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STUDIES ON ORGANIC POLLUTION BASED ON PHYSICO-CHEMICAL AND PHYCOLOGICAL CHARACTERISTICS OF SOME TEMPLE PONDS OF ERNAKULAM, KERALA, INDIA

L. Jose, Sanjo Cine Mathew and Sreekumar S. Menon
Department of Botany, St. Albert's College, Ernakulam, Kochi-682 018, Kerala

ABSTRACT

The present study is an attempt to evaluate the physico-chemical parameters and phytoplankton distribution of some temple ponds of Ernakulam. Phytoplankton belonging to Cyanophyceae, Chlorophyceae, Euglenophyceae and Bacillariophyceae were studied. Fifty percent of the ponds showed *Microcystis aeruginosa* bloom. Among the ponds studied thirty percent of the ponds showed lack of organic pollution, forty percent moderate pollution, twenty percent probable high organic pollution, and ten percent confirmed high organic pollution. The physico-chemical analysis data supported the organic pollution level.

INTRODUCTION

Degradation of natural resources is a matter of grave concern for all living forms. Due to urbanization and consequent landfilling, many of the natural water bodies are lost. The surviving ones are facing the problem of pollution due to anthropogenic activities. Kerala is blessed with many ponds and natural lakes. There are only few studies conducted on the quality of freshwater bodies in Kerala (Jose & Sreekumar 2005, 2006). In the present study the phycological and physico-chemical studies to evaluate level of organic pollution of ten temple ponds in Ernakulam district have been carried out.

MATERIALS AND METHODS

The present study was carried out in ten temple ponds in and around Ernakulam city. These ponds are as follows.

1. Bagavathy Temple pond, Chottanikkara
2. Poornathrayeesa Temple pond, Tripunithura
3. Chakkamkulangara Siva Teftiple pond, Tripunithura
4. Adampillikavu Bagavathi Temple pond, Tripunithura
5. Sri Marattil Kottaram Bagavathy Temple pond, Maradu
6. Ponnethu Kavu Temple pond, Kadavanthara
7. Sri Subramanian Temple pond, Vyttila
8. Sri Narayaneswaram Temple pond, Ponnurunni
9. Siva Temple pond, Ernakulam
10. Kuthappadi Temple pond, Thammanam

Collections were made from December 2005 to January 2006. The samples were collected in one-litre plastic bottles. Algal samples were preserved with 4% formaldehyde. Algae were identified using standard monographs. Analysis of water was carried out following APHA (1975). Palmer's pollution index (Palmer 1969) was employed to find out level of organic pollution in these ponds.

RESULTS

The present study in the ten ponds showed different phytoplankton communities which were dominated by thirty different algal species. The distribution of phytoplankton in ponds is summarized in Table 1.

Among the algal species found six belonged to Cyanophyceae, 16 to Chlorophyceae, three to Euglenophyceae, and five to Bacillariophyceae. The Genus *Nitzschia* was dominant in sixty percent of the ponds and *Microcystis* and *Ankistrodesmus* dominated in 50 percent of the ponds. Algal blooms were observed in some of the ponds. Among them Sri Marattil Kottaram Bagavathy temple pond showed *Merismopedia* bloom. Ernakulam temple pond showed *Microcystis aeruginosa* bloom. Kuthappadi temple pond showed *Spirulina* bloom. Eighty percent of the ponds showed presence of *Scenedesmus.* The physico-chemical analysis data are summarized in Table 2.

The nutrient concentration of the ponds is generally low, may be due to dilution caused by frequent rains. The concentration of phosphate was not in the detectable level in about 90% of the ponds.

The Palmer's Algal Generic organic pollution index is applied to all the ponds and the results are given in Table 3.

Table 1: Distribution of phytoplankton in the 10 temple ponds (Nos. given to ponds as per Materials and Methods).

Algal genera	1	2	3	4	5	6	7	8	9	10
Chroococcus					+	+				
Merismopedia		+			+	+				
Microcystis			+		+	+			+	+
Spirulina							+		+	
Oscillatoria		+		+			+		+	
Anabaena									+	
Chlamydomonas	+									
Oocystis			+						+	
Ankistrodesmus			+			+		+	+	+
Coelastrum	+	+	+					+	+	
Crucigenia			+						+	
Dictyosphaerium			+			+			+	
Kirchneriella		+	+						+	
Pediastrum	+		+						+	
Tetrahedron				+				+		
Tetrastrum									+	
Scenedesmus	+	+	+			+	+	+	+	
Closterium		+	+					+	+	
Cosmarium		+		+				+	+	
Straustrum	+	+		+				+	+	
Desmidium				+						
Stigeoclonium	+									
Euglena	+			+					+	
Phacus									+	
Trachelomonas									+	
Cyclotella							+			
Melosira	+		+			+			+	
Navicula							+			
Nitzschia		+		+			+	+	+	+
Pinnularia		+								

Table 2: Physico-chemical characteristics of the ten ponds.

