Water quality assessment of Nallacheruvu, Hyderabad, Telangana, India.

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ABSTRACT

The present study has been undertaken to assess the water quality of Nallacheruvu located in Uppal, Hyderabad, Telangana, India. The lake water samples were collected seasonally and were analyzed for the parameters like Temperature, pH, Dissolved Oxygen (DO), Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Total Dissolved Solids, Total Alkalinity, Calcium, Magnesium, Chlorides, Phosphates, Nitrites, and Nitrates. Some heavy metals like Copper, Iron, Zinc, and Cadmium were also analyzed. The results reveal that nutrient load in the Nallacheruvu is very high and the water is not suitable for consumption and domestic purpose.

KEY WORDS: Nallacheruvu, Water quality, Physico-chemical parameters, Heavy metals, Eutrophication.

INTRODUCTION

A healthy lake ecosystem could conserve natural and social balance by contributing healthy environment of its location. Nowadays naturally existing dynamic equilibrium of water bodies like rivers, lakes, and estuaries are affected by the human activities (Lodh et al. 2014). Anthropogenic influences (urban, industrial and agricultural activities, increasing consumption of water resources) as well as natural processes (changes in precipitation inputs, erosion, weathering of crust materials) degrade surface waters and impair their use for drinking, industrial, agricultural, recreation or other purposes (Pravat Ranjan Dixit et al. 2013). India is facing a serious problem of natural resource scarcity, especially that of water in view of population growth and economic development. Most of fresh water bodies all over the world are getting polluted, thus decreasing the potability of water (Sulekh Chandra et al. 2012). Lakes are important part of urban ecosystem. Though relatively small in size, lakes perform significant environmental, social and economic functions, ranging from being a source of drinking water, recharging groundwater, acting as sponges to control flooding, supporting biodiversity and providing livelihood. Heavy metals are the most dangerous contaminants since they are persistent and accumulate in water, sediments and in tissues of the living organisms, through two mechanisms, namely bioconcentration (uptake from the ambient environment) and biomagnification (uptake through the food chain) (Ramesh and Krishnaiah 2014). Water in lakes is an easily available source of water for the needs of many sectors of economy such as...
Monitoring and assessment provide the basic information on the condition of a water body. The present study has been undertaken to assess the water quality of Nallacheruvu located in Uppal, Hyderabad, Telangana, India. This is carried out to understand the pollution (physico-chemical and some heavy metals) status of the lake.

MATERIALS AND METHODS

The Nallacheruvu water body is located exactly at latitude and longitude 17°24'12"N 78°34'43"E. The water samples were collected in polyethylene bottles of 2-l capacity from the Nallacheruvu Lake and transported to laboratory in an ice box to avoid unpredictable changes in physicochemical characteristics. Nitrates and phosphates in the surface water were studied monthly for a period of 2 years. Sampling and physicochemical investigation was carried out according to standard methods. Dissolved oxygen in water was determined by the Winkler’s iodometric method and biological oxygen demand determined by 5-day biochemical oxygen demand (BOD) test method. Alkalinity, Magnesium, Chlorides and calcium were determined by titrometric methods. Phosphates in water were determined by the molybdo phosphoric acid method and nitrate determined by brucine method. Heavy metals were analysed according to APHA (1989).

RESULTS AND DISCUSSION

Temperature

The temperature of water is basically an important parameter because it affects the chemistry of aquatic organisms. Temperature of Nallacheruvu water varies from 29°C to 34°C with an average of 32.33 ±1.86°C. Maximum temperature was recorded during August. The temperature of most polluted Chandola lake in Ahmedabad ranged between 17-30°C (Verma et al 2012).
Figure 2. Seasonal variations of Temperature

$\text{pH}$

$\text{pH}$ is the measure of the intensity of acidity or alkalinity and measures the concentration of hydrogen ions in water. $\text{pH}$ has no direct adverse effects on health, however, a lower value below 4 will produce sour taste and value above 8.5, an alkaline taste. $\text{pH}$ value of 7.2 was recorded which is just above neutral in the March 2011 and maximum $\text{pH}$ of 8.9 was recorded in the month of August 2010 and 2011 (8.9 $\text{pH}$). The mean $\text{pH}$ value of water was 8.2± 0.6. This is reflected in the range of fluctuations of $\text{pH}$ brought about the operational dynamics of carbonates and bicarbonates. Most of the fresh water bodies are alkaline due to the above components. In this lake the $\text{pH}$ range was observed as alkaline in its nature. This may be due to continuous discharge of dumping various domestic wastes in the lake.

