



Evaluation of Pollution by Palmer's Algal Pollution Index and Physico-Chemical Analysis of Water in Four Temple Ponds of Mattancherry, Ernakulam, Kerala

L. Jose and Chethan Kumar

Department of Botany, St. Albert's College, Ernakulam, Cochin-682 018, Kerala, India

Nat. Env. & Poll. Tech.
Website: www.neptjournal.com

Received: 5/10/2010

Accepted: 30/12/2010

Key Words:

Palmer's algal index
Temple ponds
Organic pollution

ABSTRACT

The present study has been made to evaluate the organic pollution level of four temple ponds of Mattancherry Taluk in Ernakulam district. The Palmer's algal index showed that all the four ponds have high organic pollution. Algae found in the ponds belonged to Chlorophyceae, Cyanophyceae, Euglenophyceae and Bacillariophyceae. A toxic bloom forming algae *Microcystis aeruginosa* was observed in three ponds. The physico-chemical analysis data supported the Palmer's organic pollution index.

INTRODUCTION

Kerala is a state blessed with a large number of freshwater resources, which serve as source of water for drinking and recreational purposes. Many of the freshwater resources are currently under threat due to human interference. The main reasons for this include urbanization and industrialization. Land filling is yet another problem leading to destruction or impairment of traditional ponds. In India many studies have been carried out in lotic and lentic systems, but significant study has not been carried out in the ponds of Kerala except a few studies by Jose & Sreekumar (2005, 2006), Jose et al. (2008). The present study is an attempt to evaluate the pollution by using biological and chemical methods.

MATERIALS AND METHODS

The present study was carried out in four temple ponds located in Mattancherry Taluk of Ernakulam district. These ponds are Dharma Sastha temple pond, Anavathil temple pond, Tirumal Devaswom temple pond and Janardhana temple pond.

Studies were carried out from February 2006 to January 2007. For qualitative estimation, a portion of samples was preserved in 4% formalin and later observed under a light microscope. The algae were identified with the help of relevant monographs, books and research publications. Physico-chemical analysis of water was carried out by standard methods (APHA 1975). For rating the water sample as high or low organically polluted the Algal Generic Pollution Index of Palmer (1969) was employed.

RESULTS AND DISCUSSION

In the present study the algal flora was represented by

members of four groups viz, Cyanophyceae, Chlorophyceae, Euglenophyceae and Bacillariophyceae. The distribution pattern of phytoplankton in different ponds is summarized in Table 1.

Thirty one algal genera represented the flora. Among them 8 belonged to Cyanophyceae, 14 to Chlorophyceae, 2 to Euglenophyceae and 7 to Bacillariophyceae. The Chlorococcales like *Ankistrodesmus*, *Dictyosphaerium* and *Scenedesmus* were well distributed in all the ponds studied. Cyanophyceae members present in all the four ponds include *Chroococcus* and *Oscillatoria*.

The Palmer's Algal Pollution Index is employed in all the ponds and the results are given in Table 2. All the ponds showed probable high organic pollution

The physico-chemical analysis of the four ponds is given in Table 3, which represents the average value of various parameters during the year. From the study, it was observed that the concentration of nitrates and phosphates are considerably high. The freshwater bodies receive a load of nutrients from surrounding lands as well as from anthropogenic activities, bathing and washing. Sometimes, human and cattle excrement also play a significant role in increasing the nutrient concentration of these water bodies which in turn manifest in the phenomenon like eutrophication. Algae, being a primary inhabitant of water, play a significant role in the ecology of these water bodies. Algal communities dominated by *Chroococcus*, *Microcystis*, *Ankistrodesmus*, *Dictyosphaerium*, *Pediastrum*, *Scenedesmus*, *Trachelomonas*, *Melosira* and *Nitzschia* were found in the ponds. Their presence is an indication of organic pollution of the water as established by Palmer (1969), Robert et al. (1974) and Hosmani & Bharati (1980). The genus, *Scenedesmus* is

Table 1: Algal distribution in four ponds.

Algal Genera	Pond 1	Pond 2	Pond 3	Pond 4
<i>Anabaena</i>	+	+	-	-
<i>Anabaenopsis</i>	-	+	+	-
<i>Chrococcus</i>	+	+	+	+
<i>Merimospedia</i>	+	+	+	-
<i>Microcystis</i>	+	+	+	-
<i>Oscillatoria</i>	+	+	+	+
<i>Phormidium</i>	+	+	-	-
<i>Raphidiopsis</i>	+	-	-	-
<i>Chlamydomonas</i>	+	+	-	-
<i>Pandorina</i>	+	-	-	-
<i>Ankistrodesmus</i>	+	+	+	+
<i>Coelastrum</i>	+	+	-	+
<i>Crucigenia</i>	+	+	-	+
<i>Cosmarium</i>	-	+	-	-
<i>Dictyosphaerium</i>	+	+	-	-
<i>Dimorphococcus</i>	-	-	-	+
<i>Scenedesmus</i>	+	+	+	+
<i>Tetrastrum</i>	+	-	-	-
<i>Tetraedron</i>	+	+	-	+
<i>Pediastrum</i>	+	+	+	+
<i>Oedogonium</i>	-	-	-	+
<i>Staurastrum</i>	-	+	-	-
<i>Trachelomonas</i>	+	+	-	-
<i>Euglena</i>	-	+	+	-
<i>Achmanthes</i>	+	-	-	-
<i>Cyclotella</i>	+	+	-	+
<i>Cymbella</i>	+	+	-	-
<i>Melosira</i>	+	+	-	+
<i>Nitzschia</i>	+	+	+	+
<i>Synedra</i>	+	-	-	-
<i>Pinnularia</i>	-	+	-	+

