How to Cite:
Muhsin, S. H., & Issa, M. J. (2022). Study the pollution with sewage water in for the Al-Hussainiya area in Karbala Governorate – Iraq. *International Journal of Health Sciences*, *6*(S4), 11641–11652. https://doi.org/10.53730/ijhs.v6nS4.11259

Study the pollution with sewage water in for the Al-Hussainiya area in Karbala Governorate – Iraq

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***Abstract*---**The research dealt with the study of some determinants of sewage pollution and evaluation of some of the trocars of Al-Hussainiya district, all the way to Lake Al-Razzaza In Karbala Governorate. Wastewater is the water that comes out of homes after being used for various purposes such as washing dishes, washing clothes. This study aims to determine the effect of sewage water on the quality of Lake Razzaza by analyzing the results of the characteristics of biological and physical indicators, where wastewater recorded values within the permissible environmental determinants of indicators Acidic function (pH) and (PO_4^{-3}), while the indicators recorded a higher value than the environmental determinants (BOD), (COD), and (TSS).

***Keywords*---**biological properties, physical properties, sewage water pollution.

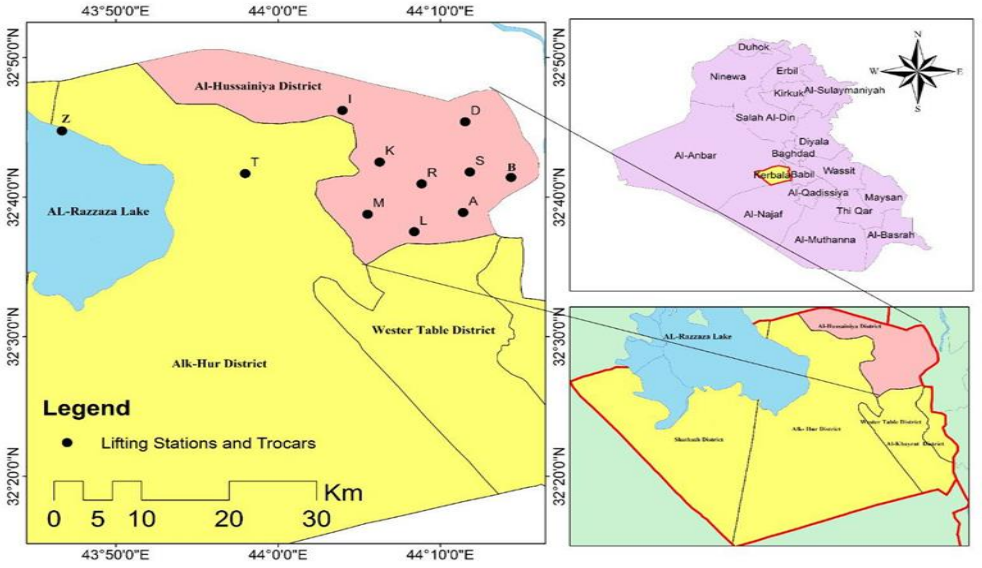
Introduction

Wastewater is the water that comes out of homes after being used for various purposes such as washing dishes, washing clothes, and rinsing the toilet, and then it is called sewage, Wastewater travels from cesspools through pipes installed during plumbing, and then sewage travels to the sewers built by the owner of the house or the sewage facility established by the municipality. If sewage water is not treated and disposed of in a sanitary manner it may become the agent of diseases such as cholera, typhoid fever, and other enteric infections. Furthermore, the discharge of untreated sewage water may cause a physical, chemical, and biological deterioration of water sources. It may also lead to a depreciation of land values, the breeding of insect vectors of disease, offensive smell, the destruction of aquatic life, the eutrophication of ponds and lakes, and

the eventual curtailment of other beneficial uses of water courses, e.g., recreation, boating, agriculture, fishing and the cultivation of shellfish. The accelerating growth of the population aggravates the pollution of water sources and land by the discharge of sewage water. This study was conducted in the trocars of the Al-Hussainiya district, all the way to Al-Razzaza Lake during the rainy period. This is one of the most important trocars since it collects water from all of the Al-Husseiniya project's trocars, which receive water from the agricultural lands it passes, and finally to the Razzaza central trocar and then to Lake Razzaza via Al-Mabazil channel the northern city of Karbala which is 6300 meters, and the width of the current after the pumping station is about 25 meters, where water is pumped to Lake Al-Razzazah using a pumping station, where there are stations that represent a vital and complementary part(Al-Rubayi, I.T.,2015). This study aims to determine the effect of sewage water on the water quality of Al-Razzaza Lake by analyzing the physical(pH, TSS, T°C), chemical(PO_4^{-3}), and biological characteristics(BOD, COD, and DO).

