Qualitative characteristics of irrigation water in the Dujaila irrigation

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Abstract:
The study aims to know the qualitative characteristics of irrigation water in the Dujaila irrigation project, and its suitability for human uses. 15 elements were analyzed at the level of ten samples distributed over the study area, as it is noted that all elements in the samples are within the permissible standard limits. CA) Which was the global standard limits of (75) mg / liter, and the reason for this is the sediments that are originally present in river waters as a result of the melting of sedimentary rocks in them . CL2 (Which was the standard border (200) mg / l , while the total salinity amounted to 648 mg / L and conductivity electrical 876 mg / L either Ekorh , (12.9) and it became clear through the analysis of measuring the quality of water that the quality of the rock and the characteristics of the soil , climate and human factors factors affected the quality of Water and its uses, the study recommends to protect water resources from pollution by activating legislation and establishing water treatment plants .

key words.: (Water pollution , environmental impacts , irrigation and drainage)

the introduction

The need for safe water for drinking and for domestic and agricultural uses is increasing on a large scale, but the deterioration of water quality and its pollution is reducing the possibility of exploiting water sources without treatment and polluting water with waste, any natural or human source, which affects the water and the degree of its different use, and the quality of irrigation water plays a key role in The productivity of the
agricultural crop and there are some considerations that must be known to determine the problems that poor quality water may cause from lack of productivity and a deterioration in the physical and chemical properties of the soil. Physical and chemical by increasing the field in the study area and taking samples of water from different locations and these samples were analyzed in the upper holy shrine laboratory, Fadak laboratories for central analyzes on 01/21/2021. The decrease in the values of the elements from the standard limits and the statement of the effect Raha about human uses

**the study Problem:**

The study problem stems from a main problem:
What are the environmental impacts of irrigation and drainage projects for the Dujaila irrigation project?

**Study hypothesis:**
The study of the hypothesis can be determined by the following:
There are several environmental impacts of the Dujaila irrigation project, including effects on agricultural lands, including effects on the population in the study area, and this can be known by comparing the results of the analyzes with the standard limits of the elements.

**Purpose of the study:**
The protection of the environment and its resources has become an environmental awareness and a correct understanding of environmental issues through the optimum use of materials in light of sustainable development is a primary goal for man. Therefore, the study aims to achieve the following things:

- 1Identifying the natural and human characteristics affecting the Dujaili Irrigation Project
- 2Clarifying the reality of the geographical extension of the irrigation and drainage network in the Dujaila irrigation project and the extent of its conformity with the hydrological standards.
- 3 Studying the hydrological situation of the project and evaluating its efficiency and the project’s suitability for irrigation.
- 4 Developing appropriate treatments and procedures to reduce the problems that the project water is exposed to.

**Study Justifications:**

The topic was chosen for several reasons, including:
- 1 The study aims to reveal the environmental challenges that cause water wastage and the continued deterioration of water quality, and to achieve the proper management of water resources.
- 2 The study area suffers from a scarcity of water resources at the present time.
- 3 The researcher's desire to contribute to putting forward means that enable the sustainability of water resources.

**The limits of the study:**

The project is located in the province of Wasit on the right side of the Tigris River and on the left side of the Shatt al – Gharraf, and is the site boundaries and the area of the most important things that you need a researcher when studying any water source or agricultural land, as through which the definition of water resources, or the region or the region and determined to A fixed basis for the duration of the study, the study came with spatial boundaries represented by the study area and its astronomical location located between latitudes 315010 ) and 323515) north and longitudes (455505 and 464810) east . To the west, the district district, to the south by Dhi Qar governorate, and to the east by Maysan governorate, where the irrigation project ended in Al–Musandak Mar, east of the study area. The area of the study area is (1968.48 km²) .

Branches Dujailah from the right bank of the project of the Tigris River from a point located 330 m north of the embankment and be between the two holes land each 5 meters with a maximum discharge of my design
42 m/s, the nature of governing the president and gates designed to secure taking water from the provider helm of Kut, the main tables without causing entry Sandy or natural deposits in it. The length of the project is 57 km and 13 sub-channels branch from it to feed distributed streams, their total lengths are 250 km, of which 40.7 km are lined.

Main troughs were implemented in the project, as were secondary troughs and grouped troughs. The total length of the main, subsidiary and aggregate troughs is 1131 m.

The irrigated area within the boundaries of the project is 369,000 dunums of irrigated and non-irrigated lands. The total area allocated for irrigation according to the budget indicators is 225 dunums, and the net area of irrigation covered by the irrigation and drainage network, while the area covered in Salah is 118 thousand dunums.

