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ASSESSMENT OF THE WATER QUALITY OF THE BIG ALMATY RIVER IN THE INFLUENCE ZONE OF ALMATY BY MICROBIOLOGICAL INDICATORS

Abstract. The article presents data on discharges of pollutants into surface water bodies of Almaty region. It has been shown that large volumes of discharges of insufficiently treated wastewater degrade the ecological state of river ecosystems and reduce the quality of natural water. The purpose of the study was to assess the water quality of the Big Almaty River in the influence zone of Almaty by microbiological indicators. The results of physicochemical as well as microbiological analyses of the Big Almaty River water are presented. As a result of the studies, the dependence of the number of common saprophytic bacteria, common coliform bacteria and coliphages on the chemical composition of water, hydrological and weather conditions was revealed. A comparative analysis of water quality in the upper and lower reaches of the Big Almaty River was carried out. A positive correlation was found between the number of saprophytic bacteria and water levels, between saprophytic bacteria and water flow rates, saprophytic bacteria and precipitation levels. A reproducible increase in the number of coliphages in the subglacial period has been established. A negative correlation was found between the number of coliphages and mineralization, the number of coliphages and water temperature. The results obtained can form the basis of the information base for making decisions on the implementation of environmental protection measures aimed at reducing the level of pollution of water bodies.

Keywords: water quality, surface water bodies, water pollution, river, microbiological indicators, hydrochemical indicators.

Introduction.

Of the surface water bodies, rivers are most often used for the purpose of water supply. In Kazakhstan, 30% of all water supplied by water pipelines does not meet sanitary standards. One of the reasons for this situation is the low quality of surface water bodies [1]. The quality of water supplied for water supply should comply with the sanitary and epidemiological requirements established by regulatory legal acts in the field of sanitary and epidemiological well-being of the population [2].

Only 58% of the surface waters of Kazakhstan are formed on the territory of the Republic, the rest come from the territory of neighboring states. A number of water bodies of the country faced a deterioration in water quality. According to the results of observations for 2021, the quality of water in 32 water bodies is classified as poor class, and in 28 water bodies it is classified as the worst class [1].

Given the danger of microbiological contamination of surface water sources for both drinking and cultural purposes, strengthening control over the quality of surface water is of particular relevance.

Almaty city is provided with water from 4 main sources: the Big and Small Almaty rivers, as well as from underground water intakes of the Almaty and Talgar fields [2].

Over the past decades, the pace of construction of residential facilities without developed communal infrastructure has intensified in the Big Almaty River zone. Along the Big Almaty River there are hundreds of buildings that do not comply with environmental standards, construction is carried out in violation of the country's legislation, which makes it relevant to conduct comprehensive monitoring of the Big Almaty River ecosystem [3].

The development of industry and communal services in the city led to an increase not only in water consumption, but also in water disposal. Large volumes of discharges of insufficiently treated wastewater impair the ecological state of river ecosystems and reduce the quality of natural water. In this regard, a comprehensive study of microbiological indicators of river water quality in zone of influence of a large industrial center, as well as factors affecting microorganisms in the ecological system of the Big Almaty River, is relevant.

The purpose and objectives of the work:

- assessment of water quality of the Big Almaty River in the influence zone of Almaty by microbiological indicators;
- identify the dependence of the number of common saprophytic bacteria, common coliform bacteria and coliphages on the chemical composition of water, hydrological and weather conditions;
- conduct a comparative analysis of water quality in the studied flows of the Big Almaty River.

Research objects and methods

Object of research: the Big Almaty River, flowing through the territory of Almaty city and the Almaty region. Big Almaty River is a right-bank tributary of the Kaskelen River, the length of the watercourse is 96 km, and the catchment area is 425 km^2. Like all rivers of Almaty city, Big Almaty River is a mountain river; according to the type of nutrition and runoff, a merger of three currents flowing under the front is formed - two powerful moraines of glaciers. The river basin is located in different zones - mountain, flat and transitional foothill. The Big Almaty River is affected by surface runoff from utilities, industrial enterprises, wastewater from horticultural associations, storm runoff from urban areas, as well as a significant recreational load.

