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Bacterial And Algal Components Of Sediments Close To Sources Of Sewage Drainage In The Euphrates River, Anbar Governorate

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Abstract

Samples were collected from river mud close to the sediments of sewage estuaries that flow directly to the main river for most areas of Anbar Governorate, which starts from Al-Qaim district and is considered the beginning of the mouth of the Euphrates River from western Iraq to Fallujah in the east, with 9 regions (36 samples), which are (Al-Qaim - Al-Obaidi - Rawah - Anah - Haditha - Al-Baghdadi - Hit - Ramadi - Fallujah) over a range of about 400 km2, where samples were taken from October 2019 until June 2020 in four seasons (Fall - Winter - Spring – Summer).for site study of the phytoplankton community and its impact on the river water quality, comparing the characteristics in one season and then the four seasons.

The current study showed that the highest number of Bacillus bacteria was in the summer season. Several other genera such as E. coli, Klebsiella, Pseudomonas and some other pollutants were isolated. The highest percentage of bacterial contaminants was also recorded after the estuary compared with other sites.A 73 species of algae were diagnosed in different regions of Anbar Governorate, and the results showed that there were no significant differences between the different seasons of the year with regard to algae, and the current study also demonstrated the presence of significant differences in most algae after the downstream compared to the rest of the sites.

key words: Euphrates River,clays,bottom,algae,Bacterial Pollution

Introduction

The Euphrates River is one of the most famous rivers in Southwest Asia, and it is the longest and its length is about 2800 km. The river extending from Iraq represents about 35% of the total length of the river. The river passes agricultural lands with an area estimated at (5615330) acres,Sediments and clays are an integral and basic part of aquatic environments as they are the basis for living organisms by providing their food, so they have a fundamental role in the aquatic ecosystem, (**Burden,*et al.*,2002**).It is also the main carrier and potential source of pollutants in aquatic environments, and its pollutants may affect the quality of groundwater and agricultural products when used for agriculture(**Miller et al.,2000**).indicated that the

cause of the deaths from the cholera epidemic was their use of drinking water from a well contaminated with human excrement, and he also indicated that 18,000 people in Hamburg had contracted cholera from drinking unfiltered water from the Alba River. And that led to more than 800 deaths.Statistics indicate that between 1975 and 1976 there were 59 diseases caused by water pollution that occurred in the United States, and the number of infections was 15947, which included the following bacterial types: *Shigella flexneri, Shigella sonnei, Salmonella typhimurium* and *finally Giardia lamblia*, which is one of theProtozoa infects The digestive system **(Khalaf,1987**).On the other hand, the reports of the World Health Organization, published in **1976**, indicated that nearly half a million people in the world suffer from the problems of using polluted water annually. Ten million people - the vast majority of them children - die annually due to infection with some dangerous diseases such as typhoid, cholera, viral hepatitis, and amoebic and bacillary dysentery caused by the use of unsanitary water.On the other hand,(**Pempkowiak,1999)** indicated the presence of many pathogenic bacteria in the water, which he studied, such as salmonella, shikella, faecal coliforms, faecal rocks, and some vibrio, and one study indicates that cholera vibrio and Vibrio eltor were able to live in water. Non-sterile containing salts and at a temperature of 37 ° C for a period of 289 and 423 days respectively.Due to the destruction of water quality in many places around the world, all types of water have been polluted when the initial composition of the water changes, or the state of the water changes directly or indirectly due to natural changes or human activities, or both, the water is considered polluted, and thus the water becomes unsuitable The nature assigned to him (**Al-Obaidi,2014**).This makes this water a source for many pathogenic bacteria, as well as bacteriacolon, which are used as evidence for recent fecal pollution in the water **(WHO,2004)**.

Materials and methods:

1-Sample collection

Samples were collected from river mud close to the sediments of sewage estuaries that flow directly to the main river for most areas of Anbar Governorate, which starts from Al-Qaim district and is considered the beginning of the mouth of the Euphrates River from western Iraq to Fallujah in the east, with 9 regions (36 samples), which are (Al-Qaim - Al-Obaidi - Rawah - Anah - Haditha - Al-Baghdadi - Hit - Ramadi - Fallujah) over a distance of approximately 400 km2, As samples were taken from October 2019 until June 2020, in four seasons (autumn - winter - spring – summer). The clay samples obtained in each region are from four places distributed as follows:

- The start of the estuary was denoted by the number (1)

-Depth of the estuary was symbolized by number (2)

-After the estuary, it is denoted by number (3)

-Before the estuary and has been denoted by number (4)

The distance between them is approximately 10 meters to measure the extent of the pollutants' impact. Samples were first collected by Ekman device and then hooks and skimming machines were used.

