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Physico-chemical and Bacteriological Studies of Daphrin Hostipal Discharge at Sagar, Madhaya Pradesh

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Abstract : Present investigations were carried out from Daphrin hospital discharge. Temperature is one of the most important ecological factor which play significant role on the earth. Present paper reports a study on water quality. In the physico-chemical parameters such as pH ranged from 7.0 to 9.0, temperature (°C) ranged from 18.0 to 27.1, alkalinity (mgL^{-1}) varied from 65 to 151.7; free carbon dioxide (mgL^{-1}) ranged from 5.6 to 52.4; BOD (mgL^{-1}) from 13.8 to 22.1; chloride value (mgL^{-1}) ranged from 28.0 to 191.7; dissolved oxygen (mgL^{-1}) varied form 1.3 to 6.5; nitrate (mgL^{-1}) varied from 0.1 to 12.1 and phosphate (mgL^{-1}) values varied from 0.1 to 0.4. Most of the physico-chemical variables showed monthly variation. High values of total alkalinity, chloride, biochemical oxygen demand and chemical oxygen demand of effluents of Daphrin hospital discharge mixing in the lake water indicates the high pollution status of the lake. High degree of pollution can be correlated with the presence of high heterotrophic bacterial density, thus indicating the tropic status and organic strength of the water body.

Key words : Sagar lake, Daphrin hospital, Physico-chemical parameters, Bacteriological studies.

Introduction

A lake is a large body of water surrounded by land and inhabited by various aquatic life forms. Lakes are subjected to various natural processes taking place in the environment , such as the hydrological cycle. As a consequence of unprecedented development, human beings are responsible for choking several lakes to death. Storm water run off and discharge of sewage into the lakes are two common ways that various nutrients enter the aquatic ecosystems resulting in the death of those systems (Sudhira and Kumar, 2000).

Physicochemical and biological characteristics characterize any water body. The physical and chemical properties of fresh water body are characterized by the climatic, geochemical, geomorphological and pollution conditions. The biota in the surface water is governed entirety by various environmental conditions. The primary production of organic matter is in the form of phytoplankton and macrophytes, which are more intense in lakes and reservoirs than in rivers. Generally, the functions directly related to their physical, chemical and biological integrity. Water quality evaluation for wetlands leads to information about their misuse by indicating the pollution status. The quality of aquatic life depends on the water quality and a thorough assessment of the water quality is an integral part of wetland evaluation.

Present investigation was carried out to study some physico-chemical parameters of

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Daphrin hospital discharge. It is situated in the southern side of Sagar Lake. It is a government ladies hospital.

Material and Methods

Collection of Samples

Water samples were collected for over a period of six months from Jan 2004 to June 2004 from three sites *i.e.* sewage discharge point (Site A) , Sewage and lake water mixing point (Site B) and lake water (Site C). The water samples were collected in glass - stopper sterile bottles for physico-chemical studies and 100 mL stopper bottle for bacteriological studies. These samples were transported to the laboratory in an ice box to avoid unpredictable changes in physico-chemical characteristics and bacteriological test (Adoni, 1985; NEERI, 1988; American Public Health Association,1985). Water temperature measured in the field using mercury glass thermometer, pH was measured by Systronics Digital pH meter.

Chemical Analysis

Samples were collected for the laboratory analysis of dissolved oxygen, chemical oxygen demand, biochemical oxygen demand , alkalinity, chloride and free carbon dioxide were determined titrimetrical methods (American Public Health Association,1985). Nitrate and phosphate were determined by the spectrophotometric method.

Bacteriological Studies

The heterotrophic plate count (HPC) was used for the bacteriological studies. Different dilutions were prepared from the sample. 0.5% peptone solution in distilled water was used as the dilution water. For the preparation of dilutions; the first tube contained 10 mL of the pure sample, which was considered as stock. There after consecutive 4 dilutions of 10^{-2}, 10^{-4}, 10^{-6}, and 10^{-8} were prepared (Afzal *et al.*, 2000).