In recent years, the waters of the river from the category of “very clean” have moved to the category of “moderately polluted,” which indicates the impact of constant anthropogenic load on the watercourse and the loss of the river ecosystem’s ability to self-clean [4-5].

Studies of the waters of the Big Almaty River were carried out from February to May 2023 in accordance with ST RK ISO 5667-6-2017 “Water quality. Sampling. Part 6. Guidelines for Sampling from Rivers and Watercourses.” All analyses were carried out in accordance with ST RK 3468-2019 “Methods of sanitary and microbiological analysis of surface water bodies” [6].

The work was carried out in the laboratory of the Department of Chemistry, Chemical Technology and Ecology, microbiological analyzes of the samples were carried out in the accredited testing laboratory of Almaty Technological University Research Institute of Food Safety.

Samples were taken for microbiological studies (total number of saprophytes, total coliform bacteria and coliphages) - in the upper (Bostandyk district of Almaty) and lower (Alatau district of Almaty) currents of the Big Almaty River. Samples were taken from the surface horizon (depth 15 cm) at 9 a.m. Table 1 presents the sampling setpoints.

Table 1 - Sampling

Denomination	Main objects of anthropogenic impact
1 sample. On the borders of Bostandyk and Auezov districts, above Satpayev street	Garden associations, urbanized territories of Almaty city
2 sample. In Alatau district, below Zhanaarka street	Industrial zone

Research methods

For water sampling, both reusable and disposable sterile dishes are used. Reusable is made of materials that withstand dry heat and autoclaving. Water intake containers are closed with tight plugs and a protective cap made of foil or thick paper.

Microbiological parameters of water quality were determined in the samples.

From open water bodies, samples are usually taken from a depth of 10-15 cm from the surface, and from shallow water sources - at a level of 10-15 cm from the bottom.

Microbiological indicators. Total saprophytic bacteria were determined by seeding on fish-peptone nutrient agar, with an incubation period of 24 hours, at a temperature of 37°C; total coliform bacteria (TCB) were determined by the titration method, with growth on lactose-peptone medium (incubation for 24 hours, at a temperature of 37°C), seeding on Endo agar (incubation for 24 hours, at a temperature of 37°C) and passage into Giss medium with lactose (incubation for 24 hours, at a temperature of 37°C); coliphages were determined by the titration method, with growing on meat-peptone broth with washing off the E. coli K 12 + strr culture (incubation for 24 hours, at a temperature of 37°C), seeding on nutrient agar with washing off the E. coli K 12 + strr culture (incubation for 24 hours, at a temperature of 37°C).

All microbiological indicators were determined according to the methods recommended by ST RK 3468-2019 “Methods of sanitary and microbiological analysis of surface water bodies” [6-7].

Results and discussions

Microbiological indicators

General saprophytic bacteria is one of the laboratory sanitary and hygienic indicators indicating the “total number of microbes” in 1 ml of river water, 1 g of soil or 1 m of air grown on fish-peptonnomagar in 24 hours at a temperature of 37 °C. The composition of saprophytic bacteria with these characteristics is extremely numerous and diverse, but taxonomic groups are not determined, since the purpose of this analysis is to determine the “total number of microbes.” Saprophytic bacteria are extremely widely present in the surface layer of soil and water in bodies of water rich in organic matter. The microbial population of wastewater is also huge, which causes the constant decomposition of the components of these waters [8-11].

The dynamics of saprophytic microorganisms during the studied period in the investigated flows of the Big Almaty River in the zone of influence of Almaty is presented in Table 2.

The distribution of saprophytic bacteria between February and May 2023 can be characterized as dynamic. A significant variation in the number of saprophytic bacteria relative to the average value per month indicates unpredictable changes associated with the processes of channel deformations or with anthropogenic impact.

Monitoring of observations and studies performed using a single methodology, taking into account the analysis of comparable time periods from February to May 2023 (in the context of each month), climatic factors, unauthorized discharges, and other conditions, made it possible to determine the dynamics and draw conclusions for each month of observations (Table 2).

