Vol. 9, №1, 2025 ISSN 2520-6133

KHAZAR JOURNAL OF SCIENCE AND TECHNOLOGY

(KJSAT)

Hamlet Isayev/Isaxanli[1] *

Editor-in-Chief Khazar University, Azerbaijan

[1] Also H. Issakhanly, H. Isakhanly, H. Isakhanli, H.A.Isayev, G.A.Isayev, or G.A.Isaev due to differences in transliteration. I use Hamlet Isayev in mathematics and science fields and Hamlet Isakhanli/Isaxanli in humanities.

Khazar University
41 Mehseti str., Baku AZ1096 Republic of Azerbaijan Tel: (99412) 4217927
Website: **www.kjsat.com**

KHAZAR UNIVERSITY PRESS

Content

Khazar Journal of Science and Technology `Volume 9 №1 2025, 5-14
 DOI: 10.5782/2520-6133.2025.9.1.5

Analysis of Physico-Chemical Parameters of Drinking Water from Kur River, Azerbaijan

[1]Fidan Yolchuyeva, [1]Sevinj Hajiyeva, [2]Ali Huseynli
[1]Ecological Chemistry Department, Baku State University
[2]Mathematics Department, Khazar University
Corresponding author: ahuseyinli@yahoo.com

Abstract
The present study was conducted to determine the physicochemical parameters of drinking water. The samples were collected from six sites along the Kur River. We have analyzed some physicochemical parameters such as pH, Electrical conductivity (EC), Total dissolved solids (TDS), Total alkalinity (TA), Chloride (Cl^-), fluoride (F^-) and others. Results showed that the physicochemical parameters of drinking water were also within the normal range.

Keywords: physicochemical parameters, drinking water, Kur river

Introduction

Drinking water is distributed unevenly in Azerbaijan, with limited resources. At present, the country's surface water reserves are 27 cubic meters, while in dry years these reserves are reduced to 20-21 cubic kilometers. The sources of surface water resources are rivers, lakes, reservoirs and glaciers. 70-72% of the freshwater resources of our country are formed outside the country (Badalov, 2016).

In the 1960s, the demand for drinking water in the Absheron peninsula increased sharply as a result of the construction of new residential areas and micro-districts in Baku and the growth of surrounding villages and villages. The Binagadi district we take as a research site is located in the northwest of the Absheron Peninsula. Its territory is 169.38 km2 and the population is 1496 people per 1 km2. According to 2014 statistics, the population of Binagadi district is 254,500.

Binagadi district is currently supplied with drinking water from three sources - Oguz-Gabala, Kura and Jeyranbatan (Aliyev, 2000).

Kura is a source of drinking water for 60-70% of the republic's population. It is a vital factor for the population, agriculture and industry of our republic. From this point of view, the analysis of the contamination of the Kur River in Azerbaijan is of great importance (Tagiev et al., 2001).

Samples were taken from the Kur River to test the quality of drinking water supplied to the Binagadi area. The Kur River, the largest transboundary river in the Caucasus, is located in five countries, and its water is used for various purposes. As a result, the Kur River is exposed to both natural and anthropogenic effects. There are about 30 transboundary rivers in the Kur basin. The largest of these is the Araz River (Aslanov, 2013). The total water reserve of the Kur River is 25.9 km.3, of which 9.39 km^3 belongs to Georgia, 4.6 km^3 to Azerbaijan and 1.54 km^3 to Armenia. The main water users in the downstream zone of the Kura River are irrigation and water supply. Thus, 7335 million m3 of water (7214 million m^3 of water and 122 million m^3 of drinking water) is extracted from the Kura River in the republic, of which 3160 million m^3 falls on the downstream zone (Aslanov and Huseynova-Javadova, 2005). During periods of high water demand, water from the rivers, which is irreversible, contributes to the deterioration of the ecosystem. Reservoirs built on the basin also have a significant impact on water flow (Aslanov et al., 2012).

