Study of Bacterial Contaminants and some Chemical Elements of the Euphrates River and Al-Fallujah City Drainage

Shaimaa M. Dawd

Lecturer, University of Anbar – Education Collage for Women

Abstract

This article included bacteriological and some chemical elements study of pollution from Euphrates river and Al-Flalloja city drainage. The study of four selected sites which are Euphrates river (T), Al-Falahat (F) drainage, Al-Ne'emya (N) drainage, and Al-Bo Alwan (B) drainage in the period 11-13/December/2016 Bacteria were isolated and diagnosed in water samples depending on their cultural, microscopic biochemical tests. Results showed that the water samples were polluted with bacteria produced by human and animal wastes, 7out 20 isolates were selected and diagnosed. The study included counting the concentration of some chemical ions such as Sodium, Potassium using a flame photometer, the highest concentration of Sodium was in station F and the highest concentration of Potassium was at the station B, concentrations of carbonates and bicarbonates were measured using titration method, the highest concentration of bicarbonates ion was at station T, it also showed no carbonates in a water sample.

Keywords: *Bacterial pollutants, Chemical elements, Euphrates, bacteriological, Bacterial isolates*

Introduction

The considerable prevalence of salts in the agricultural lands located between the Dijla and Euphrates rivers in the plain sedimentary region led to the necessity of establishing a main network of puncture for the country's need for fertile agricultural lands, Still the problem of biological pollution that is caused by sewage water is one of the most critical problems that have been aggravated by the political conditions, it went through Such as wars, blockades and others that have increased water treatment problems [1]. The current reality of treatment stations is one of the most important environmental problems that will undoubtedly lead to pollution of wastes, and of drains and hence the pollution of water bodies [2]. The severity of water pollution is closely related to the source of pollution, and factory water and wastes constitute (60%) of all water pollutants, most of these pollutants are emitted from factories and their chemical waste, containing chemical elements pollution water [5,9]. This makes this water a source of pathogenic bacteria such as Faecal Coliform Bacteria, Enterococcus and Pseudomonas Bacteria, which are evidence of stool water pollution [13].

In light of this: We use this study to detect the degree of pollution present in the studied water stations. As well as the diagnosis of bacteria resulting from pollutants and wastewater using microscopic and chemical analyzes

Materials and Methods

The Study Area

Samples were collected from the study sites by one sample from each region during a season in addition to the sample taken from the Euphrates River using containers of polyethylene (1 liter) as shown in Table 1

Table (1) Symbol and location of the stations included in the study

Site number	Location	Symbol
site No. 1	Euphrates River in the city of Fallujah	T
site No. 2	AL-Flfalahat trocar In AL-Flfalahat suburb	F
site No. 3	Al-Nuaimia trocar in Al-Nuaimiya suburb	N
site No. 4	Al-Baalwan trocar in Al-Baalwan suburb	B

Identification of isolates

Microscopic and biochemical tests were performed using the scientific sources used in the diagnosis of bacteria, Diagnostic steps included cultural properties, Microscopic tests, and motility tests [3, 10]. As for biochemical tests, they included conducting the Oxidase test, the Catalase test, and the Citrate utilization test, Voges- Proskauer test, Methyl red test and Indole production test.

Determination of chemical elements in water samples

Determine the potassium K^+ and sodium Na^+ elements by flame atomic emission using a flame photometer and prepare a standard curve for the potassium element from KCL and a standard sodium curve from NaCl, the carbonate ions (CO_3) and the bicarbonate (HCO_3) were measured by solution (0.01n H_2SO_4) [11].

Results and Discussion

The diagnosis was performed on (20) isolates obtained from the water samples of the studied sites according Bacterial Density, by (3 isolates at site T, 4 isolates at site F, 9 isolates at site N and 4 isolates at site B).

Micro and agricultural characteristics

Microscopic examination showed that the isolates that we obtained were (17) isolates in single or bilateral bacilli and (3) isolates in the form of staphylococci. As for the dye of gram, there was (15) negative isolation of gram. And (5) isolation is positive for gram. As for its ability to move, there are (14) of them grown on the medium semi-solid agar and (6) non-move isolates. Most bacteria isolates showed that ability to grow at a temperature of (28º) and (38º), as shown in Table No. (1).

