The Dynamics Are Changes In Organoleptic Parameters And Chemical Composition Of Amudarya River Water

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Abstract: The distributions of chemical elements in surface waters are determined by their prevalence in the Earth's crust and their solubility in water. The complexity of the chemical composition of surface water bodies are determined by the presence in them of a large number of chemical elements and the diversity of their compounds, as well as by the different content of each of them, which varies in different types of waters, which is associated with the peculiarities of conditions of their formation Aim:To study and assess the dynamics of changes in the chemical composition of water samples from the Amudarya River.
Materials and methods. The water intake point was located in Olotsky district of Bukhara region, 110 km from Bukhara city on the bank the Amu-Bukhara canal the Amudaryariver. To determine organoleptic characteristics, chemical composition, and

mineralization of water, water samples were taken in compliance with all official requirements [9, 10]. The studies were carried out during the last 5 years (2015-2019) and primary and repeated studies were conducted every 2 years.

Results.It was found that during the period of observation, all indicators, and components affecting organoleptic properties of Amudarya River water - iron, manganese, copper, zinc, fluorine, SSFA, polyphosphates were within the norm, except for the content of petroleum products and BOC5, which were above the upper limits of the norm in some samples. But this increase in the standard is of random nature and does not reflect the true state of water quality of the AmudaryaRiver at the point of water intake.

Conclusions.It was found that organoleptic indices and some indicators of water mineralization, as well as ammonia nitrogen, nitrite nitrogen, nitrate nitrogen, sulfate, chlorides in samples of Amudarya River water in primary and repeated studies was mainly within the normative values (O'zDSt 950-2011). The absence of nitrites indicates that there is no fresh contamination of the studied water body. It is proved that no increase in inorganic concentrations (aluminum, beryllium, arsenic, mercury, lead, etc.) were found in samples of Amudarya River water in comparison with normal values, but some parameters of toxic chemical elements (calcium) remain stably high for the whole period of observation. It is established that according to these studied parameters the studied water is suitable for use by the population for household and cultural and domestic purposes, but when providing the population with drinking water, it is necessary to keep in mind the constantly increased content of water salinity (calcium).
Key words: dichlorodymethyltetramethane, dichlorodiphenyldichloromethyl methane, ichlorodiphenylldichloroethylene,Amudaryariver, BOC-biochemical oxygen consumption,SSFA-synthetic surfactants,mineralisation

1. INTRODUCTION

Surface water resources in Uzbekistan are quite diverse. There are large and small rivers flowing through the territory of the country. Besides rivers, there are hydrotechnical constructions used for household, irrigation, energy, and other purposes. The largest rivers used for the water supply of the country and water use of population are Amudarya and Syrdarya [1, 8].

The Amudarya originates at the confluence of the Panj and Vakhsh rivers. Apart from Panj and Vakhsh, the main tributaries are include Surkhandarya and Kafirnigan. The former tributary of Zeravshan no longer flows into Amudarya. The average annual flow of the Amu Darya basin is about 78 km³. The Amudarya delta suffers from reduced runoff and poor quality water resources that have a negative impact on ecosystems. Reduced runoff of the Amudarya caused by the withdrawal and discharge of river water exacerbates problems related to water quality[4].

Factors negatively affecting the water quality of the Amudaryainclude: domestic waste disposal sites; return water from irrigation systems; insufficient capacity of sewerage networks; floods, mudflows, earthquakes; floods and landslides, coastal erosion and land degradation; flow regulation of the river that changes its regime and others [3, 4].

The chemical composition of surface water bodies is a set of dissolved mineral and organic substances in different states. About 80 of 87 stable chemical elements installed in the Earth's crust were found in open reservoirs [6, 7, 12].

The distributions of chemical elements in surface waters are determined by their prevalence in the Earth's crust and their solubility in water. The complexity of the chemical composition of surface water bodies are determined by the presence in them of a large number of chemical elements and the diversity of their compounds, as well as by the different

content of each of them, which varies in different types of waters, which is associated with the peculiarities of conditions of their formation [2, 6, 8, 11].

