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Pollution Study of Upper Lake of Bhopal, India

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The Upper Lake of Bhopal is perhaps the biggest Lake of India, is passing through the very serious environmental stress since last few years, therefore the pollution status of the Lake was studies during the year 2006 for which four sampling stations were selected and the water samples were studies from surface and bottom levels. From the values of Coliform, B.O.D., C.O.D., D.O. etc. it was concluded that the water quality of Upper Lake is not fit for drinking purpose and therefore immediate measures should be adopted to check the inflow of pollutants to entering into the Lake.

Key words: Pollution, Upper Lake, Coliforms, , B.O.D., C.O.D., D.O.

Upper Lake was built by Raja Bhoj and the catchment area of the Upper Lake is 361Km^2 the maximum and minimum depths are 9.5 m and 0.5 m, respectively water holding capacity is 1107.69 Mm^3. It is situated Latitude 23°-12'N and 77°-18' E Longitude and is located on a hard pink -red sand stone of the vindya region at 503 m above the mean sea level (MSL).

The Upper Lake drains into the Kolans river It is a major source of potable water for the people of the city of Bhopal, Madhya, Pradesh, India. According to the Meterological Department of India (Bhopal observatory,Bhopal) , the three seasons of this region are Monsoon (from mid-June to Sept.)Winter (from Octo. to February) and summer (From March to mid June). The most common and widespread danger associated with drinking water is bacterial contamination by sewage and other organic wastes, or human and animal excrement.

Coliforms are negative rod–shaped bacteria, which are readily distinguished from other microorganisms by means of their biochemical properties. The culture medium which is used to grow the Coliforms contains a and meanwhile promotes the growth of Coliforms. De- pending upon the environmental condition,

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Coliforms survive only a few hours or days outside their hosts. Their presence in water, therefore, suggests the recent contamination of Colifrom. *Escherichia coli (E. coli)* is excreted by healthy individuals and hence, it is found abundant in sewage. Coliforms are the only organisms used as indicators of faecal contamination or indicator of sewage contamination (Bande 1977). Cholera is a water – borne disease caused by *Vibrio cholerae. Salmonella typhi c*auses Typhoid fever. Polio and hepatitis are viral diseases. New enterovirus types are *Enterico viruses* and other *Parva viruses* which cause different viral diseases in human beings by consum ption of polluted water.

According to Bhatnagar (1984), nearly 3 Mg (tons) of phosphorus and 8Mg (tons) of nitrogen are discharged annually in the Upper Lake of Bhopal through six main drains carrying city sewage. The Lake occasionally emits an obnoxious smell like a septic tank due to a large amount of of rotting algae. The higher number of phyto-planktonic species, especially those belonging to Cyanophyceae, and the presence of other pollution – indicating organisms reveal heavy water pollution in the Lake.

A number of investigators have carried out bacteirological examinations pertaining to the most probable number (MPN) notable studies are those of Taylor (1941,1949), Keller (1959,1969), Panicker *et al.* (1966), Lonsane *et al*.(1967),Raii and Hill (1978),Kumar and saha (1989), and Bhattacharjee *et al*. (1989). The bacterio logical examination of water has a special significance in pollution studies; it measures deleterious effects of pollution on human health. Bacterial population is often considered an important indicator of pollution and eutrophication in aquatic ecosystems. The total of coliform bacteria indicates degree of pollution (keller 1960; Rai and Hill 1978;Bhatnagar 1984; Kulshrestha 1988; Kumar and Saha 1989;Clark *et al.*,(1973, 1977).Some physicochemical factors are similar to those reported by Lonsang *et al.,* (1967), e. g. temperature, availability of nutrients presence and quantity of non–Coliforms oxygen tension ingestion by protozoa, presence of toxic materials, and struggle for existence, which also controls the bacterial populations. All bacteria require inorganic phosphate that is utilized by growing organisms almost as fast as it is made available. These findings are consistent with Rai and Hill (1978).

