

A STUDY ON THE PHYSICO-CHEMICAL PARAMETERS AND DIVERSITY OF PHYTOPLANKTON IN VELLAYANI LAKE, THIRUVANANTHAPURAM, KERALA, INDIA



Priya Gopinath, T. and Ajit Kumar, K.G*.

Dept. of PG Studies and Research in Botany, Mahatma Gandhi College, Thiruvananthapuram, Kerala.

*Email: ajitanchal@gmail.com

Received on: 10 October 2013, accepted on: 12 December 2013

Abstract: Vellayani Lake is the largest fresh water lake in Thiruvananthapuram district, of Kerala. The lake water is extensively used for drinking and irrigational purposes. The lake is under the threat of pollution, encroachment and sand mining. The present study is aimed to analyse the physico chemical parameters and algal diversity in 8 sites of Vellayani Lake. The phytoplanktons and physico chemical parameters such as PH, temperature, dissolved oxygen, Chemical and Biological Oxygen demand, silicate and phosphate in the water were studied during the pre-monsoon and monsoon period of 2013. Phytoplanktons were collected using plankton net and direct mass collection was employed for larger ones. The specimens were preserved at the site itself and brought to the laboratory and observed under Trinocular Advanced Research microscope. The algal genera were identified referring various monographs and journals. The physico- chemical parameters were analysed according to the guidelines of APHA. Dissolved oxygen, phosphate, silicate were found to be higher in pre monsoon and the Biological oxygen demand was high during the monsoon period. The phytoplanktons showed abundance in the pre- monsoon and had low density during the monsoon. The degree of abundance of phytoplanktons can be shown as follows. Bacillariophyceae> Chlorophyceae> Cyanophyceae> Euglenophyceae. In certain sites the physico- chemical parameters were above the desirable limits and the pollution indicator phytoplanktons like *Closterium*, *Nitzschia*, *Navicula*, *Oscillatoria* were found and hence these sites are in the verge of pollution.

Key words: Plankton net, APHA, Dissolved Oxygen, Closterium, Euglenophyceae, Bacillariophyceae.

INTRODUCTION

Lakes, rivers and reservoirs are the important water resources and used for several purposes. The water quality of all fresh water environments is assessed by the physico- chemical and biological parameters. Much work has been carried out through out Kerala regarding the diversity and water quality of fresh water. The present investigation is focused on the water quality and phytoplankton diversity of Vellayani lake, which is the only fresh water lake in Thiruvananthapuram district, Kerala. The lake is located about 7 km away from Kovalam. The lake water is extensively used for drinking and irrigational purposes. It supports a variety of flora and fauna which begins from microscopic forms to macroscopic ones which have ecological as well as economic significance. Although several ecological studies have been performed in the Vellayani Lake, it is under

constant threat of urbanization and anthropogenic influences. The lake is under the threat of pollution, encroachment and sand mining. Hence a continuous monitoring of the water quality status is essential in order to create awareness about the value and relevance of aquatic bodies.

MATERIALS AND METHODS

Vellayani Lake lies between 8°24'09"-8°26'30" N Latitude and 76°59' 08"- 76°59'47" E Longitude. The lake is bordered by Thiruvallom and Nemom villages of Neyyatinkara Taluk. Major part of the lake is stagnant but a small portion flows to Karamana River. It is the main source of water supply to four nearby panchayats. Water samples were collected from 8 sites of Vellayani Lake during the pre-monsoon and monsoon period of 2013. The collected samples were brought to

the laboratory for the analysis of various physico chemical parameters like pH, temperature, TDS, Conductivity, dissolved oxygen, Biological Oxygen Demand, alkalinity, silicate and phosphate in the water. The pH was determined electrometrically using digital pH meter, TDS and Conductivity by TDS – Conductivity meter. Alkalinity, silicate, phosphate, etc were determined by the method suggested by APHA. Estimation of Sodium and Potassium were done by Flame photometric method. Phytoplanktons were collected using plankton net and direct mass collection was employed for larger ones. The specimens were preserved at the site itself using 4% Formaline and brought to the laboratory and observed under advanced Research microscope. The algal genera were identified referring various monographs (Prescott, 1978; Anand, 1980) and journals.

