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Original Research Paper

A Study on Eutrophication Level in Hosur Town Lakes

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ABSTRACT

The present concern for eutrophication relates to the rapidly increasing quantities of nitrogen and phosphorus which are otherwise present at fairly low concentrations in unmodified natural waters to limit the algal growth and biomass. In the present study an attempt has been made to measure the level of eutrophication in Hosur town lakes. Three lakes namely Chandrakudi lake, Doddan lake and Kelavarapalli dam were selected for the study. The samples were collected and analysed for soluble orthophosphate, chemical oxygen demand, organic nitrogen, free ammonia, inorganic nitrogen, total phosphorus and dissolved oxygen, etc. The onsite study like transparency, fish kill information and impairment of lakes, etc. was also conducted. The level of eutrophication in the lakes was calculated by using Wetzel's scheme. The results revealed that the eutrophication level in all the three lakes is very high, i.e., hypereutrophic to very eutrophic.

INTRODUCTION

The term eutrophication has been derived from a Greek word eutrophos, meaning corpulent or rich. The use of the term eutrophication in limnology was made for the first time by Naumann (1919) in order to denote nutrient poor (oligotrophic) and nutrient rich (eutrophic) conditions in relation to the development of different algal associations.

The present study area Hosur town is a selection grade Municipality and extends over an area of 11.71 km^2 with a population of 84,314 as per 2001 census. It is located at just 45 km from Bangalore. Hosur has seven tanks, each having an area of 40 ha and above. It also has one reservoir and six irrigation tank canals with a length of 13 km. The Hosur minor basin with an area of 107863.63 feeds the Kelavarapalli reservoir constructed across the Ponnaiyar River. The normal rainfall for Hosur is 822.4 mm with a rainfall of 18.7 mm in the months of January and February, 182.5mm from March to May; 349.8 mm during the southwest monsoon and 271.4 mm during the northeast monsoon. Hosur falls under a heavy rainfall region. In 1971, when the town created SIPCOT, the Tamilnadu Government envisaged developing Hosur into an Industrial satellite town of Bangalore. This idea is a grand success now. The Hosur town has many large industries with 1500 medium and large industries. At present Hosur is facing water scarcity.

The aim of the present study is to investigate the eutrophication levels in some important lakes of Hosur and the same to be brought to the notice of the concerned authority for necessary action.

MATERIALS AND METHODS

Three lakes were selected for the present study and the details are given in the Table 1. The composite samples were collected in 2-litres presterilized polythene containers from each lake and immediately transported to the laboratory for analysis. The samples were preserved and analysed by adopting standard methods (APHA 1985). Wetzel's scheme (Table 2) was used for measurement of eutrophication.

RESULTS AND DISCUSSION

The results of the study are given in Table 3. The eutrophication level in the lakes was calculated by using Wetzel's scheme and the results are shown in Table 4.

Dissolved oxygen: Oxygen is classified as poor soluble, and since it does not react with water chemically, its solubility is directly proportional to partial pressure. The solubility of O_2 varies greatly with temperature. The solubility of atmospheric oxygen in freshwater ranges form 14.6 mg/L at 0°C to about 7 mg/L at 35°C under 1 atm. pressure. The low solubility of oxygen is the major factor that limits the purification of natural water. The principal sources of dissolved oxygen in water are atmospheric diffusion and from the process of photosynthesis. Nevertheless, the total loss of dissolved oxygen is due to decomposition of organic matter, the prevailing range of the temperature and the volume of water body.

In the present investigation, the dissolved oxygen in all the lakes was found to be within the permissible limit of 6.5 mg/L to 8.5 mg/L (Chandrakudi lake 6.89 mg/L, Doddana lake 6.91 mg/L and Kelavarapalli dam 6.78 mg/L). This may be due to algal development and photosynthetic activity in the lakes. A large number of investigators have stressed the importance of dissolved oxygen and the quality of water containing less amount of dissolved oxygen (Deshmukh et al. 1964, Kaul et al. 1980, Croom & Taylor 1988, Swarnalatha & Narasingha Rao 1993).

Chemical oxygen demand: The COD test is helpful in indicating presence of organic substances. In the present investigation the COD value in Chandrakudi lake was 102 mg/L, in Doddana lake 204 mg/L and in Kelavarapalli dam 86 mg/L. The higher value of COD in Doddana lake is mainly due to discharge of domestic wastewater into the lake.

Phosphate: The phosphate determination has grown rapidly in environmental engineering, as engineers have realized the many ways in which phosphorus compounds affect phenomena with which they are concerned. In surface waters, sometimes, the concentration is subjected to variation due to inflow of sewage. The other sources of phosphorus are pollution or soil fertilizers which find their way into the lakes through agricultural runoff that enters into the complicated cycle involving various physical, chemical and biological processes. These processes tend to keep the phosphorus in the lake water either in the soluble or inorganic form.

