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Investigation of the Drinking Water Quality in Some Water Pumping Stations at the Euphrates River (Shatt Al-Mudaina), in Al-Mudaina city, Basrah, Iraq

Amaal S. Al-Sharaa, Khaled K. Al-Khafaji
Dep. of Marine Biology, Marine Science Center, Basra University, Basra, Iraq
Corresponding author email: khaledalkhafaji70@gmail.com
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Abstract This study aimed at using of physical, chemical and bacteriological parameters in evaluating the quality of water drinking by choosing four sampling stations: (St.1- Inlet of Abu-Shawi water pumping station, St.2- outlet of Abu-Shawi water pumping station, St.3-Inlet of Al-Abaraa water pumping station and St.4- outlet of Al-Abaraa water pumping station) in the Euphrates River (Shatt Al-Mudaina) in Al-Mudaina city. Samples collected monthly for each station from January to June 2017. The measured parameters were ranged each for (water temperature 11.1-30.2, pH 7.0-.81, TDS 942.4-2155.7mg/l, total hardness 597.5-1052.3(mg CaCO3/l). Other chemical parameters like chloride ranged from 45.4-185.4 mg/l and dissolved oxygen (DO) ranged between (4.9-11.6) ppm.The results of bacterial tests shows that a total coliform bacteria which is Low fecal contamination levels in the outlet of both drinking water pumping stations, in contrast fecal contamination levels are high in water samples at the inlet of both drinking water pumping stations.
Keywords Drinking Water, Bacterial contamination, Euphrates River

1 Introduction

Drinking water in Iraq comes from rivers, lakes, wells and springs. These sources are exposed to a variety of pollutants caused by the diffusion from nonpoint and point sources which are difficult to control, monitor, and evaluate, such as sewage, agricultural and industrial wastes (Ahuja, 2003).

The Euphrates is the longest and one of the most historically important rivers of Iraq. Euphrates flows through Syria and Iraq to join the Tigris in the Shatt al-Arab, which empties into the Arabian Gulf. It is a vital resource to communities, agriculture and industry in Turkey, Syria and Iraq (Shamout and Lahn, 2015).

Rivers not only supply drinking water for human consumption but also receive wastewaters discharged from all human activities (Abo-Nasrya, 2009). Water has uncountable benefits, but on the other hand is more environmental components susceptible to contaminants because of its characteristics that make it to be more environmental components received for the pollutants in the environment and then get the pollution, which is defined as a disturbance in natural balance for environment which leads to affect the lives of organisms (Abo-Nasrya, 2009).

The internal water in Iraq covers about (24000) km² which consist more than (5%) of Iraq area including, marshes, lakes, Tigris, Euphrates, their tributaries and branches (Jerry and Webb, 2004).

The aim of this study is to assess the present status of water quality in at the main Pumping of water stations (St.1-Inlet of Abu-Shawi water pumping station, St.2- outlet of Abu-Shawi water pumping station St.3-Inlet of Al-Abaraa water pumping station, St.4- outlet of Al-Abaraa water pumping station in Al-Mudaina city) for three uses; domestic, recreation, and aquatic life support. The quality of water used for different purposes has an important effect on living being's health. Water of poor quality can be the reason behind the spread of disease and the growth of undesirable aquatic life.

2 Materials and Methods

2.1 Water sampling

Monthly water samples were collected from selected four sampling stations: (St.1- Inlet of Al-Abu-Shawi water pumping station, St.2- outlet of Al-Abu-Shawi water pumping station 3-Inlet of Al-Abaraa water pumping station, St.4- outlet of Al-Abaraa water pumping station) in the Euphrates River (Shatt Al-Mudaina) in Al-Mudaina city, from January to June 2017, (Figure 1). 3 replicates of water samples, One of each 3 replicates from each station assigned for bacterial analysis, the other two replicates assigned for chemical tests water samples for bacterial analysis were collected in previously sterile screw cup glass container size 500ml and kept in an ice box until reaching the laboratory.

