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Study of the Physical and Chemical Properties of the Euphrates River Water in the City of Hit

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Annotation: The study includes a comparison of the Euphrates River's physical and chemical characteristics in the city of Hit between October 2024 and April 2025 with the normative standards for drinking water in Iraq and elsewhere. Turbidity, electrical conductivity, total dissolved salts, pH, total hardness, and total basicity were all measured as part of the study, along with the concentrations of various positive and negative ions. The findings of all physical and chemical testing were confirmed to be within the acceptable limits for drinking water after being compared to the standard requirements. Low rainfall, high temperatures, and a small percentage of Iraq's water coming from the source nation were the causes of the high values of dissolved salts, total hardness, and sulfates in November. The high concentration of suspended particles in the research was also attributed to the breakdown of aquatic vegetation and the occurrence of flash floods during rainstorms, which cause some soil to be eroded into the river.

Keywords: Euphrates River, water tests, Hit, dissolved salts, drinking water specifications.

Introduction

Humans and other living things depend heavily on water for survival, and it is the most prevalent basic material in protoplasm. The expansion of human societies, the development of agriculture and industry, the desire for leisure products, and the eradication of diseases and epidemics have all led to a rise in population, which in turn has caused waste and pollutants to be released into

the water that were previously absent, causing natural waters to become contaminated in a variety of ways (2,1). Since water makes up over 71% of the Earth's surface, 97% of it is sea water, and 3% is river water, snow, and spring water, it is one of the most abundant resources in the world (3). Water is susceptible to both direct and indirect contamination as its usage has grown from basic agricultural and human needs to major industrial and civil applications. Consequently, there has been a global surge in interest in water resources and pollution control strategies (4). Water contamination is a result of human industrial, agricultural, and development activities, many of which are excessive. Water's capacity to remove pollutants has diminished due to the rise in these activities, and the signs of these pollutants are starting to raise red flags. Sea and ocean yields have declined, and water supplies in many places are now unsuitable and hazardous to human health (5).

Materials and Methods

Water samples from the Euphrates River in the city of Hit were collected monthly for six months, from October 2024 to March 2025, as part of the study. A location where the river runs swiftly and at a reasonable depth was selected for water sampling. Water samples were taken from one-liter plastic bottles, and details about the sampling site and time were noted. Additionally, the pH and temperature were recorded. Anya at the location of the sample. To guarantee that the samples' characteristics would not alter until they reached the lab for additional physical and chemical testing, they were kept at 4°C. The National Laboratory's water testing procedures were followed when performing the physical and chemical tests.

Results and Discussion

Temperature: Because it affects aquatic organism activity and efficiency, the nutrient cycle process, and the absorption of water and nutrients by roots, temperature has a significant and influencing influence on water quality and its physicochemical characteristics (6). Both the ambient air temperature and the water movement-induced excellent mixing characteristic have an impact on river temperature (7). Temperature levels varied from 13-23% to an average of 18 degrees Celsius, according to test findings.

Water temperature at all sites is determined by air temperature, and this is generally evident for all study sites. The higher the air temperature, the higher the water temperature, as the relationship was directly proportional (8).

Turbidity: According to test findings, the average international turbidity unit was 11.5 and the range of turbidity values was 4–22. Variations in river flow velocity, internal lake currents, suspended particles carried by the stream, and the amount of heavy water released into the river all affect how turbid the water is in rivers and lakes.

Electrical conductivity: Because electrical conductivity is directly proportional to the percentage of dissolved salts in the water, its values ranged from 1080 to 1316 microsiemens, with an average of 1177.

Suspended solids: The average suspended solids concentration in the studied regions was 58 mg/L, with values ranging from 20 to 128 mg/L. Rainfall prior to collecting the water sample from this region during the research period is the cause of the high suspended solids values because it brings silt and clay fragments into the river.

pH: Field measurements showed that pH values generally tend towards basicity. This tendency is due to the presence of carbonates and bicarbonates, as pH values ranged between (7.3-8.4) with an average of (7.8) (10.9).

