Study of the Specifications of Some Chemical Standards for The Water of The Unified Tikrit City Water Project

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ABSTRACT
This study was conducted in the laboratories of the University of Tikrit / College of Education for Girls / Department of Life Sciences / and quality control laboratories for the study of the unified Tikrit city water station project , which is located on the course of the Tigris River within Salah al-Din Governorate, where the study included five stages, starting with river water, sedimentation basins and preservation tank, and ending with the last stage liquefaction water for the Shuhada neighborhood, For the purpose of studying the properties and chemicals of the project water and comparing the results with standard specifications, and the study period extended from August 2023 AD to January 2024 AD, the study included measuring (pH, dissolved oxygen, biorequirement for oxygen, total basic, chloride ion, phosphate and nitrate), pH values ranged towards basal Where their levels ranged between (7.3-8) mg / liter and it was noted that the values of dissolved oxygen ranged between (5.4-9.2) mg / liter, and depending on the values of the vital requirement for oxygen the water was somewhat clean, so its levels reached between (0.5 -3.2) mg / liter, and the total basic values ranged between (106-256) mg / l and the proportions of chloride ions were within the permissible limits ofFor drinking, the values ranged between (17.216-136) mg/L, while for the concentrations ranged (2.120439 3.748021-) µg/L, as for phosphate, values ranging between (0.6-2.7) µg/L, the results show that the phosphate values did not conform to the Iraqi standard specifications No. 417 for drinking water (2001) of 0.4 µg/L.

1. Introduction

Water is an essential compound for all living organisms, and its importance lies in being one of the basic components that enter into the composition of the living cell by 75-95% of the protoplasmic mass, and enters the composition of the various tissues of the human and animal body and most of the components of the plant, as well as none of the digestion, absorption and metabolism processes take place except in an aqueous medium (Bresha and Sharif, 2018). Due to the development in various areas of life, developed countries have invented various stations that filter and purify water and ensure Water retains its chemical and physical properties in its natural proportions, and to obtain water of ,excellent quality and high quality (Al-Sultan 2019 .(Many reports have indicated that the next crisis) will be due to water and maytransform the water crisis globallyEwaid, 2019 River water is one of .(the most important freshwater resources for humans as economic and social development is linked to the distribution and availability of fresh water in river systems) Hanna *et al.*, 2019 Water often .(contains different compounds and elements that vary in their concentrations and may be useful to ,living organisms, but when these concentrations are excessive, they cause pollution to the water which causes its use not to be allowedIn different areas of life (Al-Kamar, 2018). The world is now suffering greatly from the problems of water pollution, which negatively affects all living things (Al-water sources, but also not only polluted This urbanization and rapid industrialization .(Sultan, 2019 led to a shortage of water in different regions, so effective management of water resources is very necessary for sustainable development(Singh *et al.*, 2020) in addition, environmental activities also ، contributed to the arrival of many pollutants to the river (Al-Majma'i, 2022). Pollution is any change in the physical and chemical properties of water quality and may occur directly or indirectly, which .affects the properties of water and makes it undrinkable (Oyouni et al., 2009)

,Analysis and examination of the physical, chemical and biological properties of water is important through which it is possible to know the quality and mechanism of its interaction with the surrounding)environment, as well as to describe water nutrition and runoff conditionsYuping *et al.*, 2016.

2. Materials and Methods

This study was conducted on the project of the unified Tikrit water liquefaction station, located on the

Tigris River in the city of Tikrit - Salah al-Din Governorate, which was established in 1975 and has a production capacity of 750 $m^{3/}$ hours and the index with coordinates (N43.6812). E 34.6212) As the chemical properties of the water were analyzed and examined, the Tigris River is the main supplier of the city's water, and for this reason the Tikrit Unified Water Project was established on it.

Sample collection

The sample collection process was carried out in the morning at a rate of once a month, starting from raw water to theliquefaction area, as the study period extended for six months from August 2023 until December 2024, where the sample was taken using sterile bottles prepared in advance and washed with sample water to maintain the chemical properties of the samples, and a quantity of sample water must be pumped for a quarter of an hour before filling the bottles to get rid of the contaminated water Stagnant samples, samples are collected inside plastic bottles made of (Polyethylene) size (2.25) (and transported to the laboratory for the purpose of physical and chemical tests) The analyzes were conducted in the laboratories of the Department of Life Sciences at the College of Education for Girls and the quality control laboratories of the Water Department and chemical engineering laboratories.

pH

The pH value was measured using a Germany PH meter Lovibond after being titrated with Buffer solution pH (4,7,9) at the Beginning Of Each Measurement.