Map (1) of the location of the study area of Wasit Governorate

Source: Based on the administrative map of Iraq 1:100000
Qualitative and quantitative characteristics of the Dujaila Irrigation Project:

The qualitative and quantitative characteristics are analyzed by (10) samples of the project water. These samples were analyzed and the extent to which the values of these elements increased or decreased according to the standard limits and their validity and impact on human uses. As shown in map (2), it is represented in the following items:

1. **Water temperature**:

It can be seen from Table (1) that, the highest temperatures in the end-of-project sample (S10) in the age of 14, it reached (26.6) degrees Celsius, while the lowest value of the temperature was in the chest of the regulator (S1) on the Tigris River (20.8) degrees Celsius. The reason for the drop in temperature is due to the proximity of the sample to the Tigris River, and the water is constantly renewed in the regulator’s chest, in addition to taking a sample at the beginning of the early morning hours, while the values ranged between the highest value and the lowest value. As shown in the figure (1) As for the standard limits of the sample, it is noted that all samples are within the standard limits of temperature.

Map (2) locations of the samples in the study area

[Map of sample locations]

Source: The researcher based on satellite visual landseat8
Table (1) Physical and chemical properties of samples taken from the study area

| Source: The Upper Holy Shrine, Fadak Laboratories for Central Analytics, Issue 0047, dated 1/21/2021 |
| Figure (1) Water temperature values taken from the study area |

| Source: Table(1) |

**2. Total total salts TDS**

The percentage of total salts varies from one sample to another according to the nature of the mother rocks of the study area, as well as the salts in the water of the irrigation project. From the data of the table, it is noted that the highest value of salts was in the sample (S2) it reached (648) and the reason for the rise is due to the location of the sample after the center of Kut city and the neighboring areas of the project, which
supply the city with large quantities of salt through liquid waste, while the lowest value in the sample reached) S4(Sheikh 4) amounted to (446), while the values remained between the highest and lowest values in the table as in Figure (2). It is noted that the standard limits of the samples were all less than those limits, which amounted to (1000) mg / liter.

**Source: Table(1)**

Figure (2) values TDS In the samples taken from the study area

![Figure 2](image1)

**Source: Table(1)**

**Electrical connection (EC)**

The electrical conductivity with the total salts is directly proportional, as it is noted that its highest value was in the sample) S2,(which amounted to (876) millimose / cm, while it reached the lowest value in a sample) S4,(which amounted to (732) millimose/cm, while the values ranged between the highest value and the lowest value as in the figure and map below.

**Source: Table(1)**

Figure (3) values EC In the samples taken from the study area

![Figure 3](image2)

**Source: Table(1)**
.4pH (pH):

It is defined as the negative logarithm of hydrogen ion concentration. It represents a measure of the acidity and basicity of solutions (pH). In solutions between (0–14) When the value of (pH) Less than (7) the solutions are acidic, but if they are greater than (7) they are basic, and when they are equal to (7) the solutions are neutral, when the temperature and pressure are normal. It is noted from the table data that the highest value was in a sample (S10) At the end of the irrigation project and the lowest value was in a sample (S2) The bridge of the Kut-Al-Hayy highway, and the reason for this sample’s proximity to acidity is due to the occurrence of the sample after the city of Kut, which in turn throws a lot of liquid waste into this river from the neighborhoods (Al-Karimiyah – Old Glory – New Glory – Al-Hawra neighborhood). As for the remaining values, they ranged between the highest and lowest tabulated value as in Figure (S8) and the map below. As for the standard limits, all samples were within the standard limits, which ranged (7.6 – 8.5), as shown in the table.

Source: Table(1)

Figure (4) values PH In the samples taken from the study area

Source: Table(1)

.5Sulfate ion (SO₄):

The sulfate ion is present in surface waters due to disintegration and dissolution like gypsum (Gypsum) anhydrite (CaSO₄) evaporite rocks (Evaporates) (CaSO₄.2H₂O). In some cases, this is due to the
decomposition of agricultural fertilizers and consequently its presence in the studied samples. It is noted from the table that the highest value of sulfate came in a sample (S4) in Shakha 4, it reached (236.5) as a result of the large number of fertilization of lands in this area, and the lowest percentage was in a sample (S2) (The bridge of the Kut–Hay highway, which amounted to (218.2), as for the rest of the samples, they ranged between the highest value and the lowest scheduled value. As it is noted from Figure (5) below, as for the international standard limits, all samples were less than the international standard limits, which amount to (250) mg / liter.

Source: Table (1)

Figure (5) values SO₄ In the samples taken from the study area.