RESULTS AND DISCUSSION

The results on the variation of, DO, BOD, silicate, phosphate, sodium and potassium are reported in the figures.

pH- is one of the most important single factor which influences aquatic production. In the present study pH value remains alkaline throughout the study period and it ranged from 6.5 to 7.9. pH is an important parameter in water body since most of the aquatic organisms are adapted to an average pH and do not withstand abrupt changes (Mini *et al.*, 2003).

TDS and Conductivity- Total Dissolved Solids shows an average value of about 85 mmho where as the conductivity was about 143 mmho. According to Trivedy *et al.* (1989) the variation in the conductivity values seasonally is mostly due to increased concentration of salts because of evaporation; the dilution resulted from precipitation brings down its values.

Dissolved Oxygen- A fair amount of dissolved oxygen is always essential to support aquatic life. In Vellayani Lake, the amount of dissolved oxygen recorded ranges from 4.05 mg/l to 15.2 mg/l. the maximum value of DO was recorded during monsoon and minimum value was recorded in the pre- monsoon period. The low dissolved oxygen value may be due to higher water temperature (Singh *et al.*, 1991).

Biochemical Oxygen Demand- BOD refers to the amount of oxygen used by the microbes in the aerobic oxidation of organic matter. The BOD recorded in the present study ranges from 0.5 mg/l to 30 mg/l. (Fig. 1)

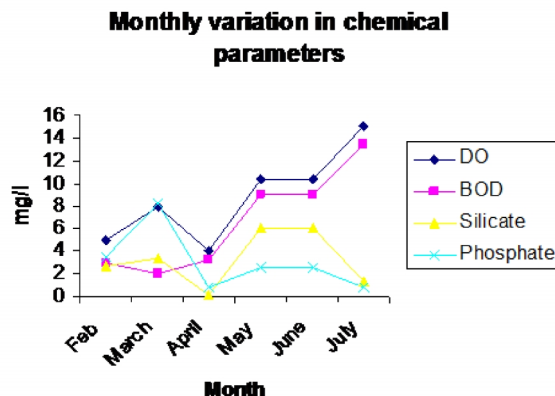


Fig. 1. Monthly variations in chemical parameters

Sodium and Potassium- During the study period, the concentration of sodium ranged from 4 ppm to 10 ppm. The maximum amount of sodium was observed in the pre-monsoon months and it may be due to shrinkage of water volume in those months (Solanki, 2001). The amount of potassium recorded in the lake ranged between 2 ppm-11 ppm.

Phosphate - The major sources of phosphate in the lake are domestic sewage, agricultural effluents etc. Hastler (1947) observed that constant addition of phosphorus to aquatic environment could greatly stimulate algal growth. During the study period, the concentration of phosphate does not showed

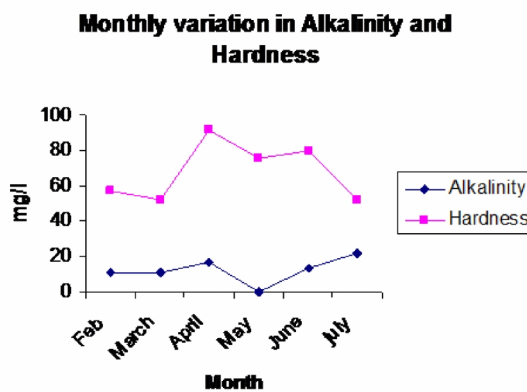


Fig. 2. Monthly variations in Alkalinity and Hardness

Table 1. Phytoplankton genera recorded during the study period

Chlorophyceae	Cyanophyceae	Bacillariophyceae	Euglenophyceae	Chrysophyceae
<i>Ankistrodesmus</i>	<i>Anabaena</i>	<i>Aulacoseira</i>	<i>Euglena</i>	<i>Chrysococcus</i>
<i>Botryococcus</i>	<i>Arthrospira</i>	<i>Eunotia</i>	<i>Phacus</i>	
<i>Cosmarium</i>	<i>Cylindrospermum</i>	<i>Fragillaria</i>	<i>Trachelomonas</i>	
<i>Closterium</i>	<i>Merismopedia</i>	<i>Gyrosigma</i>		
<i>Pediastrum</i>	<i>Oscillatoria</i>	<i>Hyalodiscus</i>		
<i>Protococcus</i>	<i>Synechococcus</i>	<i>Lyngbya</i>		
<i>Scenedesmus</i>		<i>Navicula</i>		
<i>Schroederia</i>		<i>Nitzschia</i>		
<i>Staurastrum</i>		<i>Pinnularia</i>		
<i>Stauroneis</i>		<i>Pleurosigma</i>		
<i>Tetraedron</i>		<i>Rhizosolenia</i>		
		<i>Synedra</i>		
		<i>Gomphonema</i>		
		<i>Melosira</i>		
		<i>Cyclotella</i>		
		<i>Cymbella</i>		

marked difference although low values were observed during the rainy period.