Results and Discussions

The physico-chemical properties of Daphrin hospital discharge which is situated near lake of sagar, showed (Table-1) the pH values, which varied from 7.4 to 9.0 at site A(sewage discharge point), 7.0 to 9.0 at site B (sewage and lake water mixing point)and 7.1 to 9.1 units at site C (lake water). It is observed that the potability of fort lake water of Belgaum district exhibits high alkalinity with pH ranging from 8.36 (June) to 10.6 (Feb and March). Increase in environmental temperature increases water solubility of atmospheric carbon-dioxide and the rate of degradation of organic matter leading to further built up of carbon dioxide in water (Sunkad and Patil, 2004). The CO_2 level influences pH of water. The physico chemical parameters of water bodies in Jaipur found that Jalmahal lake is most polluted due to high pH (Srivastava *et al.*, 2003).

Temperature (°C) ranged from 18.0 to 27.1 at site A (sewage discharge point), 18.0 to 26.1 at site B (sewage and lake water mixing point) and 18.1 to 26.0 at site C (lake water). The temperature of the Kolar reservoir of Bhopal from 22.4 to 33°C (Kataria *et al.*, 1996). The temperature levels were similar at all the sampling sites. Dry period temperature was constantly above those of the wet period, due to lack of sunlight.

The alkalinity (mgL^{-1}) varied from 102.5 to 151.7 at site A, 99 to 104 at site B and 65 to 94.9 at site C. The correlation matrix and cluster analysis indicated that water temperature, phenolphthalein, alkalinity and

pH have greater similarity (Nagarathna and Hosmani, 2003).

Free carbon dioxide (mgL^{-1})ranged from 6.9 to 47.3 at site A, 5.6 to 52.4 at site B and 5.7 to 43.2 at site C. The variation in free CO_2 values from the month of July 2000 to January 2001, in two water bodies of Tiruvannamalai district of Tamilnadu. Maximum values (56.70 mgL^{-1} for pond I- Pallakkothukulam and 51.20 mg/L for pond II- Sonatheertham) were observed during November 2000 and minimum value 36.20 mgL^{-1} for pond I-Pallakkothukulam noticed during January 2001 whereas minimum value 32.50 mgL^{-1} for pond II observed in July 2000.

The BOD mgL^{-1} varied from 14.4 to 22.0 at site A, 13.8 to 20.1 at site B and 14.3 to 22.1 at site C. The fort lake water is inferior and not suitable for drinking purpose, where the BOD ranged from 42.6 - 60.6 mgL^{-1} (15). The BOD of Bellandur lake water of Bangalore ranged from 89-99 mg/L which may be due to absorption of pollutants by aquatic flora in lake system (Chanandrashekar *et al*., 2003).

Chloride value (mgL^{-1}) ranged from 30.7 to 180.9 at site A, 28.0 to 181.6 at site B and 33.7 to 191.7 at site C. Directly correlated chloride concentration with pollution. The chemical oxygen demand (mgL^{-1})varied from 25.4 to 47.9 at site A, 28.4 to 50.7 at site B and 18.3 to 49.7 at site C. Large variations in the levels of various measured parameters (COD, BOD, pH, total soluble substances and trace metals) were observed along the Hudiara drain in the Pakistan vicinity. These variations were due to different types of industrial effluents and small village drains (Afzal *et al*., 2000).

The dissolved oxygen (mgL^{-1}) ranged from 1.3 to 2.7 at site A, 3.5 to 5.2 at site B and 4.6 to 6.5 at site C. The Yamuna river in Delhi up stream was of better quality, whereas the Delhi down stream was polluted as indicated by very low DO (Ravindra *et al*., 2003).

