Using Some Qualitative Indicators in Evaluating the Water Pollution of The Euphrates River After the Cities Fallujah and Ramadi

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Abstract
Three sites were selected for a part of the Euphrates River between the cities of Ramadi and Fallujah in Anbar Governorate - western Iraq, where samples were collected from August 2021 to April 2022. For phytoplankton communities and their seasonal and local variations, the results of the current study showed the effect of seasonal and local changes in addition to human activities on the average values of chemical and physical characteristics in the waters of the Euphrates River. Where the air temperature within the study sites ranged between 41.40-13.20 degrees Celsius and that the degree of the water temperature was between 27.40-10.40 degrees Celsius. Therefore, the water of the Euphrates River is considered warm and the phosphates have risen in the summer and decreased in the winter, where their value ranged between 9.08-2.92 mg/l, while the silicate values ranged between 17.6-8.8 mg/l as they exceeded the limits allowed in natural waters, and the reason for its rise in the summer is due to the water currents that cause water circulation and the rise of silica to the surface. The values of the vital oxygen requirement ranged (BOD) between 30.2-9.2 mg/L Bacillariophyceae, it contained 114 species and 38 genera.
Keywords: environment, chemical pollutants, physical pollutants, diatomaceous algae, Euphrates

1. Introduction

Environmental pollution has become a major global problem as it has clear effects on the physical, chemical and qualitative properties of water. Studies related to pollution have increased because of the clear changes that it causes in the environment, and that the substances that are presented to the environment are a major reason for changing the characteristics of the environment. In general, water pollution is considered to have a clear role. In changing the growth of organisms, and sometimes it may add some toxic substances to the environment, which leads to harm to human health and impedes the use of water in daily life Whereas, diatomaceous algae are considered good biological indicators indicating the health of aquatic systems, as they constitute a great dominance and constitute the primary food source for many fish and invertebrates. Also, environmental pollution is responsible for the pollution of rivers, seas, lakes and the air, as studies related to pollution have increased due to the clear changes it causes in the environment, as the substances that are thrown into the environment are considered a major reason for changing the characteristics of the environment. Rivers are the most important freshwater resources for humans, as Economic, social and political development is closely related to with the distribution and availability of fresh water in river systems, river systems can be considered as arteries of the earth that supply and provide water for all living organisms (Hanna et al., 2019). Water pollution can be defined as the poor quality of ecosystems as a result of human interventions, which makes them unsuitable for industrial and life uses. (Al-Mashhadani, 2019).

Study area

The study area for this research was determined within the municipal boundaries of the city of Ramadi and the city of Fallujah, in addition to all the areas through which the Euphrates River passes between Ramadi and Fallujah in the study area, where the study area was divided into stations along the areas selected for the study in which the Euphrates River runs.

Table (1) study sites using the geolocation system device and the geographical information system program.

GPS READING						T
Latitudes (North)			Longitude (East)			
33	23	46.36	43	30	25.48	(1) AL-SJARYAH
33	23	47.67	43	30	25.22	KHALDEAH(2) AL
33	22	9.73	43	37	22.59	ALFALAHAT(3)

2. Materials and Working Methods

Chemicals

It was of a high degree of purity and supplied by well-known international companies. The study included collecting samples of river water from August 2021 to April 2022 from three locations between the cities of Fallujah and Ramadi, where physical and chemical factors were analyzed according to Pearson's law, as well as samples of phytoplankton were collected through the use of a special network. Phytoplankton net where the diameter of one hole from this net is 26 microns and

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it was thrown into the water and pulled more than once, and its content was emptied into small glass bottles.

Preparation of phytoplankton cell count slides

Furet and Benson - Evan (1982) showed an approved method for sedimentation in which a graduated cylindrical bottle of 500 ml capacity was used, and 500 ml of sample water was also placed in it, and 5 ml of solution s'Lougal was added to it and left for ten days without stirring. Then the upper part of the model using a siphon and making sure that the cylinder is not moved until the withdrawal process is completed and 90 ml of it was left from the bottom part in the inserted cylinder, and the rest was transferred to another cylinder with a capacity of 100 ml and then 10 ml of distilled water was added to the first cylinder to be washed Then it was added to the second cylinder and left for a whole week without moving as well, and after a week the upper part of the model was withdrawn in the same way and 8 ml of it was left. necessary.

Temperature

Two mercury thermometers with a temperature of 0.1 degrees Celsius were used to directly measure the water temperature in the study sites.