The Kura River is exposed to severe pollution primarily due to industrial and municipal waste from other settlements in Georgia. As a result, the Kura river enters our republic as a highly contaminated river, which is dangerous for human and aquatic organisms (Aslanov et al., 2005). The Khramchai Kura, the right arm of the Kura, which runs along the border of the two republics, brings a lot of wastewater. In Georgia, the Khram River is joined by the most polluted river of Armenia - the Debed River. Industrial and domestic wastes from these cities are discharged into the river without treatment (Huseynov and Imanov, 2017; Ismayilov and Karimov, 2012).

Methodology

Drinking water samples were collected from Kur river for the analysis of their physicochemical parameters. Six samples of water were collected from the Kur river in a plastic bottle. Samples taken to the laboratory have been analyzed some physico-chemical parameters such as pH, Electrical conductivity (EC), Total dissolved solids (TDS), Total alkalinity (TA), Chloride (Cl^-), fluoride (F^-) and others. (Table 1.)

Table 1. Analysis method of samples

Water quality test	Description	Instrument/ method
pH	Determination of hydrogen ions in water	pH meter
Electrical conductivity	Numerical expression of the electrical conductivity of a solution	Conductivity meter
Total Hardness	Determination of calcium and magnesium in water	Titrimetric method
Total Alkalinity	Alkalinity of water is its quantitative capacity to react with a strong acid to a designated pH.	Titrimetric method
Chloride	Measurement of Chloride amount in water	Titrimetric method
Sulfate	Measurement of Sulfate amount in water	Titrimetric method
Nitrate	Measurement of Nitrate amount in water	Titrimetric method

Results and discussion

pH

The pH is a measure of the hydrogen ion concentration in water. First of all, the device is calibrated. After calibration, the pH of the water samples was measured. The heat affects the pH. As the temperature increases, the characteristics of the electrode change. The curve increases with increasing heat and an error occurs on the device. Therefore, sample analysis and calibration solutions should be performed at room temperature. When electrodes are not used, they should be stored in KCl solution of 0.1M. The pH in drinking water should be in the range of 6.5-8.5. uric acid causes corrosion. Alkaline water becomes bitter. It ranges from 8.07-8.30 in the samples taken in this analysis. It complies with WHO and 98/83 EC directive standards (WHO, 2004): Guidelines for drinking water quality. 3rd edn. World Health Organization, Geneva.). This amount does not adversely affect human health. (Figure1)

.