Of Measurement Dissolved Oxygen

According to the method mentioned in (APHA, 2005), dissolved oxygen was measured using the device (Oxygen meter Lovibond) made in Germany in the laboratory, where the device was calibrated at each reading by calibrating it with the amount of oxygen in the atmosphere, as the device is read (20.9), which is the amount of oxygen in the atmosphere, and then the reading is converted to mg / liter and oxygen is measured in water.

Biological Oxygen BOD

The biological requirement ofoxygen was calculated ,to measure dissolved oxygen by the method used) theopaque Winkler bottles were placed for five days at a temperature of25 º) º C inside a water bath) and then determined the dissolved oxygenDO5 and the difference between the primary dissolved ( ) oxygenDO_0 the value of ,(BOD5) mg / liter APHA, 2005).(

$BOD5 = DO_0 - DO5$

Total Alkalinity

The basicity was determined according to the method described by (1984) Welch, and the results were expressed in mg\L, where 50 ml of sample water was taken and 3 drops of orange methylation index were added to it to form a yellow color and it is brushed with sulfuric acid at a concentration of 0.02N until the color changes and the rate of two readings is taken and the basic calcium carbonate is calculated according to the equation:

$$Total\ Alkalinity(mg\backslash L) = \frac{VH2SO4 \times NH2SO4 \times 1000 \times M.W\ as\ CaCo3}{Vsample}$$

Sulfate MeasurementSulphate SO4

The percentage of sulfate was estimated by the Turbidity Method, where a volume of (100 ml) of the sample water was taken, then (5 ml) of the conditioned solution was added Condition reagent and mechanically shaken at a constant speed using the magnetic stirrer, then barium chloride crystals were added with persistence By mechanical shaking for another minute, the concentrations are read and calculations are performed compared to the standard curve and the results are expressed in mg/L (Abawi and Hassan, 1990).

Chloride Chloride

Chloride measurement It's done According to the American Society for Testing and Methods (1984) ASTM Within the water tests by taking 50 ml of water of the sample to be examined and added to it Few Drops of potassium dichrome, then rinsed with standard silver nitrate solution at a concentration of 0.025N، Until the color turns from yellow to red-brown and expresses H in mg\ L.

Nitrate (NO3) measurement

Nitrates were measured using an indole visible UV spectrometer at a wavelength of 395 nm.

Alfosfat Orthophosphate

The phosphates of the water samples were measured using the Spectrophotometer CE 1011 CECIL at a wavelength of 690 nm. (10) ml of the sample was placed in Baker and a solution of 2) ml of sulfuric acid with (40) ml of ionic water is added to it, then the reaction mixture is cooled, and (2) is added) ml of aluminum molybdate solution is diluted to 100, and then 5-7 ml drops of tin chloride solution are added, heated to the point of completion of the dissolution process, a blue color is formed, and then the absorbency is measured at a wavelength of (690nm), and by preparing the standard solutions, the phosphate concentration was found from the special equation for each curve.

Results and discussion

Table (1) shows the values generated during the study period and the monthly and location changes of PH in the studied stations. The highest value after treatment recorded for pH in water was 8 in the fifth station in January and the highest value before treatment was recorded was 8 in the third plant in August, as shown as the pH values were close and within the base level, and this is a characteristic of Iraqi water, as the pH values in natural water are between (8.5-5) (Al-Saad). *et al*., 2008). The pH results in the present study show conformity to the specifications of Standard No. 417 for drinking water (2001) and the World Health Organization (WHO, 2004), which ranged between (8.5-6.5). While the values of dissolved oxygen were high in the first station before purification in November where they were (9.2) mg / l as shown in Table (2), while the highest value recorded after the treatment process in the drinking water sample was (9) mg / liter in the fifth station during November. The results of this study were similar to the results of the study of each of (periodic, 2019), (Ismail, 2018) and (Al-Bayati, 2022), as the values of dissolved oxygen (9.1-4.9), (8.0-4.8) and (6.1-10.6) mg/l respectively, while the results of the study (Saleh, 2020) for dissolved oxygen values were between (1.7-4.4) mg/L. The friction process between the surface of the water and the atmosphere is the main source of oxygen *(Ayanshola et, 2019),* in general, the efficiency of the water produced by the liquefaction plant is considered good and almost identical in its rates to the values of dissolved oxygen, proposed for potable water within the specifications for Iraqi drinking water (Standard No. 417 for drinking water).2001) and global adult 5< mg/L (WHO, 2004).

