



Ecological studies on sarooranagar lake with reference to water quality

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Abstract

The present investigation deals with the ecological studies of Sarooranagar lake, Hyderabad. It is one of the prominent lakes that was to provide water for domestic purposes and irrigation of farm lands. The lake is heavily polluted in the recent years with rapid urbanization in the catchment and command areas and also with population explosion. Hence it is very important to assess the degree of pollution and water quality. Comprehensive physico-chemical analysis was carried out by collecting samples from four different sampling stations for a period of one year to determine various physico-chemical parameters for evaluating Water Quality. Chlorides, total hardness, calcium, magnesium, phosphates, sulphates, BOD, total solids and total dissolved solids were recorded in very high concentrations and dissolved oxygen is in very low concentration indicating severe water quality deterioration, high degree of pollution and eutrophication of Sarooranagar lake. Hence, it is unsuitable for drinking, domestic and recreational Purposes.

Keywords: physico-chemical parameters, water quality, eutrophication

Introduction

Fresh water lakes are vital resources for any country. These aquatic ecosystems have very high scientific, economic and cultural significance. Lakes have prominent effect on ground water table and ground water quality (Ravikumar, 2013) [11] along with regulating urban climate. Surface waterbodies like lakes, ponds, streams and rivers are highly polluted by manmade sources such as urbanization, industrialization, improper management of water resources, various human developmental activities and solid waste disposal. This has led to severe water quality deterioration. Eutrophication of inland waters is an outcome of huge population growth, surface run offs, improper agricultural practices and improper agricultural practices (Suresh, 2015) [13]. These reasons can interfere the beneficial characteristics of lakes. The water quality of the lake is highly influenced by physico-chemical parameters besides geological, topographical and various other environmental factors.

Sarooranagar lake is one of the bigger lakes of Hyderabad and lies in the coordinates of 17.35584°N latitude and 78.52714°E longitudes. It is also an urban lake which is under stress. Hence it is important to evaluate its Physico-chemical characteristics which calls for immediate setting up of well-designed environmental monitoring systems.

Materials and Methods

The water samples were collected monthly intervals for a period of one year (September 2019 to August 2021) in Sarooranagar Lake. Water samples from four sampling stations in the Sarooranagar Lake were collected. Station I, II, III and IV are situated near Priyadarshini Park, Pochamma temple, Singareni colony and Green park colony respectively. The samples were analyzed for pH, Temperature, Carbonates, Bicarbonates, Chlorides, Dissolved Oxygen (DO), Biological Oxygen Demand (BOD), Organic matter (OM), Chemical oxygen demand (COD), Total hardness, Calcium, Magnesium, Phosphates, Sulphates, Nitrates, Nitrites, Total solids (TS) and Total dissolved solids (TDS) as per the standard procedures of APHA (2005).

The average values of the important physico-chemical variables of the water body studied along with the standards stipulated by WHO (1971), ISI (1982) and BIS (1998) standards were compared. To define the interrelationships between two or more variables through The Pearson' scorelation matrix was carried out using SPSS 17.0 version.

Results and Discussion

Physico-chemical characteristics of Sarooranagar Lake

The samples were collected and analyzed from the four sampling stations within the Sarooranagar Lake on monthly intervals for a period of one year (September 2019 to August 2021). The average, analytic results of each parameter during the period of investigation are summarized in Table 1.

Table 1: Average values of Physico-chemical parameters All values are expressed in mg/L except pH and Temp (°C)

S. No	Physico-chemical Factors	Station-I	Station-II	Station-III	Station-IV
1.	Temperature	25.6	25.3	25.6	25.7
2.	pH	8.37	8.37	8.37	8.36
3.	Carbonates	22.3	20.8	23.2	18.3
4.	Bicarbonates	738.9	736.7	792.4	758.8
5.	Chlorides	781.1	759.5	756.3	759.8
6.	Dissolved Oxygen	0.6	0.5	0.5	0.3
7.	Biological Oxygen Demand	238.7	192.0	218.3	226.6
8.	Organic Matter	63.7	80.8	88.3	101.6
9.	Chemical Oxygen Demand	141.0	153.8	288.3	343.9
10.	Total Hardness	648.0	602.4	605.5	615.8
11.	Calcium	145.2	154.3	136.9	133.6
12.	Magnesium	51.7	53.2	57.8	60.8
13.	Phosphates	16.9	20.3	20.1	17.8
14.	Sulphates	247.7	257.7	255.7	252.9
15.	Nitrates	16.5	19.8	19.6	17.4
16.	Nitrites	1.07	1.54	1.09	1.43
17.	Total Solids	2814	2715	2755	2804
18.	Total Dissolved Solids	2615	2521	2556	2606

It is evident from the Table.1 that the physico-chemical parameters such as chlorides, total hardness, calcium, magnesium, phosphates, sulphates, BOD, total solids and total dissolved solids were higher than permissible limits and dissolved oxygen is in very low concentration in the lake.