Table 2 - Change in the number of saprophytic microorganisms in the Big Almaty River in influence zone of Almaty city

Period (month)	Количество сапрофитных бактерий (КОЕ/1 мл) по месяцам	
	Sample 1 (On the borders of Bostandyk and Auezov districts, below Satpayev street)	Sample 2 (In Alatau district, below Zhanaarka street)
February	60	50
March	270	190
April	290	330
May	370	340

The results of studies in the context of each month showed the following.

In the upper studied course at the borders of Bostandyk and Auezov districts, below Satpayev Street, the concentration of saprophytic bacteria in the ice period (from February to March) averaged 55 KOYe/1 ml, the limits of fluctuations in the content of saprophytes are also not large, which is explained by the lack of soil and pollution in the water, since the river mirror is covered with ice.

In March, there was an increase in the concentration of saprophytic bacteria by almost five times and amounted to 270 KOYe/1 ml, which was a high indicator, as in April. In March, the number and size of margins increases and with meltwater there is an active flow of soils and pollutants into the river. In April, the concentration of saprophytic bacteria practically does not change compared to March. This is due to a slight change in the water level during the month. If the difference in water levels in the river in

March was 403 cm, then in April only - 150 cm, therefore, the bulk of soils and pollutants with flood waters arrived in March and April.

In May, the concentration of saprophytic bacteria increases one and a half times, compared with April. This is due to the ingress of soils and pollutants with flood waters.

Thus, based on the results of monitoring the entire study period from February to May, it follows that the number of saprophytic bacteria increased in March, April and May.

In the lower studied course in the Alatau region, above Zhanaarka Street in February, the concentration of saprophytic bacteria is not large and is equal to 50 KOYe/1 ml, which is explained by the lack of soil and pollution in the water, since the river mirror is almost covered with ice. However, in March, there is a fourfold increase in concentration - 190 KOYe/1 ml, compared to February, which indicates the ingress of pollutants into non-large edges formed closer to the beginning of the month. In April, the number and size of the edges increases, ice drift begins and with meltwater there is an active flow of soils and pollutants into the river, as evidenced by a further increase in the concentration of saprophytic bacteria compared to the ice period in February and March. In May, the concentration of saprophytic bacteria practically does not change, which is also associated with an increase in the active intake of soils and pollutants.

To assess the impact of water quality, a comparison was made of the number of saprophytic bacteria in the two studied river flows.

In February, the content of saprophytic bacteria of the upper studied course slightly exceeds the content of saprophytic bacteria of the lower studied course of the river, this is due to the flow of wastewater. In March, the content of saprophytic bacteria of the upper reaches of the river exceeds the content of saprophytic bacteria of the lower reaches of the river, which is explained by the ingress of a large number of humic pollutants into the water during channel deformations. In May, the content of saprophytic bacteria of the upper reaches of the river slightly exceeded the content of saprophytic bacteria of the lower reaches of the river, which is explained by the ingress of a large amount of humic pollutants from flood and rainwater.

Common coliform bacteria

Common coliform bacteria, being the most important indicator of water quality, carry information about pollution of the reservoir due to economic activities. The results of monitoring the change in the number of total coliform bacteria in the studied flows from February to May 2023 are presented (Table 3).

Table 3 - Change in the number of total coliform bacteria in the waters of Big Almaty River in in influence zone of Almaty city

Coliform count (KOYe/100 mL) by month		
Period (month)	Sample 1 (On the borders of Bostandyk and Auezov districts, below Satpayev street)	Sample 2 (In Alatau district, below Zhanaarka street)
February	20	30
March	22	25
April	21	19
May	35	37

The results of studies in the context of each month showed the following.

High concentrations of coliform bacteria and large ranges of fluctuations in their number indicate large volumes of discharge, concentrated household wastewater. In the upper studied course of the river in February, the number of coliform bacteria is low and the limits of fluctuations in the numerosity of the studied period (from February to May) are also small. Throughout the flood period (March, April), the concentration of coliform bacteria is quite stable and indicates the entry of pollutants from the entire surface of the catchment with melt and flood waters, including from filtration fields where partially treated household wastewater is transported. In May, there is an increase in water content, but the concentration of coliform bacteria does not decrease, which is associated with an increase in the intake of pollutants, including wastewater.

