Limnological Studies of Pedda Cheruvu, With Reference to Water Quality

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Abstract: *The present paper deals with the limnological studies of Pedda Cheruvu with reference to water quality and pollution. For this purpose both chemical and phycological parameters were collected and analyzed. Pedda cheruvu has been lack of an environmental perspective on the part of local authorities. It is located near HMT Nagar Hyderabad, Telangana.*

Water samples from the surface were collected at all the sampling stations at monthly intervals for a period of one year from 2012 to 2013. The samples were analyzed on the same day in the laboratory for different physico-chemical parameters following the standard methods. The water was slightly alkaline and recorded high concentrations of chlorides, organic matter, total hardness, phosphates and sulphates. Four groups of algae were recorded in the lake i.e.Chlorophyceae, Cyanophyceae, Bacillariophyceae and Euglenophyceae. Among them Bacillariophyceae and Chlorophyceae were dominant. Nitzschia .hungarica, Nitzschia palea, Gomphonema sphaerophorum and Cyclotella meneghiniana were dominant and serve as good indicators of pollution in the lake.

Key Words: *Pedda cheruvu, Algae, Physico-chemical parameters, Water Quality.*

1. Introduction

The physico-chemical factors of water are very important to determine the development of algae and to know the strength of the pollution. Water is a wonder of the nature. ''No life without water'' So its quality is likely to change day by day and from source to source. Any change in the natural quality may disturb the equilibrium system and would become unfit for designated uses. The present study focus on physico-chemical and biological assessment of water quality of Pedda cheruvu .Its geographical coordinates are 17° 25' 13 " North, 78° 33' 19 " East, of Ranga Reddy District, Telangana state. Pedda cheruvu has been the lack of an environmental perspective on the part of local authorities. This trend today, is a general phenomenon in most growing metropolises in India. Urban lakes are being increasingly used as urban waste disposal outlets and the Pedda cheruvu is an important example.

2. Material and Methods

PEDDA CHERUVU LAKE: It is located behind the HMT NAGAR at a distance of 4 km from the university college of science, Osmania University. It covers an area of 90 acres and is the largest among the Lakes under investigation. It has a depth of about 4 meters. The catchment area on the north- west side is occupied by rice fields. It receives wastes, invariably during monsoon and winter seasons from industries and surrounding areas. During summer, the water level of the lake drops considerably due to the withdrawal of water for irrigation purpose.

3. Collection of Water Samples

Water samples from the surface were collected at all the sampling stations at monthly intervales for a period of one year from 2012 to 2013. The samples were analyzed on the same day in the laboratory for various physico-chemical parameters following the standard methods (APHA, 1995).

One liter of surface water samples were collected from all the stations of the lake and were kept in the sedimentation column undisturbed for about one month to complete settling of the organisms. Finally, the concentrated material was used for frequency measurement and identification of species. (Pearsall et al., 1946)

4. Results and Discussion

Average values of Physico-chemical parameters are incorporated in Table– 1

The water was alkaline in nature with a pH ranging from 8.1 - 9.2 and temperature was at the range of 24 – 26C0. D.O. was recorded very low concentration throughout the period of investigation.The organic matter ranged between 4 to 12 mg/L.The concentration of BOD values ranged from 40 to 70 mg/L. Calcium concentration between 64.0 to 160.0 mg/L. Magnesium content in the water samples were ranging from 4.9 to 53.5 mg/L. In the present study, chloride concentration was found in the range of 461.5 to 553.8 mg/L. The nitrite content is varied from7.2 to 13.6 mg/L. The sulphate concentration varied between 22.4 and 25.8 mg/L. The phosphate concentration was in between 18 to 23.6 mg/L. The silicate was in between 16.6 to 38.4 mg/L

The water samples are slightly alkaline due to the presence of carbonates and bicarbonates. Dissolved oxygen is important parameter in water quality assessment and reflects the physical and biological processes prevailing in the water. The DO values indicate the degree of pollution in water bodies. DO values varied from 0 to 1.0 mg/l. The high value of BOD indicates the presence of domestic, industrial wastes in huge quantities.The chloride concentration serves as an indicator of pollution by sewage. People accustomed to higher chloride in water or subjected to laxative effects. Sulphates occur naturally in water as a result of leaching from gypsum and other common minerals. Discharge of industrial wastes and domestic sewage tends to increase its concentration. Phosphate may occur as a result of domestic sewage, detergents, and agricultural effluents with fertilizers.