Drinking water for the population and used for various purposes from open and closed reservoirs in our republic are regulated by O'zDSt (SSRUzb), SanPiN and other normative and methodological documents of the Republic of Uzbekistan [5, 9, 10].

2. MATERIALS AND METHODS

The water intake point was located in Olotsky district of Bukhara region, 110 km from Bukhara city on the bank the Amu-Bukhara canal the Amudaryariver. To determine organoleptic characteristics, chemical composition, and mineralization of water, water samples were taken in compliance with all official requirements [9, 10]. The studies were carried out during the last 5 years (2015-2019) and primary and repeated studies were conducted every 2 years.

Water sampling was carried out in the same conditions. Samples transportation was carried out traditionally. During transportation, attention was paid to the protection of samples from physical (direct sunlight, high temperature, mechanical effects), chemical (ingress of various natural and artificial pollutants) and biological factors (ingress of pathogenic, conditionally pathogenic and saprophytic microflora from the external environment).

Organoleptic methods and photometric methods were used to determine taste, odor, chromaticity, and turbidity. The determination of total hardness is based onformation of a strong complex compound of trillion "B" with calcium and magnesium ions. The definition was performed by titration in the presence of an appropriate indicator. The dry residue was determined by the weight method. Determination of sulfate content by the complexometric method is based on the deposition of SO2-4 ions in an acidic medium by barium chloride in the form of barium sulfate, followed by its dissolution in the titrated solution of trillion "B" with reverse titration by magnesium chloride solution in the presence of the corresponding indicator. The chlorine ion content in water was determined by titration with nitric acid mercury in the presence of biphenylcarbazone indicator. The method for determining nitrates is based on the reaction of nitrates with sodium salicylic acid in the presence of sulfuric acid with the formation of nitrosalicyl salt. Determination of nitrate-nitrogen was conducted colorimetric method using sulfonyl acid and α-naphthylamine.

Methods for determining total iron based on the interaction in a highly acidic environment of oxide iron and rhodanide with the formation of a red-colored complex compound of rhodium iron. Quaternary ammonium was determined by the chemical method with Nessler solution and QUANTOFIX QUIT test strips (Germany). The determination of polyphosphates was performed by the colorimetric method. Toxic chemical elements were determined on the basis of Methodical instructions 8m/254-2011 approved by the Ministry of Health of the Republic of Uzbekistan with the help of Optima 2100 DV optical emission spectrometer with inductively coupled argon plasma (OES ICP) Perkin Elmer (Germany).

3. RESULTS

The results of the primary study show that some organoleptic indicators of Amudarya River water are close to drinking water (the selected standard is O'zDSt 950-2011). The results of the odor and hydrogen index (pH) were within the norm, only chromaticity 2 times, and turbidity 4.3 times higher than the selected norm
(Table 1).

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The total mineralization or dry residue in our primary studies was at the normal level, amounting to 433.6 mg/dm3 (0.43 MAC) against 1000 mg/dm3 in the selected standard.

In terms of permanganate oxidation the values were also within the normative values (0.42 MPC) - 2.09 mgO2/dm3 in the studied water against 5.0 mgO2/dm3 in O'zDSt 950-2011.

The total hardness of the water we studied (5.0 mg-eqv/dm3- 0.71 MPC) was within the normal values (normal 7 mg-eqv/dm3).

The chloride content in drinking water was normalized within 250-350 mg/dm3 (O'zDSt 950-2011). Chloride detectability in studied water samples averaged 109.5 mg/dm3 (0.44 MPC), which is 2.3 times lower than the permissible concentration.

Sulfates in drinking water are normally allowed up to 400 mg/dm3 (O'zDSt 950-2011). Sulfate content in water samples we studied was 183.9 mg/dm3 (0.46 MPC), which is 2.2 times slower than the norm.

Nitrates in drinking water are allowed up to 45 mg/dm3 (O'zDSt 950-2011). In the conducted primary studies, in samples of water from the Amudarya River, they were released in low amounts (on average 14.0 mg/dm3 - 0.31 MPC).