3. Total Dissolved Solids

The method of Symons and Morey (1941) was used to measure the total soluble solids of water, as the pallet was weighed accurately after it had been washed and dried for one hour and the oven temperature was set at 103-105 °C), then 100 ml of the sample was taken and transferred to the lid and evaporate it in a water bath until it dries, and then transferred to the oven at a temperature of 103-105 °C) and kept in the oven for an hour, then cooled in a dehydrator.

Biological Oxygen Demand (BOD5

The method described by the American Public Health Association (APHA, 2005) was adopted after storing the samples in an incubator at a temperature of 20 ° C for five days, and the results were expressed in mg/L. Noting that a portion of the samples were diluted, and the dilution process depends on the severity of the contamination of the area

Phosphate (PO4) Phosphate

The method of Murphy and Riley (1962) described by Parsons et al. was followed. (1984) by adding the mixed solution to (100) milliliters of the sample and using a spectrophotometer at a wavelength of 885 nm, the absorbance of the solution was read, and the results were expressed in (mg/L).

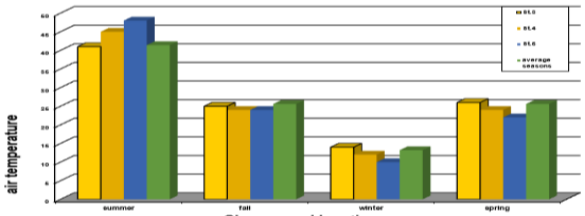
Silicate (SiO2)

The method described by Milton (1951) was followed to measure the silicate by adding 5 ml of hydrochloric acid with 5 ml of acid of ammonium molybdate with adding 5 ml of EDTA with the addition of sodium sulfite at a concentration of 10 ml to the sample water, and after half an hour the color changed and the reading was done on A wavelength of 700 nm was used by using a spectrophotometer and the results were expressed in (mg/L).

4. Results and Discussion

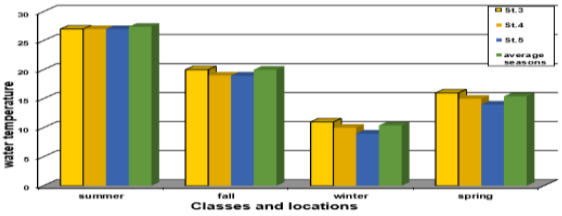
Temperature of Airandwater

The results of the study between clear seasonal differences in the average air temperature recorded its highest average (41.40 m) in the summer, and its lowest average (13.20 m) in the winter.



Shape 1: Seasonal and local variations and their average values of air temperature/°C

These seasonal changes in temperature are due to the fact that Iraq's climate is characterized by high temperatures during summer and low temperatures in winter, in addition to differences in temperature between night and day (Al Ghurairi, 2014). The difference in temperatures between sites for one season is due to the difference in sampling times, where the temperature is low in the morning and gradually rises in the middle of the day (Hassan et al, 2007). It was 48 o'clock for the summer. The lowest reading was recorded for the winter, when the temperature was (12°C)



Shape 2: Seasonal and local variations and their mean values of water temperature/°C

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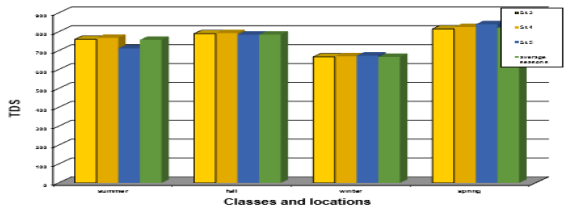
We note through the results that the seasonal changes of water coincide with the seasonal changes in the air temperature due to the effect of the water temperature and its variance with the air temperature that the relationship between them is direct. M). The results of the statistical analysis showed that there were significant differences between the seasons at the level of probability ($P < 0.05$) and there were no significant differences between the sites. The air temperature was positively significant with the water temperature and the vital oxygen requirement (0.92630 = ($r = 0.831$) (0.01 P) respectively, as well as air temperature was positively correlated with dissolved solids and phosphate ($r = 0.758$)) ($r = 0.735$) respectively at the probability level ($P < 0.05$). As for the water temperature, the results of the statistical analysis showed that there were no significant differences between the sites and the presence of significant differences between the

seasons at the level of probability (P < 0.05), where there was a significant positive correlation with the vital requirement for oxygen, phosphate and silica) (r = 0.939) (r = 0.824). (r=0.782) is respectively below the probability level of (0.01>P). There was a positive correlation below the probability level (P < 0.05) with TDS (r = 0.532).

