A study Some Physico-Chemical And Bacterial Properties of Wastewater for Ramadi Teaching Hospital and its Impact on the Euphrates River

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Abstract

Physiochemical and bacteriological characteristics of Euphrates river water were examined monthly to assess the possible impacts of wastewater discharged from Ramadi Teaching hospital for the period from August 2019 to January 2020. The obtained results showed that air and water temperature mean values varied from 12.0 ±11.3 to 40.0 ± 11.3 C ° and from9.1.0 ±3.12 to 33 ±9.5 C° respectively. Also, turbidity values were found to range from 14.0±8 to 144 ±9.6 NTU. while EC value was situated between 567.0±44.67 µS/cm and2899 .0±274 .3µS/cm. The current results have shown that total hardness mean values were very high and ranged between 252.0±27.5 and1114.0±96.3 mg/l while chlorides mean values ranging from92.0±62 to 588 ±104 mg/l, but nitrate mean values were found with the range of 1.2 ±1.86 and 50 ±4.5mg/l.The BOD mean values were found to range from1.0 ±1.2 to 34 ±6.5 mg/l, while DO mean values varying from 1.7 ±3 to 11.1 ±1.3 . This study has shown that the total bacterial count (222 to 1800000 cells/1 ml), Total Coliform (61 -170000 cells/100 ml), Fecal Coliform (0-58000 cell/100 ml), and Fecal Streptococci (18 -9200 cells/100 ml).

Key words : *Ramadi Hospital , BOD , Euphrates river; toxicity*

Introduction

Rivers are the most important natural resource for human development but they are being polluted by indiscriminate disposal of sewage, industrial waste and plethora of human activities, which affects its physicochemical and microbiological quality(1). Water pollution is widely characterized as any physical , chemical or biological change in water quality that adversely affects living organisms in the environment or renders a resource of water unsuitable for one or more of its beneficial uses. Occasionally, pollution may derive from natural processes such as weathering and soil erosion. (2).

Wastewater generated from hospitals usually contain pathogens, human tissues and fluids, pharmaceuticals, substances with genotoxic properties, chemical substances, heavy metals, and radio-active wastes, which may endanger public health, and contribute to oxygen demand and nutrient loading of the water bodies and in the process promote toxic algal blooms and leading to a destabilized aquatic ecosystem, if discharged without treatments into water bodies(3).

Wastewater in hospitals isisimilar in the texture to the iwastewater in the city public and different in containing very idifferent and diverse types of liquid waste with low quantities ithat they contain many infectious and dangerous compounds resulting from ipatient care, which makes processing it separately from wastewater an urgent necessity. Multiplev practices that happen in hospitals (surgery, drug, radiology, laundry, operation room, chemical andibiological laboratories, etc.) are a principal source of pollutant discharge intoithe environment (4).

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2. Material and Methods:

2.1. Study area:

The Ramadi Teaching Hospital is located in the city of Ramadi, center of Anbar Governorate, on the eastern bank of the Euphrates River. These hospital facilities discharge the wastewater (once daily in the morning and in the evening) directly into Euphrates River with simple treatment.

Three Stations were selected for water sampling where the first site was located around 100 meters before the Hospital to act as control. The second station was the discharge point of Hospital discharge and the third was about 100 meters away south the second site .

2.2. Samples Collection

The water samples were collected during the period from August 2019 to January 2020 from three stations**.** The water samples were collected from a depth of 30 cm beneath the river surface. They have been done once a month and the sample were placed in clean poly-ethylene bottles and stored in ice containers until reach to Laboratory.

2.3 Physico-Chemical and Microbiological analysis :

Total dissolved solid (TDS) and dissolved oxygen (DO) were determined at the time of sampling in the field using pH meter, WTW model, portable EC meter, WTW model and portable HANNA dissolved Oxygen meter and HI9142 model, respectively**.** Tur- Biological Oxygen demand (BOD)**,** S_{O4} S_{O4}, $P_{o4}P_{o4}$,Cl-,$N_{O3}N_{O3}$, TH(total hardness)and Total dissolve solid determined according to APHA [5].Total count (TC) of bacteria was determined according to [6].