The study area

The research dealt with the Al-Hussainiya district, which is one of the districts of Karbala Governorate, which is located in the middle Euphrates region of Iraq on the outskirts of the eastern edge of the northern Badia plateau of the western plateau west of the Euphrates River, Its administrative borders are shared with three governorates, Anbar Governorate from the north and west, at a distance of (112) km from the city center. From the east, the province of Babylon, at a distance of (45) km, and from the south, the governorate of Najaf, at a distance of (74) km, and its location relative to the capital is (106) km south-west of it, and the area of the governorate currently is 5034 km2. As shown in(Fig.1), the governorate is administratively composed of three districts and four districts.



(Fig.1): Location of the study area.

Materials and Methods

Field work and sampling

Fieldwork started in January 2022 representing the rainy period, in which (11) models were collected. The fieldwork included collecting sewage samples located in the Al-Hussainiya district and arriving at Lake Al-Razzaza in the Karbala governorate as shown in(Table.1), drainage systems are clearly observed during the field trip in order to support data interpretation. The sample sites are selected on the basis of trocars distribution in the study area, and sewage water drain sites (electrical thermal station). The fieldwork comprises survey trips for defining the effective sampling sites along the studied area.

(Table .1): locations of the collected samples

Sample Name	Name trocars	Latitude	Longitude
R	Al-Rasoul district station(aleatashiy)	32°40'41.35"	44°09'38.47"
B	Al-Abbas district station(Imam Noah)	32 .681011	44.171156
A	Al -Asafiat	32°39'10.0"	44°09'44.3"
L	Al-layih	32°37'31.2"	44°08'24.1"
I	Imam Aoun's	32°41'12.35"	44°07'02.8"
S	Abu -Suleiman	32°41'31.9"	44°10'19.7"
K	Al- kakaiyya	32°40'40.0"	44°07'14.0"
D	Al -Aswad	32°430'1.2"	44°10'12.8"
M	The Main trocar	32°38'46.62"	44°05'31.36"
T	Al-Nahalat station (Al--Razzaza main trocar)	32°41'41.24"	43°57'58.92"
Z	Lake Al-Razzaza	32.7525	43.635

Laboratory Works

Laboratory work is focused on the physical and Biological analyses of wastewater samples in the Holy Karbala Governorate Directorate of Environment Laboratory.

Physical Properties

Temperature

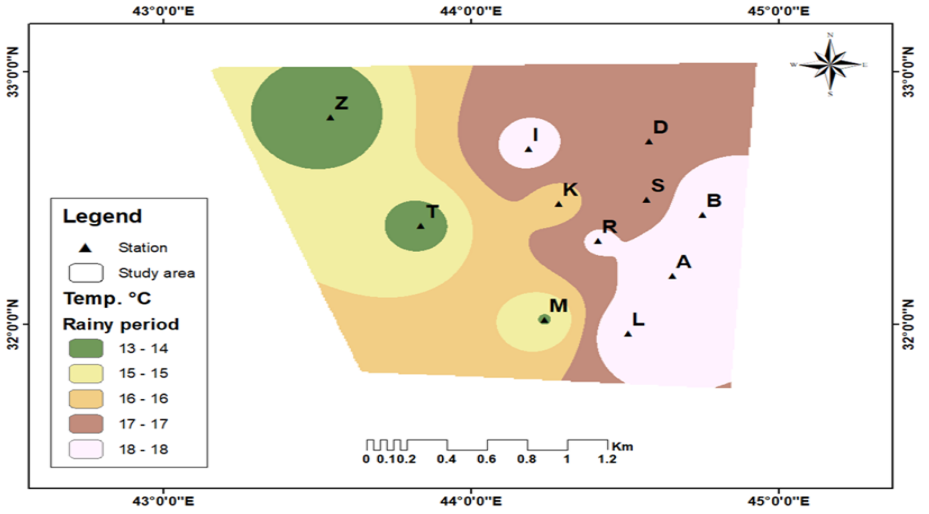
Temperature is one of the main factors affecting the photosynthesis processes of all living organisms are also one of the factors affecting water quality, as it is one of the physical properties of water, which affects the chemical properties, the increase in temperature leads to an acceleration of the speed of chemical reactions and works to dissolve gases that affect the taste and smell of water, causing It affects the elements contained in water and reduces the amount of dissolved oxygen, thus affecting the suitability for irrigation(WHO,2006). The spatial distribution of temperature is shown in (Fig.2). The temperature

concentration in water samples of the study area during the rainy period ranges between (12.9- 18.2 OC) with an average of (16.25oC) (Table .2). The small difference in the temperature of wastewater samples is related to the variation of piezometric depth.

