



IMPACT OF HUMAN ACTIVITY ON WATER QUALITY OF A LENTIC WATER BODY IN ASANSOL

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ABSTRACT

Assessment of some physico-chemical and microbial parameters of a water body for its suitability of public recreation and human consumption have been carried out during the two years of investigation period from November 2000 to October 2002. This water body lies in the heart of Asansol town and continuously receiving polluted sewage from the surroundings and producing bad smells, which are largely retarding the public recreation of the town. Analysis of some physico-chemical characteristics like water temperature, transparency, total suspended solids, total dissolved solids, pH, dissolved oxygen, free CO₂, total alkalinity, hardness, BOD, COD, chloride and bacteriological parameters like total coliforms has been done during the investigation period. The results show severe deterioration of the quality of lake water.

INTRODUCTION

Asansol town in West Bengal is the 2nd most populated town where a large water body having approximately 10,000 sq. m area is situated. It is surrounded by dense residential colonies, railway hospital, nursing homes, small-scale factories, mills, and cattle sheds. Polluted water from the surroundings is continuously mixed up with the water body through a large channel from its south side. On its west side a public recreational park, called Shatabdi Sishu Uddyan established in 1989 by Eastern Railway Authority of Asansol, is situated. This water body is used for recreational purposes such as boating, swimming and other water games. Some pipelines are also used for lifting the water for domestic purposes and railway service. High quantity of domestic waste is gradually increasing the thick algal blooms, which produce bad smells. The high magnitude of physico-chemical and bacteriological parameters are largely responsible for retarding its recreational use. Once this water body played an important role for fish culture and recreation but today it signifies as deteriorated water body.

The present paper deals with the physico-chemical and biological characteristics of this water body, which indicates the level of the deterioration of its water quality for diverse uses.

MATERIALS AND METHODS

Water samples were collected monthly during morning hours (between 8 am to 10 am) covering two years from November 2000 to October 2002. Some changeable and sensitive parameters like pH, temperature, dissolved oxygen and free CO₂ were directly analysed in the field. The preserved and unpreserved samples were transported to the laboratory keeping in icebox for analysis of remaining parameters. All necessary precautions were taken during sampling and transportation.

Microbial analysis was carried out by multiple tube fermentation technique and coliform density was calculated as per MPN Table (APHA 1980).

RESULTS AND DISCUSSION

The analysed data of the water samples were classified into six seasons which are represented by winter (November and December), post winter (January and February) summer (March and April), post summer (May and June), monsoon (July and August), and post monsoon (September and October).

The average seasonal variations of the parameters are shown in the Table 1 whereas minimum, maximum, average and SD values are shown in Table 2.

It is evident that the maintenance of healthy conditions in aquatic ecosystems is dependent on the physico-chemical properties of water and biological diversity. The temperature of the water body is an important parameter influencing the water quality. It varied according to the seasonal fluctuation of atmospheric temperature with maximum during summers and minimum during winters.

Transparency of a water body is influenced by turbidity present in the water. In the present study, transparency values varied between 7.44 and 39.3 cm. The general decreasing trend observed is winter months whereas the increasing trend was observed in summer months.

Total suspended solids ranged from 27.84 to 118.84 mg/L. Water body exhibited high values of TDS which is caused by the addition of huge quantities of sewage. TDS values varied between 234.5 and 504.5 mg/L. The peak value was observed in post summer period. High solids in water cause inferior potable quality of water.

pH is one of the most important factors that serves as an index of the pollution. The water body registered an alkaline pH with the values ranging from 7.45 to 8.1. pH value of majority of lakes and reservoirs in India has been found between 6 to 9. The higher range of pH indicates higher productivity of water (Khan & Khan 1985).

Dissolved oxygen is an important parameter of the lakes and reservoirs, which is essential to the aerobic metabolism of all aquatic organisms (Wetzel 1975). The accumulation of DO in water may be due to direct diffusion from air and photosynthetic activity of autotrophs. Dissolved oxygen representing good quality of water should have 7.6 and 7.0 mg/L at 30°C and 35°C respectively. In the

Table 1: Average seasonal variation of physico-chemical and microbial properties of the lake water at Asansol.