4.1. Phytoplankton

Four different groups of algae were represented. Chlorophyceae, Cyanophyceae, Bacillariophyceae and Euglenophyceae in the lake. Among them Bacillariophyceae and Chlorophyceae were dominant. Bacillariophyceae constituted by the species of Nitzchia and Cyclotella. These species can tolerate wide range of environmental conditions, low D.O high concentrations of organic matter, nitrites and phosphates favour the growth of Nitzchia species. The numbers of individuals are high. High chlorides, organic matter and BOD influencing the growth of Chlorophyceae. The dominant algal species present predominantly are *Ankistrodesmus and Scenedesmus.* They can tolerate high concentration of organic matter, phosphates and chlorides. Euglenophyceaen members tend to grow in small pools or ditches enriched with organic matter and constitute the blooms. These blooms are quite common in some habitats in and around Hyderabad city, (Seenayya, 1971) and Jyoti, 1990). The water temperature around 27°C apparently suited all the members of this group as supported by Seenayya, 1972. High sewage content, low DO, alkaline waters and high carbonates supports the growth of Euglenophyceae members as is found in the present study. The lake in the present study was predominantly occupied by Euglena species. The water was concentrated and had a dirty green appearance. Due to sewage from nearby domestic apartments. Different genera have been found in the lake *Euglena, Trachelomonas and Phacus*. The presence of Euglena species in water bodies indicates organic pollution and tolerates high degree of pollution. *Euglena and Trachelomonas* can be used as bio-indicators of a eutrophic lake, because the lake is highly polluted due to the entry of sewage and industrial effluents constantly.

Blue – green algae serve as indicators of eutrophy of water bodies. Blue green algae flourish well inhabitat rich in organic matter such as polluted lakes, ponds, shallow water bodies, subjected to a high temperatures and bright light conditions (Ananthaiah, 2010). Hence it can exhibit wide range of diversity and can tolerate wide range of temperature (22 -32^{0}C). Satyamohan and Zafar (1986) pointed out that the growth was influenced by variation in organic matter and the blue green algal population increased with an increase in organic matter. The results in the present study are in conformity with their findings. In the present study blue greens constituted the

good number of phytoplankton. They were present throughout the period of investigation. The Blue green algae attained high peaks during summer with Oscillatoria *species*.

5. Assessment of Water Quality

The assessment of water quality is based mainly on both physico-chemical and biological methods. The average values of various physico-chemical factors of Pedda cheruvu Lake and the standards of water quality is given by ISI and WHO are given in table 2. It is evident from the table that the, bicarbonates, chlorides, total hardness, organic matter and biological oxygen demand are exceeding the tolerance limit of ISI and WHO.

The minimum or complete absence of dissolved oxygen and with the entry of huge quantities of domestic sewage and a bad pungent odor is imparted to the water at all the stations. The impact of wastes on the lake is evident not only in the chemistry of the water but in the flora as well. Like the physical and chemical parameters, the biological parameters especially the algae can be used as good indicators in assessing the quality of water. Algae serve as good indicators of water pollution (Manikya Reddy and Vankateswarlu, 1987). In the present study the algae was dominated by Bacillariophyceae, followed by Cyanophyceae, Cholorophyceae, and Euglenophyceae (Table 3). This indicates the existence of dispersed pollution. The presence of many individual species such as *Chlorella vulgaris, Pyrobotyri incurve, Pandorina morum, Euglena acus, E. polymorpha. Phacus onyx, P. curvicauda, Oscilatoria ornata, Microcystis aeruginosa*, indicates the richness of organic matter, sewage and domestic waste in the lake.

The presence of *Nitzschia hungarica, Nitzschia palea, Ni. obtusa, Gomphonema sphaerophorum* ,Cyclotella menegheneana and Gomphonema parvulum indicate the high degree of pollution in the lake and can be used as pollution indicators.

