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Assessment of pollution in Foxsagar Lake, Jeedimetla, Hyderabad Telangana

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ABSTRACT

Fox Sagar Lake, also Jeedimetla Cheruvu or Kotta Cheruvu, is the fifth largest lake,spread over 2 km^2, in Hyderabad, India. The main objective of physico-chemical analysis of water is to determine the pollution of the medium. The present study continued for the period of 1 year (2019-2020) by collecting periodic water samples for the estimation of physico-chemical and biological aspects with reference to the existing social and cultural factors that affect the lake. The activities of man have a profound influence on the degradation of water quality in the lake. The algal communities that are adapted to the hypertrophic conditions are represented by the genera belonging to the classes Cyanophyceae, Chlorophyceae, Euglenophyceae and Bacillariophyceae. The phytoplanktonic diversity and the dominance of blue greens is an indication to organic pollution. Hence on the basis of both physico-chemical and biological parametersthe lake is highly polluted and eutrophic.

Keywords : Fox Sagar Lake, Pollution, Physico-chemical parameters and Algae.

I. INTRODUCTION

Eutrophic lakes, which are relatively shallower, are more productive and are dominated by warm-water fishes such as bass. Natural processes of lake formation most commonly include glacial, volcanic, and tectonic forces while human constructed lakes are created by reservoirs or excavation of basins (Hosmani, 2002). When pollutants enter lakes and other water bodies, they get dissolved or lie suspended in water or get deposited on the bed. The system is able to withstand the pollutants up to a certain threshold, beyond which the quality of the water deteriorates, affecting aquatic ecosystems (Deeksha Dave, 2011). Eutrophication can produce problems such as bad tastes and odours as well as green scum algae. Also, the growth of rooted plants increases, which decreases the amount of oxygen in the deepest waters of the lake. It also leads to the death of all forms of life in the water bodies (Kumar and Rai, 2005).

II. Material and Methods

Fox Sagar Lake, also Jeedimetla Cheruvu or Kotta Cheruvu, is the fifth largest lake, spread over 2 km^2, in Hyderabad, India. It is often visited by bird watchers. The local fisherman rear fish in the lake.The lake is polluted by emissions from an adjoining industrial estate, killing fish and migratory birds.

Water samples were collected in separate 250 ml glass bottles (BOD bottles) for the estimation of dissolved oxygen. All the samples were carried to the laboratory. The samples were analyzed on the same day for different physico-chemical factors following the standard methods (APHA, 1995).

Three sampling stations were selected from the lake and are characterized as follows. Station I is located at the right side of the lake. Station II is situated at the left side of the lake and Station III is located 200 meter after station II.

Surface water samples for phytoplankton were collected from the 3 sampling stations for a period of 1 year from June 2019 to May 2020. One liter of the sample was kept in sedimentation columns after adding 4% Formaldehyde solution. The samples were kept in dark undisturbed for about fifteen days for complete settling of the organisms. Finally the sample was concentrated to 100 ml (Pearsall, 1946 and Venkateswarlu, 1969b).

III. Results and Discussion

The results of various physico - chemical factors were compared with WHO and ISI Standards (Table - 1).

Temperature is one of the most significant factors that affect the aquatic environment (Sedamkar and Angadi, 2003). During the two years of investigation the mean atmospheric temperature was 29^0C in winter, 41^0C in summer. pH is indicative of hydrogen ion concentration and it expresses the intensity of acidity or alkalinity. Carbonates were present in low concentration when compared to bicarbonates. Carbonates were present in low concentration when compared to bicarbonates (Mahananda et al., 2005). Maximum bicarbonates values were recorded at Station-II and minimum at station-I the variation in the concentration probably due to the fluctuations in the inflow of domestic and industrial wastes. In the present study the chloride values were very high indicating high salinity and heavy sewage pollution. In the Fox Sagarlake chlorides were high at all the stations. In the current investigation, the chloride content was high due to discharge of domestic sewage. The similar observation was made by PremalathaVikal and SandyaTyagi (2007).

The dynamics of dissolved oxygen concentration is one of the fundamental and important factors influencing the aquatic environment both chemically and biologically. A high pollution load may also decrease the DO values to a considerable level (Yeole and Patil, 2005). On an average basis, the demand for oxygen is proportional to the amount of organic waste to be degraded by aerobically (Pagriya, 2012). Hence, BOD approximates the amount of oxidizable organic matter present in the solution and its value can be used as a measure of waste strength. The organic carbon in water is composed of a variety of organic compounds in various oxidation states. Oxidizable organic matter is determined as the oxygen consumed by the sample from permanganate and is designated as carbonaceous organic matter. This controls the growth and multiplication of planktonic components to some extent (Murugesan and Sivasubramanian, 2008).

