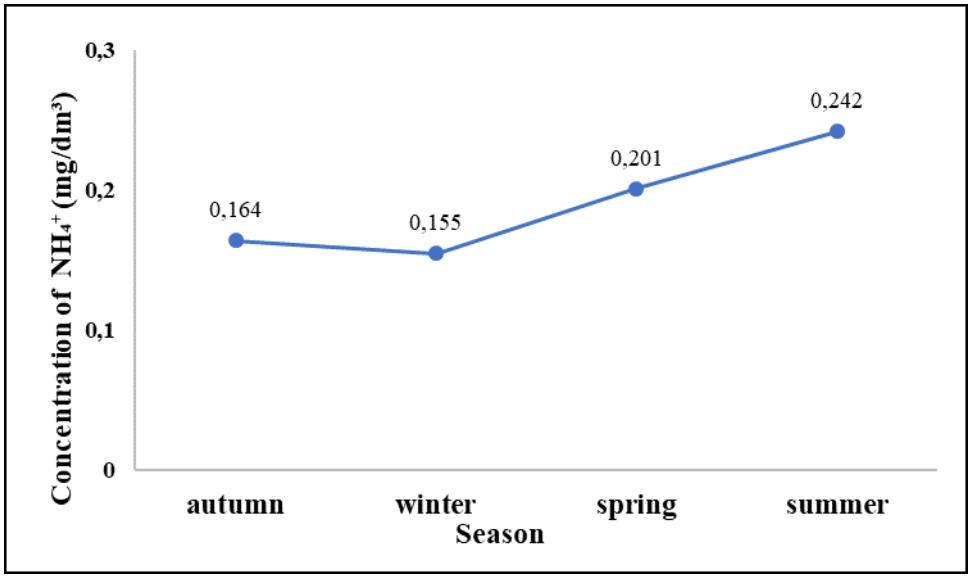

Figure 4 – Seasonal variations in ammonium nitrogen ion concentration

The content of ammonium nitrogen in the water of the Zhaiyk River in 2024-2025 ranged from 0.137 to 0.355 mg/dm³. The lowest values were recorded during the cold season (November-December and April), when concentrations were close to the minimum. With the onset of the warm season, a sharp increase was observed: in May the indicator more than doubled compared to the winter values, and in June it reached its maximum (0.355). During summer, a gradual decrease occurred, although the levels remained higher than in the cold period. This dynamic is associated with the intensification of biochemical processes and the decomposition of organic matter as water temperature rises, as well as with the possible input of nitrogen compounds from agricultural and domestic activities. Overall, minimum concentrations of ammonium nitrogen are typical for the winter–spring period, while maximum values are characteristic of summer.

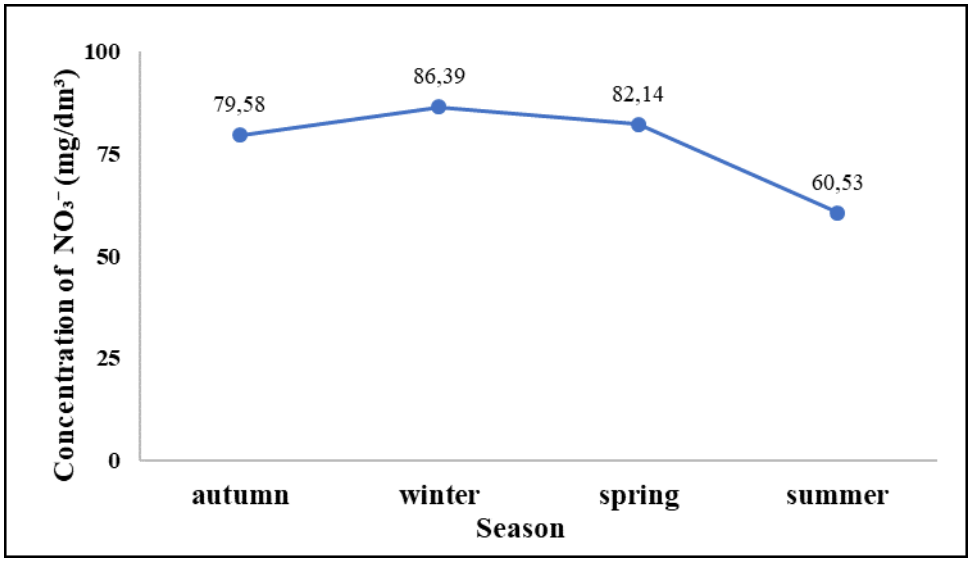

Figure 5 – Seasonal variations in nitrate ion concentration

In 2024-2025, the concentration of nitrates in the Zhaiyk River ranged from 51.8 to 94.8 mg/dm³. The highest values were recorded during the autumn–winter period – in October and February, the concentration exceeded 90 mg/dm³. The lowest values were observed in summer –

