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Lake Water Pollution and Treatment

Antara Bhattacharya and Anugya Shandilya
Department of Architecture and Planning,
MANIT Bhopal, (Madhya Pradesh), INDIA

(Corresponding author: Antara Bhattacharya)
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ABSTRACT: Water pollution has been one of the major topics in the environmental issue of urban India. This study was conducted to find out the pollution situation of Upper Lake (prime source of potable water for half the population of Bhopal) and the level of treatment provided to make it drinkable. The Upper Lake is well equipped with a water treatment plant. This paper observes the negative and harmful effects of lake water pollution on the environment and the surrounding community as well as the quality of water after its treatment. The most common form of water pollution has been waste disposal via human activities. The study conducts tests on water samples from the Upper Lake. Recorded values of pH, color, turbidity, biochemical oxygen demand (BOD5), hardness, total dissolved solids (TDS), chloride (Cl-), carbon dioxide (CO2), chemical oxygen demand (COD) and other microbiological tests for presence of bacteria before and after the water treatment have thus been compared to analyze the extent of water hygiene delivered..

I. INTRODUCTION

Adequate water supply of befitting quality is a key ingredient in the health and well-being of humans and ecosystems as well as for social and economic development. Water quality is becoming a global concern of increasing significance, as risks of degradation translate directly into social economic impacts [1]. However, there have been examples of regional successes in improving water quality, yet, there is absence of data that may suggest if there has been an overall improvement in water quality on a global scale. Quality of water is just as important as water quantity to satisfy the basic human and environmental needs. Moreover, the two are directly linked, with poor water quality impacting water quantity in a number of ways. Evidently polluted water that cannot be used for drinking, bathing, industry or agriculture significantly reduces the amount of water available for use provided in an area.

In the city of Bhopal, Upper Lake, Kolar Dam, Bhadbhada dam, Halali dam and Hataikheda dam, are the chief providers of water in the city besides their contribution to recreational needs. Upper Lake has a water area of 30.7 km at full tank level and a catchment area of 361 km. The variation in depth at shallow and deeper zones varies from 0.5 meter to 9 meter with a mean depth of 6 meter. It fulfills 40% of the drinking water demand for the city's growing population [2]. The increasing development and urbanization of Bhopal is rapidly polluting the Upper Lake.

Fringe areas are getting converted to chunks of urban development at a faster pace. These developments have increased the anthropogenic pressures on the lake and are accelerating its eutrophication and microbial contamination [3].

Other than the solid waste that is deposited by the visitors each day, the Lake receives more than 140 tonnes of solid waste directly or indirectly. With so much of waste being pumped into the Lake, no sooner the waters will lose potability. This could be a serious setback to water availability in Bhopal water. It has been found by the researchers that that aquatic life of Upper Lake has noticeably been affected along with a decline in its flora and fauna.

II. MATERIALS AND METHODS

A. Locale of Study

The study was made on the catchment areas of the Upper Lake, Bhopal (figure 1(a)). Water samples from two different locations (figure 1 (b) and (c)) were collected within one day. To test untreated water, samples from surfaces of Upper Lake had been collected. For treated water, samples were collected directly from the Nagar Palika water treatment plant. The vegetation pattern of the lake reflects that the shallow zones of the lake is covered with rooted, emergent and submerged plants in many places while the deeper zones have limited weed infestation.

B. Data collection

The sources of data are divided in to two categories. The data collected during field visit or from study area is termed as primary data. Primary data was collected through field observations and test results of samples from laboratory. The secondary data was collected from authentically published sources such as books, research papers or other documents containing the topics relevant to the study.

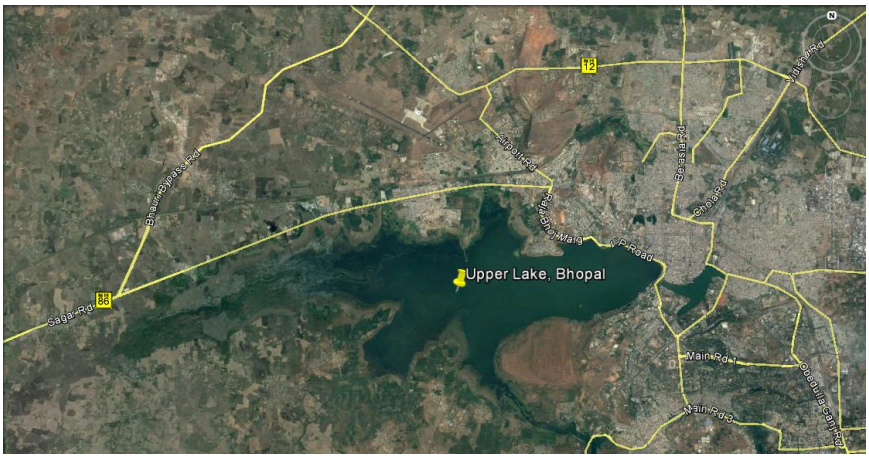

Fig. 1(a) Upper Lake, Bhopal.

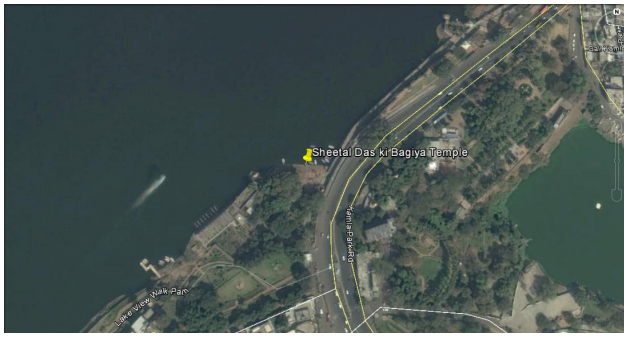

Fig. 1(b) Untreated water sample collection point (Sheetal Das ki Bagiya Temple).