In the present investigation the highest total hardness recorded in summer (322 mg/L) and the lowest values were recorded in winter (309mg/L). In the present study, the accumulation of calcium content was more in Fox Sagarlake. This may be due to discharge of sewage from the city. Though there is no relationship between calcium and magnesium, magnesium showed a direct relation with total hardness.

Sulphur is always present in adequate quantities in water to meet the high requirement for protein synthesis (Sandhya, 2011 and Veerandra et al., 2006). Ecological importance of phosphates is significant due to its role in biological metabolism. Phosphates are the least abundant and usually the first element to limit biological productivity. In the lake, the phosphate values were on higher in winter and monsoon with minimum values during summer. Similar observation was made by Mishra *et al.,* (2008) and Mustapha (2003). Nitrites were observed in traces during the major part of investigation at the lake but exhibited high values on the onset of rain. In the present investigation the determination of nitrates is significant in that it is a measure of the status of eutrophication as it gives the content and availability of decomposable organic matter.

Determination of solids is relevant in the present study in view of their ecological significance in an aquatic ecosystem. Total solids in natural water refer to suspended and dissolved material. The values did not show a definite pattern in their seasonal variation. The maximum monsoon or summer values were followed by minimum winter values. Suspended solids did not show a distinct seasonal variation. The values were higher at station-II compared to station-I and station-III.

In Fox Sagarlake four groups of algae were recorded i.e, Cyanophyceae, Chlorophyceae, Bacillariophyceae and Euglenophyceae. Among the four groups of algae Cyanophyceae dominated over the other groups of algae, followed by Chlorophyceae. The diatoms were represents very less in number (Table - 2). In general the Cyanophyceae constituted the high peaks during summer and diatoms in winter. Chlorophyceaee dominant in early summer.

The Cyanophyceae population has been represented primarily by the species of *Oscillatoria limosa, Merismopedia punctata, Microcystis aeruginosa*, *Chroococcus minutus and Arthrospira platensis.* The abundance of Chlorophyceae is mainly due to the presence of *Chlorella vulgaries, Coelastrum microporum, Scenedesmus acutiformis*, *Eudorina elegans, Chlamydomonas angulosa and Pandorina morum.*

Euglenophyceaewere represented by *Euglena polymorpha, Euglena acus, Euglena oxyuris, Phacus acuminatus, Phacus curvicauda* and *Phacus longicauda.* The presence of these species indicates organic pollution.

Bacillariophyceae is one of the most significant groups. This constitutes *Cyclotella meneghiniana, Navicula rhynchocephala and Nitzschia palea* which are marked as species showing wide range of tolerance to pollution.

IV. Conclusion

The physico - chemical characteristics exhibited certain interrelationships. The pH and carbonates are directly correlated. The pH and carbonates are inversely proportional to bicarbonates. chlorides showed an inverse correlation with carbonates. Dissolved oxygen shows an inverse correlation with organic matter and biological oxygen demand. The total hardness negatively correlated with carbonates. Sulphates and phosphates showed positive correlation with chlorides. Nitrates showed positive correlation with carbonates, bicarbonates, calcium and negatively correlated with total dissolved solids.

The results of various physico - chemical factors were compared with WHO and ISI Standards (Table-1). All the physico - chemical parameters are well above the permissible limits. Hence on the basis of both physico-chemical and biological parameters the lake is polluted. From the foregoing accountit can be concluded that the lake is highly polluted and eutrophic in nature.

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Table-1. COMPARISON OF THE PRESENT DATA WITH ISI AND WHO AND STANDARDS

Parameters	Station-I	Station-II	Station-III	ISI 1991	WHO 1971
pH	8.25	8.20	8.18	6.5 - 8.5	6.5-8.5
CO_3^{2-}	17.30	14.13	12.62	.	.
HCO_3^-	213.14	217.63	216.68	.	.
Cl^-	364.95	375.99	365.72	.	250 mg/L
DO	2.90	3.10	2.95	6 mg/L	3 mg/L
OM	17.00	16.43	18.05	.	.
TH	529.27	530.08	530.94	300 mg/L	300 mg/L
Ca^{2+}	79.15	82.46	82.13	200 mg/L	75 mg/L
Mg^{2+}	67.14	70.78	71.21	75 mg/L	30 mg/L
PO_4^{3-}	3.60	3.10	3.50	.	.
NO_2^-	0.28	0.20	0.25		
NO_3^-	6.80	6.25	4.20	45 mg/L	.
SO_4^{2-}	43.00	38.00	33.00	200 mg/L	150 mg/L
Total Solids	782.66	767.38	771.1		
TDS	425.61	452.38	484.40		
TSS	358 .33	320.00	389.55		

Table – 2. Percentage of Phytoplankton

Groups	Station-I	Station-II	Station-III
Cyanophyceae	79.69	82.07	78.95
Chlorophyceae	11	9.37	11.38
Euglenophyceae	5.72	5.41	6.4
Bacillariophyceae	3.57	3.13	3.27