(Table.2): Chemical elements concentrations of sewage water in January 2022 represent the rainy period

Sample	T(°C)	pH	ppm				
			TSS	PO_4^{-3}	BOD	COD	DO
R	17.3	7.3	61	0.68	23	100	6.3
B	17.9	7.15	77	1.145	75	299	1.2
A	18.2	7.4	42	0.003	10	42	5.9
L	18.2	7	61	0.003	B.L.D	B.L.D	8.7
I	17.7	7.4	411	0.386	17	34	3.9
S	16.8	7.34	26	0.003	6	8	8.1
K	15.5	7.31	24	0.135	15	50	3.8
D	17	7.43	29	0.006	5	49	10.1
M	13.9	7	5	0.762	B.L.D	12	5.3
T	13.4	6.77	34	0.052	B.L.D	931	10.1
Z	12.9	7.21	365	0.034	16	277	9.1
Mean	16.25	7.21	103.18	0.29172	20.875	180.2	6.590
IQS,2012	-	6.4-8.5	40	25	40	100	-
WHO,2011	-	6.5-8.5	-	0.4	-	-	-

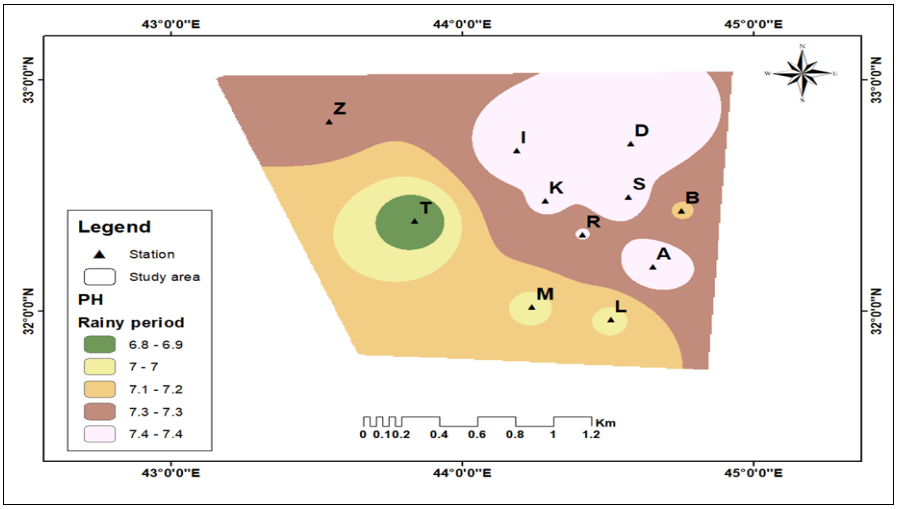
IQS: Iraqi Quality Standards (IQS, 2012) (Standards of treated wastewater used for agricultural irrigation)
WHO: World Health Organization (WHO)
* (B.L.D): Below detection limit



(Fig.2): The spatial distribution of (Temp) in the rainy period in the study area.

Hydrogen number (pH)

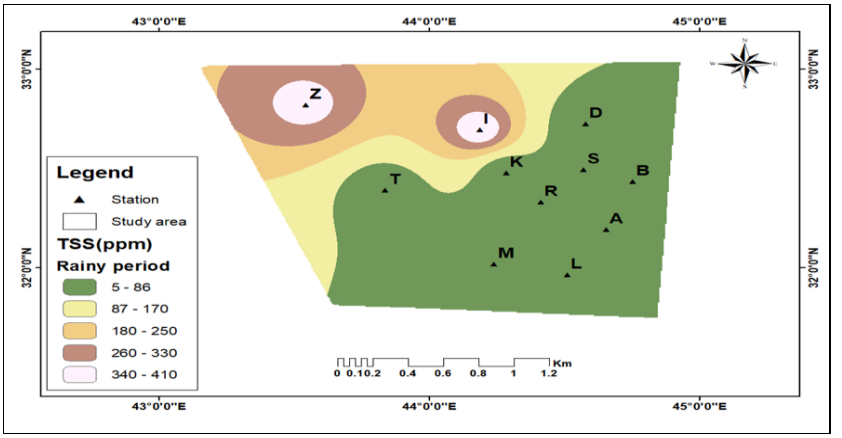
pH measurement is one of the most important field parameters. In natural waters, pH is generally between about 6.5 and 8 (Fritz and Clark, 1997). Most reactions in gas, water, and rock systems are controlled by the pH of the system (Langmuir, 1997). The spatial distribution of pH is shown in (Fig.3). The Hydrogen number concentration in water samples of the study area during the rainy period ranges between (6.77- 7.43) ppm with an average of (7.21)ppm (Table.2), which is within the permitted limit standard specifications. PH<8.2 the hydrogen ion is added to the carbonate and becomes dissolved bicarbonate PH>8.2 (Hco3) depletion to (CO3-2) in solution becomes high.