During the entire observed period, the number of coliform bacteria and the limits of fluctuations in their number are not significant, which indicates the absence of the influence of domestic wastewater. During the studied period of the upper course of the river, the number of coliform bacteria remains stable, which is explained by the high quality of wastewater treatment.

In the lower studied course, the number of total coliform bacteria is unstable. Despite the ingress of pollutants from the catchment surface into the rims of ice on the river in February, the increase in the number of coliform bacteria is associated with the discharge of untreated wastewater. In March and April, the number of total coliform bacteria compared to the previous month (February) is significantly lower, which is associated either with a decrease in wastewater volumes or with an improvement in the quality of wastewater treatment.

In May, due to the highest levels and discharges of water for the entire study period and the ingress of pollution from the entire surface of the catchment, a jump in the number of coliform bacteria is due compared to the previous period. Thus, pollution of the river with domestic wastewater occurred practically throughout the entire observed period. However, the most critical was May, when the numbers of coliform bacteria were exceeded.

To assess the influence of water quality, a comparison of the number of coliform bacteria in the two studied river reaches was made. Thus, the number of common coliform bacteria below the city indicates that the main pollution of the river by the sewage waters of industrial utilities in the city occurred in May.

Coliphage

When assessing the ecological state of rivers, the study of water pollution by coliphages is of great practical importance, since they indicate long-term water pollution by household wastewater (Table 4) [12].

Table 4 - Change in the number of coliphages in the waters of Big Almaty River in influence zone of Almaty city

Coliphages (BOYe/100 mL) by month		
Period (month)	Sample 1 (On the borders of Bostandyk and Auezov districts, below Satpayev street)	Sample 2 (In Alatau district, below Zhanaarka street)
February	5	9
March	1	3
April	3	2
May	15	11

In February, the number of coliphages of the lower reaches of the river slightly exceeded the number of bacteria of the upper reaches of the river, which is associated with the discharge of wastewater of the upper course of the river under study.

In March and April, the number of coliphages of the upper and lower reaches of the river practically does not differ, which indicates insignificant inflows of pollutants throughout the river. In May, water levels increase, and there is an increase in coliphages in the upper studied reaches of the river, which is associated with both dilution and an increase in wastewater inflows. In the lower reaches in May, water with a large number of coliphages, from the area of the upper studied reaches passing downstream, is diluted, which leads to a decrease in the number of coliphages of the lower reaches of the river.

Thus, the change in the number of coliphages in the water area of the river does not depend on weather conditions, but varies depending on the volume and amount of wastewater from both city enterprises and settlements located in the area of the studied reaches. However, the highest concentrations of coliphages of both the upper and lower reaches of the river were recorded in February, which is associated with low water temperature, high concentration of dissolved oxygen and high mineralization, as well as in May, due to an increase in water content in the Big Almaty River.

Correlation analysis revealed a direct relationship between the concentration of coliphages and mineralization (k = 0.74); between the concentration of coliphages and the amount of dissolved oxygen (k = 0.81). The inverse relationship between the concentration of coliphages and water temperature (к = - 0.89) (Table 5). This can be explained by the following reasons: an increase in the concentration of E. coli, in the cells of which this virus multiplies; increasing the concentration of potassium and magnesium ions required for phage adsorption; slowing down the process of self-purification of water.

Table 5 - Significant rank correlation coefficients between microbiological indicators of water quality and weather conditions

Indicators/ weather conditions	Water temperature	Water levels	Water discharges	Precipitates levels
Saprof. bacteria	0,40	0,72*	0,69*	0,61*
Common Coliphoras. bacteria	-0,11	-0,42	-0,40	-0,21
Coliphages	-0,89*	-0,29	-0,39	-0,34

- links to reproducible characteristics noted.

Hydrochemical indicators

In the course of the work, a comprehensive study of the following hydrochemical indicators of water was carried out: temperature, value of pH, suspended solids, mineralization and hardness. Hydrochemical indicators of the water quality of the Big Almaty River were determined by laboratory methods, subject to the rules for sampling and storage of samples.