2.4 Statistical analysis.

All statistical analyzes were performed using SPSS (Statistical Package for Social Science) Version**.**

3.Results and discussion:

The current results found that the highest value for T.H. was 1414±96.3 mg/l in November at Station 2, while the lowest value was 252.0±27.56 mg/l in January at station 1. Higher values of total hardness in Euphrates river at station 3, due to the major increase occurred after receiving the hospital wastewater, If you compare it to the station1 that located before the hospital discharge point to the river. Based on the foregoing, the waters of the Euphrates are considered a very hard depending on the rating [16] Which is considered water very hard when the hardness is more than 200 mg/L .

The results were supported by those [17] on Shatt Al-Hilla , [18] on Euphrates river and [19] on Euphrates river in Heet city.

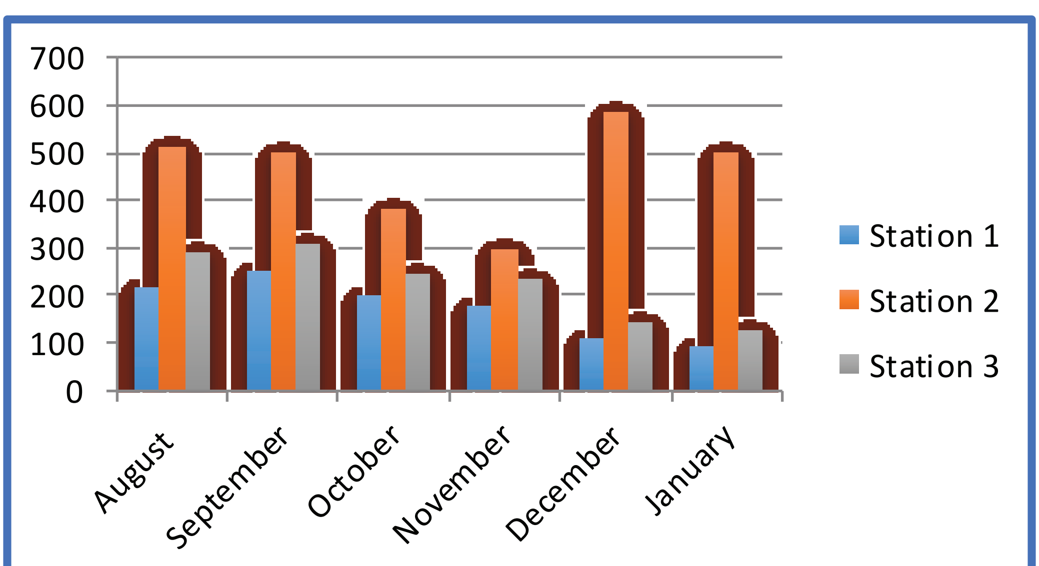

Figure (1). Monthly variation in chloride ion during study period

During the study recorded lowest value of Cl^- (92 ± 62.1mg/l) at station 1 in January 2020 and recorded the highest value (588 ± 104mg/l) at station 2 in December 2020. (figure 1).

The mean value of CI (314 mg /l) exceeds the permissible limit for both Iraqi standards river water 1967 No. (25(, which was 200 mg/l , and World Health Organization WHO [7] which was 250 mg/l. The increase of Cl- value indicates to pollution by sewage in the waters of Euphrates river due to the discharged sewage from the Hospital , where Chlorine is commonly added to reduce potential pathogens .Studies on hospital wastewater reported that Cl value might reach to higher concentrations, due to the disinfectants [20]. The results of this study were higher than that reported by [12]who registered a mean value 146 mg/L in Euphrates river and [21]in Chambal river India who registered a mean value 48 mg/L.