(Fig. 3): The spatial distribution of (pH) in the rainy period in the study area.

Total Suspended Solids

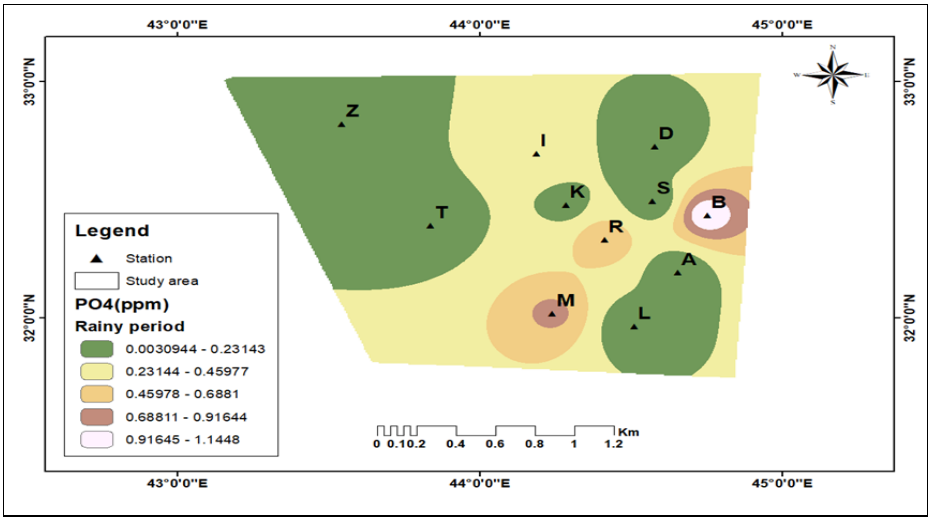
Environmental waters may contain a variety of solid or dissolved impurities. In quantifying levels of these impurities, suspended solids is the term used to describe particles in the water column. Practically, they are defined as particles large enough to not pass through the filter used to separate them from the water. Smaller particles, along with ionic species, are referred to as dissolved solids. Turbidity is a measure of the cloudiness of water. It may be caused by TSS. Total Suspended Solids (TSS) represents the number of filterable solids in a water sample that can be removed from the raw water by physical or mechanical means, such as precipitation or filtration (Bartram and Ballance, 1996). The spatial distribution of TSS is shown in (Fig.4). Total Suspended Solid concentration in water samples of the study area during the rainy period ranges between (5-411) ppm with an average of (103.18)ppm (Table.2).



(Fig.4): The spatial distribution of (TSS) in the rainy period in the study area.

Phosphate(PO_4^{-3})

The apatite mineral groups are the primary source of Phosphorus in the earth's crust, accounting for 0.12% of the total. Phosphate levels in sediments are higher than those found in surface water and groundwater (Boyd, 2000). Phosphates are rocks that contain phosphorus-containing chemical compounds. Small amounts of calcium and phosphates are carried away by water as it passes over and through rocks. Phosphorous is a nutrient for living organisms that have limited solubility in most of its inorganic constituents (Hem, 1985). Plankton transforms orthophosphate to organophosphate and produces organic phosphate as a result of the biological activity of aquatic plants (Hem, 1985). The spatial distribution of PO4-3 is shown in (Fig.5). Phosphate concentration in water samples of the study area during the rainy period ranges between (0.003-0.762) ppm with an average of (0.29172)ppm (Table .2). The main sources of phosphate pollution are run-off from land, sewage effluence, detergents, and effects on aquatic life (Hutak, 2000).

