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Archives of Applied Science Research, 2014, 6 (2):8-11
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ISSN 0975-508X
CODEN (USA) AASRC9

Assessment of water quality parameters of lower lake, Bhopal

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ABSTRACT

Some physicochemical characteristics of lower lake, Bhopal were investigated. Physical parameters such as colour, odour, temperature, electrical conductivity(EC), total suspended solid(TSS), total dissolved substance(TDS), turbidity and chemical parameters such as pH, alkalinity, hardness, chloride, sulphate, nitrate, fluoride, dissolved oxygen(DO), chemical oxygen demand(COD), biochemical oxygen demand(BOD) were examined. Results of the study indicated that lake water is highly contaminated and not suitable for drinking purpose as it receives a large amount of raw sewage from its densely populated habitation.

Key words: lake, physical, parameter, temperature, BOD, hardness

INTRODUCTION

Water is one of the most common and necessary resource on earth. Without water there would be no life on earth. Water is the source of all biological lives and their sustenance too. Water quality has become a major global concern due to increasing human developmental activities. Pollution is a serious problem as almost 75% of India's surface water resources have been contaminated by chemical and biological pollutants. Increase in human population creates extreme pressure on the provision of safe drinking water especially in developing countries [1]. In India river and lake pollution is very severe and critical problem due to huge amount of pollutants discharged by urban activities [2-4]. Thus, water pollution needs serious immediate action and continuous monitoring of pollution level in order to prevent the water because of its importance in maintaining the human health, plants and agriculture. Without fresh water sustainable development will not be possible. Study of physico-chemical parameters of river and lake water of various regions have been carried out by some workers [5-7]. The aim of this study was to evaluate the composition and quality of lower lake water of Bhopal.

Study Area

The lower lake built in 1794 is located to the east of upper lake. The lower lake has an area of 1.29 km² and its catchment area is 9.6 km². The lake receives subsurface seepage from upper lake and drainage from 28 sewage filled nallahs. The lower lake does not have any fresh water source. The lower lake suffers pollution due to drainage from sewage filled nallahs, lack of fresh water source and commercial washing of clothes. The entire lake is eutrophic and its water is not very much suitable for drinking.

MATERIALS AND METHODS

The methodology of proposed work purely analytical done according to the procedure recommended in APHA(1992) and NEERI (1991) guidelines [8,9] for ambient water quality. The physical, chemical characteristics of lower lake were evaluated during premonsoon, monsoon and post monsoon seasons. The sampling was done from kali Mandir site of lower lake All the collected samples are immediately preserved in dark sterile boxes and processed for following different analysis.

- **Temperature:** Temperature was measured with the thermometer immersed directly in the water body, after a period of time sufficient to permit constant reading.
- **Colour:** Colour is measured by visual comparison method.
- **Turbidity :** It is determined by HACH UV-VIS spectrophotometer .
- **Conductance:** Conductance is the measure of salinity and measured by conductometer.
- **Total Dissolved Solid:** It is determined by evaporation method
- **Total Suspended Solid:** It is determined by filtration method and defined as the mass retained on the filter per unit volume of water.
- **pH:** pH value of water sample is determined by pH meter using standard buffer solution of pH 10.
- **Total Hardness :** The hardness of water body was determined as per standard methods (APHA, 1995).
- **Total Alkalinity:**Total alkalinity is analysed as per prescribed method with standard hydrochloric acid solution.
- **Chloride:** Chloride measured by Argentometric titration method with standard silver nitrate using potassium chromate as an indicator.
- **Sulphate and Nitrate:**Both are determined by HACH UV-VIS spectrophotometer.
- **Fluoride:** It is measured by Colorimetric SPADNS method.
- **Dissolved Oxygen :** The water sample was collected and Dissolved Oxygen was fixed instantly on the spot and analyzed immediately as per the Winkler's method with Azide modification.
- **Biochemical Oxygen Demand :** The water sample was collected and incubated at 200C for 5 days (NEERI, 1991).
- **Chemical Oxygen Demand :** COD was determined by potassium dichromate open reflex method.