The present results showed that the highest value of DO was 11.1±1.3mg/l at station 1in January, while the lowest value was 1.7 ±3 mg/l at station 2 in December (Figure10). The mean value of DO (6.1mg/l) during study , World Health Organization (WHO) [7], and American standards for protecting river water mentioned that the optimal value of DO was more than 5 mg/l , based on the above results it can be said that the dissolved oxygen content is within the permissible limits. The mean value of DO (6.4 mg/l) during study.

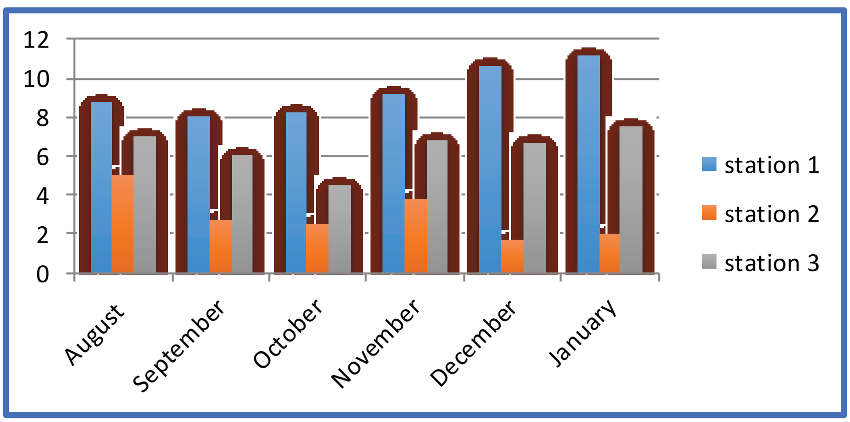

Figure (2). Monthly variation in DO during study period

The DO mean values of stations 3 was lower than of station 1 due to discharge wastewater for hospital, this variation in DO values for this station may be mainly attributed to the consumption of DO in the oxidation of organic matter from the medical waste discharged from hospitals to the river. The results of present study are in agreement with those of [22] who found that DO Average values (6.1 mg/l) in Shatt Al-Hilla River and [23] who recorded in his study DO average values was (6.1)mg /l in Euphrates river.As shown figure 2.

The study has shown that the lowest value 1± 1.2 mg/l) was recorded in station 1 during December while the highest value (34± 6.5 mg/l) was recorded in station 2 during October. The mean value of BOD for station 3 (5.9 mg/l) exceeds the permissible limit WHO standards(2008) which was less than 2 mg/l

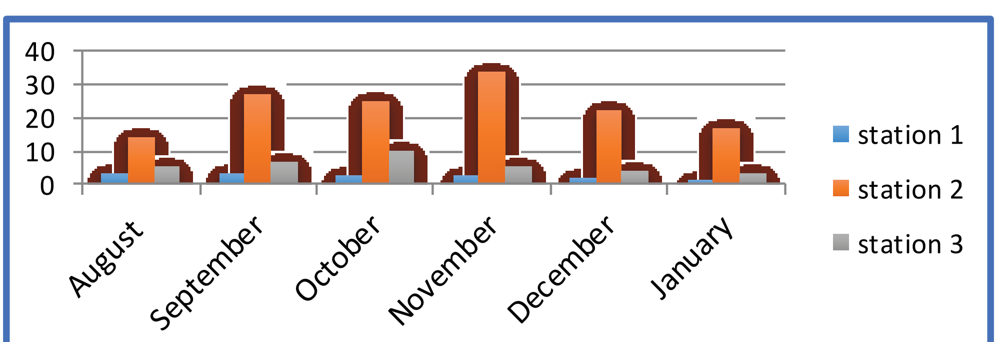

Figure (3). Seasonal variation in BOD in Tigris River during study period

This study's results were higher than those stated by[24]found the range for BOD5 was (2.8 -14.5 mg/L) on Euphrates revir at Al-Kaldia city and [25] found the range for BOD5 was (0.5 – 28 mg / l) in Greater Zab river.As shown figure (3).