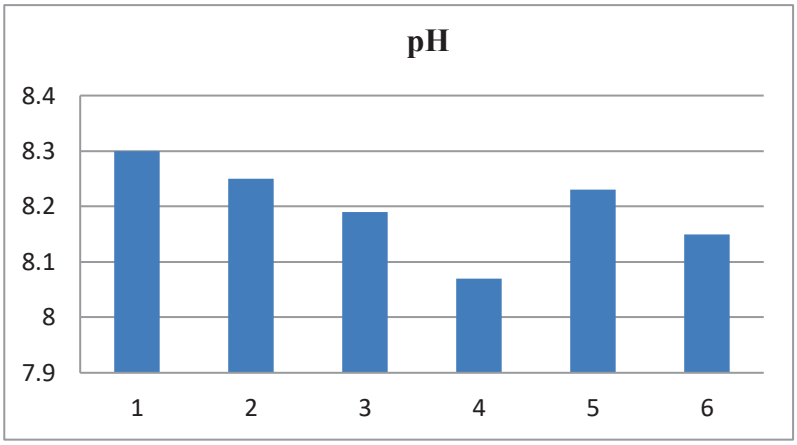

Figure1. pH of drinking water samples from Kur river Azerbaijan

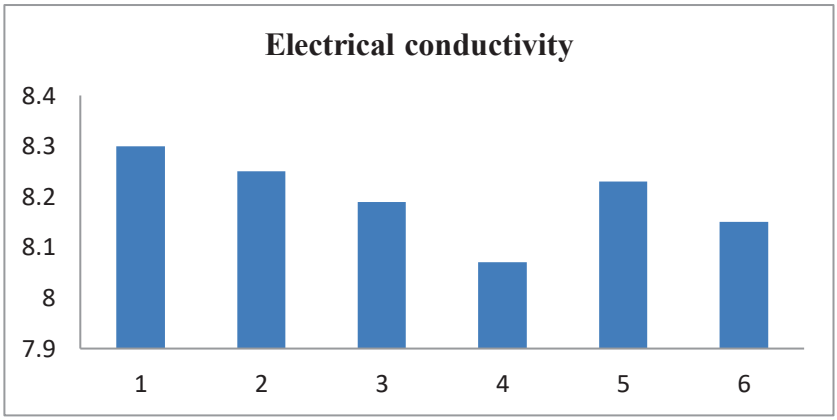

Figure 2. Electrical conductivity of drinking water samples from Kur river Azerbaijan

Turbidity

It is based on measuring the intensity of light emitted by the particles of a substance by nephrometric method. Turbidity should be measured quickly. If this is not possible, the sample should be kept at 4 ° C for 24 hours in the dark. Thermal fluctuations and particle collapse may be an error in the analysis.

Electrical Conductivity (EC)

Conductivity was measured using conductivity meter. Conductivity meter was calibrated using 0.1 molar of KCl. Electric conductivity is a numerical

expression of the ability of aqueous solution to conduct electricity. In our samples, the electrical conductivity is 723-1155 μS / cm.Conductivity of drinking water samples is given Table 2 and shown Figure 2. The conductivity of water is affected by the suspended impurities and also depends upon the concentration of ions in the water. (Figure 2).

Total Alkalinity (TA)

It is derived from hydroxide, carbonate and bicarbonate ions. Sodium thiosulaft solution is added. An indicator of phenolphthalein is being added. When the solution turns pink, the solution is vibrated with 0.02 N HCl until it is discolored. With 0.02 N HCl, a pointer may be added to analyze the overall look so you can see the color without the blue-green color. The alkaline content in the samples is 2.6-3.58 mg / L (Figure 3).

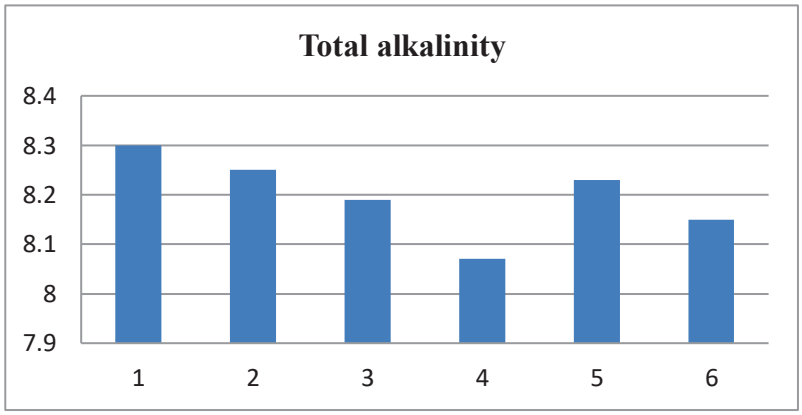

Figure 3. Total Alkalinity of drinking water samples from Kur river Azerbaijan.

Total Dissolved Solids (TDS)

The sample is passed through a glass fiber filter and heated until the filtrate dries. The increase in the weight of the container indicates the presence of solids in the sample. When the sample contains too much calcium, magnesium chloride or sulphates, it increases the hygroscopicity of the sample. This reduces the accuracy of the analysis. For this you need to dry the sample even more. According to WHO standards, the tolerance for TDS should not exceed 500 mg / L. In the samples, the TDS ranges from 486-724 mg / L (Figure 4).

