

WATER QUALITY ASSESSMENT OF THE CHAKRESHWAR LAKE, NALLASOPARA, PALGHAR, USING PHYSICO-CHEMICAL PARAMETERS.

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Abstract

Water contamination is becoming a significant threat to human health. Contamination of lakes and other reservoirs is one of the commonly happening trend in almost all developing nations, especially urban ones, due to demographic expansion coupled with lack of civic amenities. Due to the human neglect and anthropogenic sources like industrialization, urbanization and several human developmental activities, majority of the urban and rural lakes have disappeared and those which could endure this pressure, present non-potable water or are not able to meet human requirements. The present study aimed at evaluation of Lake using physico-chemical parameters. Lakes being a natural rich source of water can be utilized for commercialization by practicing aquaculture. This will in turn can add up to the financial assets of the newly formed Vasai -Virar Municipal Corporation. This area is very well known for the coastal area and for exporting marine catch but a lot of freshwater resources are available, which if made suitable can be used on large scale for carp culture, which is preferred next to marine fishes. In this line, water quality assessment was carried out based on values obtained for factors including pH, temperature, conductivity, turbidity, dissolved oxygen (DO), biological oxygen demand (BOD), Chemical oxygen demand (COD), Free CO₂, Phosphate, Nitrate, Nitrite, Alkalinity, Salinity, Hardness of water in the laboratory using Standard procedures (APHA 1945). Lastly, analysis results were compared with water quality standards such as BIS 10500 (2012). Majority of the parameters had values within the permissible limit set by BIS and WHO.

Key words: *Anthropogenic, Aquaculture, Industrialization, Physico-Chemical, Water quality.*

1. Introduction

The proportion of freshwater on earth's surface is merely 2.5% out of which just 1% is accessible to be used (Worako, 2015). Lakes are the planet's one of the most important resources of freshwater providing plentiful benefits. They serve for domestic and irrigation purposes, provide ecosystems for several aquatic life like fish and for substantial elements of the world's biotic diversity. They play a major role in flood control (Moslem Sharifinia et al., 2013). In such context, lakes are foremost important water resources. They are a major source of water supply for human consumption and generally accounts for about 0.3% of the entire source of surface water body. All over India water bodies are exposed to various forms of environmental degradations because of rapidly increasing population, exponential industrialization and urbanization. Aquatic environment of water bodies is also getting disturbed as a result of mismanagement and unawareness of people (Sharma & Walia, 2015; Mahananda et al, 2010).

Contamination of lakes and other reservoirs is one of the commonly occurring phenomenon in almost all developing nation (Garg et al., 2009; Srivastava et.al, 2011). In India, water is most essential but scarce resource. There are many environmental challenges currently in the quality and availability of the freshwater resources (Zhang et.al. 2017; Xue et al. 2017). The stress on water resources is from numerous sources and the effects can take various forms. Only 4% of world water resources is possessed by about 16% of the world population residing in India. Therefore, there is a high pressure on water resources in India. Water scarcity is already a crucial environmental problem hence the current focus is to improve the quality of existing water sources specially lakes through characterization for improvement and restoration of quality of water (Cosgrove & Loucks, 2015; Bob et al. 2015).

Lakes are inland water bodies with no direct exchange with an ocean and are a part of freshwater ecosystem which are very useful to man. Lake ecosystems is made up of physical, chemical and biological properties hence provide an important habitat to study ecosystem dynamics (Bhateria & Jain, 2016). A significant role in the ecological sustainability of the region is played by lakes. However, quality of many lake ecosystems in India is seriously waned due to its easy accessibility for disposal of pollutants and wastewaters (Andong et al., 2019). Testing of water using physico-chemical parameter is vital to get precise idea about the quality of water and based on that we can compare the results obtained with standard prescribed values. Analysis of water quality is significant to protect the natural ecosystem like lake (Dirican, 2014; Weldemariam, 2013; Behmel et al., 2016).

Thus, present study entails details of human impact on lake and suggests some measures for restoration of this important resource. This can further be recommended to the newly formed Vasai -Virar Municipal Corporation for the measures to be taken for remediation of lake in order to be utilized for commercialization by practicing aquaculture.

2. MATERIALS AND METHODS

2.1 STUDY AREA

Chakreshwar Lake is in Nallasopara in the Palghar district of Maharashtra. It is a natural, shallow, perennial eutrophic lake situated at $9^{\circ} 25' 0''$ N and $72^{\circ} 47' 58''$ E in Nallasopara west. It is an ancient lake and has a temple named Chakreshwar Mahadev Temple at one corner of the lake in Nallasopara West. The lake is a major tourist attraction. The main source of pollution to the lakes is from the idol immersion and dumping of garlands and flowers offered to the temple. Figure 1 and 2 shows the map of the study area and the pictures of the lake respectively.



Figure 1 Map of the study area.



Fig 2. Pictures of the lake

2.2 SAMPLING AND ANALYSIS

During study period the surface water samples (0.5–1.0 m) were collected in clean plastic cans during the morning hours for a period of six months. The samples were collected and brought to the laboratory by following necessary precautions for testimonial analysis to avoid unusual change in water quality.

Temperature was recorded in the field at the time of sample collection. Water quality was analyzed for the following physico-chemical parameters as per the standard methods (APHA, 2005): Temperature, pH, Conductivity, Turbidity, Phosphate, Nitrates & Nitrites Alkalinity, Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Dissolved Oxygen (DO), Free CO₂, Salinity and Total Hardness. Observations were recorded and shown in table.