Total Dissolved Solids (TDS)

The total dissolved solids (TDS) is considered a measure of the organic and inorganic substances and other substances that are dissolved in water (AL. Haidarey, 2009) that the waters of the Euphrates River in the study area showed that the TDS values exceeded the permissible limits for the purposes of living aquatic organisms mentioned before (Goher et al, 2004), as seasonal changes were recorded, where the highest mean of (TDS) was recorded in the spring (820.4 mg / l) and its lowest average in winter (666.6) / l (5)) due to the reason for the rise in the values of (TDS) to the rain falling during the spring, in addition to the fact that the river water is affected by the remnants of human activities Throughout the season, which causes its accumulation to increase the TDS, and this is consistent with the findings of Al-Janabi (2011), Al-Makdami (2016) and Al-Nile (2021) (2013). Also, the river water is affected by the remnants of sand washing plants and military residues that exist in that area, causing an increase in TDS values. The results of the statistical analysis showed that there were significant differences between the seasons under the probability level (P<0.05) and that there were no significant differences between the sites.

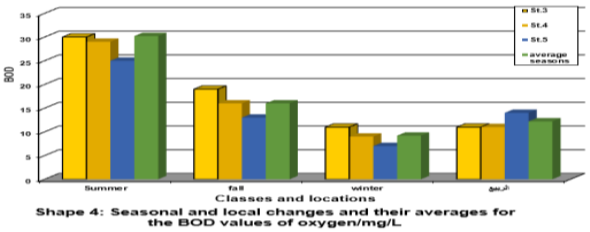


Shape 3: Seasonal and local variations and their mean values of TDS mg/L

Biological Oxygen Demand (BOD)

The seasonal changes recorded a marked variation in the (BOD) values as they exceeded the Iraqi and international determinants. Where the highest average of (BOD) values (30.2 mg/L) was recorded in the summer and the lowest average (9.2 mg/L) in the winter. Concentration of organic matter due to evaporation and low water levels (Al-Husseini, 2020) This study is in agreement with the study of Al-Hassu (2021) on Lake Habbaniyah in western Iraq, where it recorded values close to what was recorded in the current study, and it also coincided with the study of Al-Obaidi (2021) in the upper Euphrates River between the cities of Haditha and Al-Baghdadi.

The results of the statistical analysis showed that there were no significant differences between the studied sites and the presence of significant differences between the seasons at the level of probability (P<0.05), where (BOD) was significantly related Positive with phosphates (0.914=r) below probability level (0.01>P)



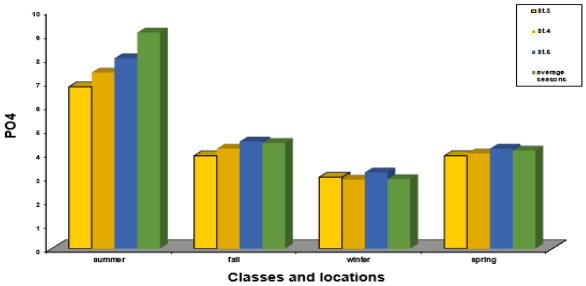
Shape 4: Seasonal and local changes and their averages for the BOD values of oxygen/mg/L

Phosphate (PO4)

The seasonal changes of phosphate showed an increase in their values with variation in all seasons of the year, where the highest average (9.08 mm / liter) was recorded in the summer and the lowest average (2.92 mg / liter) in the winter. to high the water level is due to the effect of rain, and its rise may also be due to the use of fertilizers that contain phosphorous and nitrogen elements, the products of sand washing and what they wash into the river, as well as the watering operations of various crops, and this is consistent with the opinion of Al-Saadi and others (1999). Moving the bottom and mixing water as a result of the movement of the water current and the fall of rain increases the value of phosphate (Al-Janabi, 2011).

Phosphate values rise in the river as a result of the presence of sewage and houses that contain cleaning materials, as they vary in their concentration according to the nature of the surrounding lands and the nature of the rocks.

The quality of agriculture and population density, and this is consistent with the findings of the researchers (Guzha et al, 2019, Diazet et al, 2019). The results of the statistical analysis showed that there were no significant differences between the studied sites with significant differences between the seasons. Phosphate was significantly positively correlated with silicates (r=0.670) (P<0.05).