approximately 51-67 mg/dm³. In spring, nitrate levels remained moderate (77-87 mg/dm³) without sharp fluctuations. This dynamic is associated with seasonal processes: elevated nitrate content during the cold period is due to soil leaching and the inflow of meltwater, while the summer decrease is explained by river water dilution and the active biological uptake of nitrogen compounds. Overall, maximum concentrations are typical of autumn and winter, while minimum values are characteristic of summer. However, throughout the entire period, nitrate levels exceeded the maximum allowable concentration of 45 mg/ dm³, indicating a deterioration in water quality and raising environmental concerns.

Discussion. The results obtained for 2024-2025 indicate that the hydrochemical regime of the Zhaiyk River is characterized by pronounced seasonal variability, reflecting the combined influence of natural hydrological conditions and anthropogenic activities within the basin. Sodium concentrations were highest in the winter–spring period and lowest in summer, which is mainly explained by reduced river discharge, weaker dilution, and the accumulation of dissolved ions during the cold season, followed by dilution under higher summer flow conditions. In contrast, potassium showed an opposite trend, with minimum concentrations in winter-spring and a distinct increase during the warm season, likely due to intensified evaporation, surface runoff, and the inflow of potassium-containing compounds from agricultural lands.

Ammonium nitrogen also demonstrated clear seasonal variation, with low values during the cold period and a maximum in summer, which may be associated with intensified decomposition of organic matter, enhanced microbial activity at higher temperatures, and the possible input of nitrogen compounds from domestic and agricultural sources. Among all analyzed parameters, nitrates were of greatest environmental concern. Although their concentrations followed a typical seasonal pattern-higher in autumn-winter and lower in summer-their levels exceeded the maximum allowable concentration (45 mg/dm³) throughout the entire study period. This indicates persistent nitrogen pollution and suggests chronic anthropogenic loading, most likely related to agricultural runoff and wastewater discharge. Overall, the results confirm that the chemical composition of the Zhaiyk River is strongly controlled by seasonal processes, while anthropogenic pressure significantly contributes to nutrient enrichment and deterioration of water quality.

Conclusion. The Zhaiyk River plays a vital role in supporting both ecological balance and socio-economic development in the transboundary region shared by Kazakhstan and Russia. However, the growing anthropogenic pressure–primarily from industrial and agricultural sectors-has led to significant deterioration in the river's ecological state. Analysis of the river's hydrochemical parameters during 2024-2025 reveals distinct seasonal fluctuations in the concentrations of sodium, potassium, ammonium nitrogen, and nitrates, which reflect both natural processes and human-induced influences. Elevated pollutant levels during specific seasons indicate ongoing challenges related to wastewater discharge, fertilizer runoff, and reduced river flow, especially during winter and spring. These trends underscore the need for integrated water resource management, improved pollution control measures, and continuous monitoring to ensure the sustainable use and protection of the Zhaiyk River ecosystem for future generations. The obtained results also demonstrate that seasonal hydrochemical monitoring is essential for identifying periods of increased ecological risk and assessing the extent of anthropogenic influence on river water quality. Among the studied parameters, nitrate concentrations are of particular concern due to their consistently elevated levels, which may indicate chronic nutrient loading from agricultural and domestic sources. The observed fluctuations in sodium and potassium further confirm the strong dependence of the river's chemical composition on seasonal hydrological conditions and external pollutant inputs. In addition, the increase in ammonium nitrogen during the warm season suggests intensified biochemical processes and possible inflow of organic contaminants. These findings provide an important scientific basis for improving environmental monitoring programs and developing more effective management strategies for transboundary water resources.

References:

1. Kadimov E.L., Urazgaliyeva R.K., Sharipova O.A. Hydrochemical and toxicological characteristics of the Zhaiyk River within the Atyrau region // Khabarshysy – Bulletin of Atyrau State University named after Khalel Dosmukhamedov. – 2020. – No. 1(56). – P. 144-151.