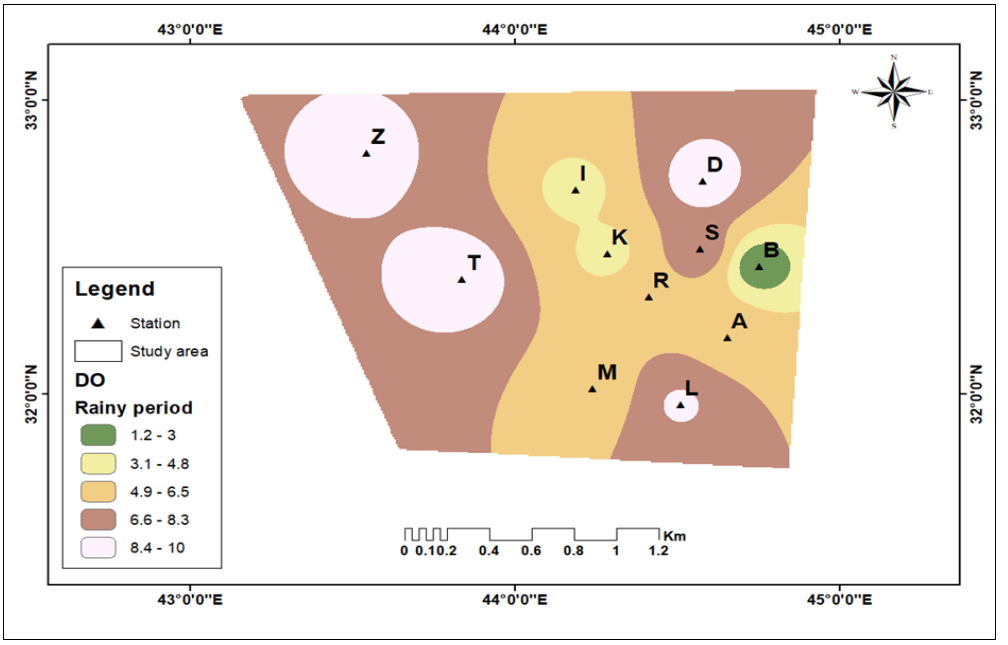


(Fig.5): The spatial distribution of (PO_4^{-3}) in the rainy period in the study area.

Biological Properties

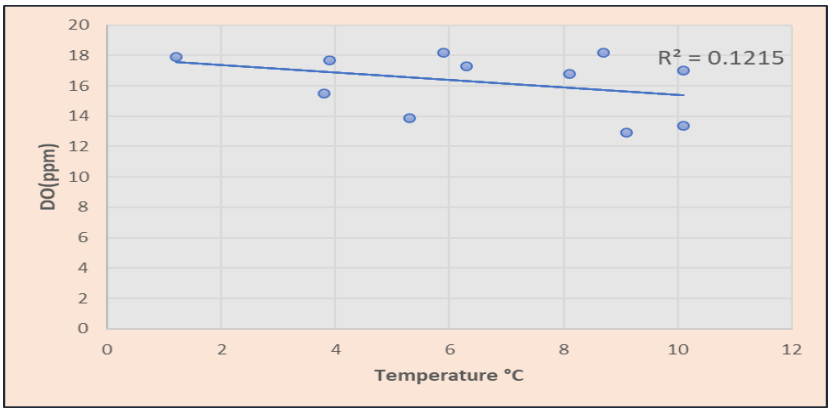
Dissolved Oxygen (DO)

Dissolved oxygen is a water quality indicator that indicates free oxygen dissolved in water. The amount of dissolved oxygen in water is usually measured in parts per million (ppm) or milligrams per liter (mg/l). Due to the high level of microbial cells and biodegradable organic matters, sewage has a very low level of dissolved oxygen. In some sewage, DO is completely absent. The level of Do depends on the age and condition of the sewage. Low level DO is also due to the lower solubility of oxygen in sewage. Oxygen is only 95% soluble in sewage than in pure water. (Michael, 2006). The spatial distribution of DO is shown in (Fig.6). The Dissolved oxygen concentration in water samples of the study area during the rainy period ranges between (1.2- 10.1) ppm with an average of (6.590)ppm as shown in (Table.2).