Shown Results in table No. (3) The highest value of the biological requirement for oxygen in water before treatment is 3.2 mg/l at the first leg in January, while it was higher value After treatment of 2.1 mg/L in the fifth leg of January, the results of this study were similar to what was stated (Al-Hamdani, 2013).) (03.) mg/L with results (Nasiri، 2019) where They recorded values ranging fromt (3, 3-0) The activity and effectiveness of microorganisms results in increased biodegradation processes of organic matter and thus depletion of dissolved oxygen in water. Ibo *et al*., 2020). The decrease in BOD5 values is due to the number of pollutants, as for its increase, it indicates the arrival of some human pollutants to Water and the occurrence of processes Oxidation of organic matter (Negi *et al*., 2020), that most of the rates for the biological requirement of oxygen were identical Oxygen Biorequires Values For drinking water within the standard specifications of the World Health Organization (WHO, 2004) and adult <3 mg/L.As for the total basic values Total Alkalinity They are shown in Table No. (4) where Highest value for basal in water recorded before treatment andShe was 256 mg/L at the first stop From November month and above Value for basicity After processing in the sample prepared for drinking She was 160 mg/L at the fifth station in January، Fatlawi (2006) noted that Reason for low Values

Basals In the water during Dry season May be back into Exhaustion Bicarbonate due to increased in The rate of photosynthesis processes due to an increase in in Algae preparation. Matched the results of the study Current in more Its rates for the total basic values Suggested values for drinking water within the standard and international specifications (WHO, 2004; US-EPA, 2002) and adult 250 mg/L.

As for sulphate values: Sulphates SO4-2 shown in Table (5) The highest sulphate value before treatment was 86 mg/L, in the month of January at the first station, and the highest sulphate value was 82 mg/L, in January at the fifth station, and it may be Adding alum (aqueous aluminum sulfate) to water in order to remove turbidity leads to an increase in the concentration of sulfate in the water as a result of the formation of calcium sulfate, the results of the published sulfate varied, as the results of Al-Lahibi (2021) ranged between 27)-59) mg / liter, and Fertam (2018) stated in his study that the sulfate values ranged between (130-37.7) mg/L. This variation in sulfate concentrations at plants may be due to the decomposition of soil organic matter in these areas (Varol *et al*., 2015). The sulfate concentrations in the present study were below the limit allowed in the US Environmental Protection Agency Society (US-EPA, 2002), Iraqi Standard No. (417) for Drinking Water (2001), and the World Health Organization (2004, WHO) where the maximum level of 250 mg/L was set.While the results of Chloride Cl− Table (6) showed that the highest value of chloride ion in water was 136 mg / liter in thefirst station in August, and the highest value after treatment was 74 mg / liter in the fifth station in August, and these results were close in terms of the lowest values with the results of the study of each of Al-Hadidi (2018), Mahmoud (2021) and (2020) AL–Sarraj, with values ranging from 13.8) (5.9) (11.9) mg/L respectively, and inconsistent with the findings of the Sultan (2019) (30.0-60.0) mg/L in the duration of the study. As a result, the results of the current study were within the permissible and proposed chloride concentrations for drinking water within the Iraqi and international standard specifications (WHO, 2004; US-EPA, 2002) proposed for drinking water of 250 mg/L. Many studies have proven that water and soil pollution with nitrate NO3 ions due to agricultural activities has become a global problem that has been widely documented (As-Cott *et al*., 2017), and the results of the current study as shown in Table (7) have shown that the highest nitrate value in untreated water 3.748021 µg/L in the first station for the month of October, while the highest value of water after treatment was 3.281823 g/l in the fifth station in January, the results of the current study did not agree with the results of Al-Dulaimi's study (2021), where his study recorded values ranging between (1.26-0.35), the results conform to the standard specifications No. (417) for drinking water, which is a maximum of 50 µg/l. Table (8) shows the values of the current study of active phosphate PO4 Reactive phosphate and the highest concentration of phosphate in water before treatment was 2.7 µg/L in the first plant during the month of October while the highest value after treatment was 1.6 µg/L in The fifth stop is in October.

Table (1) Monthly and Location Changes in pH in the Studied Stations.

Average months	Fifth stop	Fourth stop	Third stop	Second stop	First stop	Stations / Months
7.80 A	7.7	7.7	8	7.8	7.8	City of Water
7.73 A	7.6	7.9	7.8	7.6	7‹6	September
7.85 A	7.9	7.9	7.8	7.8	7‹7	October

7.52 B	7.9	7.6	7.4	7.3	7.4	November
7.84 A	8	8	7.4	7.9	7.9	December
7.48 B	7.5	7.4	7.4	7.5	7.6	January
	7.76 A	7.75 A	7.63 A	7.65 A	7.68 A	Average sample type

Table (2) Monthly and Site Changes of Dissolved Oxygen in the Studied Stations

Average months	Fifth stop	Fourth stop	Third stop	Second stop	First stop	Popular Stations
5.780 D	5.4	6.1	5.7	5.5	6.2	City of Water
6.446 C	6.2	6.63	6.47	6.32	6.61	September
6.378 C	6.1	6.57	6.92	5.78	6.52	October
8.740 A	9	8.7	8.4	8.4	9.2	November
8.580 A	8.7	9	7.8	8.4	9	December
7.540 B	7	7.1	7.3	7.7	8.6	January
	7.067 A	7.350 A	7.098 A	7.017 A	7.688 A	Average sample type

Table (3) Monthly and localized change of oxygen biorequirement.