It is evident from the data the complete absence of D.O and the high concentrations of organic matter, chlorides, total hardness,and BOD indicates that the lake is highly polluted due to high quantities of sewage and domestic wastes. Therefore, from the forgoing account it is clear that on the basis of both chemical and biological parameters the lake is highly polluted.

Finally on the basis of physico-chemical and biological parameters the following conclusions were made:

Pedda cheruvu Lake water was alkaline. Bicarbonatcs and chlorides were recorded in high concentrations. DO was absent in most part of the investigation. OM was recorded in high concentration. Among the algae Bacilariophyceae constituted the major group of phytoplankton, followed by Chlorophyceae and Euglenophyceae. In Bacilariophycae, *Gomphonema sphaerophorum, Nitzschia palea, Navicula rhynchocephala and Synedera ulna* and Nitzschia hungarica were dominant. In Chlorophyceae, *Chlorella vulgaris, Ankistrodesmus* falcatus, *Scenedsmus quadricauda* were dominant. In Euglenophyceae. *Euglena acus, Trachelomonas hispida* were present in considerable number.

On the basis of chemical and biological parameters the Pedda cheruvu water is highly polluted. Hence, the Pedda cheruvu water is polluted and not suitable for drinking and aesthetic use.

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TABLE I: Range and Average Values of Physico - Chemical Parameters

	STATION -1		STATION - 2	
	Average	Range	Average	Range
Temperature	25.08	24-26	25.00	24 - 26
pH	8.51	8.1 - 9.2	8.55	8.2 - 8.9
CO3 -	87.01	60 - 120	90.50	59 - 122
HCO3-	1235.61	1067.7 - 1604.8	1336.35	1064.1 -1608.6
Cl	515.34	465.1 - 553.8	505.90	461.5 - 550.3
D.O	0.33	0.1 - 0.5	2.05	0.1 - 4
BOD	50.00	40 - 70	55.00	40 - 70
Organic Mtter	8.00	4.0-12.0	8.05	4.1-12.0
Total Hardness	377.33	360 -398	403.00	356 - 450
Ca2+	104.00	72 - 152	112.00	64 - 160
Mg2+	28.79	4.9 - 46.2	31.06	9.7 - 53.5
PO43-	21.60	18 - 23.6	22.50	21.5-23.5
NO2-	11.10	7.2 - 13.6	10.25	7.2-13.3
SiO2	25.67	20 - 37.2	27.50	16.6 - 38.4
SO42-	24.43	22.4-25.8	24.13	22.6-25.6

TABLE II: Comparison of the Present Data with Isi, Who and Bis Standards

Parameters	STA-1	STA-2	ISI 1982	WHO 1971	BIS
Tempratuer	25.08	25.00			
pH	8.51	8.55	6,5 - 8,5	6,5-8,5	6,5-8,5
CO$_3$ -	87.01	90.50	,	,	
HCO$_3$-	1235.61	1336.35	,	,	
Cl	515.34	505.90	,	250 mg/l	250 mg/l
D.O	0.33	2.05	6 mg/l	3 mg/l	
Organic Mtter	8.00	8.05	,	,	
Total Hardness	377.33	403.00	300 mg/l	300 mg/l	200 mg/l
Ca$_2$+	104.00	112.00	200 mg/l	75 mg/l	75 mg/l
Mg$_2$+	28.79	31.06	100 mg/l	30 mg/l	30 mg/l
PO$_4{}^{3-}$	21.60	22.50	,	,	
NO$_2$	11.10	10.25			
SiO$_2$	25.67	27.50	,	,	45 mg/l
SO$_4{}^{2-}$	24.43	24.13	,	150 mg/l	200 mg/l

TABLE III: Percentage of Phytoplankton

	Station-1	Station-2
CHLOROPHYCEAE	36.03%	8.50%
CYANOPHYCEAE	9.02%	16.85%
BACILLARIOPHYCEAE	42.73%	71.97%
EUGLENOPHYCEAE	12.21%	2.68%