The presence of large amounts of nitrate nitrogen or nitrite in the water may indicate fresh contamination with nitrogen-containing organic substances. In our studies, nitrites from the water samples were determined in low amounts (0.041 mg/dm3, 0.014 MPC) and several dozen times lower than normal values (normal to 3.0 mg/dm3).

Comparative results of primary and repeated studies show that in primary studies chromaticity and turbidity parameters were 2.0 and 4.3 times higher respectively, while other organoleptic and water salinity parameters were within the normal range. The results of repeated trials differed in that almost all indicators were within the normal MPC values.

Thus, the results obtained show that the organoleptic indices and some parameters of water mineralization studied by us, as well as ammonia nitrogen, nitrate nitrogen, nitrate nitrogen, sulfate, and chlorides in water samples of the Amudarya River at the point of water intake were mainly within the normal values (O'zDSt 950-2011). The absence of nitrites indicates that there is no fresh contamination of the Amudarya River.

Further studies were devoted to studying the chemical composition of the water under study.

Obtained results of primary researches show that the content of chemicals in samples of Amudarya river water at the point of water intake was within normal values.

The results of repeated studies show that the content of chemicals in samples of Amudarya River water was within normal values (Table 2).

According to the standard, iron content in water samples should not exceed 0.3 mg/dm3. In the water samples under study, the iron content was established at the standard level (0,3 mg/dm3), making 1,0 MPC.

Determination of manganese, copper, and zinc content showed that they were not found in the water under study, although the standard allows a certain amount of them in the water samples - respectively up to 0.1 mg/dm3, 1,0 mg/dm^{3}и 3,0 mg/dm^3 (0,43 MPC).

The results obtained allow us to conclude that the parameters of these chemical elements in the investigated water samples were in the norm according to O'zDSt 950-2011.

Fluorine content according to the standard is allowed up to 0.7 mg/dm3, and in our investigations the content of this element in water, samples were 0.3 mg/dm3 (0.43 MPC), which is within the limits of the selected standard.

The content of oil products and anionic synthetic surfactants (SSFA) are also important parameters of the quality of the tested water, so they are standardized in O'zDSt 950-2011.

The results of repeated studies show that the content of SanR&N in the tested water samples was 0.11 mg/dm3 (0.22MPC), which is within the standard (up to 0.5 mg/dm3).

But parameters of oil products in the water samples under study were sharply increased up to 1.77 mg/dm3, though the norm up to 0.1 mg/dm3 is 17.7 MPC. It should be emphasized that the repeated analysis of water samples from the same point after 1 week showed the opposite result, i.e. the obtained repeated result was equal to 0.1 mg/dm3, which is within the norm. The increased parameter in the first sample study seems to be connected with single contamination of the water of the investigated reservoir and accidental ingress of oil products into the reservoir water area.

Polyphosphates are one, two, and three substituted compounds of phosphoric acid, up to 3.5 mg/dm3 are allowed in water according to the standard. The number of polyphosphates in water samples was relatively low (2.7 mgR/dm3 - 0.77 MPC).

In addition, the biochemical oxygen consumption (BOC) of water for 5 days (BOC 5) was slightly increased to 4.0 mgO2/dm3 (1.3 MPC), while the norm was 3.0 mgO2/dm3. This seems to be due to the water sampling site (water intake point), which has a high degree of siltation, a large number of reeds, and marshy banks. We are convinced that if the water intake meets modern requirements, the described parameter will be at the level of the norm. Our beliefs are supported by the results of numerous studies of BOC5 and BOC 20 previously conducted by domestic researchers in the water of the Amudarya River and reservoirs in Uzbekistan [1, 2, 3, 5, 8], where all the above parameters were within the standard.

These parameters, except for petroleum products, SSFA, BOC 5 were studied in primary studies from the same water sampling point. In those studies, all the results were also within the norm. It means that there were no natural or artificial factors having a negative impact on these parameters during this past time.

We also studied the content of inorganic components in water samples from this water source. According to the indicators of inorganic components, the studied water is considered safe and can be recommended for use by the population for household and cultural purposes.