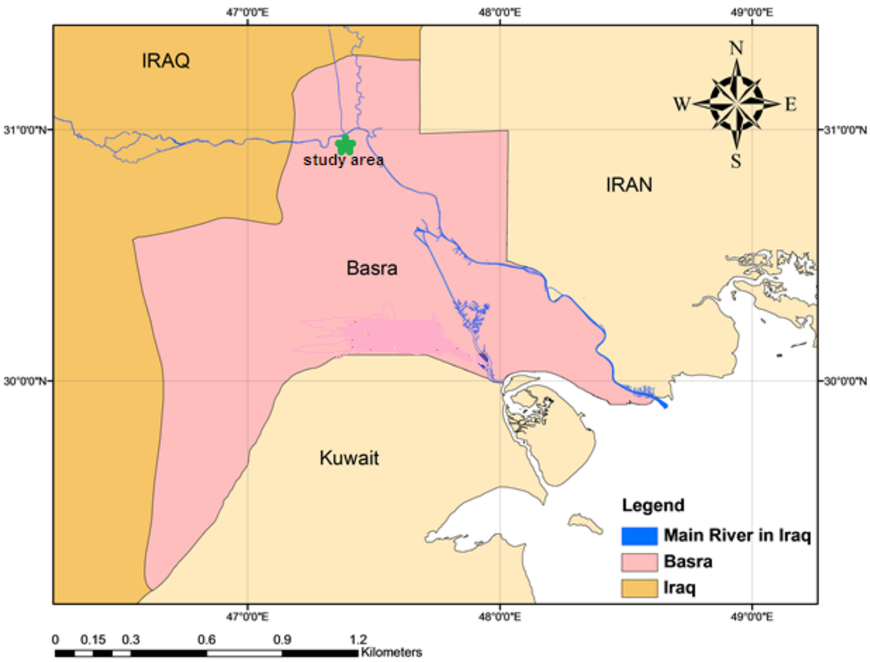

Figure 1 Study area for collected water drinking samples

2.2 Measures of physicochemical parameters

pH measured by pocket pH meter GLP pH / ORP meter WTW 720. Turbidity by turbidity meter Jenwaw Company and total dissolved solids (TDS) measured by Millipore filter paper according to Hp Technical Assistance (1999). Chloride and Total hardness (TH) measured according to standard methods (APHA, 2005).

2.3 Measure of fecal coliforms

Bacteriological examination had been done directly after collection water samples in sterilized glass bottles. fecal coliform has been detected according to APHA et al., (2005).

The results were expressed in terms of colony forming units per 100 ml of sample (cfu/100ml).

Due to the presence of high numbers of fecal colonies, tested samples have been diluted and then the numbers of colonies were calculated to get the final results.

Statistical tests for results have been done like analysis of variance (ANOVA), Duncan test, LSD and correlation coefficient.

3 Results and Discussion

3.1 Physicochemical parameters

The physico-chemical parameters of the stations were given in table (1). The highest water temperature values were observed during June (30.2^{0}C) in St.1 and the lowest values were observed during January (11.1^{0}C) in St.3. The results were showed significant difference ($p<0.05$) between months. The present study was showed obvious change in water temperature during the seasons, while the highest values of temperature were recorded during summer and the lowest were recorded during winter. These results have been agreed with what was reported by (Khudhair, 2015; Alkanany et al., 2017; Ewaid and Abed, 2017).

The highest pH values were recorded during March (8.1) in St.3 and the lowest values were recorded during august (7.0) in St.2. The results were showed significant deference ($p<0.05$) between months. The pH was showed slightly alkaline trend. Generally, pH of water would have been influenced by geological of catchments area and buffering capacity of water (Shyamala et al., 2008). This is agree with that reported by (Atiaa, 2015; Al-Abadi, 2014).

The dissolved oxygen (DO) values were ranged the between lowest values in June (5.5 mg/L) in St.2 and the highest values in February (11.6 mg/L) in St.3. The results show significant difference ($p<0.05$) between months. The results which were obtained from this study were showed an elevated DO during winter and a decrease during summer, according to the USDA (1992), the level of oxygen depletion depended primarily on the amount of added waste, the size, velocity and turbulence of the stream, the initial DO level in the water and in the stream, and the temperature of the water.

