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THE MICROBIAL CONTAMINATION AND WATER QUALITY OF LESSER-ZAB RIVER IN KIRKUK PROVINCE

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ABSTRACT

The current study was aimed to estimate microbial contamination and water quality in the Lesser-Zab River sediments in Kirkuk city, Iraq. 1l of water samples was collected, per month starting from October 2019 until the March 2020, from three studied stations. The current study included the measurement of total aerobic bacteria and Total coli form Bacteria with several physical and chemical characteristics of water. The findings of the studied stations demonstrated that total aerobic bacteria (1.3-7.5*10^3), Total coli form Bacteria (0.3-10.^{3}*103), Biochemical Oxygen Demand between (1.9-21.7 mg/l), nitrates (2.4-90.2 mg/l), ammonium (0.19–5.7 mg/l), phosphate ranged between (0.18–1.8 mg/l) and Organic Pollution Index (0.18–1.8 mg/l). It is concluded Lesser-Zab River is classified as organic contaminated.

KEY WORDS : Microbial contamination, Biological oxygen demand, Water Quality, Lesser-Zab River.

INTRODUCTION

The association between drinking water and disease was not determined until 1854 (Snow, 1855). Infections of waterborne are widespread, 2.5 billion people have no obtain to improved sanitation and more than 1.5 million children die every year resulting from diarrheal diseases (Wida'a, 2018). In recent times, investigators and environmentalists have become concerned about surface waters contamination. The World Health Organization (WHO) determined approximately 80% of ill-health especially in developing countries are water associated (Cheesbrough, 2000; Obasohan *et al.,* 2010). Digestive tract infections caused by different types of microbes and microorganisms that causes signs and symptoms like diarrhea, vomiting for patient, nausea and acute fever with bowel pain, was responsible for approximately 29.53% cases. About 27% of the cases were caused by type called *Shigella spp*. The other cases were caused by *Cryptosporidium parvum*, *Naegleriafowleri*, Adenovirus 3, *Schistosoma* spp. and *Leptospira*. In addition to acute digestive tract infections, most etiological agents like *Giarida* parasite, *Escherichia coli* and *Salmonella* were the agents responsible for different outbreaks (Craun *et al.,* 2006; Pandey *et al.,* 2014). Otherwise, the index of water quality is one of the most successful tools to transport information on water quality to the concerned citizens. It, thus, becomes a main parameter to estimate and administration of surface water, and is utilized in multiple scientific publications associated to the sustainable administration (Parparov *et al.,* 2006). Water quality in an aquatic ecosystem is estimated by different physical factors, chemical factors and biological factors (Sargaonkar and Deshpande, 2002; Sammen, 2013).

MATERIALS AND METHOD

Study area

Lesser-Zab river is originates in Iran and communicate the Tigris river just south of Al Zab in Erbil and Duhokprovinces of Iraq. Its length is about 400 kilometers and drains a region of approximately 22,000 square kilometers (Saeedrashed and Guven, 2013; Aziz *et al.,* 20177).

Sample collection

1 l of water samples was collected, per month starting from October 2019 until the February 2020, from three studied stations by using special containers that are used by health authorities as shown in Figure 1.

Fig. 1. All stations that used in present study at Lesser-Zab River

Microbial diagnosis

Total aerobic bacteria water samples were diagnosed by the method of casting the dishes by making a series of decimal decomposition. The colon bacteria total number was calculated by using Tube Multiple Method and by another way called the most probable number (MPN).

Water Samples Analysis

Biochemical oxygen demand (BOD5)

BOD5 value of water sample that was collected from Lesser-Zab was calculated as following:
BOD5 (mg/l) = dissolved oxygen quantity before incubation – dissolved oxygen quantity after incubation

Nitrate (NO_3)

Measured the levels of Nitrates were performed by using UV spectrophotometer device.

Phosphate (PO_4)

Measured the levels of Phosphate were performed by using UV spectrophotometer device.

Ammonium Ion (NH_3)

Measured the levels of the ammonium ion according to method that described by Lee (2002).

Organic Pollution Index (OPI)

The index of organic pollution was calculated according to the following equation:

$$OPI = \left[\frac{\sum Ci/Cmi}{n}\right] * 10$$

Ci : concentrations of pollution; Cmi: maximal content of permitted pollution amount; N: Variables number.

RESULTS

Total aerobic bacteria

The total number of aerobic bacteriain all stations at period of study was show in Fig. 2. The highest total number ($7.5*10^3$) was reported at station 2 in March, whereas the lowest total number was ($1.3*10^3$) was reported at station 3 in October.