As for the growth of isolates on the agricultural medium, (14) of them can grow on the medium Macconkey agar, and others have the ability to grow on the medium Triple Sugar Iron agar (TSI) where (2) isolates showed that produce hydrogen sulfide gas in contrast, (18) isolation does not produce hydrogen sulfide gas.

Biochemical tests

The results of the biochemical tests showed that the isolated isolates were tested for the tests (catalyzase and oxidase enzyme production, indole production, red methyl test, fox proscur and the consumption of *Citrate*) as follows:

The catalase enzyme test

The catalase enzyme test showed that for all isolates there are 17 positive isolates of this test, that is, they have the ability to produce the catalase enzyme, and 3 negative isolates for this test that is, they cannot produce the catalase enzyme.

Oxidase test

The test showed that for all isolates there are 3 positive isolates that have the ability to excrete the oxidase and 17 negative isolates for this test, they do not have the ability to excrete the oxidase.

Indole production test

The indole production test for all isolates showed that there are 7 isolates on the ability to produce indole from the amino acid Tryptophan by enzyme Tryptophanase and 13 isolates that do not have the ability to produce indole.

Red Instance Test

For all isolates, a red methylation test showed that 13 isolates showed red color. This indicates the

efficiency of isolated bacteria on analyzing glucose sugar altogether and produced amino mixed acid fermentation. And 7 isolates in which a yellow color was observed, this indicates the negativity of these isolates for this test, that is, they do not have the ability to thorough analyze glucose and produce this Mixed Acid Fermentation completely).

Fox Proscower Test

The results of the Fox Proscur test showed that for all isolates, there are 9 isolates that showed a red color, and this indicates the ability of bacteria to partially analyze glucose sugar and the formation of an intermediate compound is Acetyl-Methylcarbinol and 11 isolates in which a yellow color remains, and it has no ability to partially analyze glucose and form the intermediate Acetyl-Methylcarbinol

Citrate* Utilization *Test

The test showed the utilization of *citrate* for all isolates that 9 isolates are changing the color The proof blue bromothaimol from green to blue this is evidence of the ability of bacteria in these isolates to use the *citrate* as a single source of carbon and the presence of the enzyme Citatelyase and 11 isolates where it was observed that the color of the green medium was not changed, evidence for this indicates that this isolation is negative for this test.

Spread Bacteria in the studied areas:

The areas that were studied trocar showed that there are a large number of different pollutants in them, especially their pollution sewage, agricultural wastes and animal waste, in addition to their pollution with factory waste, which caused an increase in the number of bacteria in those areas, as shown in Table (2) as follows:

Table No. (2) bacterial genera isolated from the water of the Euphrates River and the ditches of the city of AL-Fallujah

Bacterial Genera	Number of isolates	Isolation%	T	F	N	B
Pseudomonas aeruginosa	3	15	1	1	/	1
Escherichia coli	7	35	/	/	6	1
Enterococcus faecalis	3	15	/	2	/	1
Proteus mirabilis	2	10	1	/	1	/
Klebsiella pneumonia	2	10	/	1	1	/
Enterobactrium	2	10	/	/	1	1
Citrobacter freundii	1	5	1	/	/	/
total number	20	100	3	4	9	4

We notice from the results in Table that the *E.coli* bacteria have the largest number of bacterial isolates diagnosed by seven isolates and at a rate of (35%), as station N recorded the highest number of isolates for this bacterium by six isolates followed by station B with only one isolate, The reason for its spread in these areas may be due to the large pollution of these Trocars with heavy water resulting from the disposal of wastewater, as well as throwing agricultural and animal wastes directly into the trocars, especially site N, as it is considered an agricultural area there is also a lot of animal husbandry in this region, as the high number of colon bacteria in the water is considered evidence of pollution of water with stool , which may be caused by drainage of wastewater into surface waters such as rivers, streams, etc. In addition to throwing agricultural wastes and animal waste in this water, which provides a fertile environment for the growth of this type of bacteria [4].