Parameters	Winter	Post Winter	Summer	Post Summer	Monsoon	Post Monsoon
Water Temperature (°C)	13.02	8.66	21.71	34.92	32.59	27.13
Transparency (cm)	27.46	29.03	31.29	21.79	19.23	34.2
TSS (mg/L)	41.38	39.20	32.99	34.60	106.87	71.02
TDS (mg/L)	389.26	356.00	413.95	440.35	347.35	266.05
pH	7.74	7.50	7.56	7.65	7.74	7.64
DO (mg/L)	3.99	2.40	2.42	1.90	3.00	3.31
FCO ₂ (mg/L)	16.48	18.72	24.80	17.13	20.28	15.35
Total alkalinity (mg/L)	252.5	274.96	325.5	207.00	359.25	213.05
Total Hardness (mg/L)	109.65	85.5	145.7	133.00	121.00	102.50
BOD (mg/L)	32.73	27.56	28.94	32.42	31.57	31.60
COD (mg/L)	53.8	42.71	45.88	58.20	56.95	44.83
Chloride (mg/L)	73.55	74.63	81.01	79.61	60.23	70.13
Total Coliforms (MPN/100 mL)	314	385	265	1487	1753	993

Table 2: Minimum, maximum, average and SD values of physico-chemical and microbial properties of lake water at Asansol.

Parameters	Minimum	Maximum	Average	SD values
Water Temperature (°C)	8.33	36.05	23.00	9.82
Transparency (cm)	7.44	39.30	27.17	8.81
TSS (mg/L)	27.84	118.84	54.34	31.18
TDS (mg/L)	234.3	504.5	368.83	66.13
pH	7.45	8.10	7.64	0.217
DO (mg/L)	1.71	4.35	2.84	0.84
FCO ₂ (mg/L)	15.10	22.33	18.38	2.61
Total alkalinity (mg/L)	165.80	354.00	255.38	50.03
Total Hardness (mg/L)	85.5	151.0	116.26	21.74
BOD (mg/L)	25.41	37.74	30.80	7.53
COD (mg/L)	33.55	60.33	49.56	7.46
Chloride (mg/L)	59.31	86.24	72.06	7.92
Total Coliforms (MPN/100 mL)	265	1753	433	742

present study DO content of the water body represents inferior quality of water. The water is not much suitable for fish with regard to the oxygen levels. The low values of DO were observed during the whole year.

The present study revealed that the free carbon dioxide is present in the range of 15.1 to 22.33 mg/L. Higher values were observed in summer, whereas lower values in winter months. Total alkalinity fluctuated between the range of 165.8 to 354 mg/L during the investigation period.

Total hardness ranged between 85.5 and 151.0 mg/L. Hardness in water depends on the presence of principal cations of Ca⁺⁺ and Mg⁺⁺. In potable water Ca⁺⁺ and Mg⁺⁺ range between 75 and 200 mg/L and 50 and 100 mg/L respectively (ICMR 1975). Hardness has no adverse effect on health. In the present study the water can be classified as moderately hard which is below the prescribed limit of 200-600 mg/L (MWH 1976).

High level of BOD values were observed during the study period varying from 25.41 to 37.47 mg/L. As per the recommendation of ISI (IS: 2269 : 1982) BOD limits for bathing and drinking purposes are 2 mg/L and 3 mg/L respectively. The COD values fluctuated between 33.55 and 60.33 mg/L, which are likely due to the addition of sewage bringing in organic matter (Jameel 1998).

Chloride concentration varied between 59.31 and 86.24 mg/L. The limit for chloride is 250 mg/L with the upper limit of 1000 mg/L for drinking water (BIS 1993). In such condition the chloride concentration of the water body is under safe limit.

Total coliforms fluctuated between 265 and 1753 MPN/100 mL. The peak value was observed in monsoon months, which might be due to the flushing of faecal contaminated water from the surrounding drains and bank sides. The increasing level of MPN of coliforms was observed in summer, which can be attributed to higher concentration of organic matter and high temperature (Palharya et al. 1993).

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