(Fig.6): The spatial distribution of (DO) in the rainy period in the study area

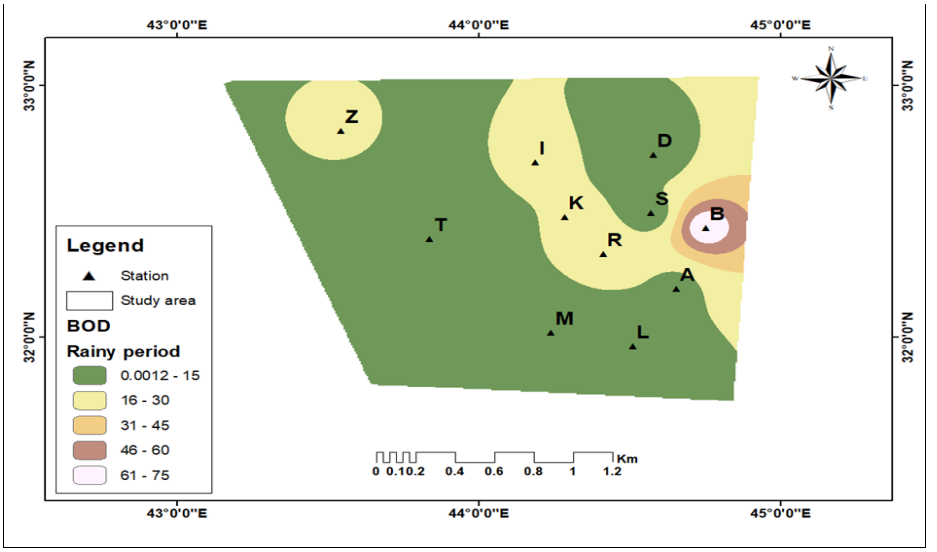
There is a negative relationship between DO and temperature as shown in (Fig.7). The decrease of DO value in some sites in the study area belongs to the density of organism which consumes the DO for their living activities.



(Fig.7): Relationship between dissolved oxygen (DO) and temperature(T °C) in the rainy period

Biological Oxygen Demand (BOD)

The change in dissolved oxygen content after five days of preparation in the dark at 20 °C is known as biological oxygen demand. Bacteria and other microorganisms are responsible for the decomposition of organic waste. When dead plants, leaves, lawn sewage, or even food waste are present in a water supply, bacteria begin the process of breaking down the waste. When this happens, aerobic bacteria consume a large portion of the available dissolved oxygen, depriving other aquatic creatures of the oxygen they require to survive. The Biological Oxygen Demand (BOD) is a measurement of how much oxygen microorganisms use to decompose waste. If the water supply contains a considerable amount of organic garbage, there will also be a large number of microorganisms present, all of which will be striving to degrade this trash. Because of the high demand for oxygen (because of all the bacteria), the BOD level will be high. BOD levels will begin to drop as the waste is digested or diffused through the water. Because the bacteria consume the oxygen that is available in the water, dissolved oxygen (DO) levels drop when BOD levels are high. Fish and other aquatic animals may not be able to survive due to a lack of dissolved oxygen in the water. The spatial distribution of BOD is shown in (Fig.8). The Biological Oxygen Demand concentration in water samples of the study area during the rainy period ranges between (5-75) ppm with an average of (20.875)ppm as shown in (Table.2).



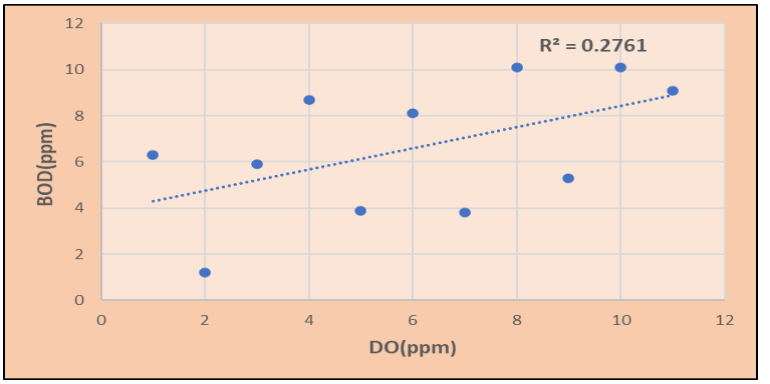
(Fig.8): The spatial distribution of (BOD) in the rainy period in the study area.

Water with a BOD concentration of 1-2 mg/l is of very high quality, indicating that there is little organic waste in the water supply. Water with a BOD concentration of 3-5 mg/l is considered fair to somewhat clean. Water contains 6-9 mg/l BOD represents poor water. Water containing 10 mg/l or more BOD represents very poorly according to Iraqi Standard No. 417, 1996. The pollution index according to Pandey, et al,(2005) is listed in (Table.3).