In case of N_{O3}-, the highest value was 50 ± 4.5 mg/l in January at station2 , while the lowest value was 1.2 ±1.8 mg/l in January also at station

The mean values of NO3 (9.1 mg /l) for station 3 are within the permissible limit

for both Iraqi standards river water 1967 No.(25) and WHO standards drinking water (2004), which was 50 mg/L . High nitrate level in during January due to sewage waste water from hospitals ,the rainfall and fertilizer runoff as well as bacterial activity which convert nitrite to nitrate and the decomposition of organic compounds [26].

The results of this study were higher than those observed [27] that found N_{O3}values ranging from 0.5 -3.8 mg/l on Euphrates river at Ramadi city and [19] that found the N_{O3}values ranged between 3.1-47 mg/l in Euphrates river .

As shown (Table 1).The highest number of total bacterial count was recorded September 2019 at station 2 which was 18000000 CFU/1ml, while the lowest number of total bacterial count was recorded in January 2020 at station 1 which was 222 CFU/1ml. High number of TBC in the study was recorded during September and November months, that may be the consequence of the high level of suspended solids and nutrients in drainge water impacting aquatic microflora survival[28] .

The findings obtained in this study were higher than those from previous studies like [30] in Tigris river but less than [22] in Shatt Al Hilla river.

Table 1- Minimum and maximum (First Line), mean and standard deviation (Second Line), for Bacteriological characteristics at study stations

Stations / Parameters	Station 1	Station 2	Station 3
Total bacteria count cell/1ml	222-34000 12487±2508	1300-1800000 680278±68415	1300-98000 43066±15397
Total Coliform cell/100ml	61-5400 3543±2308	46000-170000 80666±30.8	920-35000 11133±3695
Faecal Coliform cell/100ml	0-6300 2600±2181	10000-58000 29000±16.3	40-11000 3506±1449
Faeal Streptococcus cell/100	18-2200 1216±811	1800-9200 4700±2476	0-4600 2485±2253

The term "coliform bacteria" refers to the bacterial species in the family Enterobacteriaceae genera such as *Escherichia, Klebsiella, Enterobacter and Citrobacter* that live in the intestines of warm-blooded vertebrates (mammals and birds) [31]. Table1) shows the results of TC in this study ranged between (61- 170000 CFU/100ml). The minimum value of TC was recorded January 2020 at station1, while the maximum value of TC was recorded during August 2019 at station 2 .

Fecal coliform in this study ranged between (0 to 58000 CFU/100ml), were the lowest value recorded at station 1 in January 2020 and the highest value was recorded at station 2 in the August (Table1). Easy of detection and survival in water longer than the pathogenic bacteria[33]. This study coincided with previous studies of [8] in Al Graff river and [34] in Coastal Malaysia .

The results revealed lowest value of F.S was recorded in January 2020 at station 1 which was 18 CFU/100ml, while the highest value of F.S was recorded in August 2019 at station 2 which was 9200 CFUl/100ml . As shown Table (1). The Fecal streptococcus is intestinal bacteria, FS have been used as indicators of fecal contamination in water because presence in the intestines of humans and animals, as well as its presence in the soil and on plants and some insects [35].

These results were higher than study of [36] in Tigris river and ,[32] on Euphrates river in Nasiriyah city.

A ratio between faecal coliforms and faecal streptococci were used to indicate the origin of bacterial pollution in the surface and ground water If the ratio is 4 or greater that indicate the human source of pollution, ratio between 0.1-0.6 indicate the domestic animal source, wher as when the ratio is less than 0.1 that indicate the wild animal source of pollution. The results of current study indicate there is a mixed origin of fecal pollution in Euphrates river ,because the domestic and agricultural wastes are discharged to the river[37]. According to WHO[38], the water Euphrates river contain a high level of bacterial pollution.

Conclusions:-

There was an increase in the physical parameters , especially at the station located after the discharge point of the hospital; The BOD5 values affected clearly by excreta untreated wastewater because they decrease in stations that located before discharge points wastewater hospitals

Ethical Clearance: The Research Ethical Committee at scientific research by ethical approval of both MOH and MOHSER in Iraq

Conflict of Interest: None

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