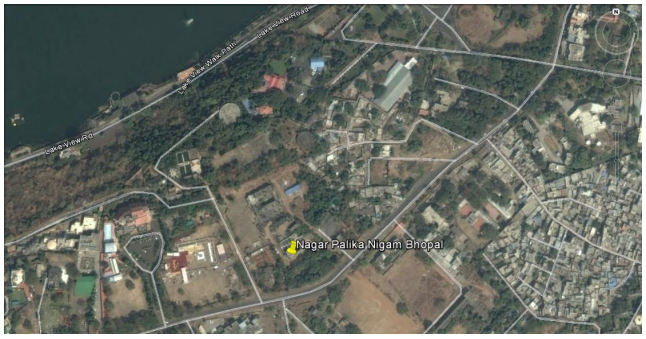

Fig. 1(c) Treated water sample collection point(Nagar Palika Nigam, Bhopal.

In this study, the primary data includes the photographs of site, interaction with the locals, field observation etc. The field observation seeks to obtain the physical condition of the study area. Results of chemical and biological water tests obtained directly from laboratory also come under primary data. In case of the secondary data, maps have been obtained from Google Imagery (dated 2/26/2016) and information has sources from reports of Town and Country Planning Bhopal (T&CP) and several relevant research papers.

C. Test Parameters

The study conducts tests on water samples from the Upper Lake. Recorded values of pH, color, turbidity, biochemical oxygen demand (BOD5), hardness, total dissolved solids (TDS), chloride (Cl-), carbon dioxide (CO2), chemical oxygen demand (COD) and other microbiological tests for presence of bacteria before and after the water treatment have thus been compared to analyze the extent of water hygiene delivered..

III. RESUTLS AND ANALYSIS

On this part, the focus of the study was to find out the harmful effects of lake water pollution on the environment and the surrounding community and to find out the quality and extent of hygienic water delivered after treatment. Following figures were obtained on comparison:

Table 1: Chemical Tests.

Parameters	Unit of Measurement	Before Treatment	After Treatment
Colour	Hazen Unit	35	<1 unit
pH		7.2	7.5
Turbidity	NTU	13.0	1.04
Total Dissolved Solids	mg/l	160	120
Chloride (Cl^-)	mg/l	15	25
Carbon Dioxide (CO_2)	mg/l	1.76	<1
Biological Oxygen Demand (BOD)	mg/l	36	<1
Chemical Oxygen Demand	mg/l	120	<1

Table 2. Bacteriological Tests

Test	Unit of Measurement	Results
Escherichia coli	In 100 ml	Absent
Coliform bacteria	In 100 ml	Absent

pH is good indicator of whether water is hard or soft. In the present study pH founds 7.8 in lake water sample and 7.6 in treated water sample. Turbidity of water observed was 13.0 NTU in Lake Water and 1.04 NTU in treated water. The difference in turbidities of untreated water and treated water indicates that the municipal water treatment plant works better in case of lowering turbidity. TDS test measures the amount or particles that are dissolved in water. The Indian standard (IS10500) is 500 mg /L. In the present investigation, it was found 160 mg/L of TDS in lake water whereas12mg/L in treated water sample. 15 mg/L of chlorides found in untreated water sample where as 25 mg/L of chlorides found in treated water sample. The amount of CO2 before treatment was noted to be 1.76mg/l whereas in treated sample was found to be <1mg/l. In case of BOD, Urban runoff carries pet wastes from streets and sidewalks; nutrients from lawn fertilizers; leaves, grass clippings, and paper from residential areas, which increase oxygen demand. Here the BOD before treatment comes out to be 36mg/l and <1mg/l in treated water. Biochemical oxygen demand is a measure of the quantity of oxygen used by microorganisms (e.g., aerobic bacteria) in the oxidation of organic matter. Urban runoff carries pet wastes from streets and sidewalks; nutrients from lawn fertilizers; leaves, grass clippings, and paper from residential areas, which increase oxygen demand. Oxygen consumed in the decomposition process robs other aquatic organisms of the oxygen they need to live. The level of oxygen often drops in case of pollution in water. Coliform Bacteria: Presence of Coliform bacteria in drinking water indicates that disease-causing organisms (pathogens) could be in the water system. Most pathogens that can contaminate water supplies come from the feces of humans or animals. Results indicate the absence of this bacterium in the treated sample. The presence of E. coli in water is a strong indication of recent sewage or animal waste contamination. Sewage may contain many types of disease-causing organisms. This was absent in the water samples tested post treatment.

IV. RECOMMENDATIONS

Aeration allows many of the factors responsible for poor water quality to circulate and reach the oxygen-water interface. It enhances water quality by stabilizing pH, reducing alkalinity, removing carbon dioxide, removing phosphorus and foul odors from the stagnant water body. It also reduces the algae by cutting down the supply of sunlight and phosphorus, which are two major things required for its growth by causing destratification.

Introducing floating fountains and promoting breeding of fishes, water quality could be improved in a cost-effective way that requires low maintenance. Since fishes lay eggs on the natural interface of water and land, therefore construction of cemented structures and artificial boundaries must be avoided because the fishes need proper substrates to breed on, like peat, rocks, shells, or plants.

V. CONCLUSION

The values of chemical and bacteriological parameters of Dam Water are ranges somewhat parallel to the standards recommended by ISI. Hence it needs primary or some treatment before supplying to urban Area. The values municipal water Samples shows that the plant or the treatment given to the Lake water is proper and the treated water is suitable for consumption by humans.

Also, by taking proper measures like, breeding of fishes and maintaining a natural land-water interface, the level of toxicities and harmful bacteria can be brought down to a certain level

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