Figure 3. Seasonal variations of $\text{pH}$
Dissolved Oxygen

Dissolved oxygen is one of the most important parameters in water quality assessment and reflects the physical and biological process prevailing in the waters. Its presence is essential to maintain the higher forms of biological life in the water; low oxygen in water can kill fish and other organisms present in water. Organisms have specific requirement of oxygen, for example, game fish requires at least 5 mg/l and coarse fish about 2 mg/l of minimum dissolved oxygen in water. Dissolved oxygen in the present study of Nallacheruvu varied from 2.2 to 3.8 mg/l with an average of 3.06±0.56. The depletion of dissolved oxygen may be the result of the high load of organic substances in the inflow from edges of the lake which is using as dumping site. These results are similar to Powai lake of Mumbai J.G.Koliyar and Rokade (2008). The lack of oxygen is a good indicator of the trophic state of the lake overloaded with inorganic and organic matter, transforming it into eutrophic Lake.

![Dissolved Oxygen](image)

**Figure 4. Seasonal variations of Dissolved Oxygen**

Biological Oxygen Demand (BOD)

Biochemical oxygen demand (BOD) is an important parameter of water quality which measures the quantity of oxygen consumption by microorganisms during decomposition of organic matter. On an average basis, the demand for oxygen is proportional to the amount of organic waste to be degraded aerobically. During the study period BOD in the surface water was from 8 to 22 mg/l, with an average of 15.41± 4.71 mg/l. BOD was found maximum in August 2011 and minimum in December 2011. Maximum BOD value of Hussain Sagar was 9 mg/L (Sulekh Chandra et al 2012).
Chemical Oxygen Demand (COD)

Chemical oxygen demand is the measure of oxygen consumed during the oxidation of the oxidizable organic matter by a strong oxidizing agent. Potassium dichromate in the presence of sulphuric acid is generally used as an oxidizing agent in determination of COD.

During the study period COD in the surface water varied from 36 to 82 mg/l, with an average of 50.43±16.42 mg/l. The COD value of Porur lake and Hussain sagar Lake was recorded as 9 mg/L and 32mg/L respectively (Sulekh Chandra et al 2012).

Total alkalinity

Alkalinity of the water is its capacity to neutralize a strong acid and is characterized by the presence of all hydroxyl ions capable of combining with the hydrogen ion. The number of mill equivalents of acid
used in the titration to combine all the hydroxyl ions is called as total alkalinity. Alkalinity in itself is not harmful to human beings. The water supplies with less than 100 mg/L are acceptable for domestic use. Expected total alkalinitities in nature usually range from 20 to 200 mg/L.

The total alkalinity ranged from 545 mg/l to 645 mg/l. The lowest value noted during March 2012 and maximum during August and December of 2010. High alkalinity values are indicative of the eutrophic nature of this Nallacheruvu. Solanki et al (2010) also observed high alkalinity in the eutrophic waters. Higher values of total alkalinity might be due to the presence of excess of CO2 produced as a result of decomposition processes coupled with mixing of sewage and industrial effluents.

![Figure 7. Seasonal variations of Total Alkalinity](image)

**Calcium**

Calcium is one of the most abundant substances of the natural waters. Being present in high quantities in the rocks, it is leached from there to contaminate the water. The quantities in natural waters generally vary from 10 to 100 mg/l depending upon the type of rocks. Calcium as such has no hazardous effects on human health. In fact, it is one of the important nutrients required by the organisms. Calcium content of Nallacheruvu varied from 146 mg/L to 151.33 mg/L, with an average value 147.33 ± 1.96. Similar findings were reported by Verma et al (2012).

