COMPREHENSIVE STUDY OF THE WATER OF LAKE AIDAR

E.A.Egamberdiyev, D.M.Azimov, M.N.Jovliev, S.A.Abdurazakova.

Tashkent State Technical University, - Tashkent, Uzbekistan

prof-azimov@mail.ru, prof-azimova@mail.ru. el.1909@mail.ru

Abstract. *In order to determine the suitability of the waters of Lake Aydarkul for use for technical, cultural, household or drinking purposes, analyzes were carried out on all physical and chemical indicators of water. It was revealed that the water in its basic physical and chemical indicators is higher than the permissible concentrations for drinking water according to GOST.*

Keywords: *Drinking water, salty, hard, sulfate, nitrate, carbonate, bicarbonate, pH, water treatment, mechanical treatment, sand filter, aerator, iron-removing filter, carbon filter, adsorption.*

Introduction. The main purpose of wastewater treatment is usually to enable the disposal of human and industrial wastewater without endangering human health or causing unacceptable damage to the natural environment. Irrigation with wastewater is both disposal and disposal, and is indeed an effective form of wastewater disposal (as is slow land clearing). However, before it can be used for agricultural or landscape irrigation or aquaculture, raw municipal wastewater usually needs to be treated to some degree. The quality of treated wastewater used in agriculture has a major impact on the operation and performance of the wastewater-soil-plant or aquaculture system. The desired quality of wastewater under irrigation depends on the crop or crops being irrigated, soil conditions, and the wastewater distribution system adopted. By limiting crops and choosing irrigation systems that reduce health risks, treatment of wastewater before application can be reduced. A similar approach is not feasible in aquaculture systems, and more reliance is placed on control through effluent treatment.

The optimal wastewater treatment to be applied before agricultural wastewater use is wastewater that meets the recommended microbiological and chemical quality guidelines at low cost and with minimal operational and maintenance requirements (Arar 1988). In developing countries, it is desirable to adopt as low a level of treatment as possible, not only from a cost perspective, but also in recognition of the difficulty of reliably operating complex systems. In many places, it is better to design a reuse system to accept low-level wastewater than to rely on advanced treatment processes that consistently produce recycled wastewater that meets strict quality standards.

However, there are areas where high levels of wastewater are required and data on the performance of a wide range of wastewater treatment technologies should be available. The design of waste treatment facilities is usually based on the need to reduce organic and suspended solids loads to limit environmental pollution. Pathogen elimination is rarely considered a goal, but for agricultural wastewater reuse it should now be a primary concern and processes should be selected and designed accordingly (Hillman 1988). Treatment to remove wastewater components that may be toxic or harmful to crops, aquatic plants (macrophytes), and fish is technically possible, but usually not economically feasible. Unfortunately, few performance data are available on wastewater treatment plants in developing countries, and they typically do not include wastewater quality parameters important for agricultural use.

Short-term changes in wastewater flows observed in urban wastewater treatment plants follow a daily regime. Flow is typically low in the early morning when water consumption is lowest and the main flow consists of infiltration-inflow and a small amount of sanitary sewage. The first peak in flow usually occurs in the late morning, when the effluent from the peak morning water use reaches the treatment plant, and the second peak usually occurs in the evening. The relative size of the peaks and the timing of their occurrence vary from country to country, depending on the size of the community and the length of the sewer. Small communities with small sewer systems tend to have higher peak flow to average flow ratios than larger communities. Although the magnitude of the peaks is reduced when passing through the sewage treatment plants, the daily variation of the flow from the municipal treatment plant in most cases makes it possible to irrigate it directly with wastewater from the treatment plants. cannot be increased. Equalization of flows or some form of short-term storage of treated wastewater is necessary to ensure a relatively constant supply of reclaimed water for effective irrigation, although storage provides additional benefits.

Today, the water problem in the Aydar Lake basin, located in the republic, is also waiting for its solution. Lake Aydarkul is a kind of ecological antipode of the Aral Sea, a huge endorheic reservoir. A large artificial reservoir in the Kyzylkum desert, located in northeastern Uzbekistan. The reservoir is located at an altitude of 247 meters above sea level of the Baltic system and is part of the Arnasay system of lakes, which occupies a huge saline depression. Aydarkul contains 44.3 km³ of slightly saline water. The mineralization of the reservoir in the east is only 1.5-2%, and in the western part - 8%. The lake stretches for 160 km and is about 34.8 km wide. Its average depth reaches 12.5 m, and the maximum reaches 33.6 m.

More than 100 species of flora and fauna have found shelter here, some of which are listed in the Red Book. On the reservoir you can see rare birds - pink pelicans, swans, pochards, white herons, Dalmatian pelicans, white-tailed geese and red goose. Among the fish that live here are carp, asp, carp, pike perch, bream, catfish, snakehead, sabrefish, etc. On the southern shore of the reservoir there is the Nuratau-Kyzylkum Biosphere Reserve, created to preserve endangered and endemic species of flora and fauna.

There are no underwater currents on Lake Aydarkul. The further you go to the west, the saltier the water. In the west, mineralization is more than 8 grams per liter. And in the mouths in the east there are 3-5 grams, which creates comfortable conditions for biological life.

