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# Study of chemical properties of water and sediments in AL-Mazag River during different months in Wasit Province

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## Abstract

To study the monthly changes in some chemical properties of Al-Mazag river water and the effect on water quality in some areas of Wasit Province, the study was applied for the period (January 2025 to November 2025). The distance between the Five sites were 10 km and the total was 50 km, samples were collected in months of (January, March, May, July, September and November).The study of chemical properties measurements of water including (pH, electrical conductivity EC, total dissolved solids TDS, total suspended solids TSS, dissolved oxygen DO, biological requirement for oxygen BOD, chlorides Cl, total hardness TH.The results showed that the highest value of pH recorded during the cold month (January) reached 8.67, while the lowest value during the hot month (July) reached 7.48, with an average of 8.03,the highest value of electrical conductivity was recorded during the hot month (July) and it reached 1.22 dS $m^{-1}$, while the lowest value was recorded at the cold month (November) which reached 0.56 dS $m^{-1}$and the total average was 0.83 dS $m^{-1}$,the results showed that the total dissolved solids TDS was the lowest value during (November) and reached 355.60 mg $L^{-1}$, while the highest value was during the July (769.40 mg $L^{-1}$) and the total average was 529.93 mg $L^{-1}$.The study explained that the highest value of TSS total solid salts was achieved (77.20 mg $L^{-1}$) and the lowest value was (44.40 mg $L^{-1}$) and the total average was 63.07 mg $L^{-1}$,the results showed that the value of CL chlorides increased in the cold months, compared to the hot months, they were 147.59 and 94.96 mg $L^{-1}$, respectively, the results were record of the lowest value of dissolved oxygen in the city of July was 5.38 mg $L^{-1}$, while the highest value was recorded in November, which was 11.88 mg $L^{-1}$.However, the value of BOD did not reach the highest value during the hot month (July) when it reached 4.31 mg $L^{-1}$, compared to the month of January, which reached the lowest value, which was 0.63mg $L^{-1}$.

**Keywords:** Chemical properties , AL-Mazag River , different months.

## Introduction

pollution is one of the most important environmental problems in most of the countries, especially developed countries ,which have serious economic and social dimensions and lead to the deterioration of the ecological system. The quantitative and qualitative change that affects the composition of the elements of this system leads to disruption and the inability of the ecological system to accept this. One of the products of human, agricultural, industrial and military operations, such as toxic and radioactive substances and sewage products that are throw in to the water of the rivers, affect human health, which is why we need to educate people about the study of pollutants and treatment methods, but they are a big and dangerous problem [19] that become more complicated when the development of various industries, technologies and the resulting chemical wastes, toxins, and environmentally hazardous waste, in addition to the tremendous expansion in the use of pesticides, disinfectants, and sterilization materials, the issue of sewage and industrial water and the process of random release for service workshops. All these activities pollute the natural resources, especially rivers and stream sand lakes contain all types of pollutant sand changes in some chemical and physical characteristics that greatly affect aquatic life, diversity and density, in addition to determining the extent of their use for agricultural purposes, human uses and drinking water [10]. It represents the chemical properties of hydrogen peroxide in water, which affects aquatic organisms and depends on most metabolic activities.

Many of the dissolved elements may be precipitated as hydroxides when the hydrogen is high and reappear again in dissolved form when it is too low [24]. In addition, to the electrical conductivity of water, which is considered one of the important environmental factors in determining water quality and indirectly affected by temperature, dissolved solids and organic materials in water [3]. Dissolved solids and total suspended solids in water consist of different minerals including Calcium, Magnesium, Sodium, Potassium, Carbonates, Bicarbonates, Chlorides, and Sulfates, in addition to dissolved organic materials and salts [4]. Therefore, this study aims to determine some chemical characteristics related to the evaluation of water quality in some areas of the Tigris River in Wasit

Province and at different time periods, such as pH, electrical conductivity (EC), total suspended solids (TSS), total dissolved solids (TDS), chloride (CL), and oxygen. Also the dissolved DO and the vital requirement for oxygen, BOD to provide a data base to help decision-makers to take the necessary decisions to protect the Tigris River.

## Materials and Methods

### Study area

Five sites in Tigris River were selected, the distance between the site was 10 km, and the total distance was 50 km, since the distance is extended from Al-Ahrar district to the center of Al-Kut in Wasit Province.