The nitrate (mgL^{-1}) was found from 0.1 to 11.7 at site A, 0.1 to 11.6 at site B and 0.1 to 12.1 at site C. The nitrate content ranged from 2.02 to 15.22 ppm in Shahpura Lake, Bhopal. The high concentration of nitrates in this lake water was recorded in May 2004, while the minimum in June - July 2003 (Kataria *et al*., 1996). There is a sharp rise in nitrate content of water from 2003 to 2004 showing the increasing anthropogenic influence on the lake. The phosphate (mgL^{-1}) values varied from 0.1 to 0.3 at site A, 0.1 to 0.4 at site B and 0.1 to 0.3 from site C. The phosphate content ranged from 6.05 to 9.21 ppm of the Shahpura lake, Bhopal, where the highest value (9.2 ppm) was recorded in May 2003, and the minimum value (6.05 ppm) in May 2004 (Kataria *et al*., 1996). For phosphates, the U.S. Environmental Protection Agency, 1976 suggested that 0.08 ppm is the critical level for the occurrence of eutrophication in lakes and reservoirs.

A critical perusal of data obtained in the study clearly revealed that the values of most of the parameters have either exceeded or are nearing the permissive limits pointing to grossly polluted nature of the Daphrin hostipal discharge at Sagar, Madhaya Pradesh.Heterotrophic plate count ($CFUx10^{-4}$) showed maximum (310±1) and minimum (90 ± 1) number of colonies from site A and C in the month of April and May respectively. (Fig. 1) Table 1 :

Table 1 - Physico-chemical characteristic of the water samples collected from the discharge of Daphrin hospital into Sagar Lake (Jan-June 2004)

S. No	Parameters	Site	Months						CD at 0.05%
			January	February	March	April	May	June	
1	pH	A	7.5	7.4	7.6	9.0	7.4	7.7	**12.1**
		B	7.0	9.0	7.4	9.0	7.5	8.1	
		C	9.0	9.0	7.1	9.0	8.4	9.1	
2	Temperature	A	18.0	20.0	24.0	26.0	27.1	27.0	**34.7**
		B	18.0	20.1	23.3	25.0	26.1	26.0	
		C	18.1	21.0	26.0	24.1	25.1	26.0	
3	Alkalinity	A	122.3	142.8	102.5	151.7	141.7	134.0	**153.1**
		B	100.0	99.0	99.7	104.0	98.0	98.9	
		C	65.3	77.2	68.7	94.9	78.4	77.2	
4	Chloride	A	110.7	153.3	30.7	30.8	178.3	180.9	**170.4**
		B	116.7	142.0	28.0	34.8	178.3	181.6	
		C	97.7	123.3	70.7	33.7	191.7	183.6	
5	DO	A	2.7	1.7	1.7	1.3	2.4	2.5	**5.9**
		B	5.2	3.9	3.5	5.2	4.2	4.5	
		C	6.5	5.1	4.6	5.5	5.1	6.2	
6	BOD	A	18.7	22	14.4	15.8	15.1	17.5	**25.9**
		B	20.1	21.1	13.8	15.8	16.7	16.2	
		C	21.1	22.1	14.4	14.3	17.8	17.4	
7	COD	A	40.5	39.4	44.5	28.3	25.4	47.9	**56.4**
		B	41.7	39.0	50.7	28.4	29.1	49.4	
		C	39.1	32.8	49.7	18.3	29.1	41.7	
8	Nitrate	A	0.1	0.2	0.3	5.0	11.2	11.7	**7.2**
		B	0.1	0.2	0.6	5.4	11.3	11.6	
		C	0.1	0.2	0.6	6.8	10.7	12.1	
9	Phosphate	A	0.3	0.3	0.1	0.2	0.2	0.2	**0.2**
		B	0.4	0.2	0.1	0.2	0.2	0.2	
		C	0.2	0.3	0.1	0.2	0.2	0.2	
10	Free CO_2	A	6.9	47.3	24.5	18.9	11.8	12.8	**30.6**
		B	5.6	52.4	31.9	15.9	14.1	13.2	
		C	5.7	43.2	29.8	10.9	14.2	11.9	

Values are in average mean
CD (Critical Difference) at 0.05%
Site A : Sewage discharge point; DO: Dissolved Oxygen
B : Sewage mixing point; BOD: Biochemical Oxygen Demand
C : Lake water; COD: Chemical Oxygen Demand