present in all the ponds, its occurrence in polluted water, especially in eutrophicated water, is established by Tripathi et al. (1987). Palmer (1969) also gave a high ranking for this genus. *Microcystis* (*Anacystis*) was considered by Singh (1973) as the best single indicator of pollution. All the ponds except the fourth pond showed the presence of *Microcystis* indicating the deteriorated quality of water.

All the ponds showed probable high level of organic pollution according to the Palmer's index. This is substantiated by the physico-chemical analysis of the water, which showed moderate levels of pollution. The study concludes that the traditional water bodies in the study sites are in potential danger of being polluted by human activity.

REFERENCES

- APHA 1985. Standard Methods for the Examination of Water and Wastewater. 16th Ed., American Public Health Association, Washington, D.C.
- Hosmani, S.P. and Bharati, S.G. 1980. Algae as indicators of organic pollution. *Phykos*, 19(1): 23-26.
- Jose, L. and Sreekumar, S. Menon 2005. A study on phytoplankton constitution and organic pollution in some rural and temple ponds of

Table 2: Palmer's algal pollution index values in four ponds.

Algal genera	Index value	Pond 1	Pond 2	Pond 3	Pond 4
<i>Anacystis</i>	1	1	1	1	-
<i>Oscillatoria</i>	4	4	4	4	4
<i>Phormidium</i>	1	-	1	-	-
<i>Chlamydomonas</i>	4	-	-	-	-
<i>Pandorina</i>	1	1	-	-	-
<i>Scenedesmus</i>	4	4	4	4	4
<i>Micratinium</i>	1	-	-	-	-
<i>Ankistrodesmus</i>	2	-	2	2	2
<i>Chlorella</i>	3	-	-	-	-
<i>Closterium</i>	1	-	-	-	-
<i>Stigeoclonium</i>	2	-	-	-	2
<i>Cyclotella</i>	1	1	1	-	1
<i>Melosira</i>	1	1	1	-	-
<i>Gomphonema</i>	1	-	-	-	-
<i>Navicula</i>	3	-	-	-	-
<i>Nitzschia</i>	3	3	-	3	3
<i>Synedra</i>	2	-	-	5	-
<i>Euglena</i>	5	-	5	-	-
<i>Phacus</i>	2	-	-	-	-
<i>Lepocinclis</i>	1	-	-	-	-
Total		15	19	19	16

According to Palmer's Algal Pollution Index values between 0-10 indicate lack of organic pollution, 10-15 moderate pollution, 15-20 probable high organic pollution and 20 and above as confirmed high organic pollution.

Table 3: Physico-chemical analysis of waters.

Parameters	Pond 1	Pond 2	Pond 3	Pond 4
Temperature, °C	29.5	29.6	29.8	29.7
pH	7.2	7.5	7.3	7.7
Dissolved Oxygen, mg/L	5.3	5	4.8	4.4
Nitrate, mg/L	0.8	0.75	0.66	0.74
Phosphate, mg/L	0.3	0.4	0.32	0.4
Sulphate, mg/L	0.5	0.5	0.46	0.9
Hardness, mg/L	37	37.6	44	45
Chloride, mg/L	23	40.6	33.3	25.3

- Ernakulam. *STARS Int. Journal*, 6(2): 36-39.
- Jose, L. and Sreekumar, S. Menon 2006. A study in organic pollution based on algal distribution in some rural and temple ponds of Ernakulam, Kerala, India. *Nature Environment and Pollution Technology* 5(2): 283-286.
- Jose, L., Sanjo Cine Mathew and Sreekumar, S. Menon 2008. Studies on organic pollution based on physicochemical and phycolgical characteristics of some temple ponds of Ernakulam, Kerala, India. *Nature Environment and Pollution Technology* 7(1): 97-100.
- Palmer, C.M. 1969. A composite rating of algae tolerating organic pollution. *J. Phycol.*, 5: 78-82.
- Robert, D.S., Robert, W.H. and Everett, L.G. 1974. Phytoplankton distribution and water quality indices for Lake Mead (Colorado River). *J. Phycol.*, 10: 323-331.
- Singh, R.N. 1973. Limnological relations of Indian land waters with special reference to water blooms. *Verh. Int. Verein. Theor. Anen. Limnol.*, 12: 831-836.
- Tripathi, A.K., Pandey, S.N. and Tiwari, R.K. 1987. Eutrophication study of Kalyanpur Pond, India. *Proc. Nat. Acad. Sci. India*, 57(B): 111.