Water temperature is an indicator that largely determines the nature of hydrochemical and hydrobiological processes, and can be considered as an indicator of anthropogenic impact on the river system, especially in the period with negative air temperature [13]. The water temperature in the Big Almaty River will not change during the ice period - 0.1°C (from February to March), when unstable ice cover is observed on the river. In April, with an increase in air temperature to an average of 5-10°C and the development of the flood process, the water temperature increases to 3°C. In May, in the last phases of the flood and a gradual increase in air temperature to 20-25°C, the water temperature is 10-15°C (Figure 1).

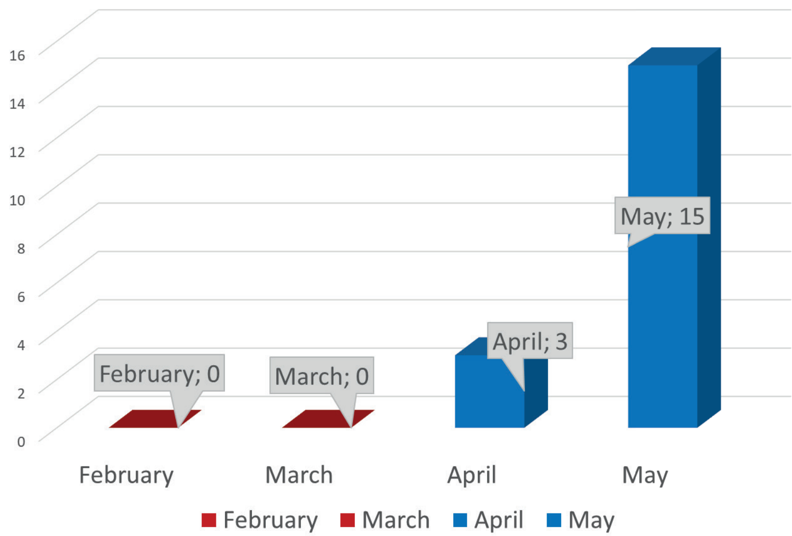

Figure 1 - Change in water temperature in Big Almaty River in the studied reaches from February to May 2023 (averaged values)

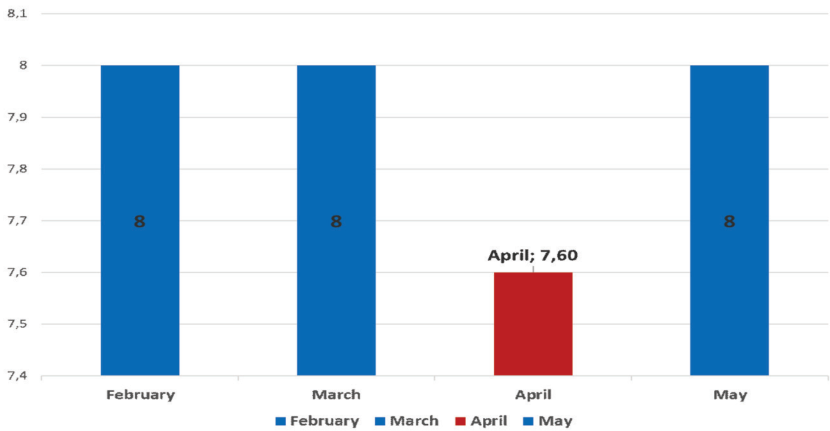

Figure 2 - Change in pH in Big Almaty River from February to May 2023 in the studied reaches (averaged values)

Thus, the pH during the entire study period (from February to May) varies slightly – 7.6-8.2 pH units and is determined by the hydrological and hydrochemical regimes of the river and weather conditions in the river basin (Figure 2).

Suspended solids. In river water in the upper studied reaches, the content of suspended matter in the subglacial period is not large: in February - at the limit of detection, in March - there is a slight increase in the concentration of suspended matter, which is associated with the ingress of pollutants from meltwater during the pre-flood period, which is characterized by minimal discharges and their gradual increase. In April, there is a sharp increase in the concentration of suspended solids - 15 times, which is associated with the intake of pollutants with the flow of melt water. In May, which is characterized by a gradual decrease in flood flows, the concentration of suspended solids also decreases.

To assess the impact of water quality, the concentrations of chemical contaminants of the upper and lower studied reaches were compared.