Source: Table (1)

Nitrate ion (NO₃⁻): The sources of this ion in water are many, the most important of which are plant residues, agricultural crops and chemical fertilizers. The nitrate ion is also produced from waste water and industrial waste. It is clear from the data of Table (17) that the highest value was in the sample (S9) in Nazim 36 as its value reached (0.99) and the reason for its high is the occurrence of the sample at the end of the irrigation project and it is unlined and abounds on the shoulder of natural plants, while its lowest value was reached in a sample (S2) (The Kut–Al–Hay highway bridge reached (0.11), while the values ranged between the highest value and the lowest scheduled value, as shown in Figure (6) below. As for the
standard limits, all samples were much less than the international standard limits, which amount to (50). mg/litre.

Figure (6) values NO₃:

In the samples taken from the study area

Source: Table (1)

7. Phosphate ion PO₄³⁻:

It is found in the form of phosphate and in low percentages in the rocks and the permissible limit according to the maintenance of Iraq’s rivers from pollution (3 mg / liter). Its importance lies in fertilizing agricultural lands and providing them with elements that help them improve crops both quantitatively and qualitatively. It is noted from the data of Table (1) that the highest value was in a sample (Regulator 36 as it reached (7.9) mg / liter, while it reached the lowest value in a sample (S2) The Kut–Al Hay highway bridge reached (2.2) mg/L, while the values ranged between the highest value and the lowest scheduled value, as noted in Figure (7). As for the standard limits, it is noted that all samples taken are less than the international standard limits of (20) mg / liter.

Figure (7) values PO₄³⁻:

In the samples taken from the study area
Dissolved oxygen:

The amount of dissolved oxygen in water is a determining factor for most of the aquatic organisms that live in it. It is known that plant life is severely affected if the dissolved oxygen concentration in water is less than 5 mg/liter. The dissolved oxygen in water comes from several sources, including what is produced by photosynthesis. It is noted from the data of Table (1) that the highest percentage of oxygen was in a sample S6 (The age of 6 reached 0.23 mg/liter, while it reached the lowest percentage in a sample) S2 (The sample of the Kut–Al–Hay highway bridge, which amounted to 0.15 mg/liter, while the values ranged between the highest and lowest tabulated value, as noted in Figure (8) and the map (10) below. As for the standard limits, it is noted that all samples are less than the limits Internationally permitted, which amount to (20) mg/liter.

Turbidity:

It could be a reason turbidity It is a phytoplankton in open waterways. Some human activities also cause disruption water such as building and construction, which may lead to high levels of sedimentation entering into water During rainstorms that increase the level water and then sour water. It is noted from the data of Table (1) that the highest
percentage of turbidity was in a sample) $S_{10}$ (at the age of 14 at the end of the irrigation project, which amounted to (12.9), while the lowest percentage in the sample was $S_9$ (in Regulator 36, which amounted to (4.2), while the values ranged between the highest value and the lowest scheduled value, as noted in the figure and map below. As for the standard limits, it is noted that all samples come under the international standard limits, which amount to (20) mg / liter.

Figure (9) **turbidity** values of samples taken from the study area

![Turbidity Values](image)

Source: Table (1)

**10 Magnesium ion** ($Mg$)

Magnesium ion is produced from the decomposition and melting of dolomite rocks, as the abundance of dolomite rocks and the increase in sulfate concentrations in the water leads to the precipitation of calcium carbonate and the release of magnesium sulfate in the water. $S_2$) The neighborhood road, as it reached (31) mg / liter, while it was the lowest concentration of magnesium in a sample. $S_9$ (Regulator (36), as it recorded (22) mg / liter, as in the figure and map below, as for the international standard limits, all samples were less than these limits, which amounted to (50) mg / liter.

Figure (10) **Magnesium** values in samples taken from the study area

![Magnesium Values](image)
Calcium ion: \((\text{Ca}^{++})\)

Calcium ion is produced from the melting of sedimentary rocks such as calcite, dolomite, aragonite, gypsum and anhydrite by chemical weathering processes. S9 (Nazem 36 as it reached (244.6), while it reached the lowest value in a sample) S1 (As it reached (207.8) while the values ranged between the highest value and the lowest value in Table (1), as can be seen in the figure and map below. As for the international standard limits, all samples are noted above the international standard limits. The reason for this is the sediments that are originally present in river waters as a result of the melting of sedimentary rocks in them.

Figure (11) values \((\text{Ca}^{++})\) in the samples taken from the study area.