2-Diagnosis of algae:

Samples are taken by scraping method at a depth of 15-20. The Hemocytometer method was used by calculating 30 microscopic fields as a minimum, then counting rates were extracted for each microscopic field and the number of cells per milliliter was calculated from the original model(**Martinez andMeybeck,1979**).

3-Diagnosis of bacteria:

The membrane filtration method was used to determine the total number of germs and according to the NSF-WQI method, where the nitrocellulose filter paper, whose aperture does not exceed 0.45 m, was placed and placed in the designated place in the filter unit.Transfer 100 ml of the sample to a container for the filter unit, after which the filter paper was transferred and placed on the hardened surface of the agar and leave the plate for a short time so that the paper adheres well to the nutrient medium, and this is evident by its red color from the back.After that, the dish was placed upside down in the incubator at a temperature of 44.5 ° C for a period of 24 hours, and the final result was recorded after 48 hours(**WHO ,1996**).

4-statistical analysis:

The programs (Statistica 8, Microsoft office excel 2007) were used to perform all mathematical and statistical calculations, to complete descriptive statistics and to calculate the correlation coefficients for the elements

Results and discussion:

1-Bacterial Pollution: The results in Table (1) showed the highest number of *Bacillus* bacteria in summer 29 (24.8%), and several other genera, such as E. coli, *Klebsiella*, *Pseudomonas* and some other pollutants were also isolated.

Table (1):Number of genus and bacterial species diagnosed and their percentages in seasons during the study period

No.	Isolated bacteria	Number of isolates	Winter %	Spring %	Summer %	Autumn %	Chi-square (x^2)

1.	*Clostridium*	92	25(20.5)	25(21.9)	29(24.8)	13(9.85)	3.415
2.	*Streptococcus*	54	18(14.8)	8(7.02)	13(11.1)	15(11.4)	2.866
3.	*E. coli*	62	14(11.5)	22(19.2)	12(10.3)	14(10.6)	0.327
4.	*Bacillus*	117	27(22.1)	32(28.1)	28(23.9)	30(22.7)	0.074
5.	*Arthrobacter*	47	------	15(13.1)	11(9.40)	21(15.9)	4.5
6.	*Pseudomonas*	36	------	10(8.80)	11(9.40)	15(11.4)	3.891
7.	*Agrobacterium*	39	21(17.2)	1(0.88)	3(2.56)	14(10.6)	24.528
8.	*Klebsiella*	38	17(13.9)	1(0.88)	10(8.54)	10(7.57)	9.098
	Total	485	122(100)	114(100)	117(100)	132(100)	1.074
Chi-square (x^2)			29.0865	26.8861	3.9501	10.8814	

Also, the results showed in Table (2) the highest percentage of bacterial contaminants after the downstream compared to other sites.

Table (2): Number of genera and bacterial species diagnosed and their percentages at sampling sites during the study period

No.	Isolated bacteria	Number of isolates	Downstream start%	Downstream depth %	After downstream %	Before downstream%	Chi-square(x^2)
1.	*Clostridium*	92	26(20.60)	19(15.83)	24(20.34)	23(19.01)	0.4177
2.	*Streptococcus*	54	13(10.30)	17(14.17)	11(9.32)	13(10.74)	0.0338
3.	*E. coli*	62	15(11.90)	16(13.33)	17(14.41)	14(11.57)	0.2583
4.	*Bacillus*	117	30(23.81)	29(24.17)	30(25.42)	28(23.14)	0.009
5.	*Arthrobacter*	47	15(11.90)	10(8.33)	10(8.47)	12(9.92)	0.9944
6.	*Pseudomonas*	36	5(4.00)	12(10.00)	8(6.78)	11(9.09)	0.6266
7.	*Agrobacterium*	39	11(8.70)	9(7.50)	11(9.32)	8(6.61)	0.0332
8.	*Klebsiella*	38	11(8.70)	8(6.67)	7(5.93)	12(9.92)	0.0314
Total		485	126(100)	120(100)	118(100)	121(100)	0.1654
Chi-square(x^2)			2.1679	3.2297	4.5861	1.6765	

Name of variable	Mean	STD-devotion	Pearson –correlation		
			Value r	p-value	P ≤
Isolated algea1	15.156	7.31	1**	0.001 Sig	0.01
Isolated bacteria1	15.156	7.31			

As for Table (3), it shows that there is a positive significant correlation coefficient between isolated bacteria and algae at a significant level (P-value = 0.0 1).