### Sample collection

The samples were collected from the five sites (1,2,3,4,5) for two months and for a year, starting from 1/1/2024 to 1/12/2024, and three replicate for each sample as follow: -Collect water samples for chemical analysis using clean polyethylene containers with a capacity of 5.0 L [16]. Chemical tests of water

### Chemical tests of sediments and water

(pH) measurement using the device pH meter according to description method and Electrical Conductivity measurement (EC) using EC meter device according to the method that described in [17], Total Dissolved Solids (TDS) Measured by TDS, then calibrated with standard solutions [9] Total Suspended Solids (TSS).The measurement was applied according to the method described by the American Public Health Association by filtering 100 ml of the sample through a filter paper, then weighing it accurately, then drying this paper in an oven at a temperature of 105-103 °C for 24 hr., after that, the weights were weighed. Chloride was measured by the correction method with silver nitrate (0.01 N) due to potassium chromate and according to the method mentioned by [9]. Dissolved oxygen (DO) and biological requirement for oxygen (BOD). The Azide modification method was used and mentioned by [9].

### Statistical analysis

The data were analyzed using ANOVA table and least significant difference test (LSD) at the level of 0.05 according to [5].

**Results and Discussion**

**Degree of interaction (pH)**

Table (1) showed that the value of Al-

Hydrogen ranged 8.67-7.48 and the highest value was at the November, which reached 8.67,while the lowest value was achieved during the July, which was7.48.The Total average was 8.03, which indicates that the increase in the value of Hydrogen towards in the cold cities such as November and January is due to the decrease in decomposition levels. However, the relative decrease during the hot months like July is due to the vitality of bacteria and other microorganism that work crease the decomposition and the tendency of the water gradually towards equilibrium almost in the case of limited pollution [22].The results of the statistical analysis indicate the existence of spiritual differences between the cities of the Sun and the locations of the study (Table1).In general, the researchers attribute the main reason for the Al-Hydrogen and its approach to the state of equilibrium in fresh water environments in general to the fact that this process is governed by the balance between the concentration of $HCO_3$, $CO_3$ and $CO_2$ and the presence of aquatic plants at different levels, which leads to the formation of bicarbonate .However, aquatic plants absorb excess $CO_2$ and thereby regulate the relationship according to the principle known as buffer capacity in water [7].

**Table1.**pH values of AL-Mazag River during different months in Wasit Province

| **sites** | **months** | | | | | | |
|---|---|---|---|---|---|---|---|
| | **January** | **March** | **May** | **July** | **September** | **November** | **Average** |
| 1 | 8.70 | 8.21 | 7.78 | 7.40 | 7.98 | 8.00 | 8.01 |
| 2 | 8.71 | 7.98 | 7.71 | 7.45 | 7.78 | 8.33 | 7.99 |
| 3 | 8.60 | 8.11 | 7.83 | 7.50 | 7.75 | 8.22 | 8.00 |
| 4 | 8.65 | 8.22 | 7.90 | 7.53 | 7.77 | 8.13 | 8.03 |
| 5 | 8.67 | 8.26 | 7.94 | 7.54 | 7.89 | 8.44 | 8.12 |
| Average | 8.67 | 8.16 | 7.83 | 7.48 | 7.83 | 8.22 | LSD.05 |
| LSD 0.05 | 0.01 | | | | | | 0.02 |

**Electrical conductivity (EC)**

The results showed that the minimum average value of electrical conductivity reached (0.56) dis.m-1 during November (Table 2). However, it was the highest value in July and reached the average of (1.22) dis.$m^{-1}$ and the total average was 0.83 Ds $m^{-1}$.Therefore, it is classified as Oligo saline in low-salinity waters. The results show that the salinity is high in hot months, especially July. The reason is attributed to the decrease in water quality, high temperatures, and the rates of evaporation and decomposition of compounds. The results of the statistical analysis is indicate the existence of spiritual differences in the values of the electrical in solution between the months, while the spiritual differences between the study periods in the Tigris River. Electrical conductivity has a strong relationship with the amount of ions and dissolved salts, in addition to the amount of soluble soil components in the river water, in addition to the amount of total dissolved solids and others [18] found that salinity determines the different uses of water, since the specifications and salinity of the required water vary according to the type of use. In the case of human use, the highest concentration of water salinity allowed for drinking water is 1000 ppm (0.5 g $L^{-1}$ of water). It depends on the type of salt and the amount of daily consumption, which governs the social status of the population and other personal factors. But for agricultural use, most types of plants cannot grow in extreme saline environments, although the plants differ in their tolerance to saline concentration levels. Most of them reduce their productivity if this concentration exceeds 2000 ppm [2].

