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Assessment of the Water Quality of Diwaniyah River

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THE REDUCTION of environmental pollutants in the river is one of the most important priorities for the production of drinking water. In this study, a river known as Shatt Al-Diwaniyah (Qadissyia, Iraq) was selected to demonstrate the potential environmental impacts of various pollutants in the area from Sunni (north of the city of Diwaniyah, about 15 km). There are 15 sites selected for the period from March 2014 until the end of October 2014. This study includes the measurements of pH, TDS, EC, Do, BOD, NO_3, and PO_4.

The results showed that the water temperature at all sites ranged between 28.98-31.2^{O}C while, the pH values were in the range of constraints in all the sites (between 7.50 to 8.06). In addition, recorded EC values ranged from 1195 to 990µ/cm, TDS values ranged from 1323 to 890 mg/L, DO values ranged between (6.30 to 8.01) mg/L. The study recorded a high concentration of vital oxygen requirement beyond the conditions allowed in most of the sites studied. Nutrients also observed which fluctuated in a narrow range and a clear concentration especially nitrate. The Nitrate concentration ranged from 0.15 to 6.34 mg/L. The effective phosphate concentration is higher in some sites, than the permissible limits. The results showed that the presence of rubber and textile factory as well as the fever and kidney hospital may deteriorate the quality of the river's water, also, the abuses of the networks in the rain by the citizens living on both sides of the river. In most cases, the efficiency of the treatment plants may be affected by the deterioration of the effluent water.

Collected main wastewater and disposable in right places are very harmful on public health. Wastewater sources vary depending on the use of water in agriculture, commerce, industry as well as to use municipal water such as showers, baths, washing machines etc. Therefore, the proper collection and treatment delivery of wastewater before discharging into the river are important to safe environment. In general wastewater contains toxic substances, heavy metals, carcinogenic, chemical and organic compounds, toxic germs and viruses. In addition to all of that, it is very rich in salt, especially boron salt used in laundry detergent powders used in homes. Discharge of poorly treated wastewater will increase the pollution of the environment [1, 2] .

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In recent years, interest increased in the study of pollutants in wastewater, which are the main cause of river pollution. In addition to other pollutants resulting from factories, car workshops, as well as hospitals because, they adversely affect the biologically, chemically and physically properties of rivers[3,4] . Rivers are the main source of drinking water in most cities, they feed into several projects and residential complexes, in addition to the use of river water in the irrigation and agriculture. Water is classified into usable pure water (safe water), which is free from bacteria and dissolved mineral substances, earned colors to make them unusable, polluted, from water exposed to natural factors earned a change in the color, taste, odur or turbidity due to the presence of foreign organic material or stuck in it. Water unusable or contaminated water contains bacteria or toxic chemicals make them harmful to public health due to the cause of disease, which underlines the lack of suitability for drinking water or irrigation [5,4] .

Diwaniyah River is an extension of Hela River in the extended hand of the Sunni region (north of Diwaniyah city in Iraq) to the south of that city about 15 km pass inside that city. Along this area there are 15 sites spread around the river's banks. Those sites differ in characteristics of the sources of pollution. This study was carried out from beginning of March 2014 until the end of October 2014, as shown in Fig.1.

Discharge of poorly treated effluents in the study area affecting the human, animal, plant or neighborhoods. Consequently, the aim of this study is to determine the level of some pollutants in Diwaniyah River (Shatt al-Diwaniyah) area.

