

Limnological features of Thirumullavaram temple pond of Kollam municipality, Kerala

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Abstract: Thirumullavaram temple pond associated with Sree Mahavishnu temple is located very close to the Arabian sea in Kollam municipality of Kerala. Physicochemical characteristics of water and sediment, productivity, plankton count, coliform count and correlation coefficients of various parameters were analysed for a period of one year from June 1999 to May 2000. It showed that the water characteristics such as conductivity, turbidity, colour, pH, total alkalinity, chloride, total hardness, silicate, phosphate, nitrate, iron, sodium and potassium; primary productivity, plankton count, and sediment characteristics such as pH, organic matter, potassium and nitrate registered higher values during non-rainy season. Coliform count recorded higher value during monsoon season. From the correlation study, it was inferred that several characteristics of water, sediment and primary productivity were interrelated. Comparison of water characteristics with BIS for drinking and swimming water showed that the pond water was mainly contaminated with coliform bacteria. However, the physico-chemical characteristics indicated that it could be used as a potential water source for drinking, swimming and for secondary production after proper treatment.

Key words: Limnology, Temple pond, Kerala.

Introduction

Temples are centers of worship for Hindus and Sikhs. Hindu temples in Kerala and other states of India have in their vicinity certain ponds which are holy and called temple ponds. Ponds are found inside the temples or outside the temples. Temple management imposes restrictions over misuse of these holy ponds, therefore they remain comparatively clean. Temple devotees use the holy water for washing their limbs, sometimes they make a holy dip into the water, people believe that it can wash all their sins away. However, temple ponds located outside temples are used by people for bathing and even washing cloths. Literature review showed that only a few studies (Anithakumari and Aziz, 1989; Maya *et al.*, 2000, 2001; Prameela *et al.*, 2001; Maya, 2002) are available on temple ponds of Kerala. Limnological features of one such temple pond, the Thirumullavaram pond, were undertaken in the present study.

Materials and Methods

Thirumullavaram temple pond is located outside the Sree Mahavishnu temple near the Arabian sea in Manayilkulangara ward of Kollam municipality. This pond has a retaining wall and a compound wall above the ground. The pond has an area of 3360 m² and depth of 190 cm as on September 1999. There are three bathing ghats. The pond is used for washing and bathing by temple devotees and local community.

Water and sediment samples were collected fortnightly from the pond during June 1999 to May 2000 and analysed for various physico-chemical characteristics of water following Trivedy and Goel (1984), APHA (1985) and Adoni (1985). Sediment characteristics were analysed following Krumbein and Pettijohn (1938) and Piper (1950). Primary

productivity was measured using dark and light bottle method (Michael, 1969) and plankton analysis was carried out by drop count method (Adoni, 1985). Coliform counts were made using tests mentioned in Mackie and McCartney (1996). Fortnightly data obtained were compiled to get the seasonal and annual mean, standard deviation, correlation (r) and significance of 'r' (Gupta, 2000).

Results and Discussion

Table 1 shows the seasonal and annual mean \pm S.D of water and sediment characteristics, primary productivity, plankton and coliform count of Thirumullavaram temple pond during June 1999 to May 2000. pH of both water (8.24 ± 0.54) and sediment (7.75 ± 0.53) remained on the alkaline side. The pond also recorded higher phytoplankton count (117904 ± 94717). Nandan and Patel (1992); Verma and Mohanty (1995); Dwivedi and Pandey (2002); Puttaiah (2002); Sedamkar and Angadi (2002) opined that higher pH value promoted the growth of phytoplankton.

Physico-chemical characteristics of water such as conductivity, turbidity, colour, pH, total alkalinity, chloride, total hardness, silicate, phosphate, nitrate, iron, sodium and potassium registered higher values during non-rainy season. Sediment characteristics such as pH, organic matter, potassium and nitrate also registered higher values during non-rainy season. Textural analysis of sediment showed that the sediment of Thirumullavaram pond belonged to the 'sandy loam' soil class.

Higher primary productivity was recorded during non-rainy season as reported by Khan and Siddiqui (1971); Saltero and Wright (1975); Singh and Desai (1980); Khatri (1984) and Sharma and Sahai (1988). Higher productivity of non-rainy season might be due to the comparatively higher pH, total

Table – 1: Seasonal and annual mean \pm S.D of water and sediment characteristics, productivity, plankton and coliforms of Thirumullavaram pond during June 1999 and May 2000.