Alkalinity: According to test findings, the average alkalinity value was 132 mg/L, with a range of 122-150 mg/L. Carbonates and bicarbonates often make up the total alkalinity of water, but the current investigation found that the bicarbonates were more prevalent, as the site's bicarbonates' basicity was the cause of the total alkalinity (11).

The research area's total dissolved solids (TDS) concentrations did not above the allowable limits; they varied from 714 to 850 mg/L, with an average of 770 mg/L. The impact of sewage disposal on local river water, urban trash, poor rainfall, Iraq's little share of water from Turkey, and the drought that has plagued the country for the previous 10 years are all to blame for this increase. As a result, the Euphrates River's dissolved solids content has increased.

Total hardness, calcium hardness, and magnesium hardness: Calcium and magnesium are among the most important causes of hardness. Their natural sources are limestone, which dissolves in water upon contact with it. The concentration of hardness in water also depends on the geological factors through which the water passes.

According to test results, the average total hardness value was 394 mg/L, with a range of 358 to 426 mg/L. The calcium hardness readings varied from 86 to 105 mg/L, with an average of 94 mg/L. Magnesium hardness varied from 32 to 40 mg/L, with an average of 36 mg/L. The overall hardness, calcium hardness, and magnesium hardness readings fell within the World Health Organization's and Iraq's acceptable criteria for drinking water. Because of the rain component, which dissolves lime and washes the soil, removing salts, including hardness salts, and sweeping them into the river, the rate of overall hardness is higher in the winter than in the summer(12).

Sodium and potassium ions: The sodium ion concentration readings did not significantly exceed the allowable limits; they ranged from 93–108 mg/L to an average of 85 mg/L. The potassium ion concentration did not above the specification's allowable limits, ranging from (3-6) mg/L to an average of (4.8) mg/L. Because potassium-containing silica resists chemical weathering comparatively better than sodium-containing silicate minerals, the concentration of potassium ions in fresh water is significantly lower than that of other positive ions, particularly sodium ions. Moreover, chemical fertilizers that seep into the river have an impact on the content of potassium, which is absorbed and fixed on certain clay minerals(13).

Chloride ion: The test's findings demonstrated that the chloride ion concentrations were within the allowable limits for drinking water in accordance with Iraqi standards, ranging from 104 to 130 mg/L with an average of 115 mg/L. The low level of the Euphrates River during the research period is blamed for this, but it might also be because the study period fell between the winter and spring, when concentrations tend to drop and rise during the summer as a result of water evaporation. This aligns with the findings of his research on the Tigris River (14).

Sulfate ion: Sulfates are considered one of the permanent causes of hardness in water, especially if they are found in the form of calcium or magnesium sulfate, so the water has a bitter taste, and they are also considered one of the causes of corrosion (15). The results of the tests showed that the concentration of sulfate ions ranged between (260-311) mg/liter, with an average of (287) mg/liter, which is within the permissible limits.

Conclusions: The following was discovered based on the outcomes of physical and chemical tests conducted on Euphrates River water throughout the research period: 1. The acceptable limits for drinking water were not exceeded in any of the physical or chemical tests. 2. November saw higher levels of dissolved salts, overall hardness, and sulfates. High temperatures, a dearth of precipitation, and Iraq's little share of water from the source nation are to blame for this. 3. The breakdown of aquatic plants and the occurrence of floods following rain, which causes some soil to be eroded into the river, resulted in increased concentrations of suspended particles.

Recommendations

1. Raise public awareness of the need to reduce pollution from human waste in order to protect rivers and rationalize water use.
2. Test the water from the Euphrates River on a regular basis to track variations in the drinking water's quality.