Table (3) The correlation between Isolated algea and Isolated bacteria

It is evident from the results that the highest number of colon bacteria was in the Ain El-Helweh site during the month of October, and the number was 15,000 cells / 100 ml, and this may be due to organic pollution of the reservoir water as a result of dredging operations due to rain.**Al-Sharida and Hashweh (1987**) confirmed that the number of total colon bacteria increases with the onset of the rains, and this number is also attributed to the population activity by some fishermen in the area in addition to the presence of some villages in the area whose excretions directly or indirectly reach the water.As for the lowest value, it was recorded in the mosquito regulator and in the middle of the Tharthar tank, and the number was 400 cells / 100 ml each, due to the ability of the internal water to self-purification, and the ability of bacteria to remain in such water.Although the intestinal bacteria can survive in water for a limited period of time only, they often multiply in interesting numbers in contaminated water without losing their ability to cause infection (**Al-Hadithi, 1986**).The increase in the number of total coliform bacteria at this time of the year was recorded by others such as (**Al-Shawani, 2001**) in her study of the pollution of the waters of the Lower Zab River.The present results are in agreement with the study that (**Sabri *et al*.,2001**) on the Euphrates,Where they found that the streptococcus bacteria were found in the

water in significant quantities compared to other bacteria isolated.The results of isolation and diagnosis showed in the area of entry to the Euphrates in the city of Ramadi and then the city of Khalidiya,Until the end of the river in Fallujah, Habbaniyah and Tharthar lakes, the possibility of isolating and diagnosing several bacterial genera such as *Enterobacter* (24%), *Klebsiella pneumoniae* (12.1%), *Escherichia coli* (12.5%), *Citrobacter* (16.2) and *Pseudomonas spp* (17.6%). And *Oryzihabitans* (3.7%), *Shigella spp* (5%), *Salmonella spp* (5.5%), *Proteus mirabilis* and *Flavimonas* (2.8%), and the *Enterobacter* genus was the most dominant species, and the presence of these bacteria is evidence of organic pollution and microbial contamination of water (***Oran et al.* ., 2009**).As well as **(Al-Ghalibi et al., 2013)** it was found that the amount of coliform bacteria was high in the water of the Euphrates River in Nasiriyah,The current study found a decrease in the number of bacteria in the autumn season. The reason for this may be due to the decrease in temperature, which reduces the activity of bacteria. The reason may also be due to the lack of availability of organic materials in sufficient quantity.The results of this study were identical to what was stated by (**Sabri *et al.*,2001**), as it was shown that the largest number of bacteria in the water of the Euphrates was in the summerThe results of the statistical analysis indicated that there is a positive significant relationship between the total number of bacteria and between (BOD), coliforms, faecal coliforms, streptococcus and faecal coliform cocci, and the presence of a negative significant relationship between the total number of bacteria, dissolved oxygen and the percentage of saturation.

2- Algal pollution:73 species of algae were diagnosed in different areas of Anbar Governorate, and the results in Table (4) showed that there were no significant differences between the different seasons of the year with regard to algae.

Table (4): the identified genera and species of algae with their percentages in the seasons of the year during the study period

No.	Isolated algae	Number of isolates	Winter %	Spring %	Summer %	Autumn %	Chi-square (x^2)
1.	*Nitzschia*	24	7(6.36)	13(14.94)	2(8.33)	2(5.41)	0.32
2.	*Synedra*	11	3(2.73)	4(4.60)	2(8.33)	2(5.41)	0.0524
3.	*Scenedesmus*	9	4(3.64)	3(3.45)	1(4.17)	1(2.70)	0.0321
4.	*Oscillatoria*	11	3(2.73)	6(6.90)	1(4.17)	1(2.70)	0.1964
5.	*Coscinodiscus*	2	0(0.00)	2(2.30)	0(0.00)	0(0.00)	on
6.	*Fragilaria*	9	2(1.82)	5(5.75)	1(4.17)	1(2.70)	0.3214

