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ASSESSMENT OF CHANGES IN SEASONAL DYNAMICS OF WATER QUALITY OF THE SYRDARYA RIVER IN WINTER

Malokhat A. Mirzakarimova [1], Islam A. Usmanov [2], Amangul Zh. Kurbanbaeva [3], Larisa G. Tetyukhina [4]

1 Doctor of Biological Sciences, Senior Researcher, Head of the Laboratory of Hygiene of Water, Soil, Atmospheric Air and Sanitary Microbiology of the Research Institute of Sanitation, Hygiene and Occupational Diseases, Tashkent, Uzbekistan

2 Doctor of Medical Sciences, Senior Researcher, Leading Specialist of the Research Institute of Sanitation, Hygiene and Occupational Diseases, Tashkent, Uzbekistan
E-mail: islamabbasovich@gmail.com

3 Senior Researcher, Research Institute of Sanitation, Hygiene and Occupational Diseases, Tashkent, Uzbekistan
E-mail: amangulkurbanbaeva2@gmail.com

4 Chemist, laboratory assistant at the Research Institute of Sanitation, Hygiene and Occupational Diseases, Tashkent, Uzbekistan

ABSTRACT

The article presents information on the water quality of the Syrdarya river in the winter of 2023 according to organoleptic and chemical indicators. The analyses of the selected water samples were carried out in accordance with the water quality standard for water supply sources UzSSt 951. It was found that, according to organoleptic and chemical indicators, the water quality of the Syrdarya river in the studied areas of water use by the population meets the imposed hygienic requirements. However, the indicators of total hardness and mineralization (based on dry residue) of the Syrdarya river water in the initial sections exceed the established hygienic standards.

Key words: Syrdarya river, water quality Syrdarya, domestic and drinking water use, wastewater, population.

INTRODUCTION

Water is a key element of the natural environment and plays a vital role in life on the planet. Issues related to water resources and their quality, as well as the importance of these resources for the economy and the functioning of ecosystems, are becoming increasingly important both at the level of individual countries and globally. For Uzbekistan, located in a region with low natural moisture, water is of particular value [1, 2].

The water resources of the middle reaches of the Syrdarya river are of great social and economic importance, contributing to the development of both industrial and agricultural production. They also provide the population with the necessary water resources for drinking and household needs [3, 4, 5].

Proper management of water resources in this region is essential for sustainable development and improving the quality of life of local residents.

As is known, the hydrochemical regime of the middle reaches of the Syrdarya river basin is formed under the influence of the Naryn and Kashkadarya rivers , and is largely determined by the discharge of highly mineralized collector-drainage waters into the river, collected from the irrigated areas of the Fergana Valley. In the Bekabad region, the main tributaries of the Syrdarya river, up to the Shardarya reservoir, are the Akhangaran and Chirchik rivers. These waterways, in addition to their natural waters, also carry filtration liquids from industrial landfills, as well as wastewater generated during the economic activities of the Angren-Almalyk industrial complex. They are joined by discharges from municipal and industrial enterprises located in the cities of Gazalkent, Chirchik, Tashkent, Yangiyul and Chinaz. As a result, the key factors contributing to the pollution of water bodies in the Syrdarya river basin are Industrie sowie various public utilities, as well as wastewater from collectors and drainage systems, including discharges from farming and agricultural activities [6, 7, 8, 9].

At the same time, studies devoted to assessing the quality of water in the Syrdarya river and its compliance with hygienic requirements are rare [10]. The water resources of the Syrdarya river, as is known, are the only sources of household and drinking and cultural and domestic water use for the population.

The aim of the study was to conduct a hygienic assessment of the quality of water in the Syrdarya river used for domestic and drinking water supply of the population.

Material and methods of the research

In December 2023, water samples were taken from the Syrdarya river in areas where local residents use water resources. Samples were taken at the following sites: section No. 1 was located 100 meters from the confluence of the Chirchik and Syrdarya rivers, section No. 2 was located directly at the junction, section No. 3 was 150 meters downstream, section No. 4 was 1 kilometer after the confluence of the Chirchik, created by No. 5 was 2 kilometers away, and section No. 6 was 3 kilometers from the Riverside recreation area.