3. Create effective water treatment techniques in case the Euphrates River experiences a scarcity or drought.

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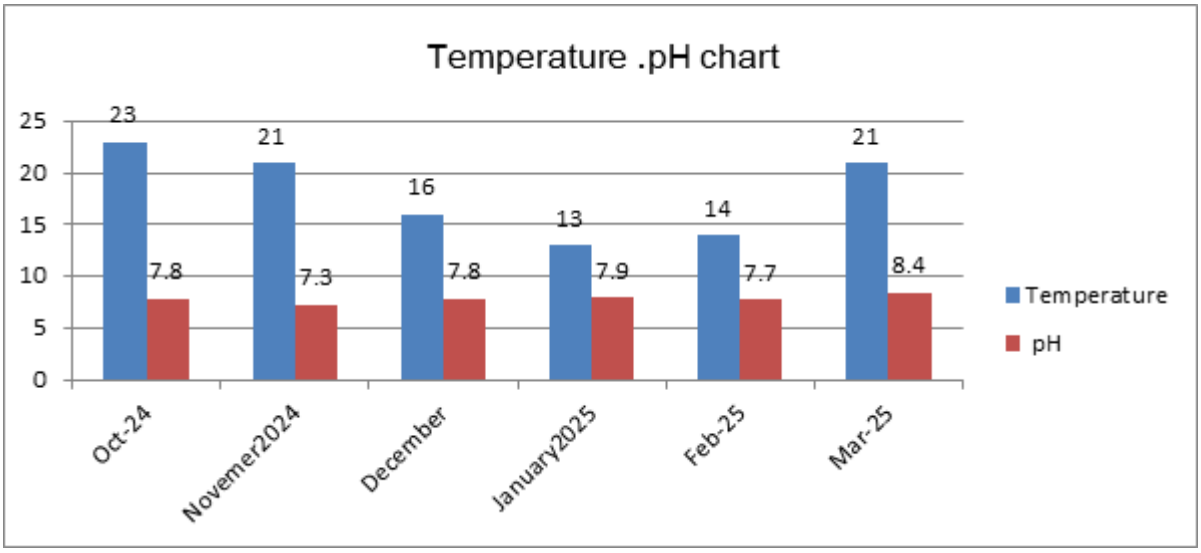
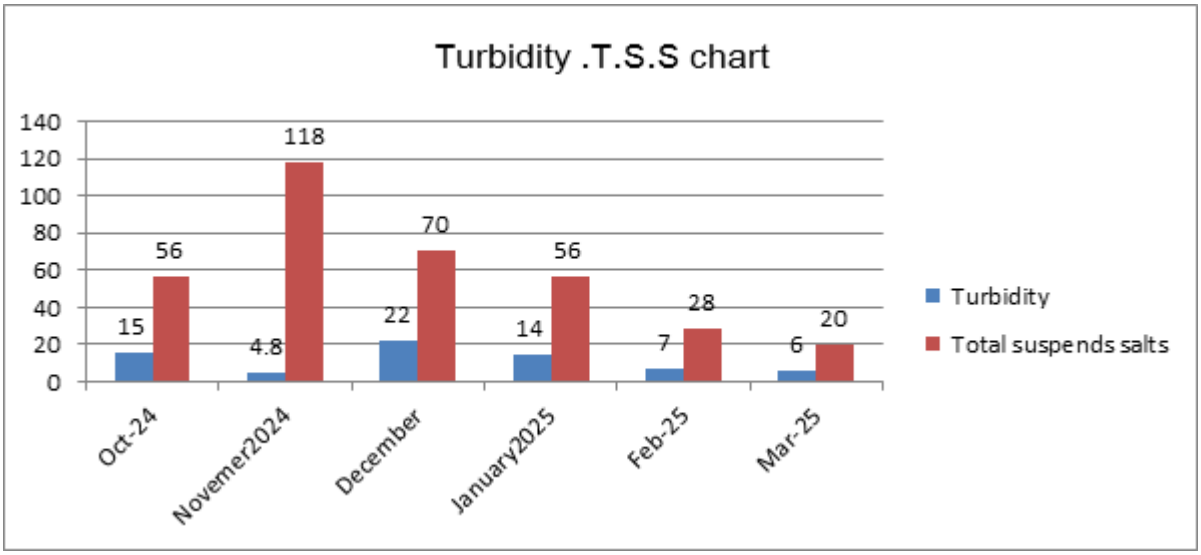
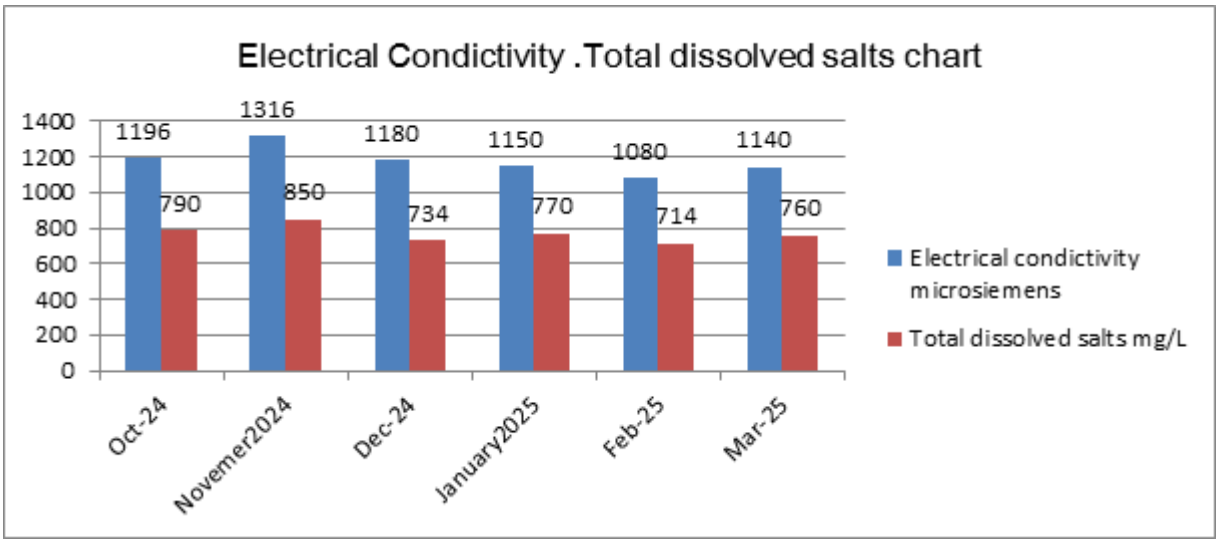
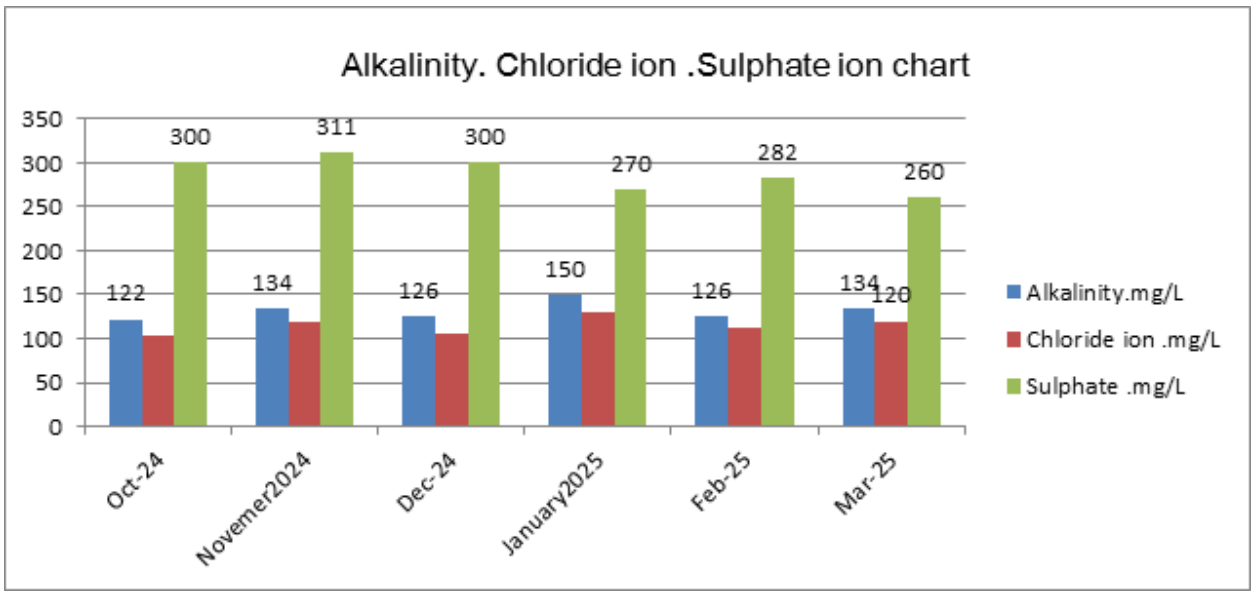
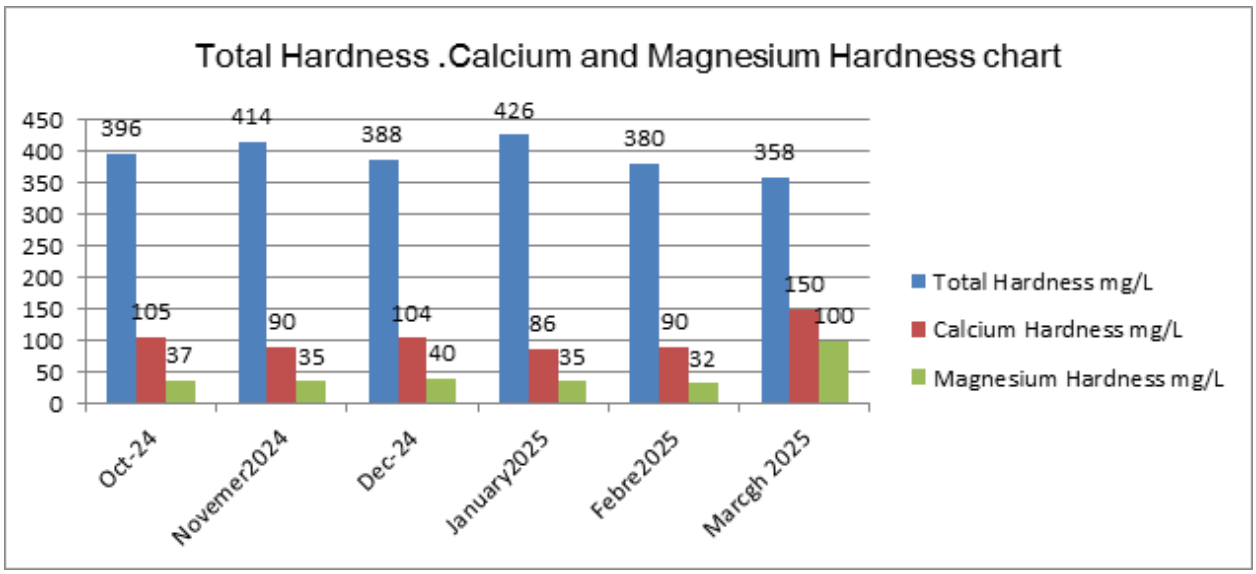
Schedule of physicochemical tests for Euphrates River water for the period from October 2024 to March 2025														
TSS	TDS	k	Na	SO4	Cl	Mg	Ca	TH	ALK	EC	pH	Tur	Tem	
56	790	5	95	300	104	36	90	396	122	1196	7.8	15	23	October (2024)
118	850	5	88	311	119	37	105	414	134	1316	7.3	4.8	21	November (2024)
70	734	6	92	300	105	35	90	388	126	1180	7.8	22	16	December (2024)
56	770	6	90	270	130	40	104	426	150	1150	7.9	14	13	January (2025)
28	714	5	85	282	112	35	86	380	126	1080	7.7	7	14	February (2025)
20	760	5	108	260	120	32	90	358	134	1140	8.4	6	21	March (2025)
	1000 mg/L		200 mg/L	400 mg/L	350 mg/L	100	150 mg/L	500 mg/L	250 mg/L	2000 Micro Siemens	6.5-8.5	5 NTU		Permitted Limits October (2024)