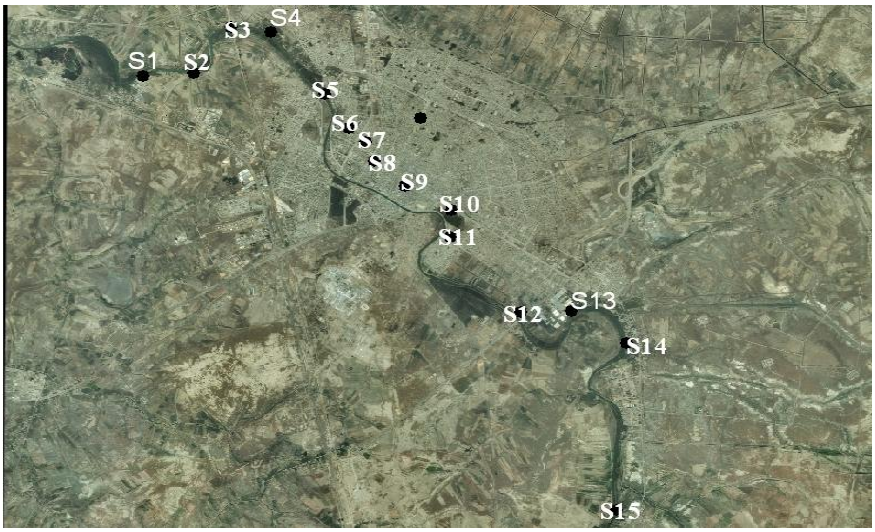

Fig. 1. Map of Al-Diwaniyah City with the locations of sites along the river (Google earth).

Materials and Methods

Grab samples were collected from some selected locations according to Fig. 1. Physico-chemical characteristics namely, temperature, pH-value, electrical conductivity (EC), dissolved oxygen (DO), biological oxygen demand (BOD_5), total dissolved solids (TDS), nitrate (NO_3), and phosphates (PO_4) were conducted for each sample. Table 1 shows the sampling sites during the study period. All the analyses were carried out according to APHA (2005) [6] . Table 1 represents the activity near the selected locations.

TABLE 1. Name and location of for the river (Scale 20 Km) .

Symbol sites	Title sites	Location of sites	
		E	N
S1	Behind the water supply project	0487434	3541573
S2	Village included the Fever Hospital	0488467	3541646
S3	Rail bridge	0489234	3542671
S4	Branch of sewage after treatment in Um Horse area	0496147	3536319
S5	Bridge names (Euphrates Bridge)	0491134	3541189
S6	Bridge names (Corniche Bridge)	0491628	3540408
S7	Branch of sewage after treatment in Aljazayir area	0491961	3540112
S8	Bridge names (Almuealaq bridge)	0492126	3539678
S9	Stream agricultural drainage	0492763	3539124
S10	The beginning of Imam Sadiq area	0493694	3538584
S11	The ending of Imam Sadiq area	0493680	3537974
S12	Residential building group in Diwaniyah	0495104	3536298
S13	Factory of the textile clothes	0490028	3542562
S14	Village name (Shaalan Flaih)	0497260	3535599
S15	Village name (Raji Gulab)	0497054	3531852

Results and Discussion

According to the collected data, it can be noted that the maximum DO concentration was (8.0, 8.1) mg/L, at sites 2 and 3, respectively. This may be attributed to the speed of the swirling of the river, thus dissolving of oxygen was more in that points. On the contrary, the concentrations of DO in the sites 4, 9 and 10 were (6.3, 6.25 and 6.3) mg/L. The low pH values could be due to the presence of wastewater treatment plant near the slow flow of the river at these points. The DO detection readings were exceeding 5 ppm, which is the minimum limit, proposed by the National Regulatory Standards for natural pollution as the maintenance of river system[7] (Fig. 2).

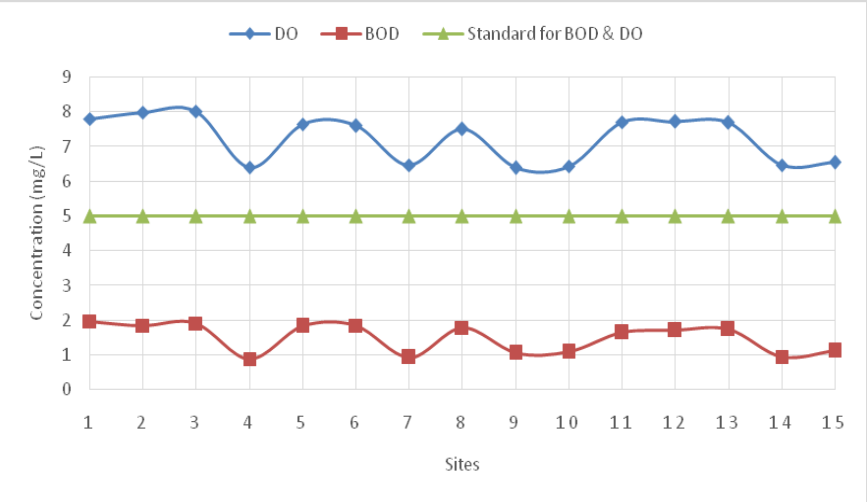

Fig. 2. Variation in average (DO and BOD) in all sites along the river during period study.