The TDS level within stations water fluctuated from 612.5 mg/l to 974.0 mg/l with an annual mean of 686 mg/l during the study, and there were no differences across the stations but there were between the different seasons. Water containing more than 1000 mg/L of TDS is not palatable as drinking water. (USGS, 2015).

The results were revealed significant difference ($p<0.05$) in values of total dissolved solid (TDS) between months and the stations were ranged from the highest value during January in St. 2 to the lowest value during April in St.1.

Total hardness (TH) was founded to be at the range between the lowest values during January 382.1mg/l in St.2 and the highest during March 495.4 mg/l in St.3. The results show significant deference ($p<0.05$) between months.

Total hardness values were below 500 mg/l, the permissible levels of the WHO for drinking water at all the stations and during all study months.

Chloride values were unstable through the study period. In winter season recorded lowest value (45.8mg/l) in February at stations 1, while the highest value (185.4mg/l) recorded in June at station 4. All readings for chloride were within the acceptable range as recommended by the WHO in 2011. In spite of the variation in the readings were significant at $p<0.05$ between stations as well as between months of study. As shown in Table 1 chloride readings tend to be high in months of summer season for S.3 and S.4 may be the treatment plant increased chloride addition to drinking water as precaution especially in summer season to destroy all pathogens (World Health Organization, 2011).

Table 1 Physico-chemical parameters of water in study sites from January to June 2017 in Euphrates River (Range, Mean ± SD)

Parameters	Sites			
	St. 1	St. 2	St. 3	St. 4
Water Temperatures ^{0}C	10.2-32.9	9.8-31.4	11.1-30.6	10.5-29.4
	21.4±6.6	20.6±6.1	20.9±6.3	19.4±5.7
pH	7.2-7.7	7.5- 7.9	7.0-7.6	7.4-8.2
	7.5±0.72	7.7±0.63	7.4±0.35	7.9±0.75
Dissolved Oxygen (mg/l)	5.6-10.3	7.1-11.6	5.5-9.5	6.6-9.7
	7.6±2.2	9.5±2.5	7.5±1.7	7.9±1.9
Total Dissolved solid (mg/l)	612.4-837.5	674.2-974.0	642.4-945.5	623.8-805.6
	1635.3±35.2	824.1±42.5	793.4±37.3	714.7±31.7
Total hardness (mg CaCO3/l)	434.2-488.7	412.5--495.4	382.1-432.6	436.5-494.2
	461.3±46.3	453.7±40.4	407.3±34.2	465.5±42.4
Chloride (mg/l)	45.8-96.9	56.5-179.7	51.0-118.4	648.8-185.4
	70.5±10.3	115.4±18.2	85.0±12.	116.6-19.7

3.2 Bacterial parameter

Bacterial tests result of six months showed that all the collected samples stations were contaminated with fecal coliforms (Figure 2; Figure 3), These results in this study agree with results by (Al-Abadi, 2014; Alkanany et al., 2017). In the current study, the effect of high temperatures, especially in the hot months of the year such as June to reduce bacterial pollution in these months, unlike cold months such as January and February.

Low fecal contamination levels in the outlet of both drinking water pumping stations in this study were back for used harmful chloride in these stations, in contrast fecal contamination levels are high in water samples at the inlet of both drinking water pumping stations.

