Assessment of physico-chemical and biological parameters in Fox Sagar Lake, Hyderabad, Telangana

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ABSTRACT

Three sampling stations were selected from the Fox Sagar Lake and are characterized. The water samples from the surface were collected from the three sampling stations every month in polythene cans for a period of 2 years from June 2013 to May 2015. 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. One litre of the sample was kept in sedimentation columns after adding 4% Formaldehyde solution. In Fox Sagar lake 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. 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.

Keywords : Phytoplankton, Physico-Chemical Parameters And Fox Sagar Lake

I. INTRODUCTION

The most important use of water in agriculture is for irrigation, which is a key component to produce enough food. Irrigation takes up to 90% of water withdrawn in some developing countries and significant proportions in more economically developed countries (Prakasam and Joseph, 2000). Water is also used in power generation. When pollutants enter lakes and other water bodies, they get dissolved or lie suspended in water or get deposited on the bed (Premlatha Vikal, 2008). The system is able to withstand the pollutants up to a certain threshold, beyond which the quality of the water deteriorates, affecting aquatic ecosystems.

The microscopic algae in water system greatly affect the chemical components and the nutrient cycles (Rajasegar, 2003). Trophic levels of lakes are characterised by the level of algal production and the types of algal species present (Tiwari and Chauhan, 2006). Generally a high algal production and deoxidation caused by the replacement of Chlorophyceae by Cyanophyceae species indicate the eutrophic nature of waters.

Fox Sagar Lake, also Jeedimetla Cheruvu or Kotta Cheruvu, is the fifth largest lake, spread over 2 km2,in Hyderabad, India. It is located in Jeedimetla near Kompally, Hyderabad. The lake is popular for fishing and a popular spot for picnics. Main objectives are to study the physico-chemical

parameters of the lake and to study the inter relationships of physico-chemical parameters.

II. METHODS AND MATERIAL

Three sampling stations were selected from the Fox sagar 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. This station gets polluted due to anthropogenic activities. Station III is located 200 meter after station II.

The water samples from the surface were collected from the three sampling stations every month in polythene cans for a period of 2 years from June 2013 to May 2015. 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.

Temperature, pH, Carbonates , Bicarbonates, Chloride, Dissolved Oxygen , Biological Oxygen Demand, Chemical Oxygen Demand, Oxidizable Organic Matter, Total Hardness, Calcium, Magnesium, Phosphates, Sulphates, Nitrates, Nitrites, Total Solids, Total Dissolved Solids and Total Suspended Solids (Table:1).

Surface water samples for phytoplankton were collected from the 3 sampling stations. One litre 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

III. RESULTS AND DISCUSSION

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 (Unnisa and Khaliullah, 2004). Nitrates showed positive correlation with carbonates, bicarbonates, calcium and negatively correlated with total dissolved solids (Guru Prasad, 2005).

In Fox Sagar lake 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 (Tables: 2). In general the Cyanophyceae constituted the high peaks during summer and diatoms in winter. Chlorophyceaee dominant in early summer.

Cyanophycean members showed well marked periodicity in the lake and formed the dominant group of the algal members (Pathi and Sahu, 1993). The periodicity of Blue-green algae is accelerated with water temperature is reported by many workers. SwarnaLatha (1990), AppaRao (1992) and Ananthaiah (2010) recorded abundance of Blue-greens during summer months. Cyanophyceae was the dominant group observed higher concentration of chlorides, magnesium, phosphates and total suspended solids contributed to the higher number of Cyanophyceae members.In Fox Sagar summer forms were dominated by the species of *Oscillatoria limosa, Merismopedia punctata, Microcystis aeruginosa, Arthrospira punctata*

Chlorophyceae occupied the second position in the lake. Chlorophycean members continued to be present in the same respect at all the stations throughout the period of investigation. The nitrate influenced the peak of Chlorophyceae members in the lake. This indicates that the nutrient nitrogen is been utilized by the growth of these algae (Gose and Pingale, 2007). A positive trend was observed in the periodicity of Chlorophyceae members and magnesium in the lake. Chlorococcales are represented by the species of *Chlorella vulgaries, Coelastrum microporum, Scenedesmus acutiformis, Scenedesmus armatus, Ankistrodesmus falcatus, Actinastrum hantzschii, Scenedesmus quadricauda.*

Euglenophyceae formed comparatively lower fraction of the phytoplankton in the waters of the present investigation. The species of *Euglena, Phacus, Trachelomonas* were present in the lake. Euglenophyceae was observed to have developed sporadically.

One of the most abundant and diversified groups of algae are diatoms. In the present study the diatoms were recorded very less number. Some diatoms existed throughout the period of investigation while many occurred rarely and were not in abundance, due to high concentration of organic matter. They species of *Cyclotella, Melosira, Nitzschia, Navicula* and *Gomphonema* were present

Temperature, organic matter, phosphates and nitrates are influenced the growth of Cyanophyceae (Hosmani, et al., 1999). Whereas the Chlorophyceae was influenced by temperature and oxygen. Silicates and oxygen are responsible for the growth of diatoms. The euglenophyceae influenced by temperature, organic matter and nitrates.

IV. SUMMARY AND CONCLUSION

The Cyanophyceae has been observed to be the most significant group in the lake with 80%. The Cyanophyceae population has been represented primarily by the species of Oscillatoria limosa, Merismopedia punctata, Microcystis aeruginosa, Chroococcus minutus and Arthrospiraplatensis. Chlorophyceae is observed as a stable community in the lake. They existed throughout the period of study. Chlorophyceae occupied the second position in the lake (11%). The abundance of this class is mainly due to the presence of Chlorella vulgaries, Coelastrum microporum, Scenedesmu sacutiformis, Eudorina elegans,Chlamydomonas angulosa and Pandorina morum.

Euglenophyceae were represented by Euglena polymorpha, Euglena acus, Euglena oxyuris, Phacu sacuminatus, Phacus curvicauda and Phacus longicauda. The presence of these species indicates organic pollution. Bacillariophyceae is one of the most significant group. This constitutes Cyclotella meneghiniana, Navicula rhynchocephala and Nitzschia palea which are marked as species showing wide range of tolerance to pollution.

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 account it 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

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

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