The measured BOD for the 15 collection sites showed that the sites were complying with the National Regulatory Standards (PRPWP, 2012). The sites 4, 7, 9 and 14 showed the lowest BOD concentrations. While, sites No. 1, 3, 5 and 6 showed the maximum recorded concentrations.

The pH value is one of the most important parameter for evaluation of the intake points. During the study period, the pH values for the 15 sites were found to be within the permissible limits. The pH values ranged from 7.5 to 8.05. Figure 3 shows the fluctuation in the pH values in the 15 sites.

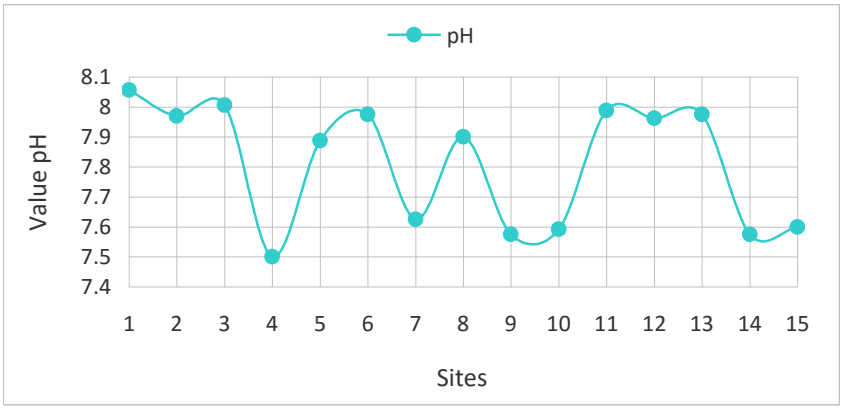

Fig. 3. Variation in parameter pH in all sites along the river during period study.

The highest reading of EC was at site No. 4 followed by sites 7, 9, 10 and 14, while the lowest value was at the site No. 3 (Fig. 4). There are no limitations for EC but is an indicator of salinity and TDS. The rising value of EC at site No. 4 may be due to the discharge of partially treated domestic wastewater directly to the river basin.

The TDS concentrations were found to be closely related to EC. It was noted that the highest concentration 1350 mg/L was at site No. 4 while, the lowest value was 890 mg/L at the sites No. 3. There is no limitations nature of TDS, as shown in Fig. 4.

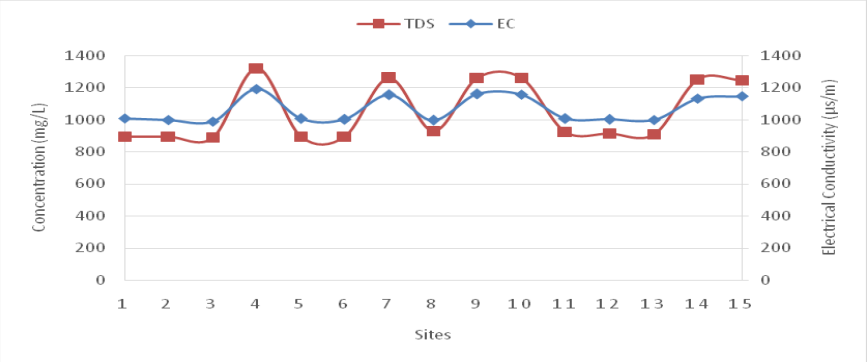

Fig. 4. Variation in parameters (EC, and TDS) in all sites along the river during study period.

The temperature was measured for the 15 sites during the study period. According to the National Regulatory Standards[7], the temperature must not exceed 35°C. It was noted that, the temperature complyies the standards. However, the temperature at site 4 was higher than the other sites, but did not not exceed limit (Fig. 5).