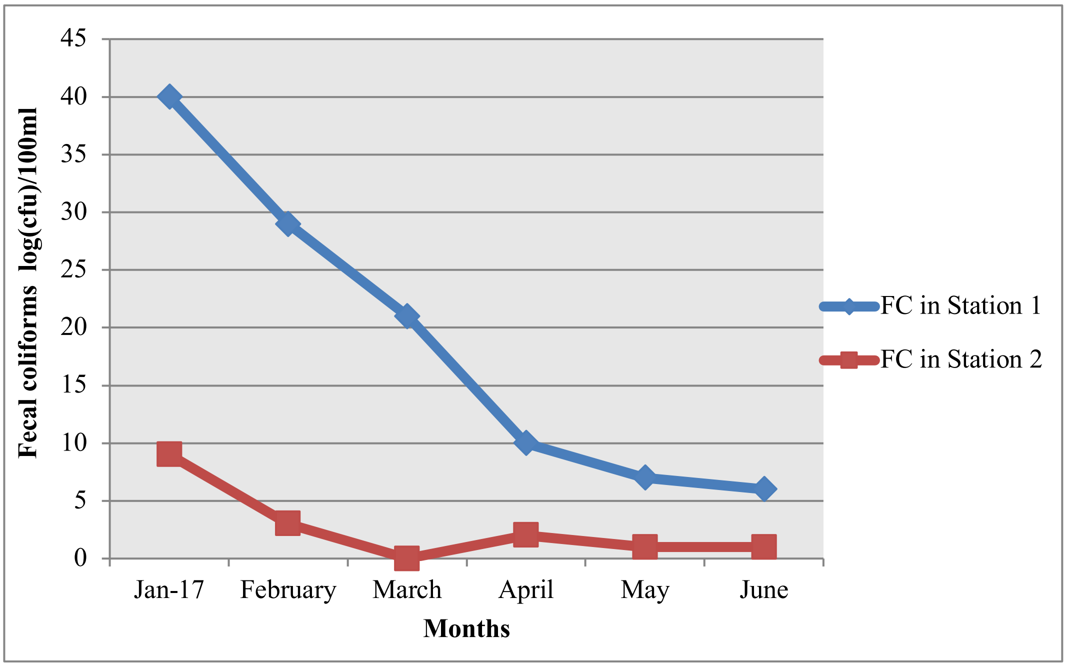

Figure 2 Fecal coliforms parameter in sampling stations-1, 2

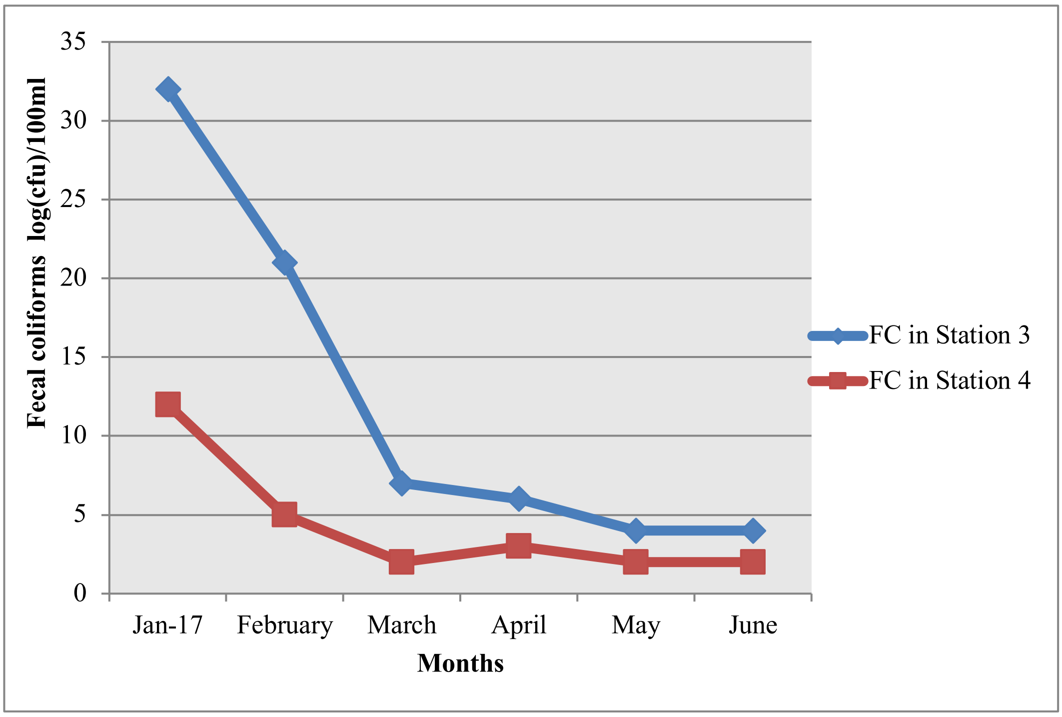

Figure 3 Fecal coliforms parameter in sampling stations-3, 4

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