RESULTS AND DISCUSSION

The various physical and chemical parameters determined for the water sample were given in Table 1 and 2 respectively

Table:1 Physical Parameters

S. No.	Parameters	Unit	Pre Monsoon	Monsoon	Post Monsoon
1	Temperature	°C	31.5	29.5	28.0
2	Colour	-----	Yellow	Light yellow	Light yellow
3	Turbidity	NSTU	4.8	5.8	5.2
4	Conductivity	mS/cm	2.16	2.91	2.80
5	TDS	mg/L	1.785	1.675	1.815
6	TSS	mg/L	60	55	60

Table:2 Chemical Parameters

S. No.	Parameters	Unit	Pre Monsoon	Monsoon	Post Monsoon
1	pH	----	8.6	8.7	8.5
2	Total hardness	-----	685	620	635
3	Total alkalinity	mg/L	680	715	670
4	Chloride	mg/L	195	158	178
5	Sulphate	mg/L	228	290	195
6	Nitrate	mg/L	49	52	47
7	Fluoride	mg/L	0.65	0.55	0.61
8	DO	mg/L	2.2	2.5	2.4
9	BOD	mg/L	3.5	3.2	3.8
10	COD	mg/L	88.2	93.5	98.5

Physical Parameters:

The temperature of the water sample is recorded highest in pre monsoon period (May), as it was the end of summer season and lowest temperature recorded in post monsoon period, as it is the onset of winter season. Colour of the water body is found to be pale yellow due to pollution. Conductance of water sample ranges from 2.16-2.91 mS/cm, the high conductivity may be due to contamination of conducting materials in water. Water sample of lower lakes had high turbidity due to agricultural discharge, inorganic and organic matter present in the water [10, 11]. Total suspended solids (TSS) and total dissolved solids (TDS) were also found high in concentration, so the lower lake water is moderately hard.

Chemical Parameters:

The pH indicates the intensity of acidity and alkalinity and measures hydrogen ions in water. Water which has pH value of more than 9 or less than 4.5 becomes unsuitable for use [12]. In the present study water is found to be slightly alkaline in nature. Total alkalinity is found more than the permissible limits. Hardness in water is due to the natural accumulation of salts from contact with the soil and geological formations or it may be due to manmade pollutions. In the present study hardness is also found more than the desirable limits which can cause health problems [13] and so the water is not very suitable for domestic as well as industrial purposes. Generally unpolluted water contains low concentration of chloride, but here in our study it is also little bit high in concentration. In the present study nitrate concentration is also found to be high. This may be due to the excessive application of nitrogenous fertilizers in agriculture. Fluoride concentration lies between 0.55-0.65 mg/L. It is within the permissible limit.

The DO level is found to be very low because of the effluent from the industries containing high amount of organic wastes depletes the oxygen level. Rapid increase in algae also leads to the depletion of DO [14]. It is observed from the experimental data that the COD ranges from 88.2 to 98.5 mg/L. It is the indication of toxicity present in water, which is further confirmed by high concentration of BOD [15,16].

CONCLUSION

Result of the study indicated that lower lake water is contaminated and not totally safe for drinking purpose. It requires proper monitoring and environment management plans to control the release of effluents. It is suggested to provide organic fertilizers to farmers, arrange the proper drainage facility and avoid the dumping of waste in lake as it deteriorate the water the quality. It is also advised to exercise all the necessary precautions before the water is used for drinking and irrigation. Otherwise, it may cause adverse effect on the health of living beings. We should give awareness to people about the need for protecting the water reservoir from pollution. Strict legal action should be taken against those who are responsible for contamination.

Acknowledgment

The authors are grateful to the Principal Career College, Bhopal for his co-operation, encouragement and for providing necessary laboratory facilities.

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