**Table2 .**EC (dS $m^{-1}$) values of AL-Mazag river during different months in Wasit Province

| **sites** | **months** | | | | | | |
|---|---|---|---|---|---|---|---|
| | **January** | **March** | **May** | **July** | **September** | **November** | **Average** |
| 1 | 0.50 | 0.61 | 0.79 | 1.11 | 0.98 | 0.77 | 0.79 |
| 2 | 0.55 | 0.64 | 0.73 | 1.20 | 0.95 | 0.75 | 0.80 |
| 3 | 0.55 | 0.67 | 0.80 | 1.23 | 0.97 | 0.79 | 0.84 |
| 4 | 0.58 | 0.70 | 0.82 | 1.25 | 1.00 | 0.74 | 0.85 |
| 5 | 0.60 | 0.73 | 0.89 | 1.30 | 1.08 | 0.76 | 0.89 |
| Average | 0.56 | 0.67 | 0.81 | 1.22 | 1.00 | 0.76 | LSD0.05 |
| LSD0.05 | 0.01 | | | | | | NS |

**Total dissolved solids (TDS)**

The results showed that the value of the total dissolved salts in water, as the minimum value was recorded in the November, was 355.60 mg $L^{-1}$,while the highest value in the July was 769.40 mg $L^{-1}$, and the total average was 529.93 mg $L^{-1}$ (Table 3).This is due to the increase in temperature and evaporation rate, high decomposition rates of various chemical compounds, and high salinity percentage due to high temperature during the hot months, compared to the rates during the cold months ,and in those months, there is a decrease in the amount of dissolved salts [6]. The results of the statistical analysis (Table 3) show that there are significant differences between the months in the amount of dissolved salts in water, while there are no significant differences between the different locations in the study. The effect to TDS rates on the biomass of the natural complex through the active relationship with salinity. Thus, this correlation constitutes as partial effect in the distribution of algae, in variable rates, shells, and others during the effect on the most physical and chemical properties of water medium [6].

**Table3.** TDS (mg $L^{-1}$) values of AL-Mazag River during different months in Wasit Province

| sites | months | | | | | | |
|---|---|---|---|---|---|---|---|
| | January | March | May | July | September | November | Average |
| 1 | 320.00 | 390.00 | 505.00 | 710.00 | 627.00 | 493.00 | 507.50 |
| 2 | 352.00 | 410.00 | 470.00 | 768.00 | 610.00 | 480.00 | 515.00 |
| 3 | 352.00 | 429.00 | 512.00 | 788.00 | 620.00 | 505.00 | 534.33 |
| 4 | 370.00 | 448.00 | 525.00 | 800.00 | 640.00 | 486.00 | 544.83 |
| 5 | 384.00 | 429.00 | 518.00 | 781.00 | 690.00 | 486.00 | 548.00 |
| Average | 355.60 | 421.20 | 506.00 | 769.40 | 637.40 | 490.00 | LSD0.05 |
| LSD0.05 | | | | | | | N |

**Total suspended solids (TSS)**

Table (4) showed that the value of total solid salts suspended in Tigris River for some locations. The lowest amount was achieved in the July, which reached 44.40 mg $L^{-1}$, compared to the January, which achieved 77.60 mg $L^{-1}$, and in all locations and the total average was 63.07 mg $L^{-1}$.The high percentage of suspended total solid salts during the cold cities such as January may be due to the amount of rain and the

erosion of the saline-containing soil adjacent to the river, thus causing the high percentage of solid saline algae. In addition to the cold water, it reduces the process of dissolving solid salts. Thus, increasing the quantities, for example, in hot cities such July, which causes the melting of soluble salts at the expense of low-soluble salts.

**Table4.**TSS (mg $L^{-1}$)values of AL-Mazag River during different months in Wasit Province

| sites | months | | | | | | |
|---|---|---|---|---|---|---|---|
| | **January** | **March** | **May** | **July** | **September** | **November** | **Average** |
| 1 | 80.00 | 75.00 | 66.00 | 40.00 | 48.00 | 69.00 | 63.00 |
| 2 | 73.00 | 70.00 | 60.00 | 43.00 | 50.00 | 65.00 | 60.17 |
| 3 | 75.00 | 71.00 | 63.00 | 45.00 | 52.00 | 64.00 | 61.67 |
| 4 | 81.00 | 78.00 | 68.00 | 48.00 | 54.00 | 72.00 | 66.83 |
| 5 | 77.00 | 74.00 | 59.00 | 46.00 | 56.00 | 70.00 | 63.67 |
| Average | 77.20 | 73.60 | 63.20 | 44.40 | 52.00 | 68.00 | LSD.05 |
| LSD0.05 | 3.00 | | | | | | NS |

**Chlorides**

Chloride is one of the negatively charged and importations due to the tendency of most chlorine salts to dissolve and dissolve in water, and the variety of sources in the environment, especially sedimentary rocks [1].The results of the statistical analysis (Table 5) indicate the presence of significant differences in the value of chlorides during the months of the year, while the non-significant increase was between the study periods. The results showed that the value of chlorides during the different months of the year, with the lowest value occurring in the July, which was 94.97 mg $L^{-1}$, corresponding to the months of October and January, when the values reached 147.59 and 144.43 mg $L^{-1}$, respectively, and the total average was 124.73 mg $L^{-1}$.This is due to the effect of rain water washing he surrounding soil, as well as the leakage of organic and industrial pollution agents containing some components on high concentrations of chlorides, especially those characterized by the tendency to dissolve [22].