Research methods. Calcium (Ca^{2+}) and magnesium (Mg^{2+}) were determined by titration with Trilon “B”. Chlorines (Cl-) were determined by the argentometric method. Sulfate ions ($SO^{2-}{}_4$) were determined by the gravimetric method, precipitating, passing through a filter and burning for 1:50 hours at a temperature of 800^0C, the remaining ash was weighed on a scale and counted. Determination of pH was carried out using a pH meter, nitrate (NO_3) - using a nitrate meter. HCO_3, that is, bicarbonate, was determined by titration, titrimetric method with a 0.05 N HCl solution. Determination of iron (Fe^{3+}, Fe^{2+}), ammonium ions (NH^{4+}) and nitrites (NO^{2-}) was carried out using a refractometer. Sodium (Na^+) and potassium (K^+) were determined in a flame apparatus. CO^2 content in mg/l by titration method. Oxidability was determined by permanganate titration. The overall hardness and aggressiveness can be found using the formula by calculation. Silicon (Si) was determined by the comparison method.

Research results. By comparing the results of samples from three different points of the Aydar-Arnasoy lake system with the established GOST standards of Uzbekistan for drinking water, the data obtained are presented in detail in Tables 1 and 2.

Table 1

Analysis results for all physical and chemical indicators of water

№	Name	Standard indicators per liter of drinking water	Collector Kizilkum			Collector Keely			Collector Akbulak		
			Content per liter			Content per liter			Content per liter		
			mg/l	mg eq/l	% eq/l	mg/l	mg eq/l	% eq/l	mg/l	mg eq/l	% eq/l
Cations											
1	Na^{+}		2182	94,86	49	988	42,97	50	594	24,54	30
2	NH_4^{+}	1 mg/l	0,4	0,02	-	0,4	0,02	-	2,1	0,12	-
3	Ca^{2+}		661	33,00	17	341	17,00	20	301	15,00	19
4	Mg^{2+}		790	65,00	34	316	26,00	30	492	40,50	51
5	Fe^{2+}	0,3 mg/l	< 0,3	-	-	< 0,3	-	-	< 0,3	-	-
6	Fe^{3+}	0,3 mg/l	< 0,3	-	-	< 0,3	-	-	0,3	0,01	-
Total				192,88	100		85,99	100		80,17	100
Anions											
7	Cl^{-}	250 mg/l	2127	60,00	31	576	16,25	19	401	20,00	25
8	SO^{2}_{4}	400 mg/l	6189	128,94	67	3094	64,47	75	2806	58,47	73
9	NO_2^{-}	3 mg/l	< 0,01	-	-	0,5	0,01	-	< 0,01	-	-
10	NO_3^{-}	45 mg/l	15	0,24	-	10	0,16	-	6	0,10	-
11	CO_3^{-}		no	-	-	no	-	-	no	-	-
12	HCO_3^{-}		226	3,70	2	311	5,10	6	98	1,60	2
Total				192,88	100		85,99	100		80,17	100

Table 2

Analysis results for other water indicators

№	Other definitions	Collector Kizilkum	Collector Keely	Collector Akbulak
Hardness meq/l				
1	general	98,00	43,00	55,50
2	carbonate	3,70	5,10	1,60
3	non-carbonate	94,30	37,90	53,90
4	pH	7,70	7,00	7,00
5	CO_2 free mg/l	35	44	15
6	CO_3 agr. mg/l	нет	нет	9
7	oxidability mg O_2/l	3,1	2,9	3,04
8	SiO_2 mg	6	20	8
9	H_2S mg/l	no	no	no
10	dry residue experiment mg/l	12600	5700	4760
11	dry residue calculated mg/l	12083	5501	4621
physical properties				
12	transparency	transparent	transparent	transparent
13	taste	bitterly salted	heavily salted	salty
14	color	no color	no color	no color
15	smell	without smell	without smell	without smell
16	sediment	no sediment	minor sediment	no sediment

According to Tables 1 and 2, the following conclusions can be drawn:

from the point of view of the total content of microelements, the water at point 1 (≈10,000 mg/l) can be classified as more saline water, and the water at points 2 and 3 (≈5000 mg/l) can be classified as brackish;

at all points the content of nitrate anions (NO^{3-}) is within the normal range, the level is below 45 mg/l;

at all points the content of nitrite anions (NO^{2-}) is within the normal range, the level is below 3 mg/l;

the content of chlorine anion (Cl-) (250 mg/l) is 2-8 times higher than the norm at all points;

the sulfate content (SO_4^{2-}) is 10-15 times higher than the norm (400 mg/l) at each point;

ammonium cations (NH^{4+}) are within normal limits, the level is below 1 mg/l;

indicator for iron cations (Fe^{2+} and Fe^{3+}) at all points the indicator is within the normal range, the level is below 0.3 mg/l;

The water hardness level is high at all points and according to the standard it belongs to the class of very hard water.

Conclusion. The conclusion was made based on the physical and chemical composition and properties of the obtained samples, based on the results of the obtained water analyzes of the Aidar-Arnasay lake systems. It was found that the water is very hard, has a very high level of salinity, and the level of minerals is higher than the permissible concentrations for drinking water according to GOST.

These conclusions do not apply to biological-bactereological and sanitary-epidemiological conditions for making conclusions about fisheries, resort recreation areas, tourist recreation areas and the medicinal properties of the waters of the Aidar-Arnasay lake system.

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