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Original Research Paper

Assessment of Water Quality of a Polluted Pond at Mysore Using National Sanitation Foundation-Water Quality Index (NSF-WQI)

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ABSTRACT

Microbes in freshwater often change the water quality and render it unfit for public use. Many methods of water quality determination have been discussed. A Simple but useful index is the National Sanitation Foundation-Water Quality Index (NSF-WQI). This index can be calculated by determining only nine physico-chemical parameters. Water temperature, pH, dissolved oxygen, biochemical oxygen demand, total phosphorus, nitrates, total suspended solids, turbidity and faecal coliforms were used for the calculation of the index. The water quality of the pond was found to be medium.

INTRODUCTION

The WQI is used to classify water quality as excellent, good, medium, bad and very bad. The National Sanitation Foundation-Water Quality Index (NSF-WQI) procedure was applied to polluted pond water at Mysore city. The chemical pollutants of industrial, domestic and agricultural origin find their way into lakes through surface runoff and precipitation and increase the level of pollutants (Yalchin & Sevinc 2001). The index ranges from 0 to 100, where 100 represent an excellent water quality condition. The water quality index (WQI) has been considered as one criteria for drinking water classification, based on the use of standard parameters for water characterization. The index is a numeric expression used to transform large quantities of water characterization data into a single number, which represents the water quality level (Bordalo et al. 2006, Sanchez et al. 2007, Prati 1971, Schaeffer et al.1977, Otto 1978a, Abbasi 2002). The WQI and classification proposed by Department of Environment, Malaysia (DOE 2001), has been used to assess the quality of major water supply sources indicating the level of pollution. A commonly used WQI was developed by the National Sanitation Foundation (NSF) in 1970 (Brown et al. 1970). The WQI is one of the most widely used of all existing water quality procedures. WQI was the intent of providing a tool for simplifying the report of water quality data (Liou et al. 2003). The computer automated tool QUALIDEX (Water Quality Index) has been developed by Sarkar & Abbasi (2006) to generate and operate water quality indices. Presently Wilkes University in the USA facilitates a simple online calculator for the NSF-WQI using nine water quality parameters i.e., temperature, pH, dissolved oxygen, turbidity, faecal coliforms, biochemical oxygen demand, total phosphorus, nitrates and total solids.

MATERIALS AND METHODS

Sampling of the pond water was carried out from December 2010 to April 2011. Water samples were taken monthly for analysis, and after determining field parameter (temperature), they were kept in dark in a cool box before being transported to a laboratory for quantification of other parameters. In the laboratory, all the samples were kept in a refrigerator at a temperature below 4°C for further analysis. The analysis of water samples was made by standard methods (APHA 1998). The laboratory analysis of pH was carried out using a pH meter. Turbidity was measured by a turbidity meter.

RESULTS AND DISCUSSION

Many methods of water quality determination have been discussed. Water quality index (WQI) is regarded as one of the most effective way to communicate water quality. There are several reports on pond water quality assessment using physico-chemical parameters (Madhyastha et al. 1999, Santhosh et al. 2008). The index values ranged from a minimum of 49 during the month of March and reached a maximum of 93 during February and April. According to the water quality rating, values of 0-25 (very bad), 25-50 (bad), 50-70 (medium), 70-90 (good) and 90-100 (excellent). The water quality of the pond under study is rated as bad during March but remains in a medium state during the remaining months. The water quality is usually intact but

Table 1: Physico-chemical characteristics of the pond water.

Parameters	December	January	February	March	April
Temperature (°C)	17.0	21.0	21.3	19.0	18.6
pH	6.8	6.8	6.8	6.4	7.1
Dissolved oxygen (mg/L)	8.9	8.9	9.4	9.4	9.8
Turbidity	155	184	163	157	162
Faecal coliforms/100 mL	1500	1000	1500	10000	2100
BOD (mg/mL)	2.4	1.9	2.3	2.5	2.6
Total phosphorus (mg/L)	2.6	2.4	1.4	1.9	2.5
Nitrates (mg/L)	1.4	1.6	2.7	2.6	1.7
Total solids (mg/L)	934	934	485	120	100
WQI	53	51	52	49	53
Rating	Medium	Medium	Medium	Bad	Medium

Table 2: Water quality index rating of the pond water.

WQI	Rating
90-100	Excellent
70-90	Good
57-70	Medium
75-50	Bad
0-25	Very bad

occasionally endangered. In the study, the physico-chemical characteristics of water samples were estimated, and the water quality index of NSF International, formerly the National Sanitation Foundation was evaluated. The conditions in it often deviate from the normal levels. Physico-chemical parameters are given in Table 1 and graphically represented in Figs. 1-9.