Water characteristics	Rainy season	Non-rainy season	Annual
Temperature (°C)	30.88 \pm 1.09	30.38 \pm 1.59	30.63 \pm 1.33
Transparency (cm)	74.83 \pm 17.59	57.00 \pm 13.70	65.92 \pm 17.68
Conductivity (mmhos)	0.38 \pm 0.07	0.44 \pm 0.08	0.41 \pm 0.08
Turbidity (NTU)	5.93 \pm 2.84	8.63 \pm 4.69	7.28 \pm 3.96
Colour (pt scale)	52.92 \pm 14.00	83.33 \pm 29.44	68.13 \pm 27.12
pH	7.87 \pm 0.24	8.61 \pm 0.50	8.24 \pm 0.54
Free CO ₂ (mg/l)	2.33 \pm 1.33	1.83 \pm 2.99	2.08 \pm 2.22
Dissolved oxygen (mg/l)	5.42 \pm 0.70	3.67 \pm 0.99	4.54 \pm 1.23
Total alkalinity (mg/l)	68.75 \pm 9.94	83.75 \pm 31.69	76.25 \pm 23.72
Chloride (mg/l)	50.77 \pm 16.31	63.75 \pm 18.95	57.26 \pm 18.17
Total hardness (mg/l)	68.88 \pm 7.60	71.67 \pm 29.11	70.27 \pm 20.34
Ca hardness (mg/l)	18.64 \pm 3.56	20.38 \pm 10.74	19.51 \pm 7.68
Mg hardness (mg/l)	14.75 \pm 4.05	13.74 \pm 3.20	14.24 \pm 3.52
Silicate (mg/l)	5.17 \pm 1.77	9.00 \pm 5.03	7.08 \pm 4.12
Sulphate (mg/l)	17.83 \pm 7.03	13.50 \pm 3.08	15.67 \pm 5.65
Phosphate (mg/l)	0.03 \pm 0.01	0.05 \pm 0.02	0.04 \pm 0.02
Nitrate (mg/l)	0.04 \pm 0.04	0.06 \pm 0.07	0.05 \pm 0.06
Iron (mg/l)	0.03 \pm 0.01	0.04 \pm 0.02	0.03 \pm 0.02
Sodium (mg/l)	6.42 \pm 2.50	8.25 \pm 1.73	7.33 \pm 2.30
Potassium (mg/l)	0.83 \pm 0.68	6.17 \pm 3.06	3.50 \pm 3.50
TDS (mg/l)	240.00 \pm 30.98	173.33 \pm 24.22	206.67 \pm 43.76
Sediment characteristics			
pH	7.52 \pm 0.57	7.98 \pm 0.41	7.75 \pm 0.53
Organic matter (%)	9.37 \pm 3.86	12.62 \pm 5.64	11.00 \pm 4.91
Potassium (mg/g)	0.02 \pm 0.01	0.03 \pm 0.02	0.03 \pm 0.01
Total phosphorus (mg/g)	0.31 \pm 0.07	0.30 \pm 0.05	0.30 \pm 0.06
Nitrate (mg/g)	0.22 \pm 0.06	0.28 \pm 0.08	0.25 \pm 0.08
Texture			
Sand (%)	59.85 \pm 4.64	52.71 \pm 5.56	56.28 \pm 6.14
Silt (%)	34.93 \pm 4.41	41.38 \pm 6.07	38.16 \pm 6.08
Clay (%)	5.23 \pm 2.21	5.82 \pm 1.98	5.52 \pm 2.02
Productivity			
GPP (gC/m ³ /hr)	0.17 \pm 0.07	0.34 \pm 0.12	0.26 \pm 0.13
NPP (gC/m ³ /hr)	0.08 \pm 0.04	0.16 \pm 0.07	0.12 \pm 0.07
CR (gC/m ³ /hr)	0.09 \pm 0.04	0.18 \pm 0.08	0.14 \pm 0.08
Plankton			
Phytoplankton (Units/litre)	65841 \pm 37856	169967 \pm 108622	117904 \pm 94717
Zooplankton (Units/litre)	317 \pm 16.67	938 \pm 131.07	627 \pm 59.93
Coliforms	Monsoon	Post monsoon	Pre monsoon
Total (MPN/100ml)	17400 \pm 848	2250 \pm 0	12600 \pm 4808
Faecal (MPN/100ml)	580 \pm 480	38.5 \pm 10	260 \pm 28

alkalinity, total hardness, chloride and nutrient content during the same season. Phytoplankton count also registered higher value during non-rainy season. This result gains support from the similar observations of Goldman and Horne (1983), Zafar (1986); Kamat (2000) and Singh *et al.* (2002). The total and faecal coliforms registered higher values during monsoon season followed by pre-monsoon and post-monsoon. Ward *et al.* (1985); Singh and Singh (1995); Pillai and Ouseph (2000); Prajapati and Mathur (2002) also recorded higher coliform count during monsoon season.

Certain significant correlations between water and sediment characteristics were obtained: pH of water recorded significant positive correlation with conductivity (0.90), colour (0.65), sediment pH (0.58) and sediment potassium (0.65); Chloride of water recorded significant positive correlation with conductivity (0.94), and negative correlation with dissolved oxygen (-0.67) of water; significant positive correlation was recorded between sediment organic matter and sediment phosphate (0.66); sediment phosphate and sediment potassium (0.66); sediment nitrate with gross primary productivity (0.90)

and net primary productivity (0.80). The interactions and interrelationships of various parameters seemed to contribute to the characteristics of the pond besides the influences of seasonal changes. From the investigation, it could be concluded that the favourable physico-chemical characteristics of water and sediment promoted secondary production through higher primary productivity and phytoplankton count.

When the annual means for physico-chemical and bacteriological characteristics of water were compared with the desirable limits of BIS (1991 and 1993) for drinking water and swimming pool, all the tested parameters except colour and coliform count were within the desirable limits. Therefore, the pond water could be used as a water source for drinking and domestic purposes after proper treatment especially disinfection. Maya *et al.* (2001) also suggested that Thirumullavaram pond could be converted into a swimming pool by taking good precautionary measures.

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