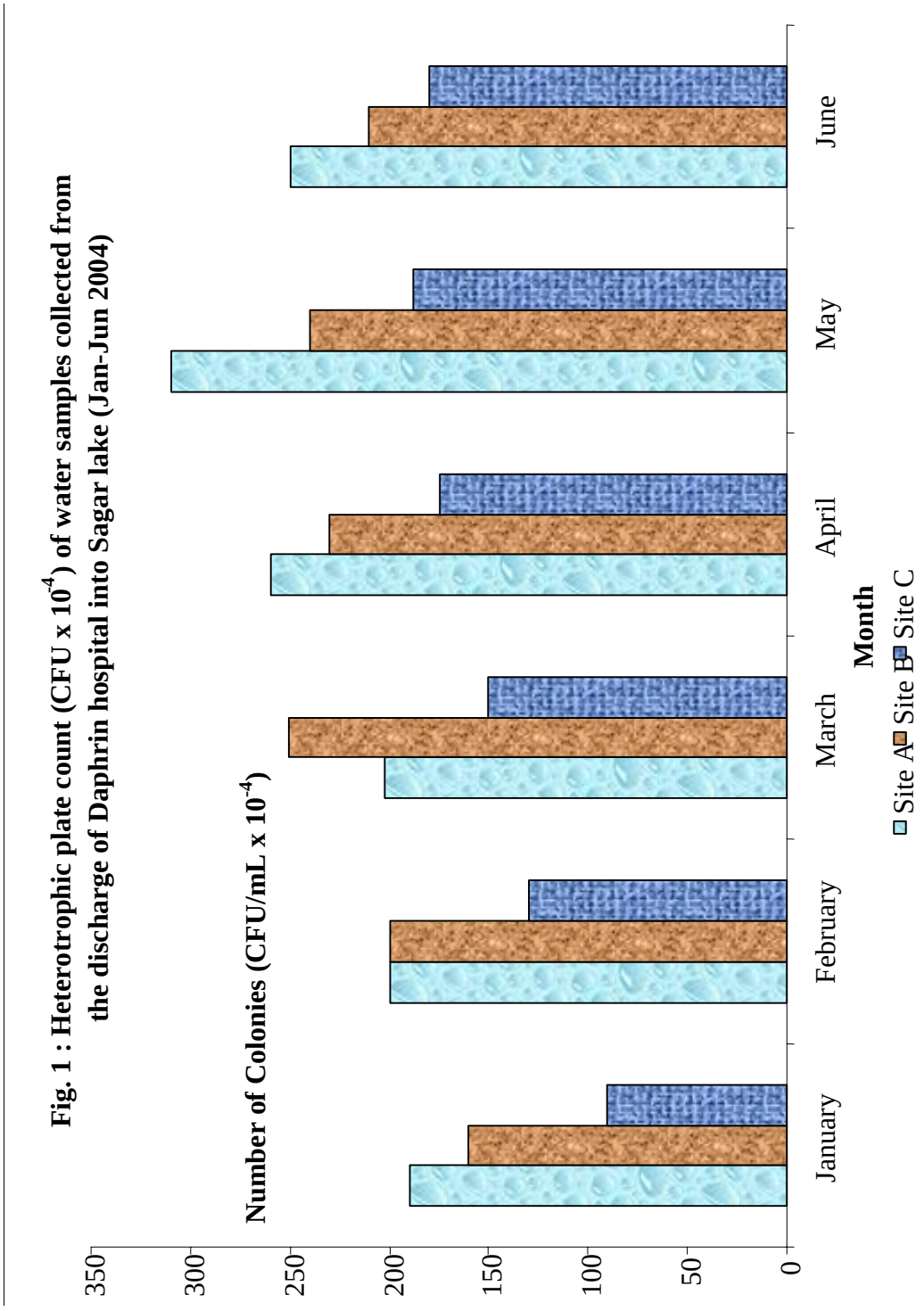

Fig. 1 : Heterotrophic plate count (CFU x 10^{-4}) of water samples collected from the discharge of Daphrin hospital into Sagar lake (Jan-Jun 2004)

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