![Figure 8. Seasonal variations of Calcium](image)
Magnesium

Magnesium occurs in all kinds of waters with calcium, but its concentration remains generally lower than the calcium. Magnesium is essential for chlorophyll growth and acts as a limiting factor for the growth of phytoplankton. In the present study Magnesium content varied between 29 mg/L and 34 mg/L with an average 32.33±1.74 mg/L. Magnesium is supposed to be non toxic at the concentrations generally met with in natural waters. Desirable limit of magnesium in natural water is 30 mg/L and permissible level is 150 mg/L. Concentrations as high as 500 mg/L impart an unpleasant taste to the water thus rendering it unpalatable.

![Magnesium](image)

Figure 9. Seasonal variations of Magnesium

Chlorides

Excess of chloride in inland water is usually taken as index of pollution. The salts of sodium, potassium and calcium contribute chlorides in water. Large contents of chloride in freshwater is an indicator of pollution (Sulekh Chnadra et al 2012). The chloride content varies from 215 to 242 mg/l with an average 224.50 ±10.19 in the present study. It is evident that the chloride content of Nallacheruvu Lake is too high. It may be due to addition of domestic wastes in large quantities. The chloride concentration depends on the characteristic of the sediment and pollution load. The chloride content of aquatic habitat gives an idea of the organic matter and nitrates present in it.
Phosphates (PO$_4$)

Phosphate is the key nutrient in the productivity of water in reservoir. Average phosphate values are 2.06±0.14mg/L. It was found minimum in December 2010 and maximum in August 2011. The Phosphates showed higher values and there was a definite increase in phosphate concentration in all seasons. Similar findings were reported by Verma et al. 2012. But Solanki et al. 2010 have reported lower values of phosphates in eutrophic Pandu lake, Bodhan.

Nitrates (NO$_3$)

In Nallacheruvu the amount of nitrates recorded varied from 17mg/l to 21 mg/l with an average value 20±2 mg/l. High levels of Nitrate may be due to less amount of dissolved oxygen. The important source of nitrates in the lake is the domestic runoff, decomposition of organic matter and domestic sewage. The values obtained during the present study were enough to cause eutrophication and weed growth.
Nitrites (NO$_2$)

In the present studies nitrites were recorded below detectable limits (BDL). Though the phosphates and nitrates were high the nitrite concentration was within the permissible limit.

Copper

Copper is most toxic to aquatic algae and the algal cells are killed at concentration as low as 0.5 mg/L. Copper levels in the Nalla cheruvu found below detectable limit in all seasons.
In the present study the concentration of Iron was in the range of 0.22 to 0.32 mg/L with an average of 0.26±0.03 mg/L. Maximum concentration of iron was recorded in rainy season. Similar findings were observed by Bhat et al 2012 in Lucknow lakes.

Zinc imparts an undesirable taste to drinking water In the present study the concentration of Zn ranges in between 0.07 mg/L to 0.09mg/L with an average of 0.07mg/L . Zinc concentration was recorded high in winter season of the study period. Higher values for metals may be because of the non point sources of the pollution discharges of surface water. In Hussain sagar lake the concentration of zinc was recorded as 0.41 mg/L (Sulekh Chandra et al 2012).
Cadmium

In surface water and groundwater, cadmium can exist as the hydrated ion or as ionic complexes with other inorganic or organic substances. It is highly toxic to a wide variety of living organism including man. It is considered hazardous to health at concentrations above 0.01 ppm. In the present investigation the concentration of Cadmium metal was <0.01 in all the seasons.

CONCLUSION

The results reveal that nutrient load in the lake is very high and hyper eutrophic conditions are prevailing. The deterioration in the quality of water and rise in nutrient level of Nalla cheruvu is Alarming. The Lake requires regular monitoring and preventive measures.
REFERENCES


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