Parameters	1	2	3	4	5	6	7	8	9	10
Temperature°C	20	35	36	35	30	34	35	30	35	35
pH	6	6.5	6.8	6.5	6.5	7.2	6.8	6.7	7.7	6.5
Total alkalinity, mg/L	150	100	150	200	4	120	50	150	40	160
Free CO_2, mg/L	8.8	4.4	8.8	13.2	0	4.4	26.4	13.2	8.8	8.8
Dissolved oxygen, mg/L	12.8	6	4	4	4	4.4	2.8	2.4	2	2.4
Nitrate, mg/L	0.24	0.37	0.24	0.49	0.74	0.74	0.61	0.61	1.24	0.61
Sulphate, mg/L	0.1	0.2	0.2	0.2	0.1	0.3	0.8	0.2	0.2	0.3
Phosphate, mg/L	0.9	0	0	0	0	0	0	0	0	0
Chloride, mg/L	56.8	42.2	21.3	14.2	8.5	21.3	41	14.2	5.7	15.6
Hardness, mg/L	124	90	80	150	20	130	50	138	10	146

Table 3: Palmer's generic pollution index values in the ten ponds.

Algal genera	Index values of genera	1	2	3	4	5	6	7	8	9	10
Anacystis	1			1		1	1			1	1
Oscillatoria	4		4		4			4		4	
Phormidium	1										
Chlamydomonas	4	4									
Pandorina	1										
Scenedesmus	4	4	4	4			4	4	4	4	4
Micractinium	1										
Ankistrodesmus	2			2			2		2	2	2
Chlorella	3										
Closterium	1		1		1				1	1	
Stigeoclonium	2	2									
Cyclotella	1							1			
Melosira	1	1		1			1			1	
Gomphonema	1										
Navicula	3							3			
Nitzschia	3		3		3			3	3	3	3
Synedra	2										
Euglena	5	5			5					5	
Phacus	2									2	
Lepocinclis	1										
Total		16	12	8	13	1	8	15	10	23	10

The maximum index was observed in the Siva Temple pond, Ernakulam with an index value of 23. Three ponds showed absence of organic pollution, five showed moderate organic pollution, one showed probable high organic pollution, and one showed confirmed high organic pollution.

DISCUSSION

The ecology of freshwater bodies is mainly controlled by the phytoplankton and physico-chemical characteristics. The type of algal community shows the trophic status of the waterbodies. Freshwater bodies like the temple ponds are constantly posed to the threat of pollution due to anthropogenic activities like bathing and washing, which result in uploading of certain nutrients like nitrates and phosphates. The organic pollution levels are usually exhibited by the presence of certain algal

communities as established by Palmer (1969), Hosmani & Bharati (1980) and Jose & Sreekumar (2006). Algal communities represented by *Anacystis (Microcystis), Oscillatoria, Scenedesmus, Ankistrodesmus, Melosira, Nitzschia* and *Euglena* dominated the pond flora. The occurrence of some desmids like *Closterium, Cosmarium, Staurastrum* and *Desmidium* in some of the ponds represents better quality of water in these ponds as the absence of desmids is often considered as an indication of eutrophication as observed by Munawar (1970). About 50 percent of the ponds studied showed presence *of Anacystis (Microcystis)* in these ponds which indicate the eutrophicated nature of the ponds. The maximum phytoplankton population was found in the ninth pond which also showed the high concentration of nitrates. Probably the high concentration of nitrates favoured the growth of phytoplankton. The absence of phosphates in detectable amounts in most of the ponds is a notable feature. This might be due to utilization of phosphates by the phytoplankton. It can be inferred that phosphates are limiting nutrient in all the ponds studied.

According to Jose & Sreekumar (2006), the biological indices offer a cheap, fast and effective means of finding the pollution status of waters. By employing Palmer's algal pollution index, it was found that about 10 percent of the ponds have confirmed high organic pollution and another ten-showed probable high organic pollution. Fifty percent of the ponds showed moderate organic pollution and thirty percent showed lack of organic pollution. As a result of the present study, it has been concluded that the water in majority of the temple ponds is in potential danger of becoming more polluted due to anthropogenic activities.

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