

Assessment of Water Quality of Powai Lake, Mumbai, India

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Abstract: *In Mumbai, increasing population always raises the demand for water supply. The main sources of water to Mumbai are five impounded lakes; Vihar, Powai, Tulsi, Tansa, Vaitarna and Upper Vaitarna. Powai Lake is in the heart of the city, located near the Vihar Lake. It was constructed by the British in 1891 to supply water to Mumbai city. Powai Lake water supply is mainly to Aarey colony and nearby industries since its water is unfit for human consumption. In spite of cleaning and maintaining Powai Lake, quality of water is deteriorating due to industries and human activities around Powai Lake. By proper cleaning and regular physicochemical analysis potable water may get from Powai Lake to fulfil the requirement of increasing demand. To study the pollution level of Powai Lake some physico-chemical parameters were investigated. This study revealed high pollution level of Powai Lake.*

Keywords: Impounded, Powai Lake, industries, physicochemical

1. Introduction and Literature Survey

Down the ages water has always played a pivotal role in human life. It is a well known fact that clean water is absolutely essential for life. It is believed that by 2050 water scarcity will cover almost the entire globe [1]. In 21st century, issues of fresh water scarcity have ranked 2nd only to global warming. 40% world population do not have access to adequate sanitation facility and this is one of the world's greatest public health crises [2]. Over population is causing a change in the delicate water balance [3].

Most of the lakes mainly near residential area are polluted because of anthropogenic activities [4]. Mumbai is one of the financial and commercial cities of India so demands for potable water are increasing day by day with increase population.

Powai water supply was brought into Mumbai for the first time in 1891. Complaints were received from the public regarding quality of Powai water. Later it was found that water is not potable. Within couple of years Tansa water supply was introduced and Powai lake was stopped due to its bad water quality [1]. More than 100 years old, Powai Lake represents a typical case of environmental degradation due to urbanization [5]. Bioremediation measure alone as in the case of Powai Lake has been unable to achieve lake equilibrium in full. [6]. The main source of pollution is by Lord Ganesha idols made from plaster of Paris and the chemical paints used to paint those idols. These idols are immersed in Powai Lake during Ganpathi visarjan in Mumbai [7]. All these aspects prompted to work on the quality of Powai Lake water.

To study pollution level of Powai Lake some physico-chemical parameters like colour, taste, odour transparency, nitrate, phosphate, sulphate, hardness and conductivity were taken into consideration.

2. Methodology

Study area: Water samples were collected from Powai Lake at three different places Near Powai garden, IIT side and

Boat club between 8.00 AM and 10.00 AM every month from October 2016 to May 2017. Samples were collected in clean brown coloured glass bottles with capacity 250ml. Colour and transparency measured at the sites of the collection by the standard methods. For rest of the estimations, water samples were brought to the laboratory. Analysis was done for colour, transparency, taste, odour, total alkalinity, phosphate, nitrate, total hardness and electrical conductivity by standard laboratory method [8]. All samples were labelled and kept in refrigerator till further use. All results are mentioned in **Table-I**.

3. Result and Discussion

Various parameters of the water samples showed variations due to seasonal and anthropogenic activity.

Colour: Colour of natural water is transparent and nearly colourless. Suspended matter, green aquatic vegetation and industrial waste give different colour shades to the water. Colour of the water is determined by visual comparison of the sample with distilled water. For visual comparison 10 ml sample was collected in the test tube and compared with the distilled water, result is given in the **Table-I**.

Taste and Odour: Decomposition of organic matter in the polluted waters by the aerobic bacteria increases the Biochemical Oxygen Demand (BOD) leading depletion of Dissolved Oxygen (DO) in water. This leads anaerobic decomposition, giving an unpleasant taste and odour to water.

Transparency: Transparency of water relates to the depth to which light penetrates water. Light is necessary for photosynthetic activity of aquatic plant life. Due to high level of Total Solids (TS), Total Dissolved Solids (TDS) and Total Suspended Solids (TSS), transparency was low. It is measured by simple oceanography instrument known as Secchi disc. Transparency is measured by gradually lowering the disc at respective sampling sites. By using formula results were obtained. **Table (I)**

Total Alkalinity: The alkalinity of water is measured by how much acid it can neutralise. It is a measure of the water's ability to absorb OH ions with significant pH change [9]. The current alkalinity analysis range was 119 to 183 milligram/litre (**Table I**).

Total Hardness: Total hardness is defined as "the sum of calcium and magnesium concentration both expressed as CaCO₃ in mg/L". It is predominately caused by cations as calcium, magnesium, alkaline earth metals etc. If the hardness of water more than 180 mg/L consider water is very hard [10]. During this work throughout year hardness was between 165 to 198 **Table (I)**.

Phosphate: Phosphates are not toxic to people or animal unless present in water in high level. Digestive problem could occur due to extremely high level of phosphate [11]. Phosphate concentration was more during the month of

September and October may be due to Genesh Idol immersion. Same results were noted by [7] Analysis of phosphates in this work is given in the **Table (I)**.

Nitrate: Domestic waste, untreated industrial effluents and chemical fertilizers are the major sources of nitrates in water. Presence of nitrate indicates pollution level in water. The study revealed the concentration of nitrates which is given in the **Table (I)**.

Electrical Conductivity: Electrical conductivity shows significant correlation with 10 parameters such as temperature, pH, alkalinity, total hardness, total solids, total dissolved solids, COD, chlorides and iron concentration of water [12]. This was measured by portable digital calibrated pen conductivity meter. Values were ranging from 120-170. These are given in the **Table (I)**.

Table 1: Physico-chemical Parameters of Powai Lake water

Parameters	October	November	December	January	February	March	April	May
Colour	Dark brown	Light brown	Light green	Light brown	Light brown	Grey	Dark Brown	Dark Brown
Transparency(cm)	94	89	78	73	77	74	95	92
Conductivity (µmhos/cm)	170	169	148	158	164	131	120	156
Total Alkalinity (mg/L)	167	159	162	153	171	143	161	166
Total Hardness (mg/L)	198	185	174	165	180	182	169	183
Phosphate (mg/ml)	0.9	0.7	0.4	0.8	0.8	0.7	0.5	0.6
Sulphate (mg/L)	2.1	2.4	2.6	2.8	2.9	2.9	2.09	2.1
Nitrate (mg/L)	0.5	0.9	1.2	1.7	1.7	1.9	1.9	2.01

4. Conclusion and Future Scope

The present assessment of physico-chemical parameters like colour, transparency, salinity, nitrate, phosphate, sulphate, hardness and conductivity of Powai Lake water, indicates water is highly polluted. Water is not fit for cattle or for bathing. Lake should be protected from all anthropogenic activities. Immediate action of cleaning should be taken. Organise mass awareness training programmes for the locals about importance of water bodies is necessary.

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