

Study of Physico-Chemical Parameters of Water in a Polluted Pond of Shivamogga City, Karnataka

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ABSTRACT

Water samples were collected for physico-chemical analysis from different sites in the polluted pond (Purle water body), Shivamogga city (Karnataka). The water samples were analysed for various parameters such as water temperature, pH, total alkalinity, total dissolved solids, suspended solids, total solids, chloride, phosphate, calcium and magnesium hardness, total hardness and dissolved oxygen. By comparing the results against drinking water quality standards laid by WHO, it is observed that water samples from this pond were non-potable for human consumption due to high levels of physico-chemical parameters.

1. Introduction

Due to rapid growth of human population the per capita water needs are increased tremendously. The water resources situated near human habitats are polluted gradually. The quality of water present in the lentic water bodies has deteriorated rapidly resulting in wide variations in the type of vegetation in different water bodies. It is necessary to study some of the water quality parameters to understand the ecology of water bodies with periodic intervals.

Water is most essential solvent for human consumption and is one of the most important renewable resources, which must be prevented from deterioration in quality. Various physico-chemical parameters like pH, alkalinity, total hardness, total dissolved solid, calcium, magnesium, nitrate, sulphate have a significant role in determining the potability of drinking water. The resulting degradation of water quality in water body creates a condition so that water cannot be used for intended beneficial uses including bathing, recreation and as a source of raw water supply (Khan et al., 2004). A perusal of available literature has revealed that there is little scientific study was carried out with respect to ecological characteristics of this pond.

2. Materials and Methods

Study Area

Polluted pond is situated near Purle village of Shivamogga district. It serves as an accumulation of all types of pollution i.e., cloth washing, cattle drinking, domestic waste and agricultural runoff. Purle pond is a perennial water body as it receives the water from Tunga canal and waste water from Shivamogga township. The total area of the pond is 55 hectares of which water spreads over an area of 43 hectares with average depth of 5-6 feet. This pond water is used for domestic purposes and also for fish culture.

The present study was carried out from January to December 2017. Monthly water samples were collected from three sites of the water body (Purle pond). Water analysis were made for water temperature, pH, DO, total alkalinity, TDS, total solids, calcium hardness, magnesium hardness, total hardness, Chloride and BOD. Water temperature was recorded with the help of mercury thermometer and pH with pH pen. Both the parameters were recorded at the sampling spot itself. But dissolved oxygen (DO) and biochemical oxygen demand (BOD) were fixed for estimation at the site as per the methods described by Trivedi and Goel (1986) and APHA (1998).

Table 1 depicts the methods for determination of water quality parameters and Table 2 shows the Indian standards for drinking water quality.

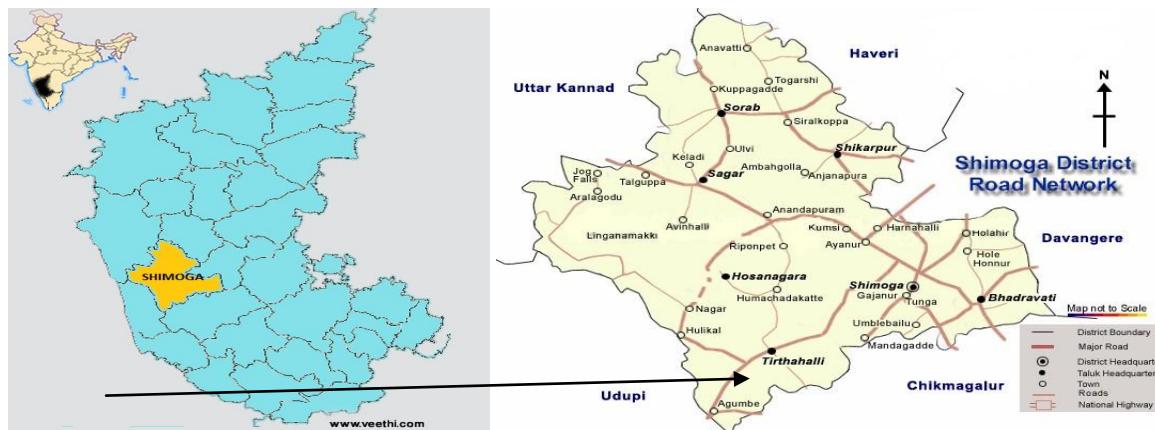


Figure 1 : Study area map (Source: www.veethi.com; en.wikipedia.org)

3. Results and Discussion

The physico-chemical conditions of water determine the status of a water body. Vijay Kumar and Paul (1990) reported that different parameters are greatly affected by the fluctuation of climatological conditions of the area. Air temperature was maximum (40° C) in the month of May and minimum (23° C) during December (Table 3). The highest range observed during the summer months of April and May. As Purle pond covers a large surface area. The changes in thermal properties were quick, which influence the nearby air mass as was observed in various water bodies (Sreenivasan, 1965).

Values of water temperature ranged from 19.6°C to 34.5°C. The minimum value was recorded in December and maximum in May. The temperature difference might be either due to difference between the collection times or due to the geographical difference in the locations (Madhuri Pejaver and Minakshi Gurav, 2008; Sayeswara et al., 2010).

The pond water was alkaline and showing small seasonal fluctuation; which could be due to the presence of free CO₂ in water. The pH of the pond fluctuated from 6.92 to 8.1. Due to uniform photosynthetic activity the pond water showed lesser significant fluctuations (Dhamija & Yatish Jain, 1996).

Total alkalinity showed continuous fluctuations without seasonal trend, with increasing values during summer months (March & April) and again in winter months i.e., October-November which might be due to bicarbonates of calcium and magnesium.