Besides, 19 parameters of salts of heavy metals and other elements in samples, the water of Amudarya River were determined, 4 (21,05%) of these 19 parameters were not found, 15 (78,95%) parameters were within the normative values for drinking water. Only 2 parameters were found in noticeably large amounts - calcium 2,4526 mg/dm3 and sodium 3,2056 mg/dm3. This increase indicates an increased content of these elements in water samples of the investigated river.

We have conducted repeated studies to study the content of inorganic components, as well as salts of heavy metals and toxic elements in water samples of this water source. The results obtained are given in Table 3.The results obtained show that the content of all the above inorganic components (chemical elements) were within the standard or were not detected at all. The given data indicate that in terms of the content of these parameters of water samples the quality of the examined water meets the standards adopted in the Republic of Uzbekistan (O'zDSt 950-2011 and O'zDSt 951-2011).

Out of 12 parameters 8 (66,67%) were not detected, and the remaining 4 (33,33%) were at the boundary of normal values. The same results, corresponding to water quality standards, were obtained as a result of primary studies, which indicates no changes in these parameters in the dynamics of studies within several years.

At the same time, there were also conducted studies on the content of toxic chemical elements, the definition of which is not obligatory according to O'zDSt 950-2011 (Table 4), but are of great importance for determining the quality of the studied water samples from various sources, including surface water bodies (Amudarya River).Table 4

Out of 13 indicators, 5 (38.46%) were not detected in 7 (53.85%) parameters. The analysis shows that high calcium content (67,2187 mg/dm3) was found in the water samples under study.

Such a high content of calcium in the studied water, apparently, is connected with constant high mineralization of water of water bodies of Uzbekistan, including the Amudarya River.

In our previous studies, we obtained close to today's indicators, and then we noted increased content of calcium (2,4526 mg/dm3) and sodium (3,2056 mg/dm3) in the studied water. If, over time, the sodium content has decreased to the standard level, the calcium content has remained high to date.

It is established that according to these studied parameters water is suitable for use by the population for domestic and cultural purposes, but when providing a population with drinking water it is necessary to keep in mind constantly increased content of water salinity (calcium).

The next stage of research was the study of pesticide content in studied water. This definition was carried out by traditional methods (MU №012-3/0010 and MU №012-3/0012 - gas chromatographic method) based on SanPiN RU "Hygienic norms of pesticides in environmental objects and food products". The residual content of α-, β- and γ-isomers of hexachlorocyclohexane (HChCH), dichlorodymethyltetramethane (DDT), and its metabolites (DDD, DDE) was determined.

The above-mentioned pesticides were not found in primary and repeated studies, so the absence of pesticides in the water of the studied reservoir is constant and stable. According to these indicators, water meets all requirements of O'zDSt 950-2011.

The obtained data allowed to unify the methodology of determining the chemical composition of samples of Amudarya River water and assess the efficiency of water use in this reservoir for household and cultural and domestic needs of the population. In addition, the results of these studies make it possible to monitor water quality and improve water use efficiency and safety.

4. CONCLUSIONS.

1. It was found that organoleptic indices and some indicators of water mineralization, as well as ammonia nitrogen, nitrite nitrogen, nitrate nitrogen, sulfate, chlorides in samples of Amudarya River water in primary and repeated studies was mainly within the normative values (O'zDSt 950-2011). The absence of nitrites indicates that there is no fresh contamination of the studied water body.

2. It was found that during the period of observation, all indicators, and components affecting organoleptic properties of Amudarya River water - iron, manganese, copper, zinc, fluorine, SSFA, polyphosphates were within the norm, except for the content of petroleum products and BOC5, which were above the upper limits of the norm in some samples. But this increase in the standard is of random nature and does not reflect the true state of water quality of the Amudarya River at the point of water intake.

3. It is proved that no increase in inorganic concentrations (aluminum, beryllium, arsenic, mercury, lead, etc.) were found in samples of Amudarya River water in comparison with normal values, but some parameters of toxic chemical elements (calcium) remain stably high for the whole period of observation. It is established that according to these studied parameters the studied water is suitable for use by the population for household and cultural and domestic purposes, but when providing the population with drinking water, it is necessary to keep in mind the constantly increased content of water salinity (calcium).

