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A study of some environmental factors and their effects on bacterial community in Haj ali's drainage in Babylon province - Iraq

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KEYWORDS

pH, Dissolve oxygen (DO) , Electrical conductivity (E.C), Bacterial indicator

A B S T R A C T

This study deals with the study of some physical and chemical properties and its impact on some of the bacterial community in the Haj Ali's drainage, which is one of the main important drainages in Babylon province. Two stations were selected for the study, the first station (S 1) in the village of Tuhmaziya west of Hilla city and the second station (S 2) in Abu- Garaq towards Saddat Al-Hindia. The samples were collected by three replicates of month and for the period from October 2008 to September 2009. The results showed some changes in the physical and chemical properties during study period which includes air and water temperature, pH, Electrical conductivity (E.C) and Dissolved oxygen (DO). The results of the current study showed a disparity in the total count of bacteria also diagnosed with certain species of Enterobacteria through the stations of the study, including *E. coli, Shigella, Klebsiella* and there was a disparity in their count during stations due to vulnerability to physical and chemical factors surrounding. The current study refers to presence a fecal pollution in the Haj ali's drainage and the bacterial community affected by the environmental factors which surrounding it.

Introduction

The environmental pollution is a matter of great concern worldwide, consequently contamination of food chain is getting increasingly important in view of its role in human health (Khan *et al.*, 1996) .The quality of water may be described according to their physiochemical and biological characteristics (Agarwal and Rajwar, 2010). One of the most important needs of society is clean and secure water supply (Harwood *et al.*,2002). The provision of good quality water is often regarded as an important means of improving health (Moyo *et al.*, 2004). Many developing regions suffer from either chronic shortages of freshwater or the pollution of readily accessible water resources (Lehloesa and Muyrima, 2000). According to World Health Organization (WHO, 2003), there were estimated 4 billion cases of diarrhea and 2.2 million deaths annually. The consumption of unsafe water has been implicated as one of the major causes of this disease. Fecal pollution of water causes water-borne diseases which wiped out entire population of cities (Farah *et al.*, 2002).

The transmission of waterborne diseases is still a matter of major concern, despite worldwide efforts and modern technology being utilized for the production of safe drinking water (Venter, 2000). Various physico-chemical parameters like pH, temperature, turbidity, residual chlorine, electrical conductivity, dissolved oxygen and biological oxygen demand (BOD5) have a significant role in determining the quality of water (Shaikh *et al*.,2009).

Materials and Methods

Physiochemical parameter was measured which includes Temperature by Thermometer, Electrical conductivity by E.C meter (HANNA) in µs/cm, PH by PH meter (HANNA), DO were measured by using Azide Modification test of Winkler method according to (APHA, 2003).

While bacteriological parameters includes the total count of aerobic bacteria were measured by using standard plates count method (SPC) according (APHA, 2003) while the total Coliform bacteria were measured by using most probable (MPN) according to (WHO, 2003). Detection of bacteria in the water samples have been study according (Macfaddin, 2000).

Statistical analysis

All data were expressed as means ±SD. least significant difference (LSD) was used for mean separation. The significant level was set at the probability level of ($P<0.05$)

Result and Discussion

The monthly variation of Physicochemical parameter and microbiological analysis of water samples presented in Table 1 and 2. The air temperature values ranged between 18–43°C in S1 and 19–45°C in S2 and the water temperature was ranged between 16–36°C in S1 and 17–37°C in S2. Temperature showed significant positive correlation ($p > 0.05$) with (pH) and significant negative correlation ($p > 0.05$) with (E.C, total viable count, *Coliform*, *E. coli*, *Klebsiella spp*, *Shigella spp*). In current study E.C found in the range of (2300 – 3212 µs/cm) in (S1) and (2311–3682 µs/cm) in (S2). E.C showed significant positive correlation ($p > 0.05$) with (temperature, DO and all bacteriological indicators). The pH found in studied samples in a range of 6.4–7.6 in S1 and 6.7–7.6 in S2. The pH showed significant positive correlation ($p > 0.05$) with (temperature, DO, all bacteriological indicators). Dissolved oxygen found in studied water samples in range of 2.9–4.6 mg/l in S1 and 2.8–4.2 mg/l in S2 and showed significant positive correlation ($p > 0.05$) with E.C, pH and all bacteriological indicators. The high total viable counts in some site in current study presents in the range of 2.4×10^4/cfu in S1 and 2.2×10^4/cfu in S2 while the high count of *Coliforms*, *E. coli*, *Klebsiella* and *Shigella* were 3.6×10^2/ cfu, 2.2×10^2/ cfu, 2.5×10^2/ cfu and 1.6×10^2/ cfu in S2, respectively.