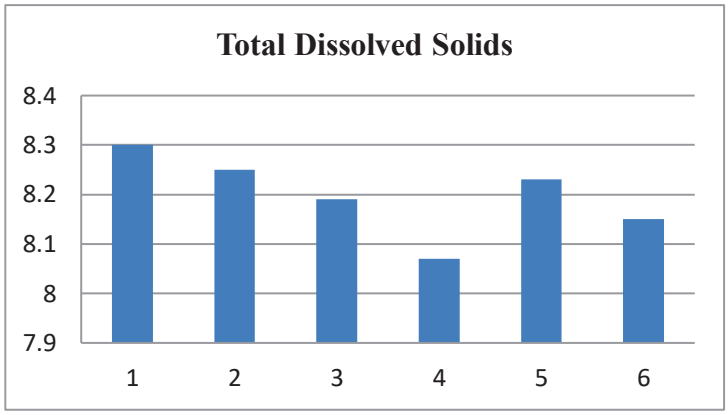

Figure 4. Total Dissolved Solids of drinking water samples from Kur river Azerbaijan

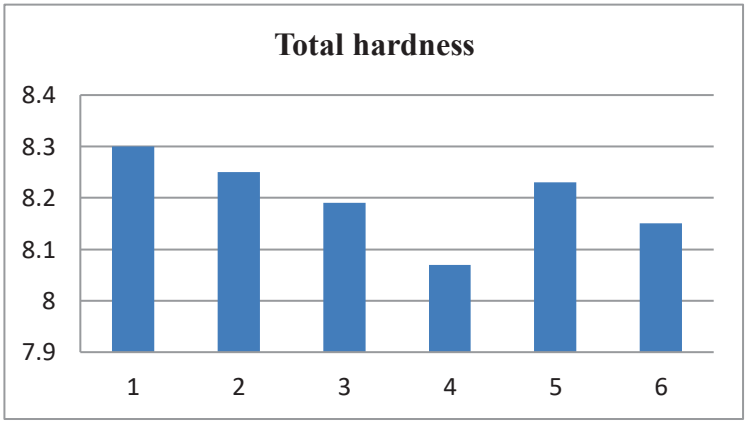

Figure 5. Total Hardness of drinking water samples from Kur river Azerbaijan.

Total hardness (TH)

Total hardness is mainly contributed by bircarbonates, carbonates, sulphates and chlorides of calsium and magnesium. 50 ml of the sample is added 1-2 ml of buffer solution (ammonium chloride, ammonium hydroxide mixture) and 2-3 drops of eryochrome black T indicator. The solution is colored red. The mixture is then vibrated with the EDTA solution until light blue. Finally the total hardness of the water samples was determined in mg / L og CaCO3. In the samples we take, TH varies between 239-348 mg / L. According to Who standards, TH must not exceed TH 500 mg / L in drinking water. According to magic, water is subdivided into soda and multiple cod waters (Figure 5).

Chloride

50 ml of sample is taken for testing. For example, the pH value should change in the range of 7-10. if the pH is not within this range, it is reached with 1N NaOH or 1 H_2SO_4 solution. The mixture is then titrated with the indicator K_2CrO_4. Vibrating is done until pink is obtained. Finally, the amount of chloride in the sample is calculated by the following formula.

$$\text{Concentration of chloride (mg/l)} = \frac{(A - B) \cdot N \cdot f \cdot 35450}{\text{V samples}}$$

A- The amount of silver nitrogen used for the sample,
B- The amount of silver nitrate used for the blank,
N- normality of silver nitrate solution,
V- sample volume

The concentration of chlorine ions in the samples varied in the range of 37.5-92 mg / L. According to 98/38 EC and WHO standards, the amount of chlorine ions in drinking water should not exceed 250 mg / L (Figure 6).