As for *P. aeruginosa* and E. faecalis, it was 15% each, and by one or two isolates of the station, the presence of these two types of bacteria is also an important indicator of bacteriological pollution of water resulting from human excrement and excreta in addition to other wastes [12, 19]. While bacterial species *Pr. mirabilis*, K. pneumonia and Enterobactrum are 10% each, and the presence of these bacterial species in the water is considered a danger to human health if this water is used for drinking, as *Klebsiella Pneumonia* is one of the causes of bowel disorders and pharyngitis, as well as urinary tract infection that may cause it. Also, Enterobactum bacteria [7, 8].

As for the bacteria *Citrobacter freundii*, the lowest percentage of bacterial isolates (5%) was recorded with only one isolate at station T, as this station has the advantage of being the lowest number of bacterial isolates diagnosed in it because the river water is running water and heavy elements are deposited as well as the discharge of pollutants. [20].

Content of some chemical elements in water samples:

Positive ions:

Sodium ion:

Sodium (Na) concentrations in water samples have been reported between 215.6 $mg.l^{-1}$ at site B and 762.5 $mg.l^{-1}$ at site F and 443.1 $mg.l^{-1}$ at site N, while its concentration in the Euphrates River (T) was 104.9 $mg.l^{-1}$ as shown in Table (3). When comparing the results of sodium concentration, it appears to us that the highest value of the Na concentration was at site F, This may be due to the drainage of agricultural lands on both sides of the trocar, as the Al-Falahat suburb is considered an agricultural area containing many palm groves and other trees, where the process of trocars and evaporation in summer causes an increase in the percentage of salts in the water, including sodium salts [6 , 20]. Whereas, the lowest value of the sodium concentration was recorded in the site T, because the river water is running water in which the concentration of chemical elements decreases in general, and also because of the growth of algae, and living organisms that consumer these nutrients [14].

Potassium ion:

The results of the study showed that the highest value of potassium ion concentration was for site B 16.7 mg / l, followed by site F 8 mg / l, then site N 4.8 mg / l. As it is noticed the low potassium concentration in the water compared to the sodium ion, This is due to the element potassium that is included in the composition of clay minerals during weathering and the other reason is that potassium minerals are more resistant to weathering compared to sodium minerals [18] , While the lowest value of the Euphrates River T was recorded at 4.4 $mg.l^{-1}$, because the river water is considered running water and the consumption of the elements by the aquatic organisms that are present in it occurs a lot compared to other stations (Table No. 3).

Negative ions:

Carbonate ion, CO_3 and bicarbonate, HCO_3:

The results showed that the highest concentration of the bicarbonate ion was in the water of the river and this is consistent with the study carried out by [17], which also showed an increase in the concentration of bicarbonate ion in the Euphrates River for the city of Fallujah,_ The high concentration of these ions in the water of the river is due to the availability of dissolved non-organic carbon in addition to the heavy rains falling on the soil rich in carbon dioxide whose waters descend into the river, which is one of the main reasons leading to an

increase in the value of the bicarbonate ion [15]. As for other sites, we note that the site N is 6 $mg.l^{-1}$, followed by the Euphrates River, followed by the site F 2 $mg.l^{-1}$, then the site B is 0.9 $mg.l^{-1}$. This is proportional to the number of diagnosed bacteria in these sites that rely on *citrate* as a carbon source, where it was observed that the concentration of the bicarbonate ion increased with the increase in the number of diagnosed bacteria in that water except for the Euphrates River water T 28 $mg.l^{-1}$ where the concentration of the bicarbonate ion increased for the reasons mentioned above (Table No. 3). It is clear to us through the above results that there is an increase in the concentration of the chemical elements studied in the water stations included in the study, Explain [16] indicated that sanitary and industrial wastewater always leads to a large increase in the concentration of chemical elements in the water.

Table (3) Concentration of chemical elements studied in water samples.

Co3 Concentration mmol / L	HCO3 concentration mmol / L	Concentration + K mg.l-1	Na + mg.l-1 concentration	Sites
Nill	28	4.4	104.9	T
Nill	0.9	15.7	215.6	B
Nill	2	8	762.5	F
Nill	6	4.8	443.1	N

Conclusions

Through the results of this study it was found that studied water suffers from the pollution that reached a degree that negatively affected its use; Hence, it became unsuitable for drinking and industrial home use, which affects public health. There was also a relationship between the pollution of this water and the increased prevalence of pathogenic bacteria in the areas under study. It also increases the concentration of elements in water samples due to their pollution with wastewater.