**Table5.**Chlorides (mg $L^{-1}$) values of AL-Mazag River during different months in Wasit Province

| sites | Months | | | | | | |
|---|---|---|---|---|---|---|---|
| | **January** | **March** | **May** | **July** | **September** | **November** | **Average** |
| 1 | 146.26 | 140.20 | 120.00 | 95.00 | 100.27 | 150.33 | 125.34 |
| 2 | 144.52 | 138.26 | 128.69 | 98.55 | 103.49 | 147.29 | 126.80 |
| 3 | 148.12 | 135.66 | 118.00 | 94.33 | 111.00 | 151.00 | 126.35 |
| 4 | 140.11 | 130.00 | 124.36 | 96.74 | 102.24 | 142.86 | 122.72 |
| 5 | 143.15 | 133.48 | 113.00 | 90.22 | 108.28 | 146.50 | 122.44 |
| Average | 144.43 | 135.52 | 120.81 | 94.96 | 105.05 | 147.59 | LSD.05 |
| LSD0.05 | 2.89 | | | | | | NS |

## Dissolve oxygen

The results showed that the values of dissolved oxygen during the different months of the year, since the highest values appear during the cold months of the year, especially the months of January and December. The values were 11.88 and 11.31 mg $L^{-1}$, respectively, compared to hot months, which achieved the lowest values, especially July and Mays, which reached 5.38 and 8.51 mg $L^{-1}$, respectively, This is because to the many factors that affect the amount of dissolved oxygen in the aquatic environment, including its increase and decrease, such as temperature, quality of air currents, flow speed, density of plankton and dissolved compounds in water, and the amount of pollutants [8].The results of the statistical analysis indicate the presence of significant differences in the amount of dissolved oxygen in water between the Sunni and non-Sunny cities between the study periods (Table 6).

**Table.** Dissolved oxygen (mg $L^{-1}$) values of AL-Mazag River during different months Wasit Province

| sites | months | | | | | | |
|---|---|---|---|---|---|---|---|
| | **January** | **March** | **May** | **July** | **September** | **November** | **Average** |
| 1 | 12.25 | 10.00 | 8.11 | 5.30 | 9.00 | 11.00 | 9.28 |
| 2 | 11.56 | 10.27 | 8.00 | 5.36 | 9.22 | 11.11 | 9.25 |
| 3 | 11.83 | 10.80 | 9.23 | 5.28 | 9.58 | 11.57 | 9.72 |
| 4 | 12.00 | 10.50 | 8.88 | 5.44 | 9.75 | 11.69 | 9.71 |
| 5 | 11.75 | 10.48 | 8.50 | 5.50 | 9.67 | 11.19 | 9.52 |
| Average | 11.88 | 10.41 | 8.54 | 5.38 | 9.44 | 11.31 | LSD0.05 |
| LSD0.05 | 0.53 | | | | | | NS |

## Biological requirement for oxygen BOD

It represents the biological requirement for oxygen, the amount of dissolved and consumed oxygen before the aerobic organisms and biological decomposition on the consumption of dissolved oxygen and increases the biological requirement for oxygen. Table (8) shows the value of the vital requirement for oxygen in the water of the Tigris River, since the values differ according to the months of the year and the studied locations. The lowest values were achieved during the cold months, especially in the cities of November and January ;the values reached 0.63 and 1.09 mg $L^{-1}$, respectively, compared to the hot months, which achieved the highest values, especially in July and May. The values reached 4.31 and 2.57 mg $L^{-1}$, respectively, and the total average was2.04 mg $L^{-1}$.This is due to a number of factors, including the irregular flow of organic pollutants into the river, the speed of the current, air currents, and the lack of water depth. Therefore, it leads to an increase in the value of the vital requirement for oxygen in the water and at the same time replaces the dissolved oxygen in the water in the surface layer [4].

## Conclusions

The study concludes that the highest value of pH recorded during the cold months (January), while the lowest values during the hot months (July).The highest value of electrical conductivity was recorded during the hot months (July), but the lowest value was recorded at the cold months (November). The results showed that the total dissolved solids TDS was the lowest value during (November), while the highest value was during the July. The

study explained that the highest value of TSS total solid salts. Finally, the results showed that the value of CL chlorides increased in the cold cities, compared to the hot months.

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