Temperature is one of the significant factors that affect the aquatic environment (Sedamkar and Angadi, 2003)^[12] and can influence on the biological activities and growth. The pH is an important factor for plankton growth (Chisty, 2002)^[6] and also influence survival and nourishment of biological life. The lake represents alkaline nature with the pH 8.37. Alkaline nature of the lakes in India was reported by Altaf H. Ganai (2014)^[2] and Ratna V Airsang (2015)^[10]. The high values of bicarbonates at all stations can be attributed to increase in organic decomposition during which CO₂ is released which reacts to form bicarbonates. Similar observation was made by Airsang (2013)^[1]. Chloride indicates the presence of high organic matter. Higher chloride concentration represents high degree of pollution (Ameetha Sinha, 2014 and John Mohammad, 2015)^[3, 8] and is considered as very important parameter in determination of the water quality. The present investigation revealed very low values of dissolved oxygen and very high values of biological oxygen demand (BOD) were recorded at all stations. Higher BOD values indicate the decomposition and mineralization of organic matter, high nutrient loading and organic pollution. Similar observation was made by Suresh (2015)^[13]. Chemical oxygen demand (COD) is a reliable parameter for judging the extent of pollution in water (Amirkolaie, 2008)^[7]. COD is recorded high. This may be due inflow of inorganic matter from domestic sewage and oxidation of the organic waste by natural microorganisms (Kundur Surender Reddy, 2014). The total hardness (TH) of the lake was very high compared to their permissible limit of BIS (1998). High hardness may be due to addition of sewage contamination or detergents. In the present observation high values of phosphates and sulphates confirms the lake receiving sewage influx (Amin Hossaini, 2013). Total dissolved solids were higher than BIS permissible limits and the major sources of total solids in the water body are domestic sewage, detergents, runoff and may also be attributed to the catchment watershed.

The Physico-chemical parameters exhibited certain interrelationships in Saroornagar Lake. The pH values are directly proportional to carbonates. Free CO₂ is indirectly proportional to pH and carbonates. The present findings clearly indicate inverse relationship of dissolved oxygen with organic matter, BOD and COD. A positive correlation of COD with BOD, OM, phosphates, sulphates, total solids and total dissolved solids was observed in the lake. Total hardness is directly proportional to free CO₂ and magnesium. Phosphates showed positive correlation with COD, sulphates, nitrates and total solids at all stations and they also showed direct relationship with BOD, OM, total hardness and total dissolved solids and exhibited negative correlation with DO.

Sulphates showed significant positive correlation to BOD, COD, phosphates and nitrates in the lake and also maintained negative correlation with DO and nitrites. Nitrates in the lake showed significant positive correlation with BOD, phosphates, sulphates, total solids and total dissolved solids at all stations. They exhibit direct relationship with organic matter at station II and III, COD at station II and IV. Nitrates showed negative correlation with nitrites.

Nitrites showed negative correlation with BOD, OM, COD, phosphates, sulphates, total solids and total dissolved solids at all stations. In the lake total solids and total dissolved solids both showed positive correlation with BOD, COD, phosphates and nitrates at all stations and organic matter at station III and IV. Total solids exhibited direct relationship with chlorides at station II. Total solids and total dissolved solids showed negative correlation with silicates and nitrites.

The average values of the important physico-chemical variables of the water body studied along with the standards stipulated by WHO (1971), ISI (1982) and BIS (1998) standards were compared. From the comparison it is clear that the water of Saroornagar Lake is highly polluted as the physico-chemical parameters such as chlorides, total hardness, calcium, magnesium, phosphates, sulphates, BOD, total solids and total dissolved solids were higher than permissible limits and dissolved oxygen is in very low concentration.

Conclusion

In Saroornagar Lake all the physico-chemical parameters such as chlorides, total hardness, calcium, magnesium, phosphates, sulphates, BOD, total solids and total dissolved solids were higher than permissible limits and dissolved oxygen is in very low concentration compared to the prescribed values by various national and international organizations. Very high average values of physico-chemical parameters and low dissolved oxygen concentration in the lake clearly indicates that the lake water quality is severely deteriorated and representing eutrophic condition. Hence, it is unsuitable for drinking, domestic and recreational Purposes.

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