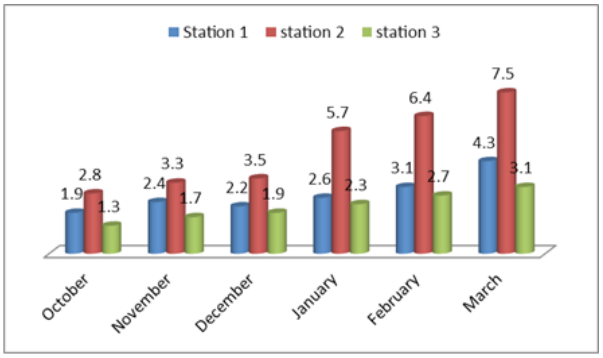

Fig. 2. Total number of aerobic bacteria in all station.

Total coliform Bacteria

The total number of coli form Bacteria in all stations at period of study was show in Fig. 2. The highest total number ($10.3*10^3$) was reported at station 2 in January, whereas the lowest total number was ($0.3*10^3$) was reported at station 3 in October.

Physical and chemical properties

Biochemical Oxygen Demand

The BOD value in all stations at period of study was

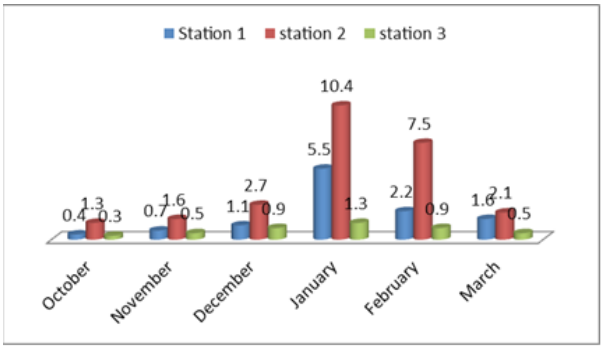

Fig. 3. Total number of aerobic bacteriain all station.

show in Figure 4. The highest BOD value was (21.7) mg/l was reported at station 2 in February, whereas the lowest BOD value was (1.9) mg/l was reported at station 1 in October.

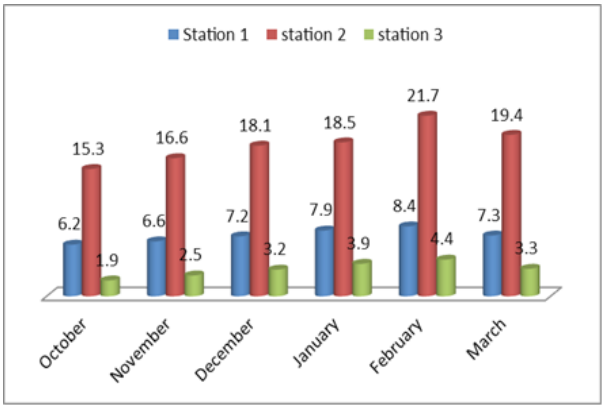

Fig. 4. The BOD value in all station at period of study.

Nitrate

NO_3 value in all station at period of study was shown in Figure 5. The highest NO_3 value was (90.2) mg/l was reported at station 2 in November, whereas the lowest NO_3 value was (2.4) mg/l was reported at station 3 in March.

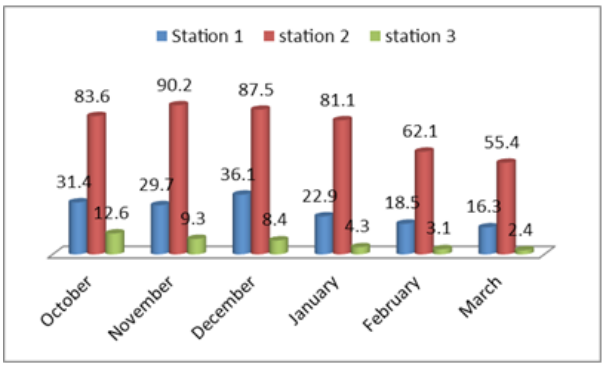

Fig. 5. The NO_3 value in all station at period of study.

Ammonium

Ammonium values in all station at period of study was shown in Fig. 6. The highest Ammonium value was (5.7) mg/l was reported at station 2 in March, whereas the lowest Ammonium value was (0.19) mg/l was reported at station 3 in October.