Thus, the content of suspended solids in the river water in the upper studied reaches in February, when the river mirror is partially covered with ice, is at the limit of detection: during the flood period, the concentration increases sharply, which is associated with the ingress of pollutants from the entire surface of the catchment with meltwater.

In the lower studied reaches, in February, the concentration of suspended solids was below the detection limit (Table 6). In March, there is a sharp rise in concentration below the city - 10 times, which is associated with wastewater discharges. Since water consumption in March is small, even discharges of small volumes of polluted wastewater could give such a sharp increase.

Table 6 - Change in suspended solids content (mg/dm^3) in the upper and lower studied reaches in the period from February to May 2023 in Big Almaty River

Sampling point	February	March	April	May
Sample 1 (On the borders of Bostandyk and Auezov districts, below Satpayev street)	>3	9	68	70
Sample 2 In Alatau district, below Zhanaarka street	>3	90	76	59

In April, the concentrations of the upper and lower studied reaches of the river practically do not differ, which is due to the influx of a large amount of suspended solids both in the upper studied reaches and in the lower one with melt waters. In May, the concentration of suspended solids is 21 mg/dm higher, which is associated with the arrival of a large number of suspended solids from the catchment surface.

Thus, the concentration of suspended solids for the entire study period (from February to May) in the lower study reaches significantly exceeds the concentration of substances of the upper study reaches of the river in March.

Mineralization. In the pre-flood period, when the flow is just beginning to form, mineralization practically does not change (Table 7). A slight increase in discharges at the beginning of the flood (early April), due to snow melting, does not lead to a decrease in mineralization, since the discharges have changed slightly, and the flow of pollutants from the entire surface of the catchment is active. In May, mineralization decreases by 44%, which is associated with an intensive increase in river discharges due to the flow of melt water.

Table 7 - Mineralization change (mg/dm³) in the upper and lower studied reaches in the period from February to May 2023 in Big Almaty River

Sampling point	February	March	April	May
Sample 1 (On the borders of Bostandyk and Auezov districts, below Satpayev street)	166	168	174	95
Sample 2 In Alatau district, below Zhanaarka street	210	194	178	78

The correlation analysis revealed a negative relationship between mineralization and water levels (k = -0.70), between mineralization and water flow rates (k = -0.67). Thus, mineralization has a pronounced seasonal character. During the flood period, when the flow rates reach maximum values, the concentration of mineral salts is the lowest. Since the content of mineral salts in the Big Almaty River does not exceed 200 mg/dm^3, the river waters are low-mineralized.

To assess the impact of water quality, the concentrations of chemical pollutants of the upper and lower reaches were compared.

Mineralization in the lower studied reaches on average exceeds mineralization in the upper studied reaches by 30 mg/dm^3. Thus, the difference in mineralization concentration indicates the influence of wastewater from urban enterprises. In April, the concentration in the reaches above and below the city practically does not differ, which is associated both with the influx of pollutants from the entire surface of the catchment of the upper and lower studied river reaches in the city, and with an increase in water content. The water level in April was exceeded, which caused a large dilution of wastewater. In May, water levels and discharges continue to increase, but the difference in concentrations also continues to increase, and averages 19 mg/dm^3, which indicates the flow of various mineral salts with the city's wastewater.

Thus, the mineralization of the lower studied reaches of the river increased significantly in the ice period, when the levels and discharges are not great.

Hardness. Similar dynamics has hardness. The increase in hardness concentration is confined to the subglacial period, which is associated with low flow rates (Table 8). Minimum concentrations are observed in the spring flood period, which is associated with an increase in river discharge.

Table 8 - Change in hardness concentration (mgeq/dm^3) in the upper and lower studied reaches in the period from February to May 2023 in Big Almaty River

Sampling point	February	March	April	May
Sample 1 (On the borders of Bostandyk and Auezov districts, below Satpayev street)	2,9	2,9	1,6	1,6
Sample 2 In Alatau district, below Zhanaarka street	3,4	3,4	1,6	1,7

During the subglacial period, hardness downstream of the river increases by 16%. During the flood period, with an increase in water content, there is practically no difference in the concentration of hardness in the upper and lower reaches under study.