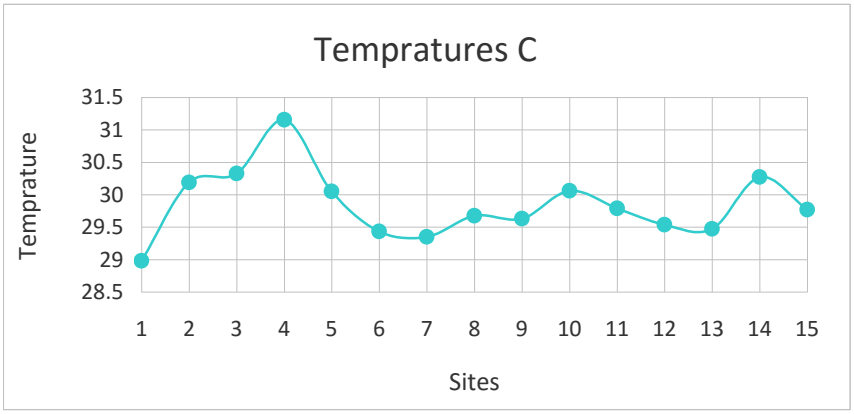

Fig. 5. Variation in temperature in all sites along the river during period study.

Figure 6 shows the variation in phosphate concentration at the all sites. It was noted that the concentrations of phosphate at sites No.4, 7, 9, 10, 14 and 15 were (8.5, 6.7, 6.9, 5.7, 8.8 and 7.9) mg/L, respectively. This measured value was higher than the permissible level estimated by the National Regulatory Standard[7] . At site No. 4, 7 and 9, there are sewage water mixed with the river water at those locations. While, at sites 14 and 15 there are agricultural drainage water mixed with the river's water. Wastewater discharged into the river is contaminated with organic matter and chemicals, such as soap and detergents, with the presence of some types of bacteria and harmful microbes. In addition to heavy metals, toxic hydrocarbon compounds that cause Eutrophication, which is the most important natural phenomena updated pollution in rivers and beaches, as the high proportion of organic matter in the water leads to an increase in metabolic processes (Metabolism) by the algae, which leads to reproduction and accordingly so active bacteria. Increasing of the biological decomposition of algae operations leads to reduction of the proportion of dissolved oxygen in the water, thus leading to rot this water and turned not possible for irrigation or agriculture in general and to the drinking in special[8] .

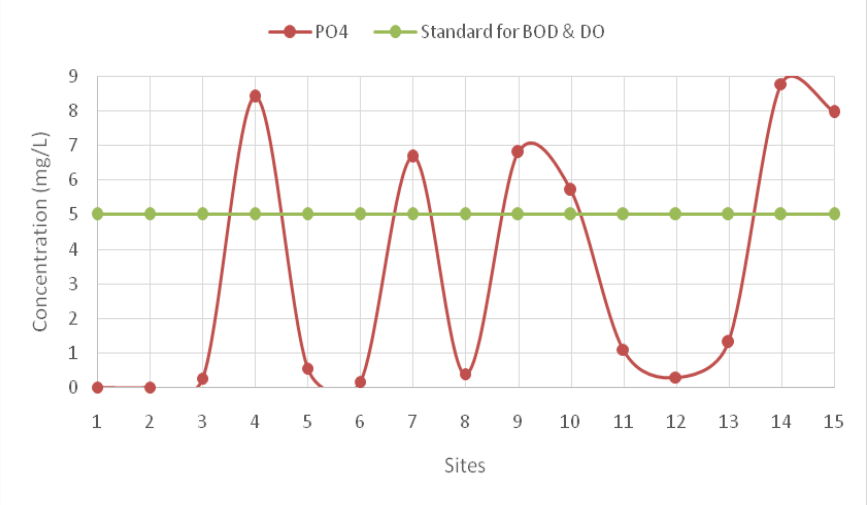

Fig. 6. Variation in PO_4 in all sites along the river during study period.

The concentration of nitrate is shown in Fig. 7. According to the National Regulatory Standards (PRPWP, 2012), the concentrations of nitrate at sites 4, 14 and 15 were exceeding the limit (5 mg/L). The concentrations of nitrate at sites 4, 14 and 15 were (6, 6.3 and 6.6) mg/L, respectively. Mixing of sewage water with river's water may deteriorate the quality of the river's water. The industrial wastewater resulting from the chemical industry, mining, manufacturing, and agriculture, discharged into rivers leads to water pollution such as, acids, alkalies, dyes, hydrocarbons, toxic salts, fats and bacteria[9] .