Phosphate

PO4 value in all station at period of study was shown in Fig. 7. The highest PO_4 value was (1.8) mg/l reported at station 2 in December, whereas the lowest PO4 value was (0.12) mg/l reported at station 3 in March.

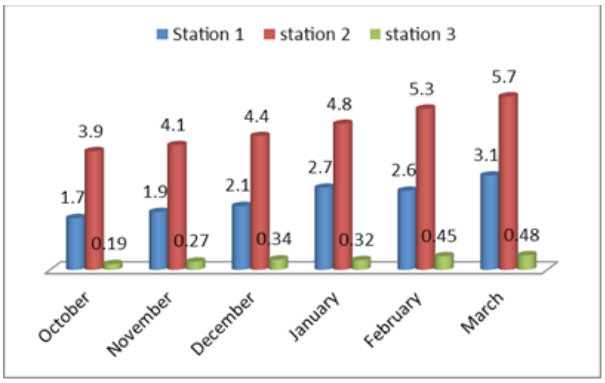

Fig. 6. Ammonium value in all station at period of study.

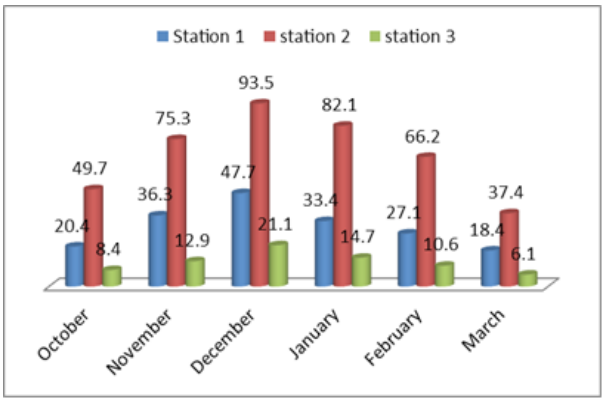

Fig. 7. The PO_4 value in all station at period of study.

Organic Pollution Index

OPI value in all station at period of study was show in Fig. 6. The highest OPI value was (1.8) mg/l reported at station 2 in December, whereas the lowest OPI value was (0.12) mg/l reported at station 3 in March.

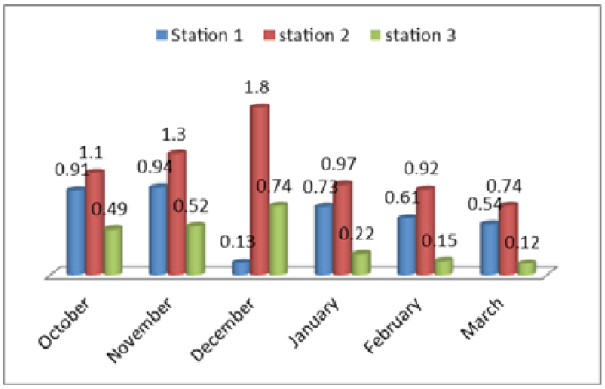

Fig. 8. The OPI value in all station at period of study.

DISCUSSION

The contamination of water by bacteria is usually of

faecal nature associated to man (treatment plants of the water sewage and overflow of combined sewage), domesticated animals and life style (Marsalek and Rochfort, 2004; Selvakumar and Borst, 2006; Aude-Valérie *et al.,* 2014). In the current study, the findings show increase in the total bacteria number and colonic bacteria in Lesser-Zab river especially at station 2, the raise of total number of colonic bacteria in stations water may be back to raise in activities of people that is leading to higher water contamination. The increase or reduction in the fecal coliform bacteria incidence among plants may back to other factors, in addition to the temperature like geographical position, the sources and type of contaminations (AL-Sudanese, 1993). In the current study, the highest BOD value was reported at station 2 in February, whereas the lowest BOD value was reported at station 1 in October and this may back to adding various amounts from domestic waste, runoff of agriculture and station position from the center city. The highest NO_3 and PO_4 value was reported at station 2, whereas the lowest NO_3 and PO4 value was reported at station 3. Otherwise, the highest OPI value was reported at station 2, whereas the lowest OPI value was reported at station 3, the main cause back to sewage plants that flow waste water to the Lesser-Zab directly without any treatment that may have caused the low quality of Lesser-ZabRiver, thus Lesser-Zab River are classified as organic contaminated Lesser-Zab river (Liu *et al.,* 2010; Al-asadi and Makia, 2020).

CONCLUSION

It is concluded form the current study that the Lesser-Zab River are classified as organic contaminated Lesser-Zab river and the rate of contamination its very high.

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