Average months	Fifth stop	Fourth stop	Third stop	Second stop	First stop	Stations / Months
1.060 B	1.3	1.6	0.5	1.2	0.7	City of Water
1,380 FROM	0.9	1.4	1.6	1.5	1.5	September
1.150 BC	1.2	1.4	1.2	0.8	0.8	October
0.700 C	0.8	0.7	0.5	0.5	1	November
1.040 BC	0.8	0.7	0.9	0.9	1.9	December
1.780 A	2.1	1.4	1.1	1.1	3.2	January
	1.183	1.200	0.967	1.000	1.660	Average sample type

	A	A	A	A	A	

Table (4) Monthly and Location Changes of Total Basals in the Studied Stations.

Average months	Fifth stop	Fourth stop	Third stop	Second stop	First stop	Stations / Months
143.00 C	106	106	140	170	193	City of Water
138.60 C	120	114	139	140	180	September
142.40 C	117	116	142	151	186	October
232.20 A	151	251	251	252	256	November
161.20 B	146	140	166	166	188	December
176.40 B	160	160	186	186	190	January
	133.33 b	147.83 B	170.67 A	177.50 A	198.83 A	Average sample type

Table (5) Monthly and Localized Changes of Sulfate in the Studied Stations.

Average months	Fifth stop	Fourth stop	Third stop	Second stop	First stop	Popular Stations
72.835 B	74.5	76.57	73.57	71.17	72.1	City of Water
69.232 C	71.16	71	66	71	67	September
67.200 D	68	68	66	67	67	October
73.200 B	71	71	73	73	78	November
71.800 B	73	73	71	70	72	December
82.400 A	82	82	81	81	86	January
	73.277 A	73.000 A	71.762 A	72.195 A	73.683 A	Average sample type

Table (6) Monthly and localized changes of chloride in the studied stations.

Average months	Fifth stop	Fourth stop	Third stop	Second stop	First stop	Months/Stations
94.720 A	74	74.3	62.3	127	136	City of Water
29.753 BC	26	25.098	26.508	29.798	41.36	September
27.028 BC	27.51	27.448	24.158	24.816	31.208	October
35.022 B	36.132	35.824	32.211	32.623	38.321	November
23.409 C	17.216	19.458	25.944	26.132	28.294	December
22.759 C	23	24.252	21.802	21.808	22.936	January
	33.976 A	34.397 A	32.154 A	43.696 A	49.687 A	Average sample type

Table (7) Monthly and Localized Changes of Nitrates in the Studied Stations.

Average months	Fifth stop	Fourth stop	Third stop	Second stop	First stop	Stations Months
2.342405 C	2.120449	2.120439	2.790135	2.144302	2.536698	City of Water
2.956586 B	2.522121	2.522015	3.173375	2.901377	3.664043	September
3.216948 A	2.987106	2.987045	3.181909	3.180657	3.748021	October
2.271009 C	2.215492	2.124652	2.235686	2.235657	2.543557	November
2.736842 B	2.598521	2.598241	2.782981	2.782982	2.921485	December
3.337307 A	3.281823	3.215461	3.381521	3.381532	3.426198	January
	2.620919 A	2.594642 A	2.924268 A	2.771085 A	3.1400 A	Average sample type

Table (8) Monthly and localized changes of active phosphates in the studied stations.

Average months	Fifth stop	Fourth stop	Third stop	Second stop	First stop	Stations / Months
1.68 B	1.4	1.2	1.7	1.7	2.4	City of Water
1.32 B	0.6	0.9	1.4	1.5	2.2	September
2.14 A	1.6	1.8	2.2	2.4	2.7	October
1.56 B	1	0.6	2	2	2.2	November
1.46 B	1.1	0.8	1.7	1.7	2	December
1.64 B	0.9	0.7	2.1	2	2.5	January
	1.10 C	1.00 C	1.85 B	1.88 B	2.33 A	Average sample type

3. Conclusions

The concentrations of all chemical tests came within the permissible limits according to what was stated in the Iraqi specifications for drinking water, with the exception of phosphate values were higher than the permissible values, where awareness campaigns must be conducted for the reasons for increasing the concentration of phosphate and farmers in places that are close to the river must be directed to reduce the use of chemical fertilizers that increase water pollution, and sulfate concentrations were lower than the permissible limit, so the station at the present time does not need units. Removal of sulfates.

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