2. Amirgaliyev N.A. K ekologo-toksikologicheskoyotsenkeUralo-Kaspiyskogobasseyna [On the ecological and toxicological assessment of the Ural-Caspian basin] // Tezisy I Mezhdunarodnoynauchno-prakticheskoykonferentsii «ProblemysokhraneniyaekosistemyKaspiya v usloviyakhosvoyeniyaneftegazovykhmestorozhdeniy» – Astrakhan, 16-18 fevralya 2005. – pp. 12-16.

3. Tulemisova, G.B., Abdinov, R.Sh., Kabdrakhimova, G.Zh., Zhanetov, T.B. Ekologicheskoe sostoyaniereki Ural [Ecological condition of the Ural River] // Vestnik Atyrauskogo gosudarstvennogo universiteta im. Kh. Dosmukhamedova [Bulletin of H. Dosmukhamedov Atyrau State University]. – 2017. – No. 3. – pp. 4-7.

4. Zhanabayeva, Zh.A., Musina, A.K., Aktymbayeva, A.A., Rysmagambetova, A.A., Narbayeva, K.T., Sarybayev, E.S., Akhmetova, R.E. Sovremennoe sostoyanie kachestva vody Zhaiyk-Kaspiyskogo basseina v Kazakhstane [Current state of water quality in the Zhaiyk-Caspian basin in Kazakhstan] // Vestnik Atyrauskogo gosudarstvennogo universiteta im. Kh. Dosmukhamedova [Bulletin of H.Dosmukhamedov Atyrau State University]. – Atyrau, 2024. – pp. 67-72.

5. Magritskiy, D.V., Efimova, L.E., Goncharov, A.V., Kenzhebayeva, A.Zh. Osobennosti sovremennogo vodopolzovaniya v nizhnemtechenii r. Ural, ego problemy i gidroekologicheskie posledstviya [Features of modern water use in the lower reaches of the Ural River, its problems and hydroecological consequences] // Vestnik Atyrauskogo gosudarstvennogo universiteta im. Kh.Dosmukhamedova [Bulletin of H. Dosmukhamedov Atyrau State University]. – Atyrau, 2022. – No. 2. – pp. 10-15.

6. Amirgaliev N., Madibekov A., Burlibaeva D., Musakulkizy A. Mnogoletnyaya dinamika mineralizatsiivodytransgranichnoyreki ZhayyknaterritoriiKazakhstana [Long-Term Dynamics of Water Mineralization of the Transboundary Zhayyk River in Kazakhstan] // Gidrometeorologiyaiekologiya. – 2025. – Vol. 117, No. 2. – P. 29-37.

7. Kozlova M.A., Sivokhip Z.T. Assessment of water quality dynamics in the transboundary basin of the Ural River / Water Sector of Russia: Problems, Technologies, Management. – 2022. – №6. – P. 107-119. – DOI: 10.35567/19994508_2022_6_7.

8. Zhalmagambetova U., Assanov D., Neftissov A., Biloshchytskyi A. Implications of Water Quality Index and Multivariate Statistics for Improved Environmental Regulation in the Irtysh River Basin (Kazakhstan) / Water. – 2024. – Vol. 16, No. 15. – P. 2-22. – Article 2203. – DOI: 10.3390/w16152203.

9. Lysova, S.S. Potentiometry. Potentiometric Titration / S.S. Lysova, T.A. Skripnikova, Yu.E. Zevatsky // Analytical Chemistry and Physico-Chemical Methods of Analysis. Physical Chemistry. – 2017. – P. 4-11.

10. Chakchir B. A., Alekseeva G. M. Fotometricheskie metody analiza: Metodi cheskieukazaniya [Photometric Methods of Analysis: Methodical Guidelines]. – SPb.: Izd-voSPKhFA, 2002. – 44 p.

Пайдаланылған әдебиеттер тізімі:

1. Кадимов Е.Л., Уразгалиева Р.К., Шарипова О.А. Гидрохимическая и токсикологическая характеристика реки Жайык в пределах Атырауской области // Хабаршысы – Вестник Атырауского государственного университета имени Халела Досмухамедова. – 2020. – №1(56). – С. 144-151.

2. Амиргалиев Н.А. К эколого-токсикологической оценке Урало-Каспийского бассейна // Проблемы сохранения экосистемы Каспия в условиях освоения нефтегазовых месторождений: тезисы I Междунар. науч.-практ. конф. (Астрахань, 16-18 февраля 2005 г.). – Астрахань, 2005. – С. 12-16.