4. It is proved that no pesticides - α-, β- and γ-isomers of HChCH, DDT and its metabolites (DDD, DDE) were found in water samples of Amudarya River during the whole period of observation. According to these indicators, water meets all requirements of O'zDSt 950-2011.

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1. Table 1.
2. Organoleptic indicators and mineralization parameters of Amudarya River water samples (primary studies)

Comparable parameters	**Name of indicators**	
	O'zDSt 950-2011	**Research Water**
Smell, Points	2	1
Turbidity, mg/dm3	1,5	6,4
Color, º	20	38,9
Hydrogen index (pH)	6-9	7,2
Total mineralization (dry residue), mg/dm3	1000	433,6 (0,43 MPC)
Total hardness, mg-eq/dm3	7	5,0 (0,71 MPC)
Calcium hardness mg-eq/dm3	7	3,4 (0,49 MPC)
Chlorides, mg/dm3	250	109,5 (0,44 MPC)
Sulphates, mg/dm3	400	183,9 (0,46 MPC)
Nitrates, mg/dm3	45,0	14,0 (0,31 MPC)
Nitrites, mg/dm3	3,0	0,041 (0,014 MPC)
Permanganate oxidation, mgO_2/dm^3	5,0	2,09 (0,42 MPC)

3. Note: The error of the used methods is ±10%.

4. Table 2

5. Indicators and components (chemical composition) affecting organoleptic properties of Amudarya River water

Comparable parameters	Nameofindicators	
	O'zDSt 950-2011	Research Water
Iron, mg/dm3	0,3	0,3 (1,0 MPC)
Manganese, mg/dm^3	0,1	Not detected
Copper, mg/dm^3	1,0	Not detected
Fluorine, mg/dm^3	0,7	0,3 (0,43 MPC)
Zinc, mg/dm^3	3,0	Not detected
Petroleum products, mg/dm^3	0,1	1,77 (17,7 MPC)
SSFA anionic, mg/dm^3	0,5	0,11 (0,22 MPC)
Polyphosphates, mgP/dm^3	3,5	2,7 (0,77 MPC)
BOC_5, mgO_2/dm^3	3,0	4,0 (1,3 MPC)

6. Note: The error of the used methods is ±10%.

7. Table 3

8. Comparative indicators of inorganic components in samples of Amudarya River water, definition of which is prescribed by O'zDSt 950-2011 (repeated studies)

Indicators or components	O'zDSt 950-2011	Results obtained
Aluminum, mg/dm^3	0,2	0,00226 (0,01 MPC)
Beryllium, mg/dm^3	0,0002	0,00013 (0,65 MPC)
Bor, mg/dm^3	0,5	Not detected
Cadmium, mg/dm^3	0,001	Not detected
Molybdenum, mg/dm^3	0,25	Not detected
Arsenic, mg/dm^3	0,05	Not detected
Nickel, mg/dm^3	0,1	Not detected
Mercury, mg/dm^3	0,0005	Not detected
Lead, mg/dm^3	0,003	Not detected
Selenium, mg/dm^3	0,01	0,0037 (0,37 MPC)
Strontium, mg/dm^3	7,0	0,1787 (0,03 MPC)
Chrome, mg/dm^3	0,05	Not detected

Table 4

Indicators of toxic chemical elements in water samples Amudaryarivers (repeated studies)

Indicators	**Units of measurement**	**Received results**
Calcium	mg/dm^3	67,2187
Lithium	mg/dm^3	0,00087
Magnesium	mg/dm^3	Not detected
Potassium	mg/dm^3	0,00153
Silver	mg/dm^3	0,00011
Sodium	mg/dm^3	Not detected
Rubidium	mg/dm^3	0,00014
Vanadium	mg/dm^3	Not detected
Gallium	mg/dm^3	0,00041

Indium	mg/dm^3	0,00031
Thallium	mg/dm^3	Not detected
Barium	mg/dm^3	0,00712
Uranium	mg/dm^3	Not detected