(Table .3): Pollution Index of water quality (Pandey et al., 2005)

Water type	BOD_5 (ppm)
Very clean	<1
Clean	2
May be clean	3
Critical	5
Polluted	>10

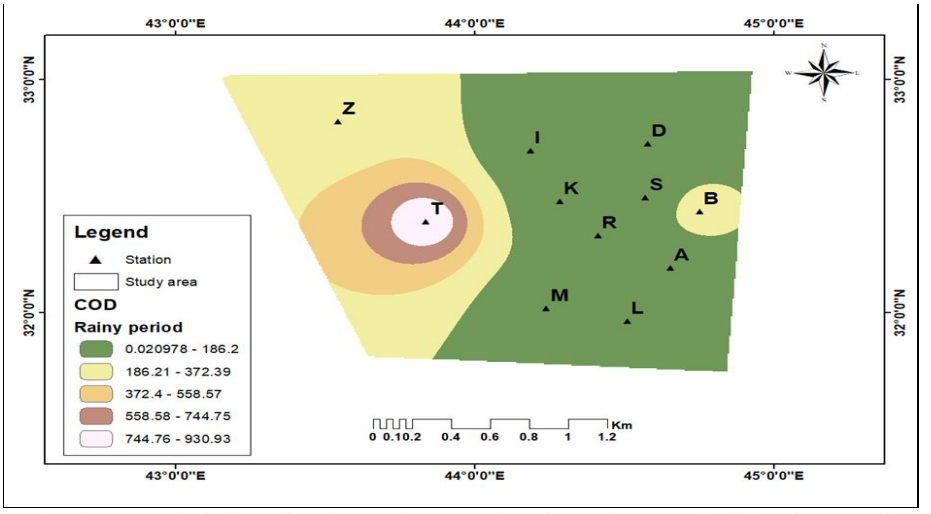
Sewage usually has high BOD due to the presence of a large amount of organic matter. The value of BOD ranges from 100mg/ltr for very dilute sewage to 600mg/ltr or more for concentrated sewage containing industrial effluent mix. This result indicates that the study area is in a critical BOD position. Organic matter is oxidized to CO2 and H2O by the organism; this causes a decrease in the amount of DO with BOD and appears to be indicating a heterogeneous distribution pattern of the organism. DO decreases with increased BOD indicating an inverse relationship (Fig.9).



(Fig.9): Relationship between dissolved oxygen (DO) and Biological oxygen demand (BOD) during the rainy period

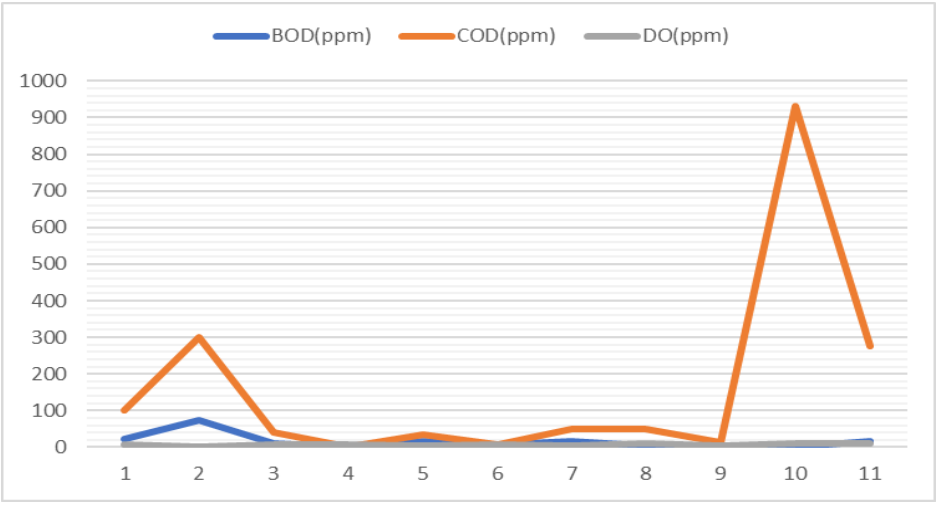
Chemical Oxygen Demand (COD)

This test is the measure of amount of O2 needed to oxidize organic and non-organic materials found in water. The measurements of COD are often higher than the biological oxygen demand due to the oxidization taking place (Abawi and Hassan, 1990). The spatial distribution of COD is shown in (Fig.10). The Chemical Oxygen Demand in water samples of the study area during the rainy period ranges between (8- 931) ppm with an average of (180)ppm as shown in (Table .2).



(Fig.10): The spatial distribution of (COD) in the rainy period in the study area

COD in the study area appears to be heterogeneously indicating the distribution pattern of the organism in the study area. The COD appears to be value high with BOD and they have a direct relationship as shown in (Fig.11). the result indicates the Al-Nahalat station in COD is more polluted because this is one of the most important trocars since it collects water from all of the Al-Husseiniya project's trocars, which receive water from the agricultural lands it passes.



(Fig.11): Relationship between chemical oxygen demand (COD) biological oxygen demand (BOD) and (DO) during the rainy period.