The water quality index (WQI) integrates complex analytical raw data and generates a single number (like a grade) that expresses subjectively the water quality. Such a rating scale allows for simplicity and consumer comprehensibility. The WQI approach has many variants in the literature, and comparative evaluations have been undertaken (SDD 1976, Otto 1978b, Dunnette 1979, Miller et al. 1986, Smith 1990, Cude 2001). A water quality index can be of different types depending on its final intended purpose. It can be highly specific for different bodies of water or could be a general one for all types of waters meant for human consumption. A WQI can also be based not just on readings at a single point of time but also on readings collected over a period of time. A WQI may also be arrived at by calculating the number of objective parameters not met, or by calculating the frequency with which they are not met or the amount by which they exceed the norm. The WQI was calculated using NSF information software (Ramakrishnaiah 2009) and compared with standard water quality rating as given in Table 2.

Monitoring the levels of certain water chemistry variables will keep the pond water in normal condition. The NSF-

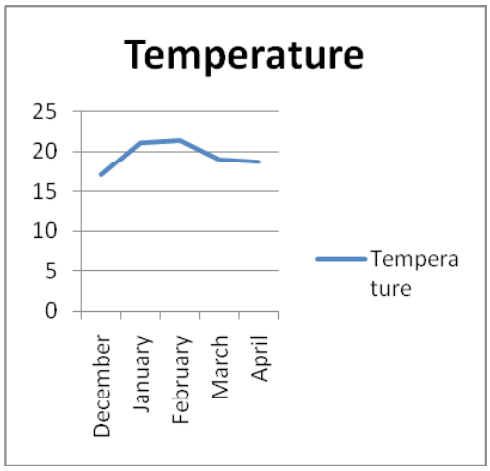

Fig. 1: Temperature values of pond from December to April.

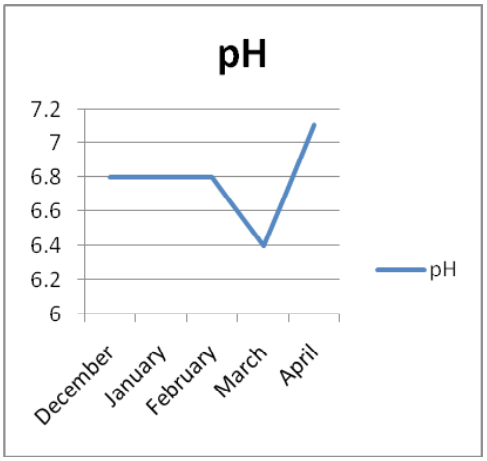

Fig. 2: pH values of pond from December to April.

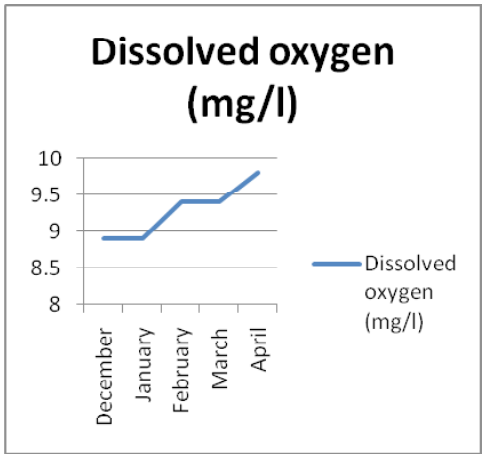

Fig. 3: Dissolved oxygen values of pond from December to April.

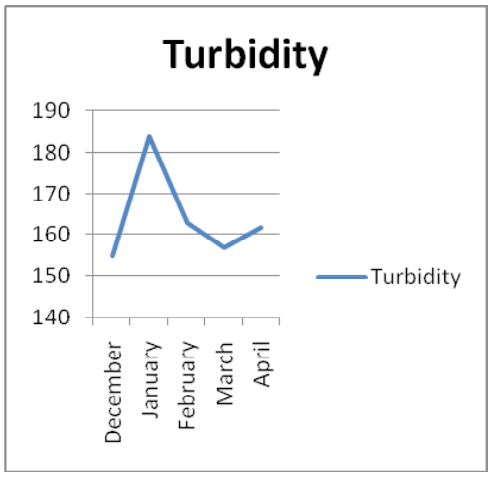

Fig. 4; Turbidity values of pond from December to April.