MATERIAL AND METHODS

Water sample were collected in 250 mL capacity sterile glass bottles having ground stoppers which were protected with a piece of sterile brown paper tied around the neck of the bottles. At the time of sampling, the bottles were lowered into the lake water at a depth of few cm. The bottles were held there by the base in one hand, while with the other hand, the stoppers and covers were removed together. These were retained in hand while the bottles were filled. Then they were immediately replaced together and the filled bottles was hauled up. The bottles were not filled completely an air space of about 3 cm was left unfilled. Samples after collection were immediately taken to the laboratory for examination and were inoculated within 1- 2 h.

Bacteriological examination

The Most Probable Number (MPN) was determined by the methods of APHA (1982), The test of MPN Coliform was carried out by the inoculation of a series of fermentation tubes, using three tubes for each dilution varying sample medium ratio (10mL sample in 10 mL medium, 1 mL sample in 10 mL medium, and 0.1 mL sample in 10 mL medium). Inoculated tubes were incubated at 35^0C for 48 h.

A lactose broth (McEnky Broth) culture medium was used for presumptive test. All tubes which produced acid and gas in the Durham,s fermentation tubes were recorded as presumptive positive tubes. Each positive tube was subjected to a confirmatory test and three loopful inoculum were introduced in a brilliant green lactose bile broth tube with a metal loop of 3 mm diameter. These tubes were incubated in for 48 h at 35^0C. Tubes showing gas bubbles in Durham,s tubes were scored as a confirmed positive test

Details are shown in as follows:

S. No.	Location	Name of Station
1	West of the Lake	Bhaisakher
2	East of the Lake	Fatehgarh
3	North of the Lake	Khanugaon
4	South of the Lake	Bhabdhada

Table 1. Monthly variation in the MPN of Coliforms during the study of year 2006. Sampling station is listed four stations at surface and bottom level.

Station	level	Month of 2006											
		Jan.	Feb.	March	April	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
West of the Lake(Bhaisakheri)	S	1500	2400	2400	2400	2400	2100	1500	2100	2400	2400	2400	1500
	B	2400	3800	4400	3800	4400	4600	2100	3800	4400	4600	4400	2400
East of the Lake(Fatehgarh)	S	2100	1200	2400	750	930	750	2100	1700	1500	1200	2100	1500
	B	2800	2400	4400	640	930	1200	2400	3800	2400	2400	4400	3800
North of the Lake (Khanugaon)	S	3800	2100	1500	930	1500	750	750	1500	2400	1500	2100	2400
	B	4700	2400	3800	1200	930	1200	640	2100	3800	2400	4400	3800
South of the Lake (Bhabdhada)	S	3800	3800	2400	4400	3800	2400	930	750	930	750	2100	2100
	B	2100	1200	2400	1700	1200	1200	1500	640	930	1200	2400	3800

S-surface, B-bottom

Bacteriological observations

Bacteriological investigations were undertaken to determin the sanitary quality of were of Upper Lake of Bhopal (India),by determining the MPN of Coliform bacteria. The lake water was found to have a significantly higher Coliform count with great fluctuations frequent in winter and lower during June-July.In Bhainsakheri. Coliform value is higher on bottom level..Lower value is found in April-July at fatehgarh and Khanugaon. In Bhadbhada station value is lower in month of July – October.

In general at the onset of summer the Coliforms showed an increasing trend and flourished during the later part of summer , but a sudden fall was observed in the rainy season, especially in the month of August. Lower population was maintained throughout the post-monsoon priod but in winter a slight increase in the MPN of Coliforms was observed.

The Coliform load was found to be season- dependent, higher in winter and early part of the summer season. The findings are similar to those of Taylor (1941; 1949), Panicker *et al.* (1996), and Sastry *et al*.(1970). Increase after rain in the bacterial numbers is due to the accumulation of run off water from near by areas. It may also be due to the stirring-up of decomposed organic matter at the bottom, which further spreads and distributes itself throughout the lake.

Some important factors related to the reduction of the bacterial numbers are natural death, competition among various groups of organisms, sedimentation of suspended matter attached to the organism, dilution through heavy rains, predatory activity of protozoans and other bacterial feeders and presence of bacterial substances and bacteriophages (Kellar 1960)

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