Conclusions

The results of this study supply valuable information around some the biological and physical elements with the study of some determinants of sewage pollution and evaluation of some of the trocars of Al-Hussainiya district, all the way to Lake Al-Razzaza In Karbala Governorate, So can be concluded that**:**

1. The examination of the components (TSS, BOD, and COD) findings in sewage water, according to IQS (2012) and WHO (2011), reveals that trocars are polluted because their concentrations are higher than the permissible level. Some concentrations are increasing as a result of the decrease in discharge, Which increases the concentration of the elements. Industrial and municipal waste are the main factors influencing the characteristics of the trocars water, and this indicator may suggest possible sources of pollution in the study area. While the analysis of the elements (pH and PO_4^{-3}) was unpolluted because of values within the permissible environmental determinants, according to IQS,(2012) and WHO, (2011).
2. It was Conclusions from the biological and physical element analysis that the Al-Nahalat station is more polluted because this is one of the most important trocars since it collects water from all of the Al-Husseiniya project's trocars, which receive water from the agricultural lands it passes, and finally to the Razzaza main trocar and then to Lake Razzaza via Al-Mabazil channel, However, Al-Razzaza Lake is less polluted than the Al-Nahalat station because of the presence of a major rift between the Al-Hussainiya district, and Al-Razzaza Lake, which is the Euphrates rift.

References

Abawi, S. A, and Hassan, M.S., 1990: Environmental Engineering water analyses. International Library, Baghdad, Iraq, 296p.

Al-Rubayi, I.T.,2015. Geographical Evaluation For Drainage Water In Kerbala Province And Its Agricultural Utilization .M.Sc.Thesis, Department Of Applied Geography, College of Education for Human Sciences, University of Karbala.Iraq. (In Arabic).

Boyd, C. E., 2000: Water quality an introduction, Kluwer Academic publisher, USA.330p.

Chilán, J. C. H., Torres, S. G. P., Machuca, B. I. F., Cordova, A. J. T., Pérez, C. A. M., & Gamez, M. R. (2018). Social impact of renewable energy sources in the province of Loja: Ecuador. *International Journal of Physical Sciences and Engineering*, *2*(1), 13–25. https://doi.org/10.29332/ijpse.v2n1.79

Collins, A. G., 1975 : Geochemistry of oil- field water. Development in Petroleum Science, No.11, Elsevier, Amsterdam, Holland, 496 p.

Hem, J.D., 1985: Study and Interpretation of the Chemical Characteristics of Natural Water.3rded .USGS. water supply paper. 263p.

Hutak, P.F., 2000: Regional trends in nitrate content of Texas groundwater. J. Hydrogeology, 228:37-47p.

Karanth, K. R., 2008: Groundwater assessment development and management, Tata McGraw-Hill Offices, New Delhi, 720 p.

Langmuir, P., 1997: Aqueous Environmental Geochemistry, Upper Saddlesaddle River, Prentice Hall, New Jersey, 600

Michael E. Lewis., 2006: Dissolved Oxygen, Version 2.1 U.S. Geological Survey TWRI Book 9. (Cited by Ahmed, R.M., 2011: Hydrogeochemistry of the Euphrates River from Hit to Al-Saqlawiya in Al-Anbar governorate, West of Iraq. M.Sc. thesis, University of Baghdad, College of Science. 119p.

Padmiswari, A. A. I. M., Wulansari, N. T., Antari, N. W. S., Damayanti, I. A. M., Indrayoni, P., & Indrawan, G. S. (2021). The effectiveness of soaking duration on blood cockles (Anadara granosa) with activated charcoal towards reducing metals lead (Pb). *International Journal of Health & Medical Sciences*, *4*(3), 304-308. https://doi.org/10.21744/ijhms.v4n3.1756

Pandey, K. J.P., Shula, S.P., Trivedi, 2005: Fundamental of Toxicology. New book Agency (P.Ltd), 356p.

Suryasa, I. W., Rodríguez-Gámez, M., & Koldoris, T. (2021). Health and treatment of diabetes mellitus. *International Journal of Health Sciences*, *5*(1), i-v. https://doi.org/10.53730/ijhs.v5n1.2864

Todd, D. K., 1980: Groundwater hydrology second edition, Jhon Wiley and Sons, Inc. New York. 535 p.

WHO , World Health Organization, 2011:Guidelines for drinking water quality. 4th ed. World Health Organization. 564 p.

WHO, World Health Organization, 2006: Guidelines for Drinking water Quality, 1st Addendum to the 3rd ed., volume 1: Recommendations, World Health Organization, Geneva, 515 p.