Source: Table(1)
12 Sodium ions (Na⁺):
Sodium ion is produced from the melting of minerals forming salt rocks in the study area, such as a mineral (Halite (NaCl) Under certain conditions as well as from the weathering of clay minerals such as (Montmorelonite)) It is clear from the data in Table (1) that the highest value was in a sample (S1) The age of 7 reached (169) while it reached the lowest value in a sample (S9) in Nazim (36), reaching (147.1), and the reason for this is due to the large number of natural plants in this area, which in turn acts as a disinfectant for the irrigation project. As in the figure and map below. As for the standard limits, it is noted that all samples are less than the international standard limits, which are (230) mg / liter.

Figure (12) values (Na⁺) In the samples taken from the study area

![Graph showing sodium ion values](image)

Source: Table (1)

13 Bicarbonate ions (HCO₃⁻)
The dissolution of limestone rocks and salt deposits of geological formations are among the most important processes that produce bicarbonate, as carbon dioxide gas dissolves (CO₂) In rainwater or the surface water of valleys to be carbonic acid (H₂CO₃) Which in turn works to dissolve limestone when the pH value is less than (8.2) All carbonates are converted to bicarbonates as in the following equation .

(\[ \text{CaCO}_3 + \text{H}_2\text{O} + \text{CO}_2 = \text{Ca(HCO}_3\text{)} \])

From the data of Table (1), it is clear that the highest value was in a sample (S1) (of the main regulator, as its value reached (198.5), while the lowest value was in a sample (S9) (Nazim 36)
as it reached (99.2), while the remaining values ranged between the highest value and the lowest scheduled value as it is noted in the figure and map below. As for the standard limits, it is noted that all elements are less than the international standard limits, which amount to (600) mg / liter. Figure (13) values (\textbf{HCO}) in the samples taken from the study area.

![Graph showing data](image)

Source: Table(1)

\textbf{14chloride ion (Cl\textsuperscript{-}):}

The reason for the presence of the chloride ion is less in fresh water than in natural water, and it results from sedimentation of evaporite rocks such as halite (Halite) sulfites (Sulfite) And from ancient sea water contained within old sediments, and from rain water.\textsuperscript{(14)} It is noted from the data of Table (1) that the highest value of it was in a sample (S3(Shakha3), with its value reaching (778), while its lowest value in a sample of (S7) age of 7 reached (923), while the values ranged between the highest value and the lowest scheduled value, as shown in the figure and map below. As for the international standard limits, it is noted that all samples are higher than the international standard limits, which amount to (200) mg / liter\textsuperscript{(1)}.

Figure (14) values (\textbf{Cl\textsuperscript{-}}) in the samples taken from the study area.
Conclusions:

1. Through the study of water quality, the salinity rate in the project was revealed (446–648) mg / liter, and this percentage affected the exploitation of agricultural land.

2. The agricultural sector is the most water consuming sector, as the water consumption in this sector ranged (85–90%). Due to the use of open irrigation channels, mismanagement of water resources and the use of old irrigation techniques and traditional farming patterns, the amount of water losses has increased.

3. The increase in temperature and the increase in the rate of evaporation led to a decrease in the water in the project and led to an increase in the percentage of salinity in the water as well as an increase in water pollution due to the increase in the concentration of pollutants, whether they were caused by untreated sewage water spent in the project or other types of pollutants.

Recommendations:

1. Reducing the excessive consumption of water by rationing the volume of water used so that the majority of the water used is consistent with the actual need of the crops, and this requires a
review of the current irrigation methods in order to achieve the optimal use of water

2. The necessity of imposing control over the irrigation canals and canceling the violating openings to prevent the excessive use of irrigation water, whose harmful effects are reflected on the productive capacity of the land, i.e. its impact on the lack of access to the latent amount of agricultural land

3. Protecting water resources from pollution is a basic requirement, as water resources suffer from pollution problems, low quality and the deterioration of their organizations as a result of backward human activities, which requires activating legislation and building wastewater treatment plants.

4. Environmental control programs on water resources suffer from their dependence on old mechanisms that are unable to keep pace with development and provide an effective environmental assessment of water. Therefore, capacity building in the field of environmental assessment and environmental control and the use of advanced software is one of the basic requirements.

5. Reviewing and developing water legislation in order to protect surface water resources in quantity and quality and by activating control mechanisms over the irrigation network

6. Raising the efficiency of investing water resources in order to reduce the waste that occurs in them before they reach the agricultural fields and finding modern irrigation methods with the quality of farmers by selling the water rationing system in proportion to the needs of the field.

7. Accumulation of sediments in irrigation streams leads to a disturbance in the water flow and then a decrease in the expenses of these streams. Therefore, annual monitoring of the schedules is required to determine the time and quantity of sediment removal..
References:


2. Wasit Governorate Irrigation Directorate, Planning Division Reports and Follow–up Data on the Dujaila Project.


5. The field study for the Al–Dujaila Irrigation Project 20/1/2020.