3. Тулемисова Г.Б., Абдинов Р.Ш., Кабдрахимова Г.Ж., Жанетов Т.Б. Экологическое состояние реки Урал // Вестник Атырауского государственного университета им. Х.Досмухамедова. – 2017. – №3. – С. 4-7.

4. Жанабаева Ж.., Мусина А.К., Актымбаева А.А., Рысмагамбетова А.А., Нарбаева К.Т., Сарыбаев Е.С., Ахметова Р.Е. Современное состояние качества воды Жайык-Каспийского бассейна в Казахстане // Вестник Атырауского государственного университета им. Х.Досмухамедова. – Атырау, 2024. – С. 67-72.

5. Магрицкий Д.В., Ефимова Л.Е., Гончаров А.В., Кенжебаева А.Ж. Особенности современного водопользования в нижнем течении р. Урал, его проблемы и гидроэкологические последствия // Вестник Атырауского государственного университета им. Х. Досмухамедова. – 2022. – №2. – С. 10-15.

6. Amirgaliev N., Madibekov A., Burlibaeva D., Musakulkizy A. Mnogoletnyay adinamika mineralizatsii vody transgranichnoy reki Zhayyknaterritorii Kazakhstana // Gidrometeorologiya i ekologiya. – 2025. – Vol. 117, №2. – P. 29-37.

7. Kozlova M. A., Sivokhip Z. T. Assessment of water quality dynamics in the transboundary basin of the Ural River // Water Sector of Russia: Problems, Technologies, Management. – 2022. – №6. – P. 107-119. – DOI: 10.35567/19994508_2022_6_7.

8. Zhalmagambetova U., Assanov D., Neftissov A., Biloshchytskyi A. Implications of Water Quality Index and Multivariate Statistics for Improved Environmental Regulation in the Irtysh River Basin (Kazakhstan) // Water. – 2024. – Vol. 16, №15. – P. 2-22. – Art. 2203. – DOI: 10.3390/w16152203.

9. Lysova S.S., Skripnikova T.A., Zevatsky Yu.E. Potentiometry. Potentiometric titration // Analytical chemistry and physico-chemical methods of analysis. Physicalchemistry. – 2017. – P. 4-11.

10. Чакчир Б. А., Алексеева Г. М. Фотометрические методы анализа: методические указания. – СПб.: Изд-во СПХФА, 2002. – 44 с.

ҒТАМР 68.37.07 https://doi.org/10.51889/3005-6217.2026.87.1.007

Г.С. Уйкасова

№4 орта мектеп, Алматы обл, Қазақстан
e-mail: kamekova.gulnur@mail.ru

ROSACEA ТҰҚЫМДАСЫ ЖЕМІС АҒАШТАРЫНЫҢ БІТЕЛЕРІ

Аңдатпа

Мақалада Қазақстандағы жеміс ағаштарының негізгі зиянкестерінің бірі – өсімдік биттерінің (Aphididae) биологиялық ерекшеліктері, таралу заңдылықтары және олардың климаттық өзгерістерге бейімделу механизмдері қарастырылады. Қазақстандағы жеміс ағаштарының 90%-дан астамы алма (Malus), алмұрт (Pyrus), шие (Prunus), алхоры (Prunus), өрік (Armeniaca) және шабдалы (Amygdalus) дақылдарынан тұрады. Бұл өсімдіктердің барлығы Раушангүлділер (Rosaceae) тұқымдасына жатады. Соңғы жылдары климаттың өзгеруіне байланысты зиянкестер құрамы өзгеріп, олардың популяциясы мен даму кезеңдері артып келеді. Зерттеу фитосанитариялық мониторинг әдістеріне негізделіп жүргізілді. Зиянкестердің таралуын болжау, олардың санын бақылау және қорғау шараларын қолдану арқылы интеграцияланған өсімдіктерді қорғау жүйесін жетілдіру жолдары қарастырылады. Зерттеу барысында Раушангүлділер тұқымдасының ағаштектес өсімдіктеріндегі өсімдік биттерін өңдеу барысында Aphididae тұқымдасына жататын 2 тұқымдас астының 20 туысынан тұратын өсімдік биттернің 51 түрлері табылды. Зерттеу жұмыстар нәтижесінде Eriosomatinae тұқымдасастынан 4 туыс, 5 түр, ал Aphidinae тұқымдасастына 14 туыс, 46 түр белгілі болды. Раушангүлділер тұқымдасының ағаштектес өсімдіктерінен яғни, алма, алмұрт,