Sampling was carried out from each of the six sections at a distance of at least 1.5 meters from the shore and at a depth of up to 20 centimeters. Water quality analysis was carried out in accordance with the UzSSt 951 standard, which establishes hygienic and technical requirements for sources of centralized domestic and drinking water supply and the rules for their selection.

RESULTS AND DISCUSSION

The level regime of natural water bodies in the republic, as in the whole world, is subject to uncontrolled seasonal, long-term and secular fluctuations. As for seasonal changes, they are most often represented by floods in the spring, evaporation from the water surface and diversion for irrigation in the summer.

In the winter period of the year, we studied the Syrdarya river water for the first time. The water level in the river increased significantly due to heavy rains and snow in the mountainous areas. The approach to the sections marked for the study was difficult due to the strong waterlogging of the sampling points.

It was found that at a temperature of 20-24^{0}C, the water from all six sites had no odor. When heated to 60^{0}C, the water had a weak but distinct earthy odor, which distinguished it from the other samples taken.

In appearance, the water being tested was very turbid, clayey-loess in color. The height of the water column from section No. 1 was 7.5 cm, had a turbidity of 0.121 mg/dm3, No. 2 was 4 cm with a turbidity of 0.041 mg/dm^3.

The most transparent water was from section No. 6 with a water column height of 19 cm and a turbidity of 0.012 mg/dm^3, after filtration by color, the cleanest water was from section No. 6 and had a color of 3.040.

Water from site No. 1 had a color of 24.6^0. Water samples from other points had a color from 11^0 to 18^0.

The changes in the hydrogen index were insignificant, from 7.69 at section No. 2 to 7.49 at section No. 5. The values of total water mineralization (based on dry residue) at sections No. 1 and No. 2 of the Syrdarya river exceed the established standards and amount to 1084.9 and 1087.4 mg/dm^3 (the standard is 1000 mg/dm^3) respectively.

In various places of the Syrdarya river, the level of water mineralization corresponded to the established sanitary standards. A similar pattern is observed in relation to the general hardness index. In section No. 1, the general water hardness was 10.97 mg- eq/dm^3, while in section No. 2 it was equal to 10.50 mg- eq/dm^3, with an acceptable standard of 1000 mg - eq/dm^3.

The concentrations of calcium in the studied areas of the Syrdarya river ranged from 63.1 to 164.3 mg/dm^3 and magnesium from 20.7 to 49.9, respectively, but did not exceed the standard values.

Carbonate hardness was also reduced, but insignificantly and no significant difference was observed between sampling points 3.34÷4.34 mg- eq/dm3. The content of carbonate ions in water from the last sections (No. 5 and No. 6) was reduced by 6 times, while in sections No. 1 - No. 4 only by 3 times. Some reduction in the content of bicarbonates in water was noted at points No. 1, 2, 3, 4, 5, while in water from point No. 6 an increase in the content of hydrocarbonates by 5% was observed.

During the winter season, a change in chloride concentration was noted. At sites No. 1 and 2, this indicator decreased by 21% and 24%, respectively. At the same time, sites No. 3 and 4 showed a more significant decrease - by 73% and 78%. Sites No. 5 and 6 also demonstrated a noticeable decrease in chloride content, amounting to 67%.

A 10-fold decrease in the concentration of sulfates in the water of sections No. 1 and 2 was established compared to sections No. 3, 4, 5, 6.

Changes in the content of phosphorus compounds (phosphate ion) in water are of a special nature. In section No. 1, an increase in the content of phosphates in water by 8.3 times was noted, which amounted to 0.976 mg/l. In the second section of the reservoir, the content of phosphates decreased by 1.7 times, and in the third, fourth, fifth and sixth sections, a decrease in the concentration of phosphate ion was noted, respectively, by 2.6; 5.2; 5.7 and 28.6 times.