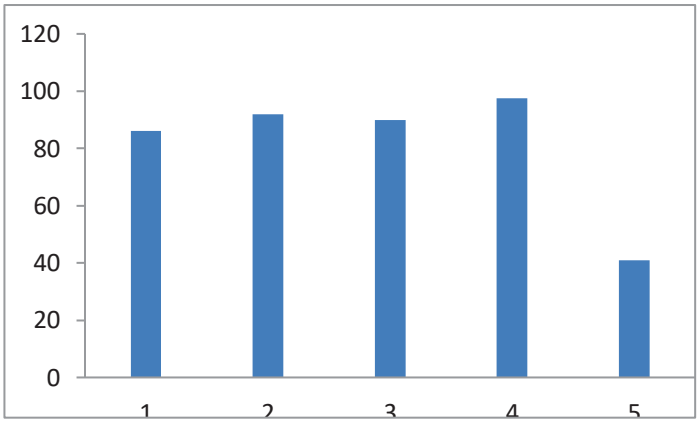

Figure 6. Chloride of drinking water samples from Kur river Azerbaijan.

Sulfate analysis

It is based on measuring the adsorption value of $BaSO_4$ suspension at wavelengths of 420 nm on a spectrophotometer. The buffer solution containing $MgCl_2 \cdot 6H_2O$, $CH_3COONa \cdot 3H_2O$, KNO_3, CH_3COOH was used in the process. 20 ml buffer solution is added to 100 mL of sample. The mixture is placed in the Kuwait and resuspended on a wavelength

spectrophotometer at 420 nm. Then pour the recyclable tube and weigh it by adding about 0.2 g of $BaCl_2 \cdot 2H_2O$. According to the standards 98/38 / EC, the amount of sulfate ions in drinking water should not exceed 250 mg / L. In our samples, the lowest concentration of sulfate ions was 165 mg / L. In some examples, this figure is 275 mg / L. This is higher than the standards (Figure 7).

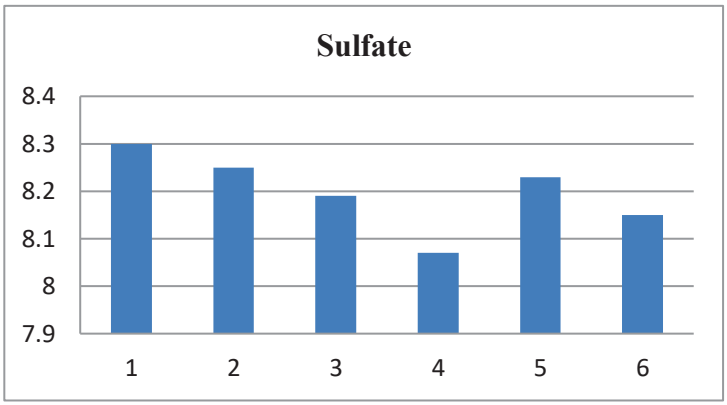

Figure 7. Sulfate of drinking water amples from Kur river Azerbaijan

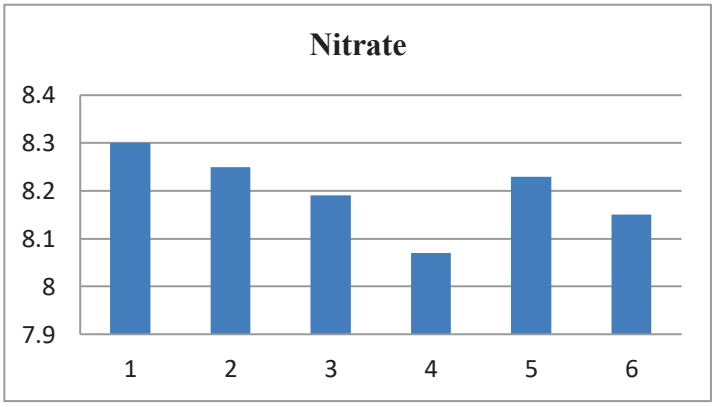

Figure 8. Nitrate of drinking water samples from Kur river Azerbaijan.

Nitrate analysis

The spectrophotometer is analyzed at wavelengths of 220-275 nm. In the process, stock nitrate solution containing 100 mg / L nitrogen and 1 N hydrogen chloride solution were used. (1 ml of 1N HCl solution is added to 50 ml sample). The amount of nitrate ions in the samples ranges from 3.1-4.5 mg / L. According to the standards 98/38 / EC, the amount of nitrate ions in drinking water should not exceed 45 mg / L.