3. RESULTS AND DISCUSSION:

Table 1. Mean results of the Physicochemical Parameters of Chakreshwar Lake and its comparison with limits set by BIS (2012) and WHO (1993).

Parameters	Unit	Average values obtained	Maximum Permissible limits	Remarks
Temperature	°C	25	25-30	Within the range
pH	-	6	6.5-8.5	Lesser than range
Turbidity	NTU	12	10	Exceeds the limit
Conductivity	µs/cm	485	500	Within the limit
Phosphates	mg/L	0.04	0.5	Within the range
Nitrates	mg/L	0.09	45	Within the limit
Nitrites	mg/L	0.07	5	Within the limit
Alkalinity	mg/L	109	200	Within the limit
BOD	mg/L	9.89	30	Within the limit
COD	mg/L	101.11	250	Within the limit
DO	mg/L	11	> 5	Within the limit
Free CO ₂	mg/L	27	250	Within the limit
Salinity	mg/L	189	250	Within the limit
Total Hardness	mg/L	175	300	Within the limit

- **Temperature:**

Temperature is an essential physical water quality parameter influencing the aquatic life by altering the amount of dissolved oxygen (DO) in the water. It reduces oxygen level accessible by aquatic organisms for various metabolic activity as well as respiration (Kumar Tank & Chippa, 2013). The water temperature of the lake showed an average value of 25°C which was within the permissible range.

- **pH**

pH maintains the acidic and basic property of water and is a critical characteristic of a lake. pH affects various physical and biochemical aspects of the water (Jalal & Kumar, 2013). The lake showed an average pH of 6 during the study period which was lower than the permissible range.

- **Electrical Conductivity (EC):**

EC is the measurement of the capacity of water to transmit an electric current. It is an important measure of total amount of salt present in water (Lodh et al., 2014). In the present study the average EC is recorded as 485 $\mu\text{S}/\text{cm}$, which is within the limit.

- **Turbidity:**

It is the optical property by which light gets scattered by the colloidal particles present in the water (Laskar & Gupta, 2009). Turbidity of a lake results from presence of microorganisms, clay, organic matter, slit, phytoplankton etc. The average turbidity is recorded as 12 NTU, which is above the permissible limit.

- **Alkalinity**

Alkalinity absorbs excess H^+ ions and maintains the pH of water thereby protecting the aquatic body from pH variation. Carbonates, hydroxide ions, bicarbonates, ammonia and so on contributes to total alkalinity. Average value of alkalinity was 109 mg/l , within the permissible limit.

- **Biological Oxygen demand (BOD):**

BOD is a vital assessment aspect of lake water quality. It measures the amount of oxygen consumed by the microorganisms during the organic matter decomposition. It exhibits the total biodegradable wastes existing in the water (Anhwange et al., 2012;. John et al. 2014). In this study the average DO obtain was as 9.89 mg/l which is within the prescribed range by BIS.

- **Dissolved Oxygen (DO):**

Dissolve oxygen is the amount of oxygen present in the aquatic ecosystem. It is representative of the general health of the lake. It significantly shows how much pollution is there in the water body (Barot and Patel, 2014). In this study the average DO is measured as 11 mg/l within the prescribed range of BIS.

- **Nitrate and Nitrites:**

Inorganic nitrogen is present in water as Nitrate. It is one of the main nutrients that accelerates the growth of algae. The average nitrate and nitrite values is found as 0.09 mg/l and 0.07 mg/l respectively, within the permissible limit.

- **Phosphate:**

Phosphate acts as a restricting factor for efficiency of water body. Domestic waste, agricultural runoff, chemical fertilizers are factors contributing to great amount of phosphate (Prakash et al., 2019). The lake showed an average value of 0.04 mg/l , within the prescribed limit.

- **Free CO_2 & Salinity:**

In the present study, the average Free CO_2 value was recorded as 27 mg/l and for salinity it was 189 mg/l , both the values where within the permissible limit.

- **Total Hardness (TH):**

Hardness of water results from the presence of cations like Mg^{+2} , Ca^{+2} , Fe^{+3} etc. TH of the studied lake was found within prescribed limit with the mean value of 192 mg/l .

4. CONCLUSION

Water quality evaluation has become a critical issue in recent years in most countries, especially due to alarms that freshwater will be a scarce resource in the future. Water quality assessment of the Lake was done using physico-chemical parameters. Majority of the parameters had values within the permissible limit set by BIS and WHO which reveals that lake water is not much polluted with non-biodegradable organic matter. Thus, it can be easily treated with conventional biological treatment system. Based on current results it can be stated that the water is fit for use and can be recommended to the Municipal Corporation for being utilized for Aquaculture practice.

5. REMEDIATION AND RECOMMENDATION

Since the main issue in the present study is due to the idol immersion ritual, following are some remedial measures which may reduce the pollution level up to some extent.

1. Immersing the idol in an artificial water tank instead of directly into natural water body.
2. The offerings like flowers, garlands etc. which are biodegradable should be disposed off separately and converted into bio-fertilizers.
3. General awareness, programs & campaigns.
4. In-Lake physical Methods: Aeration of water, Admission of Unpolluted Waters (Dilution/Flushing).
5. In-Lake Chemical Methods: Phosphorus Precipitation, Use of Algicides and Herbicides
6. In-Lake Biological Method like Species manipulation.

ACKNOWLEDGEMENT

The authors are cordially thankful to the department of Zoology, G.N. Khalsa College for all the support.

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