The temperature plays an important role in the chemical reactions and affects on the gases solubility such as O_2 and CO_2 (Weiner, 2000). The fluctuation in air and water temperature usually depends on season, geographic location, sampling time and temperature of effluents entering the stream (Ahipathy, 2006). Summer maxima and winter minima were observed at all the sites. Electrical conductivity is an indicator to dissolve solids in the water (Wetzel, 2001), also it is a measure of water ability to transmit electrical current and also it is a tool to assess the purity of water. This ability depends on presences of ions; their total concentration, mobility and valence and temperature of measurement (venkatesharaju *et al*., 2010). Increasing levels of conductivity and cation, are the products of decomposition and mineralization of organic material (Abida, 2008). Winter maxima owed to the washing of soil by means of rain water (WHO, 2003). The pH is an important factor that determines the suitability of water for various purposes (Venkatesharaju *et al*., 2010). Generally low pH values obtained in the water might be due to the high levels of free CO2 which may consequently affect the bacterial counts (Edema *et al*., 2001). The dissolved oxygen content is one of most important factor for existence of an aquatic organism and their metabolism activities in water body (Shaikh *et al*., 2009; Wetzel, 2001). The values of dissolved oxygen were decreased in most study's month in the stations may be due to the increase of salinity in drainage water which caused the increased of oxygen solubility (APHA, 2003) and may be due to increase of organic compounds which result in increase of oxygen consuming by aerobic bacteria to used it in degradation of organic compounds (Wurts and Masser, 2004). The high total viable counts in some site in current study which may be due to favorable temperature, increase the organic matter and increase the turbidity of water which provide shielding for bacteria (Asano, 2007) while the presence of other enteric bacteria such as E coli and other Coliform in water is nearly always associated with recant fecal pollution and it is the preferred indicator organisms for this purpose (APHA, 2003).

Conclusion

I concluded through this study, the presence of fecal pollution in drainage water as a result of the presence some types of Enterobacteria with high numbers and there is a shortage in the amount of dissolved oxygen, this in turn has affected the quality of water.

Table.1 The physicochemical and bacteriological properties to the first station (S 1) from October 2008 to September 2009

Month / Factors	**2008**			**2009**								
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	jul	Aug	Sep
Air temperature (C)	20	18	18	20	24	27	34	37	35	40	43	39
Water temperature (C)	18	17	16	19	21	25	29	31	31	34	36	34
E.C (µ.S/cm)	2400	2906	2700	2877	2300	2576	3212	3050	2900	2840	3200	2919
pH	7.2	6.9	7.6	6.4	6.8	7.1	7.3	6.6	6.8	7.2	6.9	7.1
D.O (mg/L)	4.4	3.8	2.9	3.2	3.5	3.3	3.9	4.6	4.1	4.5	4.6	4.2
Total viable count $\times 10^4$ Cfu/ml	2.1	2.2	2.4	1.8	1.5	2.1	1.9	2.3	2.2	1.7	1.9	1.6
Coliforms$\times 10^2$ Cfu/ml	1.8	2.5	2.5	2.2	1.9	2.1	1.8	2.6	3.3	2.7	1.9	2.3
Klebsiella spp$\times 10^2$ Cfu/ml	1.7	1.3	1.8	1.5	1.5	1.2	1.9	1.3	2.1	1.4	1.6	1.6
E. coli $\times 10^2$ Cfu/ml	1.4	1.7	1.6	1.2	0.8	1.1	0.7	1.4	1.2	0.9	1.3	0.8
Shigella spp$\times 10^2$ Cfu/ml	0.9	1.1	0.8	0.6	1.3	0.7	1.1	1.4	1.2	1.1	0.9	1.2

Table.2 The physicochemical and bacteriological properties to the second station (S 2) from October 2008 to September 2009

Month / Factors	2008			2009								
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	jul	Aug	Sep
Air temperature (C)	21	20	19	20	24	29	36	38	37	42	44	40
Water temperature (C)	18	17	17	20	20	25	29	32	31	35	37	34
E.C (µ.S/cm)	3300	3175	3682	3287	2900	2883	3012	2766	2485	2311	2800	2651
pH	7.5	7.2	7.5	6.7	7.1	6.9	7.5	6.8	7.1	7.4	7.3	7.6
D.O (mg/L)	3.8	4	2.9	3.5	3.3	2.8	3.6	3.9	4	4.2	4.2	3.8
Total viable count $\times 10^4$ Cfu/ml	1.5	1.8	1.6	1.4	1.2	1.8	2.2	2.1	1.7	1.3	2.1	1.8
Coliforms $\times 10^2$ Cfu/ml	2.1	2.7	2.1	2.5	1.6	1.9	2.2	2.4	3.6	3.1	2.4	2.1
Klebsiella spp $\times 10^2$ Cfu/ml	1.9	1.7	1.8	1.7	1.3	1.4	2.2	1.8	2.5	1.6	1.3	1.7
E. coli $\times 10^2$ Cfu/ml	1.6	1.6	1.7	1.4	1.8	0.7	1.1	1.9	2.2	1.3	1.8	1.2
Shigella spp $\times 10^2$ Cfu/ml	1.3	0.9	0.6	1.2	0.8	1.1	1.4	1.5	1.6	1.4	1.1	0.9

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