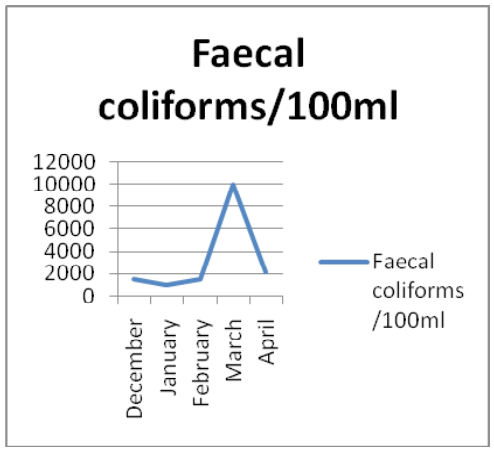

Fig. 5: Fecal coliform values of pond from December to April.

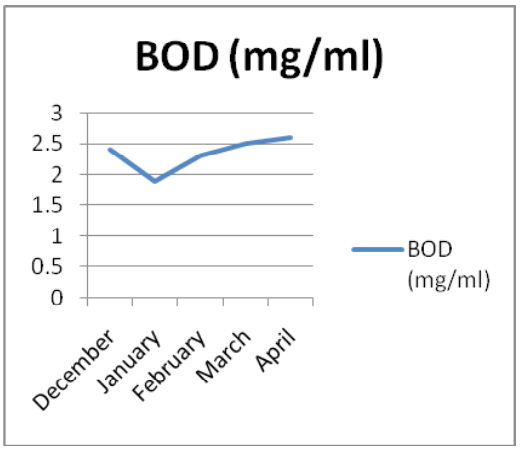

Fig. 6: BOD values of pond from December to April.

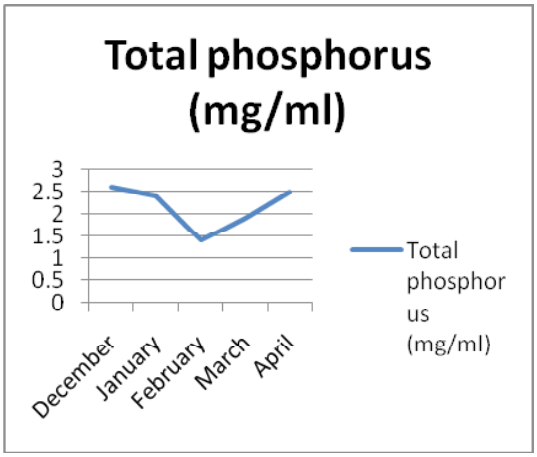

Fig. 7: Total phosphorus values of pond from December to April.

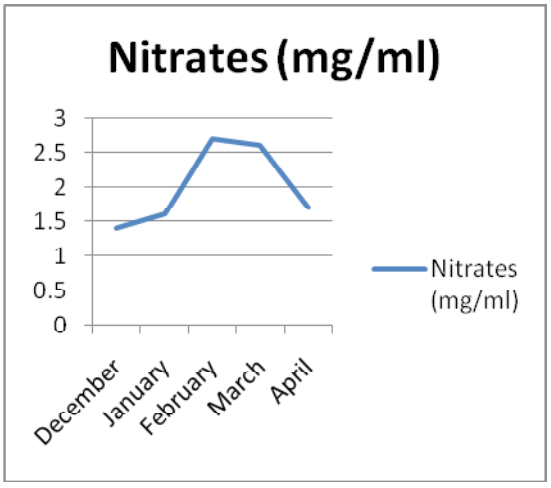

Fig. 8: Total nitrate values of pond from December to April.

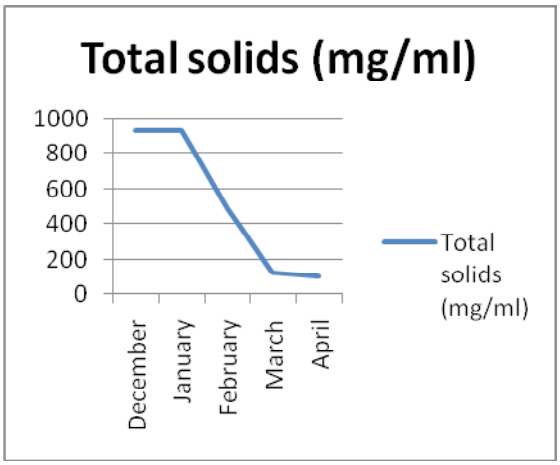

Fig. 9: Total suspended solids values of pond from December to April.

WQI serves as a useful tool in water quality monitoring. Water quality in the pond is medium for most of the period; it changes to bad only during March. Faecal coliforms reach very high during this month. Water treatment for the control of coliforms is essential.

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