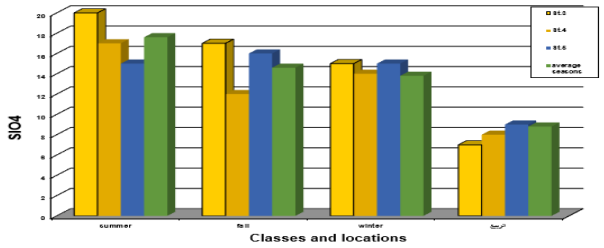


Shape 5: Seasonal and local changes and their average values for phosphate/mg/L

Silica (sio4)

The seasonal changes recorded the highest average values of silicate (6-17 mg/L) in the summer. The reason for the rise of silicates in the summer is due to water currents that cause water circulation and the rise of silicate to the surface, or it may be due to the deviation of large quantities of silicates from neighboring lands in the rainy season, which leads to an increase in the concentration of silicon in the water medium (Al-Hassani, (2010) This study agrees with the Al-Hisou study (2021), as it recorded values close to what was recorded in the current study, As for the lowest average of silicate, it was (8.8 mg / liter) in the spring, according to the results of the

current study. It was found that the silicate has exceeded the permissible limits in natural waters, which range between (1-10 mg / liter) - these results confirm the containment of Iraqi waters. On sufficient quantities of silicate (Al-Daraji and Al-Salman 2015). The results of the statistical analysis were based on the absence of significant differences between sites and the presence of significant differences between seasons at the level of probability (P < 0.05).



Shape 6: Seasonal and local variations and their average values of silicates/mg/L

Diatomaceous algae

The diatoms (organic algae) recorded superiority over the rest of the other algal groups that this phenomenon is found in Iraqi waters whose trophic level is low in terms of the concentration of nitrates and phosphates, which was mentioned by many researchers when studying the phytoplankton in the Euphrates and Tigris rivers, and this was confirmed by Ismail and Saadallah (2010). for Diyala River and attributed this to the presence of sufficient concentrations of silica in Iraqi waters. Or it may be due to the ability of diatoms to withstand extreme environmental conditions such as light intensity Salinity, temperature, nutrients and their ability to form communities quickly and also respond to chemical, biological and physical changes (Kassim and Mukai (2006), and this may be due to the ability of diatoms to exist in most different water environments (2010) Leelahakrie and Peeraporupisal, which have a hard limescale crust that diatoms are among the The most important species that have an important role in the aquatic ecosystem, as it is considered as a primary product and has also been used as a bio-indicator for environmental changes Such as acidity, salinity, organic pollution and nutritional enrichment because it has a wide range for these variables to work (2010 (Polge et al, 2010). The results of the current study also showed the dominance of feathered diatoms over central diatoms and the reason for this is due to the nature of the different resistance of the members of each group towards the surrounding environmental conditions, and this is what reached Aliyah (2014) Larris et al) This case was recorded in many Iraqi water bodies (Taleb and his group, 2014; Al-Tamimi, 2012; Hassan and Shaawiat, 2015) in addition to being recorded in many international studies (Wanget, 2014; karthikegan and Venkate 2016; Dalu et al, 2016) attributed the reason for the dominance of feathered diatoms over central diatoms to the fact that Bacillus feathery algae are dominant in the fresh aquatic environment (Kadhim et al., 2013). These results are in agreement with the study (2017) AL-Hasany & Al- Sufficient concentrations of silica in Iraqi waters. Or it may be due to the ability of diatoms to withstand extreme environmental conditions such as light intensity, salinity, heat and nutrients And their ability to form societies quickly and also to respond to chemical, biological and physical changes that diatoms are one of the most important species that have an important role in the aquatic environment system, as they are considered as a primary product and were also used as a biological evidence for environmental changes such as acidity, salinity, organic pollution and nutritional enrichment because they have a wide range to operate those variables (2010). (Polge et al, - Also, the results of the current study showed the dominance of feathered diatoms over central diatoms. The reason for this is due to the nature of the different resistance of the members of each group towards the surrounding environmental conditions and this is what was found by Larris et al (2014). Several previous studies of the Euphrates River showed the dominance of diatoms in the river water. 2010 Hassan et al; 2013 salman et al, 2014 kadhim; 2017 Ali; AL-Hussieny and Ali and Al-Mahdawi, 2015) and this case was also recorded in many Iraqi water bodies (Talib and his group, 2014; Al-Tamimi, 2012; Hassan and Shaawiat, 2015) in addition to being recorded in many international studies (Wanget, 2014; karthikegan and Venkate 2016; Dalu et al, 2016

Taxa Taxonomic units Sites				
Class:BACILLARIOPHYCEAE	2	3	4	5
Order:Centrales				
Coscinodiscus Lacustris Grunow	+	+	-	
Cyclotella sp	+	+	-	
C. catenata(Brun) Bachmann	-	-	-	
C. comta(Ehr.) Kuetzing	+	-	-	
C. meneneghiniana Keutzing	+	+	+	
Leptocylindrus minimus Gran	+	-	-	
Melosira ambigua Muller	+	+	-	
M. granulata(Ehr.) Ralfs	+	+	+	
M. raeseana Raben horst	-	-	+	
Stephanodiscus astrea(Ehr) Grun	-	-	+	
Terpsinoe musicaEhrenberg	-	-	+	

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