The content of chloride ions fluctuated from 42.49 to 144.95 mg/l. The upper permissible limit for chloride in both drinking and irrigation water is 600 mg/l according to ISI (1974). High chloride content in water is an indicator of pollution which may be due to organic waste materials.

Total hardness is the property of water which prevents the lather formation with soap and increases the boiling point of water. Cations impart hardness to the water. In Purle pond the total hardness ranged between 51.0 and 250.2 mg/l. The difference between the total hardness and calcium hardness and calcium hardness gives magnesium hardness which ranged from 10.5 – 60.5 mg/l. Hence, peak hardness observed

in November while minimum was observed in the month of April (Table-3).

Dissolved oxygen (DO) level showed a gradual increasing trend during winter months. Low value of DO might be attributed to low phytoplankton population and increased utilization by organic decay (Singhai et al., 1986).

Total dissolved solids and suspended solids are important parameters for irrigation and drinking waters. The range of total dissolved solids was deviated between 195.0 to 394 mg/l while the range of suspended solids in pond was 44.0 to 105.5 mg/l. The highest TDS were observed in the month of November. In this study, the total solids were maximum (458.0 mg/l) in November. Thus, the total solids were found to be maximum during winter and minimum in summer (Tamot and Bhatnagar, 1988; Dhamija and Yatish Jain, 1996).

Phosphate is considered as the most critical single element for biological productivity (Baruah et al., 1984; Sayeswara et al., 2010). Increased concentration of phosphates is taken up by the phytoplankton, which leads to algal blooms. Maximum value of phosphate (3.8 mg/l) was obtained in August and minimum (1.1 mg/l) in March.

4. Conclusion

The data of physico-chemical parameters under study exhibits that the degree of pollution of the pond water is greater in summer months due to the evaporation rate is higher in summer coupled with sewage water. Due to lack of rain, dilution of pond water does not occur in the months of April and May. In the light of standard of water quality recommended by WHO and BIS, the pond water should not be used by human beings especially for drinking and cooking. From the present investigation, it may be concluded that the physico-chemical characteristics of the Purle pond indicate that it is a nutrient rich water body showed dense growth of aquatic macrophytes, and therefore, there is an urgent need of preventive measures.

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Appendix

Table 1: Method of determination of water quality parameters

Sl. No.	Parameters	Methods
1	Temperature	Thermometer
2	pH	pH metry
3	Electrical conductivity	Conductometry
4	Total dissolved solids	Evaporation method
5	Alkalinity as CaCO ₃	Titrimetry
6	Total hardness	EDTA – Titrimetry
7	Calcium	EDTA – Titrimetry
8	Magnesium	EDTA – Titrimetry
9	Sodium	Flame photometry
10	Potassium	Flame photometry
11	Chloride	Argentometric
12	Nitrate	Spectrophotometry
13	Sulphate	Spectrophotometry
14	Phosphate	Spectrophotometry
15	Dissolved oxygen	Titrimetry
16	Fluoride	Fluoride meter

Table 2: Indian standard specification for drinking water ISI:10500 (Fakayode, 2005)

Sl. No.	Parameters	Desirable limit	Permissible limit
1	Temperature (° C)	-	-
2	pH	6.5 – 8.5	No relaxation
3	EC (µg/cm)	500	1000
4	TDS (mg/l)	500	2000
5	Total hardness (mg/l)	300	600
6	Total alkalinity	200	600
7	Calcium (mg/l)	75	200
8	Magnesium (mg/l)	30	100
9	DO (mg/l)	3	10
10	Chloride (mg/l)	250	1000
11	Sulphate (mg/l)	200	400
12	Nitrate (mg/l)	45	100
13	Fluoride (mg/l)	1	1.5

Table 3: Monthly variations in physico-chemical characteristics of polluted pond of Shivamogga city, Karnataka

Months	Total hardness	DO	Air Temp (° C)	Water Temp (° C)	pH	Total alkalinity	TDS	SS	TS	Cl	PO4	Ca Hardness	Mg hardness
JAN	160.0	4.6	25	22.5	7.82	140.2	282.0	85.0	367.0	76.48	1.8	100.0	60.0
FEB	172.0	4.4	32.6	26.4	7.60	128.5	275.0	70.0	334.0	98.68	1.9	120.0	52.0
MAR	135.0	3.8	34.2	27.5	7.42	202.5	329.5	80.0	399.5	122.46	1.1	105.0	30.0
APR	108.0	3.7	36.6	28.5	7.85	147.5	255.0	76.0	320.2	144.95	2.2	88.0	20.0
MAY	51.0	2.45	40.0	34.5	7.65	131.0	215.0	77.5	382.5	137.9	1.7	40.5	10.5
JUN	110.5	3.5	30.4	28.2	7.78	126.5	196.0	64.0	248.5	54.98	2.2	90.5	20.5
JUL	180.5	5.55	29.3	23.0	8.1	190.5	197.0	66.0	259.0	42.49	2.9	138.0	42.5
AUG	133.0	6.65	28.0	24.5	7.82	172.0	207.0	114.5	299.5	54.98	3.8	98.5	34.5
SEP	131.0	4.20	31.0	28.0	7.61	168.0	322.0	99.0	402.0	69.98	3.1	90.5	40.5
OCT	250.2	3.60	25.2	22.2	6.92	310.0	334.0	73.0	458.0	107.44	2.4	190.0	60.2
NOV	85.0	3.80	26.5	20.8	7.68	178.0	316.5	97.0	398.5	104.98	2.8	60.0	25.0
DEC	128.5	4.50	23.0	19.6	7.70	117.5	324.0	92.0	412.0	69.98	1.9	80.5	48.0

Note: All the parameters are expressed in mg/l except pH, air and water temperature (° C)