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Conflict of Interest: Nil

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References

1- Abu Saadah MNI. (Environmental Pollution and the role of microorganisms Positivelyand negatively . Arab Thought House Cairo , 247 pages ;2000.

2- American water work association. Water Environmental federation Examination water and waste water ; 1999.

3- Baron EJ, & Finegold SM. Baily and Scott Diagnostic Microbiology. C.V. Mos by Company Toronto; 1990.

4- Cool G., Rodriguez MJ, Bouchard C, Levallois P, Joerin F. Evaluation of the vulnerability to contamination of drinking water systems for rural regions in Québec, Canada. Journal of Environmental Planning and Management; 2010. 53(5), 615–638.

5- Deane M. The Biology of polluted waters, California university,.Press California; 1993. 71:332-339.

6- Emad AMS. Al-Heety IK, Khamees AO. Water Quality of Euphrates River in Ammereate Al-falujah city and Effect of the Anthropogenic Activities on it . UOA Journal of pure Sciences; 2015. 1(9) ;234-245.

7- Grimont F, Grimont PAD , Richard C. The Genus *K*lebsiella. *In* The Prokaryotes: An Evolving

Electronic Resource for the Microbiological Community, electronic release 3.14, 3th ed., Dworkin, M., Falkow, S., Rosenberg, E., Eds., Springer-Verlag: New York, NY, USA ; 2003.

8- Grimont PAD, Grimont F. Genus *K*lebsiella. *In* Bergey's Manual of Systematic Bacteriology, 2nd ed., Brenner, D. J., Krieg, N. R., Staley, J. T., Eds., Springer: New York, NY, USA ; 2005. Volume 2, Part B, pp. 685–693.

9- Hayder HA, Zainab YK, Saif M, Abed Zahra SM. Levels of bacterial and chemical pollutants in Euphrates River in Samawah , Iraq; 2016. 1 ,(4) : 66-69 .

10- Holt JG, Krieg SPH, Staley JT, & Williams ST. Bergy's manual of determinative bacteriology. 9th. Baltimor: William & Wilkins ; 1994.

11- Johnson J ; Zhang H. Classification of irrigation water quality, Division of Agricultural Sciences and Natural Resources, , OSU, Oklahoma; 2003.

12- Nagvenkar GS, & Ramaiah N. Abundance of sewage-pollution indicator and human pathogenic bacteria in a tropical estuarine complex. Environmental monitoring and assessment; 2009. 155(1-4), 245.

13- Oksfriani J S and Yenny R. Bacteria as Indicators of Environmental Pollution: Review, International Journal of Ecosystem; 2014. 4(6): 251-258.

14- Ragab AAM, Hellal FA, & El-Hady MA. Water Salinity Impacts on some soil properties and nutrients uptake by wheat plants in sandy and calcareous soil. Australian Journal of Basic and Applied Sciences; 2008. 2(2), 225-233.

15- Siegei I.D. Silicate dissolution in thuenceanfilson Greek chemistry north eastern Minnesota goe. Soci of Amer. Bult. 95; 1984. (12) 1446-1452.

16- Taha DH , Meshkor M , Saleh ZE, Hussein FA , Reza W. The Effect of Sewage Residues of Kufa City on the Euphrates River . Journal of Karbala University Issue 5 (the first environmental pollution symposium in Karbala); 2003.

17- Tahseen, AZ, Ibrahim AA, Rahman WMS . AN environmental study of chemical and physical pollutants in euphtares river water in Ramadi and Fallujah . UOA Journal of pure scinces 3 (3). 2009.

18- Wedepohl KH. Handbook of Geochemistry, springer verlay Berlin,, ,vol.I, 442. 1972.

19- Wery N, Lhoutellier C, Ducray F, Delgenes JP, & Godon JJ. Behaviour of pathogenic and indicator bacteria during urban wastewater treatment and sludge composting, as revealed by quantitative PCR. Water research; 2008. 42(1–2), 53-62.

20- Zerfy SKL, Mohamed AA Kazem SAI. Study of some physical and chemical properties of Kufa river water UOB Journal of Pure &Applied Sciences ; 2010. 4 (18)**.**354-362