Conclusion

This article deals with the analysis of the physiochemical parameters of water samples taken from the Kura River, which plays a major role in providing potable water to the population in Azerbaijan. The pH, electrical conductivity, TDS, TA, TH, sulfates, chlorides, nitrates, fluorides and some other parameters were determined in the samples. The results were compared with the requirements of the World Health Organization and Directive 98/38 / EC on potable water.

Table 2. All analysis results are listed

	Sample1	Sample2	Sample3	Sample4	Sample5	Sample6	WHO	98/38/EC
pH (pH unit)	8.30	8.25	8.19	8.07	8.23	8.15	6,5-8,5	
Turbitidy (NTU)	53.6	0.90	1.1	8.34	11.2	5.4	-	1
Conductivity (µS/sm)	1116	1151	1155	723	751	724	-	< 2500 (20^0C)
Total Hardness (mg/L)	331	344	348	242	247	239	500 mg/L-	-
Total Dissolved Solids(mg/L)	724	726	730	472	464	486	500 mg/L	-
T.Alkalinity (mg/L)	3.58	3.35	3.28	2.6	2.9	3.1		
Chloride (mg/L)	86	92	90	97.5	41	38	-	250 mg/L
Nitrate (mg/L)	3.9	4.1	4.5	3.8	3.5	3.1	-	45 mg/L
Sulfate (mg/L)	265	275	273	167	173	165	-	250 mg/L
Fluoride (mg/L)	0.2	0.3	0.2	0.14	0.19	0.22	-	1,5

Based on the analysis results, the water samples taken are suitable for drinking. pH 8.07-8.30 in the samples; TA 2.6-3.58 mg / L; TDS was 486-724 mg / L, TH 239-348 mg / L, sulfates 165 -275 mg / L, chlorides 37.5-92 mg / L, nitrates 3.1-4.5 mg / L. Although sulfate levels are slightly high, they are not harmful to health. Although it breaks down the intestines in non-habitual people, the digestive system is accustomed to it over time.

This work was carried out with the financial support of the Azerbaijan Science Foundation-Grant №AEF-MQM-QA-1-2021-4(41)-8/07/4-M-07.

References

Aliyev, F.Sh. (2000). Groundwater, resources use and geological problems of the Republic of Azerbaijan. Baku, Chashoglu.

Aslanov, H.Q. (2013). Ecogeographical problems of downstream Kura, "Chashioglu", Baku.

Aslanov, H.Q & Huseynova-Javadova Sh.N. (2005). Ecology and Water Management. №7, Baku.

Aslanov, H.K & Samkhalova, A.P. (2005). Natural conditions and ecological features of the Kura river basin. Ecology and Water Resources, №3.

Aslanov, H.Q & Javadova Sh.H. (2005). Natural and Anthropogenic Factors Affecting the Concentration of the Kura River Sources. Proceedings of the XXVI Scientific Conference of Students and Masters of ASU.

Badalov, E. (2016). Socio-demographic problems and settlement issues in Absheron economic-geographical region. European publishing house.

Fatullayev, G.Yu. (2002). Recurrent changes of water resources and regime in the South Caucasus (in the Caspian Basin). Baku.

Huseynov, G.J & Imanov, F.A. (2017). The role of Kura river in water supply and antropogenic changes of annual flow..“Water resources, hydraulic facilities and environment” materials of the international scientific-practical conference.

Ismayilov, R.A & Karimov, R.N. (2012). Evaluation of Contemporary Environmental Condition of River Basins in Southern pre-Caspian Areas of Azerbaijan. International Journal of Business, Humanities and Technology.USA- Vol. 1 № 1.

Tagiev, I.I., Ibragimova, I.Sh. & Babaev, A.M. (2001). Mineral resources and terminal valleys of Azerbaijan. Baku, Chashoglu.

WHO. (2004). Guidelines for drinking water quality. 3rd edn. World Health Organisation, Geneva.