Thus, the hardness of the water in the river below the city during the ice period, when the levels and discharges are not large, differs significantly from the hardness of the upper studied river reaches, on average by 20%, which indicates the flow of calcium and magnesium salts of wastewater from urban enterprises. However, no significant differences in the concentrations of hardness of the upper and lower studied reaches were found during the study period.

It has been established that the waters in the Big Almaty River in the upper studied reaches are low-mineralized and soft. The increase in mineralization and hardness concentration is confined to the period when the river discharges are not high. It was established that over the entire period of the study from February to May, the concentrations of hydrochemical pollutants did not increase evenly in the lower studied reaches of the river.

The concentration of suspended solids in the lower studied reaches gradually increased, from 25% to 33%. The hardness did not change throughout the study period of the lower river reaches.

Conclusions

The results of studies of the water quality of the Big Almaty River on microbiological indicators in the upper studied reaches revealed a 3.5 times increase in the number of saprophytic bacteria in the ice-free period, reproduced in the context of the studied period (from February to May 2023), compared to the ice-free period, due to changes in weather conditions;

A positive correlation was found between the number of saprophytic bacteria and water levels, between saprophytic bacteria and water discharges, saprophytic bacteria and precipitation levels;

There was no seasonal cyclical change in the number of total coliform bacteria. The high variability in the number of total coliform bacteria in the water of the Big Almaty River in the area of the upper studied reaches indicates the random nature of the intake of household wastewater above the city;

A reproducible increase in the number of coliphages in the subglacial period has been established;

A negative correlation between coliphage abundance and mineralization, coliphage abundance and water temperature was found;

During the study period, a steady increase in the number of total coliform bacteria of the lower reaches of the river was established, which is associated with insufficient treatment of wastewater from municipal treatment facilities;

A 10 times decrease in the number of total coliform bacteria of the lower reaches of the river during the study period has been established, which is most likely associated with the reconstruction carried out at the treatment facilities.

References

1 (ECE) Project: Kazakhstan - Targets to the Protocol on Water and Health of the Convention on the Protection and Use of Transboundary Watercourses and International Lakes, 2017. - 52 p.

2 SN RK 4.01-03-2013 "External networks and structures of water supply and sewerage"

3 «El.kz» News agency https://el.kz/ru/ Water shortage in Kazakhstan, art. June 17, 2022.

4 Wikipedia is a free encyclopedia. https://ru.wikipedia.org/ Alma-Ata and Almaty region, 2022

5 *Chigrinets A.G., Mazur L.P., Rachenkov M.N., Ismailov S.M.* Discharge and channel water balance of small rivers of Almaty within the city territory//Vestnik KazNU. Ser. geographer. – 2013. – No2. - p. 56-70. [In Russian]

6 ST RK 3468-2019 "Methods of sanitary and microbiological analysis of surface water bodies"

7 ST RK 3468-2019 Nature protection. Methods of sanitary and microbiological analysis of surface water bodies

8 *Zakharova N.G., Vershinina V.I., Ilyinskaya O.N.* Short course on microbiology, virology and immunology / Kazan: 2015. -799 p. [In Russian]

9 Handbook of Water Purity and Quality (Second Edition) Chapter 8 – Microbiological threats to water quality Lawrence B. Cahoon, 2021. p. 179-198

10 Assessment of the water quality of Oued El Kell by physicochemical and bacteriological approach, // volume 45, Part 8 // Abba El Hasan a d, Ajiyel Halim b, Zine Nasser Eddine b, IdrissiImame a, AinaneTariKa, El Yaacoubi Adnanea, BenKaddourRachid, MerimiImane, 2021, p.7511-7516

11 *Ivchatov A.L., Malov V.I.* Water chemistry and microbiology. Textbook M. Infra-M 2015. - 224 p. [In Russian]

12 ST RK ISO 5667-6-2017 "Water quality. Sampling. Part 6. Guidelines for Sampling from Rivers and Watercourses"

13 *Nikanorov A.M., Khoruzhaya T.A. & Mironova T.V.* Analysis of the effect of megalopolises on water quality in surface water bodies by ecological-toxicological characteristics, , 2011. – p. 621–628