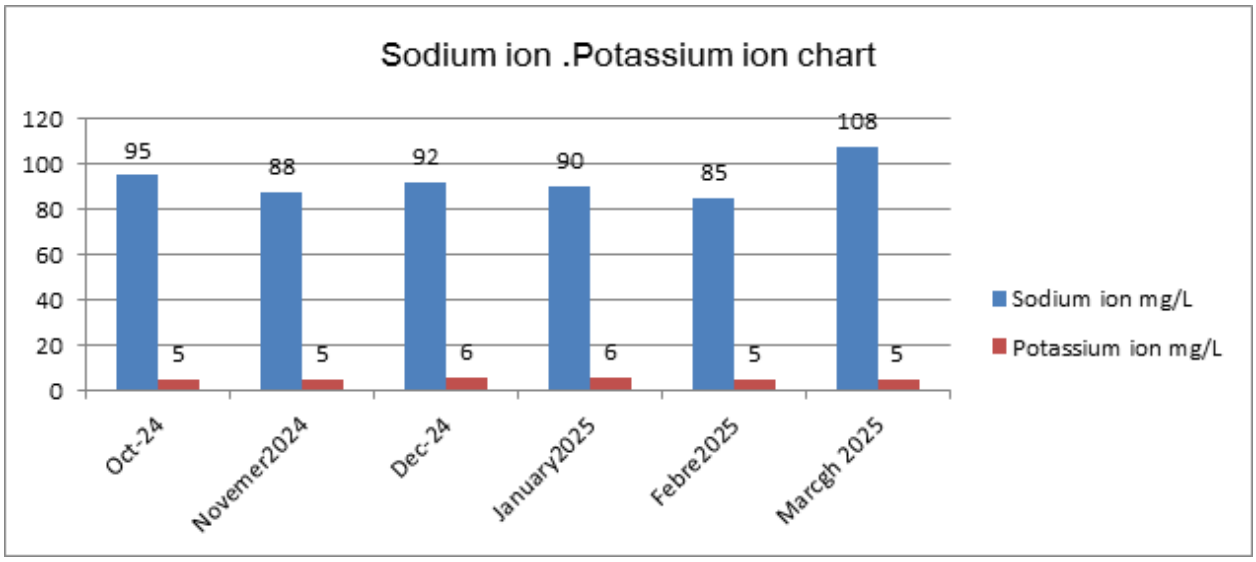







Alkalinity. Chloride ion .Sulphate ion chart
350
300
250
200
150
100
50
0
122
300
134
311
126
300
150
270
126
282
134
120
260
Oct-24
Novemer2024
Dec-24
January2025
Feb-25
Mar-25
Alkalinity.mg/L
Chloride ion .mg/L
Sulphate .mg/L


Total Hardness .Calcium and Magnesium Hardness chart
450
400
350
300
250
200
150
100
50
0
396
105
37
414
90
35
388
104
40
426
86
35
380
90
32
358
150
100
Oct-24
Novemer2024
Dec-24
January2025
Febre2025
Marcgh 2025
Total Hardness mg/L
Calcium Hardness mg/L
Magnesium Hardness mg/L


Sodium ion .Potassium ion chart
120
100
80
60
40
20
0
95
5
88
5
92
6
90
6
85
5
108
5
Oct-24
Novemer2024
Dec-24
January2025
Febre2025
Marcgh 2025
Sodium ion mg/L
Potassium ion mg/L