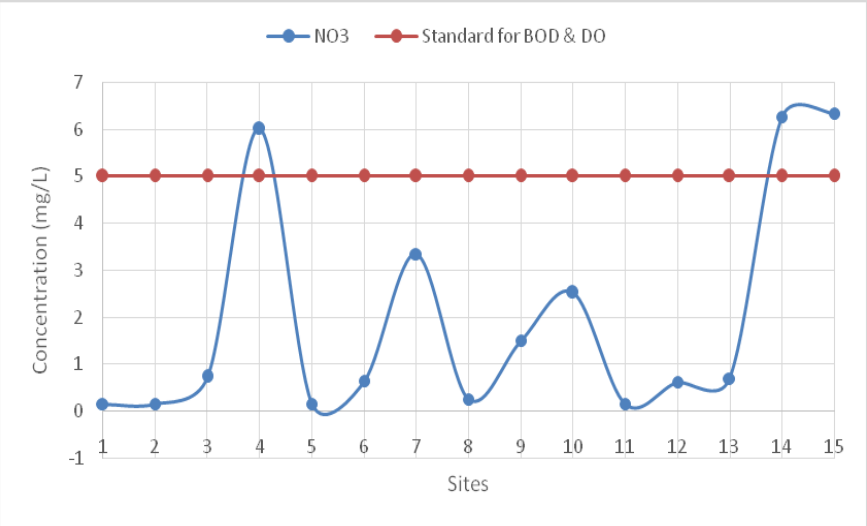

Fig. 7. Variation in parameter nitrate in all sites along the river during study period.

Conclusions and Recommendations

After a discussion and analysis of the results that have been obtained through existing sites on the banks of the River of Diwaniyah, the following are concluded :

1. The need for construction of wastewater treatment plants connecting the residential area to prevent the discharge to the water streams.
2. Monitoring of the physico-chemical and bacteriological quality of the water river is important to prevent the expected deterioration that may happen.
3. Prevent the discharge of domestic wastewater on the rain open channel.
4. Citizen awareness toward the pollution prevention of the water stream.
5. Get rid of swamps and water bodies in some residential neighborhoods, which have become gathering places for many pollutants. This water drained to the river directly without any treatment, with continuous cleaning of the river and lined to reduce pollution.
6. Prevent the abuses of alum in water treatment plants to prevent accumulation of waste materials in the environment.
7. Applying of pollution prevention techniques for the hospital located near the stream of the river.

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تقييم نوعية مياه نهر الديوانيه

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الحد من الملوثات البيئية في النهر، هي واحدة من أهم الأولويات لإنتاج مياه الشرب. في هذه الدراسة، تم اختيار النهر المعروف باسم شط الديوانية لإثبات الآثار البيئية المحتملة للملوثات المختلفة في منطقة الدراسه (شمال مدينة الديوانية، على مسافة 15 كم). هناك 15 موقعا تم اختيارها للفترة من مارس 2014 حتى نهاية شهر أكتوبر 2014. شملت هذه الدراسة قياسات كل من pH، TDS، EC،DO، BOD، NO3، و.PO4

أظهرت النتائج أن درجة حرارة المياه في جميع المواقع تراوحت بين حين (31.2- 28.98) درجه سليليزيه ، وكانت قيم pH بين (8.06-7.50). بالإضافة إلى ذلك ، قيم EC تراوحت بين (990-1195) µ/cm ، قيم TDS بين (890-1323) ملغم لكل لتر، قيم DO بين(6.30 – 8.01) ملغم لكل لتر. سجلت الدراسة نسبة عالية من الحاجة للأكسجين حيوي وراء الشروط المسموح بها في معظم المواقع التي شملتها الدراسة. لاحظ العناصر الغذائية أيضا التي تراوح في نطاق ضيق وتركيز واضح خصوصا نترات. تراوح تركيز النترات بين (0.15-6.34) ملغم لكل لتر.تركيز الفوسفات الفعال هو أعلى من الحدود المسموح بها. وأظهرت النتائج أن وجود المطاط ومصنع الغزل والنسيج فضلا عن وجود مستشفى الحمى والكلى يمكن أن تتدهور نوعية مياه النهر في حالة رمي المخلفات بدون معالجه متكاملة، أيضا انتهاكات شبكات الامطار من قبل المواطنين الذين يعيشون على جانبي النهر يسبب ذلك التدهور.بالاضافة الى كفاءة ونوعية محطات المعالجة التي ترمي المياة الخارجه في النهر.