Data on permanganate oxidizability of water in winter at the sites under study indicate that the reservoir is not significantly polluted with organic substances. This is especially evident at sites 3 and 6, where the oxidizability level was 0.69 and 0.94 mgO/dm^3, respectively. Such conclusions are confirmed by analyses of the content of ammonium, nitrites and nitrates in water, carried out at the specified sites. The concentrations of these substances are within the established standards, indicating the purity of the water body and the absence of significant anthropogenic impacts. This allows us to conclude that the condition of the water under study complies with environmental standards and does not require additional measures to improve quality. The survey results emphasize the importance of preserving this water resource and further monitoring its condition to prevent possible pollution in the future.

Concentrations of total iron in river water in the winter period in all studied sections of the Syrdarya river do not exceed hygienic standards and amount to 0.036-0.131 mg/dm^3 (tables 1, 2).

CONCLUSIONS

1. Results of a study of the water level in the Syrdarya river during the winter period show significant changes in the chemical composition, which allows for a more detailed understanding of the ecosystem of this reservoir. Analysis of samples from six sites revealed both positive and negative trends, including a snake-like split in chloride and sulfate concentrations, which may indicate temporary natural fluctuations.

2. The detected excess of total mineralization and water hardness (sections No. 1 and No. 2) requires further monitoring, however, in general, all the samples examined comply with sanitary standards. The decrease in the content of organic pollutants and the absence of significant anthropogenic impacts indicate a good condition of the reservoir in winter conditions.

3. This work emphasizes the need for regular monitoring of water quality and awareness of possible pollution threats. Maintaining the cleanliness of the Syrdarya river is an important task for both the region's ecosystem and the health of the population, which requires joint efforts of science and society.

Table 1

Comparative characteristics of organoleptic and physical indicators water quality of the Syrdarya river in winter (n = 6)

No.	Smell / points		Transparency, cm	Turbidity, mg/dm3	particles, mg/dm^3	Color, degrees	Sampling temperature, ^0C	pH	EU м/cm	Dry residue, mg/dm^3
	20^0C	60^0C								
1	0	0.5	7.5	0.121	120.57	24.6	10.8^0	7.67	1181	1084.9
2	0	0.5	4.0	0,041	41,44	18.45	10.6^0	7.69	1190.6	1087.4
3	0	0	7.5	0.091	90.55	10.76	11^0	7.57	509.7	314.2
4	0	0	7.0	0.096	96.48	12.3	10.8^0	7.58	509,0	402.5
5	0	0	12.0	0.088	88.24	15.36	10.8^0	7.49	445,0	296.6
6	0	0	19.0	0,012	11.57	3.04	10.6^0	7.63	526.3	342.5

Table 2

Comparative characteristics of chemical indicators water quality of the Syrdarya river in winter (n = 6)

No.	Chlorides (Cl^-) mg/dm3	BY mg atomic O/dm^3	Rigidity $mg\text{-}eq/dm^3$		Calcium (Ca^{++}) mg / dm3	Magnesium (Mg^{++}) mg/dm^3	Carbonates (CO^-_3) mg/dm^3	Hydrocarbonates (HCO_3^-) mg- eq / dm3	Sulfates (SO^-_4) mg/dm^3	Phosphates (RO^-_4) mg/dm^3	Nitrites (NO^-_2) mg/dm^3	Nitrates (NO^-_3) mg/dm^3	Ammonium (NH^+_4) mg/dm^3	Iron general (Fe) mg/dm^3
			general	carbonate										
1	57.8	1.31	10.97	3.76	164.3	33.7	55.5	218.7	211.2	0.976	0.0155	1.33	0.435	0.095
2	58.5	1.54	10.50	3.54	128.3	49.9	48.0	205.9	225.8	0.121	0,0110	1.75	0.360	0.131
3	20.2	0.94	4.8	3.55	62.1	20.7	52.5	205.9	42.0	0,021	0,0510	6.05	1,325	0.036
4	16.2	1.01	4.53	3.56	56.1	21.0	55.5	205.9	45.6	0.033	0,0520	6.40	0.529	0.036
5	25.0	1.01	3.95	3.34	44.1	21.3	33.0	196.7	34.4	0.024	0,0411	5.15	0.360	0,060
6	25.0	0.69	5.23	4.34	63.1	25.3	25.5	259.3	51.6	0,007	0,0013	2.15	0.303	0.048

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