7.	*Cymbella*	9	2(1.82)	5(5.75)	1(4.17)	1(2.70)	0.3214
8.	*Gomphonema*	13	6(5.45)	5(5.75)	1(4.17)	1(2.70)	0.0141
9.	*Surinella*	4	0(0.00)	4(4.60)	0(0.00)	0(0.00)	no
10.	*Ulothix*	3	0(0.00)	1(1.15)	1(4.17)	1(2.70)	no
11.	*Gyrosigma*	6	3(2.73)	3(3.45)	0(0.00)	0(0.00)	no
12.	*Nostoc*	3	1(0.91)	2(2.30)	0(0.00)	0(0.00)	no
13.	*Navicula*	18	7(6.36)	9(10.34)	1(4.17)	1(2.70)	0.0281

The current study also showed that there were significant differences in most algae after downstream compared to the rest of the sites (Table5).

Table (5): the identified genera and species of algae with their percentages at the sampling sites during the study period

No.	Isolated algea	Number of isolates	Downstream start %	Downstream depth %	After downstream %	Before downstream%	Chi-squar (x^2)
1.	*Nitzschia*	24	2(3.03)	7(10.29)	8(13.33)	7(9.38)	2.24
2.	*Synedra*	11	2(3.03)	5(7.35)	1(1.66)	3(4.69)	2.552
3.	*Scenedesmus*	9	3(4.54)	4(5.88)	2(3.33)	0(0.00)	0.138
4.	*Oscillatoria*	11	4(6.06)	2(2.94)	1(1.66)	4(6.25)	2.395
5.	*Coscinodiscus*	2	0(0.00)	1(1.47)	0(0.00)	1(1.56)	no
6.	*Fragilaria*	9	4(6.06)	2(2.94)	3(5.00)	0(0.00)	no
7.	*Cymbella*	9	2(3.03)	2(2.94)	1(1.66)	4(6.25)	2.395
8.	*Gomphonema*	13	2(3.03)	3(4.41)	6(10.00)	2(3.13)	0.035

9.	***Surinella***	**4**	**1(1.51)**	**1(1.47)**	**0(0.00)**	**2(3.13)**	**no**
10.	***Ulothix***	**3**	**0(0.00)**	**0(0.00)**	**0(0.00)**	**3(4.69)**	**no**
11.	***Gyrosigma***	**6**	**1(1.51)**	**0(0.00)**	**1(1.66)**	**4(6.25)**	**no**
12.	***Nostoc***	**3**	**1(1.51)**	**2(2.94)**	**0(0.00)**	**0(0.00)**	**no**
13.	***Navicula***	**18**	**7(10.61)**	**4(5.88)**	**3(5.00)**	**4(6.25)**	0.748

Table (6) The correlation between Isolated algea and Isolated bacteria

Name of variable	**Mean**	**STD-devotion**	**Pearson –correlation**		
			Value r	**p-value**	**P ≤**
Isolated algea2	**.8767**	**1.03927**	**0.97****	**0.00***	**0.01**

P: Probability value, STD:stander devotion, r :correlation

The qualitative study of phytoplankton showed that the life of the Euphrates River in the study area contained biological diversity. The diagnosis of diatoms in the waters of the Euphrates was recorded in many previous studies on the river**(Ali *et al*.,2015**). Some species showed their presence in all studied sites, namely, *Chroococcus dispersus var*. *Minor*, *Oscillatoria limnetica, Navicula fragilariodes*, and *Navicula sp*. This may give an impression of the ability of these species to tolerate a wide range of environmental factors such as temperatures and other environmental conditions **(Al-Asadi, 2015).**The type *Nitzschia* of algae was studied in this study, which indicates that this site is affected by industrial and sewage water as this type is a resistant species **(Lowe, 1996).**Other species considered susceptible were recorded, while Gomphonema olivaceum was recorded at sites 2 and 5,It was noticed that there is a clear variation in the species found in the current study sites, where the highest similarity ratio was recorded at 0.32 between sites 2 and 3, and the highest similarity was also recorded between sites 3 and 4.This may be due to a convergence between sites, which leads to similar physical and chemical factors, which is reflected in the diversity of phytoplankton(**Al –Tamimi,2006).**Little similarity ratios were recorded

between other sites, which confirms the difference of physical, chemical and life factors between the study sites.

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