14 *Bogatov V.V., Fedorovsky A.S.* Fundamentals of river hydrology and hydrobiology. - Vladivostok: Dalnauka, 2017. - 384 p. [In Russian]

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АЛМАТЫ Қ. ЫҚПАЛ ЕТУ АЙМАҒЫНДАҒЫ «ҮЛКЕН АЛМАТЫ» ӨЗЕН СУЫНЫҢ МИКРОБИОЛОГИЯЛЫҚ КӨРСЕТКІШТЕР БОЙЫНША САПАСЫН БАҒАЛАУ

Түіндеме. Өзен экожүйелерінің экологиялық жағдайын көп мөлшерде тазартылмаған ағынды сулар нашарлатады және табиғи өзен суларының сапасын төмендетеді. Зерттеудің мақсаты Алматы қаласындағы әсер ету аймағындағы Үлкен Алматы өзен суының микробиологиялық көрсеткіштер бойынша сапасын бағалау. Үлкен Алматы өзен суының физика-химиялық, сондай-ақ микробиологиялық талдауларының нәтижелері ұсынылған. Зерттеулер нәтижесінде химиялық судың құрамында жалпы сапрофитті бактериялар, колиформды бактериялар мен колифагтар саны, гидрологиялық және ауа райы жағдайларына тәуелділігі анықталды. Үлкен Алматы өзенінің жоғарғы және төменгі ағысындағы судың сапасына салыстырмалы талдау жүргізілді. Сапрофитті бактериялар саны мен су деңгейі, сапрофитті бактериялар мен су шығыны, сапрофитті бактериялар мен жауын-шашын деңгейі бір-бірімен байланысқан оң корреляциялық байланыс болып табылды. Мұз асты кезеңінде колифагтардың санының көбеюі анықталды. Колифагтардың саны мен судың минералдануы, колифагтардың саны мен судың температурасы арасындағы теріс корреляциялық байланыс анықталды. Алынған нәтижелер су нысандарының ластану деңгейін төмендетуге бағытталған, табиғатты қорғау іс-шараларын іске асыру бойынша шешімдер қабылдау үшін ақпараттық базаның негізінен алынуы мүмкін.
Түйінді сөздер: су сапасы, жерүсті сулары, судың ластануы, өзен, микробиологиялық көрсеткіштер, гидрохимиялық көрсеткіштер.

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ОЦЕНКА КАЧЕСТВА ВОДЫ РЕКИ «БОЛЬШАЯ АЛМАТИНКА» В ЗОНЕ ВЛИЯНИЯ г. АЛМАТЫ ПО МИКРОБИОЛОГИЧЕСКИМ ПОКАЗАТЕЛЯМ

Аннотация. В статье представлены данные по сбросам загрязняющих веществ в поверхностные водоемы Алматинской области. Показано, что большие объемы сбросов недостаточно очищенных сточных вод ухудшают экологическое состояние речных экосистем и снижают качество природных вод. Целью исследования явилась оценка качества воды р. Большая Алматинка в зоне влияния г. Алматы по микробиологическим показателям. Представлены результаты физико-химических, а также микробиологических анализов воды р. Большая Алматинка. В результате проведенных исследований выявлена

зависимость численности общих сапрофитных бактерий, общих колиформных бактерий и колифагов от химического состава воды, гидрологических и погодных условий. Проведен сравнительный анализ качества воды в верхнем и нижнем течениях р. Большая Алматинка. Обнаружена положительная корреляционная связь между количеством сапрофитных бактерий и уровнями воды, между сапрофитными бактериями и расходами воды, сапрофитными бактериями и уровнем осадков. Установлено воспроизводимое увеличение численности колифагов в подледный период. Обнаружена отрицательная корреляционная связь между численностью колифагов и минерализацией, численностью колифагов и температурой воды. Полученные результаты могут быть положены в основу информационной базы для принятия решений по реализации природоохранных мероприятий, направленных на снижение уровня загрязнения водных объектов.
Ключевые слова: качество воды, поверхностные водоемы, загрязнение воды, река, микробиологические показатели, гидрохимические показатели.

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