Silicate- Concentration of silicate in the water ranged from 0.2 mg/l to a maximum of 6 mg/l. The decreased amount of silicate may occur when there is an abundance of diatoms.

Alkalinity- It is a measure of buffering capacity of water and is important for aquatic life in a fresh water system because it equilibrate the pH ranges that occur as a result of photosynthetic activity of plants in water (Kaushik and Saxena, 1999). In the present study, the value of alkalinity ranges from 4 mg/l to 20 mg/l. (Fig. 2)

Hardness- Hardness of water is mainly due to the presence of calcium and magnesium ions and is an important indicator of toxic effect of poisonous elements present in water (Tiwari, 2001). Total hardness of the lake, during the study period ranges from maximum of 92mg/l to minimum of 48 mg/l (Fig. 2). High values of hardness may be probably due to regular addition of sewage and detergents to the lake from nearby residential areas (Kaur *et al.*, 1996).

Diversity of Phytoplanktons- Detailed microscopic examination of phytoplanktons revealed five families consisting of 37 genera (Table 1)

CONCLUSIONS

The present study on the physic- chemical parameters and phytoplanktons revealed that in certain sites the physico- chemical parameters were above the desirable limits and the pollution indicator phytoplanktons like Closterium, Nitzschia, Oscillatoria were found and so these sites are in the verge of pollution. The water is getting polluted mainly by the domestic wastes and plastic bottles dumped in certain stations of the lake. Vellayani lake is a major source of water for the local people there and also to the Karamana river, hence the lake has to be conserved and protected from further pollution.

ACKNOWLEDGEMENTS

I express my gratitude to Kerala State Council for Science Technology and Environment (KSCSTE) for their financial support.

REFERENCES

- Anand, N. 1998. *Indian fresh water Microalgae*. Bishen Singhmahendra pal Singh. Dehra Dun, India. 1-94
- APHA. 1998. *Standard method for examination of water and waste water*, 19th Ed.. New York; American Public Health Association, inc.
- Arthur D. Hastler. 1947. Eutrophication of lakes by domestic drainage. *Ecology*, 28(4): 383-395.

- Kaur, H., Dhillon, S.S, Bath, K.S and Munder, G. 1996. Abiotic and biotic components of fresh water pond in Patiala (Punjab). *Poll. Res.* 15(3): 253-256.
- Kaushik, S. And Saxena, D.N. 1999. Physico – chemical limnology of certain water bodies of central India. In, K Vismayan edited Fresh Water Ecosystem in India. Daya Publishing House, Delhi., 336
- Mini, I., Radhika, C.G and Ganga Devi, J. 2003. Hydrological studies on a lotic ecosystem, Vamanapuram river, Thiruvananthapuram, Kerala, South India. *Pollution Research* 22(4): 617-626.
- Singh, R.R., Chauhan, B.S, Devendra Swaroop and Yadav, Y.S. 2000. Seasonal variation in ground water quality of Agra city. *Indian journal. Environ. Hlth* V., 42(2): 59-69.
- Solanki, H.A. 2001. *Study on pollution of soils and water reservoirs near industrial areas of Baroda*. Ph.D thesis submitted to Bhavanagar University, Bhavanagar.
- Tiwari, D.R. 2001. Hydrogeochemistry of underground water in and around Chatarpur city. *Indian journal. Environ. Hlth*, 43: 4-176.
- Trivedy, R.K. Goel, P.K., Shrotri, A.C., Ghadge, M.R. and Khatavkar, S.D. 1989. Quality of lentic water, water resources in south western Maharashtra, India. In: Khulke, R.D. (Ed.), *Perspectives in Aquatic Biology*, Payrus Pub. House, New Delhi, 215-235