All surface water supplies support growth of minute aquatic organisms. The planktons are composed of zooplankton and phytoplankton. The latter are predominantly different classes of algae and Cyanobacteria, and since they are chlorophyll bearing organisms, their growth is influenced greatly by the amount of fertilizer elements in the water. Research has shown that nitrogen and phosphorus are both essential for the growth of algae and Cyanobacteria, and that the limitation in amount of these elements is usually the factor that controls their growth. Where nitrogen and phosphorus are plentiful, algal blooms occur producing a variety of nuisance conditions.

In the present study the content of phosphate varied from lake to lake. In the Chandrankudi lake it was 0.154 mg/L, Doddana lake 2.735 mg/L, and in Kelavarapalli dam 1.690 mg/L. A large number of investigators (Verma & Shukla 1968, Kaul et al. 1980, Zutshi & Khan 1988, Prasad 1990) have also observed similar situations in the water bodies. Verduin (1954) is of the opinion that the phosphorus acts as a suboptimum element and occurs at very low concentration in natural surface water bodies. This view was supported by Sreenivasan (1977), Naidu et al. (1990) and Unni (1985), which are of the opinion that the planktonic forms utilize phosphate for their multiplication in contaminated waters. The reasons for higher phosphate content may be attributable to the wastewater from

domestic utilities. Other reason could be the use of phosphate fertilizers in the farming operations carried out in the lake catchment area.

Nitrogen: The compounds of nitrogen are of great interest because of their importance in the life process of all plants and animals. The chemistry of nitrogen is complex because of the several oxidation states that nitrogen assumes and the fact that change in oxidation state can be brought about by living organisms. To add, the oxidation state changes brought by bacteria, can be either positive or negative depending upon the aerobic or anaerobic conditions which prevail.

In the present study the content of ammonical nitrogen and total Kjeldahl nitrogen varies from lake to lake. The ammonical nitrogen and total Kjeldahl nitrogen in Chandrakudi lake are 16.25 mg/L and 17.37 mg/L, Doddan lake 29.69 mg/L and 34.18 mg/L, and Kelavarapalli Dam 22.41 mg/L and 27.45 mg/L respectively. The higher values of ammonical nitrogen and total Kjeldahl nitrogen in all the lakes are due to discharge of domestic sewage and agricultural runoff from the fields. Prasad (1990) is of the opinion that the water body receiving continuous in flow of domestic waste, by and large, show fairly high amount of ammonical nitrogen.

Eutrophication level: In the present study Wetzel's scheme was used to determine the eutrophication level in the Hosur lakes. The study reveals that the eutrophication level in all the three lakes is very high, i.e., hypereutrophic or very eutrophic condition. Eutrophication level in Doddana lake is more comparing to Chandrankudi and Kelavrapalli dam. This is due to Hosur city domestic wastewater entry.

CONCLUSION

Based on the parameters analysis and the results obtained in the present investigation, it may be concluded that the three lakes, Chandrakudi lake, Doddan lake and Kelavarapalli dam are grossly polluted. The Eutrophication level in all the lakes is quite high. This may be due to the entry of sewage from residential layouts of Hosur town, agriculture runoff and seepage of water from the surrounding irrigation activities. Hence, restoration of these lakes is highly essential and appreciated in the present context.

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Table 1. Details of the lakes selected for the study.

S. No.	Name of the lake/dam	Name of the Panchayat	Capacity	Ayacut
1	Chandrambigai Eri	Hosur - PWD	209750 m^3	123.48 hectare
2	Doddana Eri	Hosur	11338 m^3	6.7 hectare
3	Kelevarapalli Dam	Hosur	481 Mcft	1080 acres

Table 2: Trophic classifications of water bodies on the basis of nitrogen and phosphorus in water (Wetzel 1975).

Trophic category	Inorganic-N mg/m^3	Total phosphorus-P mg/m^3
Ultra-oligotrophic	<200	<5
Oligo-mesotrophic	200-400	5-10
Meso-eutrophic	300-650	10-30
Eutrophic	500-1500	30-100
Hyper-eutrophic	> 1500	> 100

Table 3: Water sample analysis results of the lakes.

S. No.	Parameters	Chandrakudi lake	Doddan lake	Kelavarapalli dam
1	Soluble Orthophophate, mg/L	0.095	2.041	1.473
2	Chemical Oxygen Demand, mg/L	102	204	86
3	Organic Nitrogen, mg/L	16.25	29.69	22.41
4	Free Ammonia, mg/L	8.91	16.28	12.29
5	Inorganic Nitrogen, mg/m^3	17370	34180	27450
6	Total Phosphorus, mg/m^3	154	2735	1690
7	Dissolved Oxygen, mg/L	6.89	6.91	6.78
8	Transparency, meters	0.15	0.10	0.35

Table 4: Eutrophication levels of lakes using Wetzel's scheme.

Trophic Category mg/m^3	Inorg-N mg/m^3	Total P Lake	ChandraKudi Lake		Doddana Lake Dam		Kelavarapalli	
			N mg/m^3	P mg/m^3	N mg/m^3	P mg/m^3	N mg/m^3	P mg/m^3
Hypereutrophic	> 1500	> 100	17370	154	34180	2735	27450	1690

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