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Water Quality Assessment of Naganur Tank of Davangere, Karnataka, India

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Vasanth Naik T[1*], Vanaja R[1], Raj JB[2]

Abstract: An investigation was carried out in Naganur tank of Davangere on physico-chemical characteristics and Planktonic composition during January to December 2016. The results of physico-chemical parameters were compared with the standard values prescribed by the Bureau of India Standards (BIS) and World Health Organization (WHO). The study revealed that, tank water is polluted as it possesses high BOD, CO_2, phosphate and nitrogen. A total of 25 species belonging to 19 genera of phytoplanktons were recorded, of which cyanophyceae and chlorophyceae were dominant. 4 Zooplanktons and 8 Macrophytes were also recorded. In the light of standard of water quality recommended by WHO, the tank water should not be used by human beings especially for drinking and cooking.

Keywords: Naganur tank; Physico-chemical parameters; Planktonic composition.

1. Introduction

Water is one of the most precious on this universe and natural resources essential for all life sustaining processes on earth Majority of water available on earth is saline in nature: only a small quantity exists as fresh water. Fresh water has become a scarce commodity due to over exploitation and its necessities have led to the deterioration of surface and subsurface water. The causative factors for the pollution of water are industries, agriculture and domestic activities [1]. Due to over expanding population and industrial settlements, the demand for fresh water is increasing day by day. In today's scenario, unplanned urbanization, rapid industrialization and indiscriminate use of artificial chemicals cause heavy and varied pollution in aquatic environments leading to deterioration of water quality and depletion of aquatic fauna. Physico-chemical parameters play a vital role in determining the distributional pattern and quantitative abundance of organisms inhabiting a particular aquatic ecosystem [2]. Several investigators have studied the physico-chemical dynamics of varied lentic water bodies with the intent to assess the water quality [3-8] Planktons form the base of food chain in aquatic ecosystems, thus playing a vital role in fisheries. The spatial and temporal variation of planktons is regulated by major environmental factors.

The plankton study is a very useful tool for the assessment of water quality, trophic status and pollution level. Naganur tank is an annual water body receiving water from the adjacent paddy fields, TungaBhadra irrigation canal. The total area of Naganur tank is about 29.60 acres of which water spreads over an area of 20 acres with an average depth of 6 feet. It is located at Naganur village, 8 km away from Davangere town. The water is used for domestic purposes like washing of clothes, vehicles and for domestic animals, etc. The water has undergone moderate changes in its physico-chemical properties due to ecological degradation, overflowing of water from adjacent paddy fields and other excessive human activities. The basis of selection of Naganur tank was that its water is used by a large population which receives adequate waste water and periodic flooding from plains. In the present investigation, an attempt has been made to assess the plankton diversity and suitability of water for human consumption and domestic purposes.

2. Materials and Methods

2.1. Study Area

Naganur tank is situated at about 8km away from Davangere. Davangere City is located in the Karnataka State along National Highway-4(NH-4), it is at about 263km from Bangaluru. It is situated between 14° 26 to 14° 28 N Latitude and 75° 53 to 75° 56 E Longitudes.

Water was sampled on monthly basis, between 7 to 9 am from January to December 2016. This water samples were collected in good quality polythene bottles. Water temperature was recorded at the sampling site itself. Dissolved oxygen was fixed on the spot itself in BOD bottles. Various parameters like turbidity, total hardness, sulphate, free $C0_2$, alkalinity, BOD, TDS, phosphate, nitrate and chloride were estimated as per the standard methods [9]. Plankton samples were collected by using plankton net (N0.1) by filtering 100 liters of water, preserved in 4% formaldehyde. Identifications of phytoplanktons and zooplanktons were made with the help of Deshikachary, Gandhi, and Prescott [10-12].

[1] *Department of Botany,* [2]*Department of Chemisytry, D.R.M. Science College, Davangere University, Davangere, Karnataka, India.*
* Corresponding Email: drtvasanthnaik@gmail.com

3. Results and Discussion

The results of seasonal variation of physico-chemical parameters of Naganur tank are given in Table 1.

Temperature: The water temperature is largely influenced by local climatic conditions. The seasonal water temperature ranged from 20.2 to 26.9°C. The minimum value was recorded in December and maximum in April. Turbidity is a measure of cloudiness of water.

Turbidity: Turbidity in natural water arises due to the presence of suspended matter such as clay, silts, finely divided organic and inorganic matter, phytoplanktons and other microscopic organisms. The values of turbidity ranged from 10.3 to 57.5 NTU. The highest and the lowest values were recorded in July and March, respectively.

pH: pH values are slightly acidic to slightly alkaline and found within permissible limit of 5.2 to 7.1 as per the Bureau of Indian Standards [13]. The minimum value was observed during January (6.3) and maximum during July (7.4). The pH is important since aquatic organisms are well adapted to specific pH range and do not withstand abrupt changes in it.

Dissolved oxygen: Dissolved oxygen is an important gaseous factor that determines the quality of water and intern regulates the distribution of aquatic organisms. In the present study the DO level fluctuated between 2.1 to 5.3 mg/L. The highest and the lowest values were recorded in October and February, respectively. The variations of DO depend on the primary production and respiration of aquatic organisms. The permissible standard of DO is above 5mg/L [14].

Table 1 Physico-chemical characteristics of Naganur tank water

Parameters	Months:2011											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Temperature	22.6	22.9	23.8	26.9	25.9	23.3	21.3	22.2	22.9	22.4	21.8	20.2
Turbidity	12.7	11.9	10.3	13.4	20.4	48.1	57.5	32.4	34.9	26.6	13.8	12.7
PH	5.2	6.5	6.4	7.3	7.1	6.8	7.3	7.2	7.1	7.2	7.3	7.2
DO	3.2	2.1	2.5	2.8	3.5	3.8	3.7	3.9	4.3	5.3	3.5	2.9
BOD	6.1	6.3	6.2	7.8	7.1	7.8	7.5	8.2	8.4	7.1	7.1	7.8
CO_2	14.9	15.1	22.9	21.5	27.5	15.2	16.1	28.9	19.3	18.7	21.9	26.4
Alkalinity	74.3	68.0	63.8	70.6	72.1	62.7	60.4	61.1	60.3	40.2	54.7	61.7
TDS	33.6	34.5	40.9	57.3	40.7	40.1	41.1	41.1	33.8	31.3	41.4	40.4
TH	87	81	119	103	107	74	70	79	99	83	68	97
Chloride	72.1	70.1	80.2	81.4	82.9	72.1	64.4	71.1	62.2	78.1	79.3	72.3
Phosphate	1.1	1.2	1.5	1.6	1.6	1.2	1.2	1.3	1.2	1.6	2.3	1.7
Nitrate	5.3	4.7	6.2	6.1	7.8	6.9	6.1	6.5	5.2	5.1	4.2	3.7
Sulphate	11.3	10.7	9.5	7.1	10.1	8.8	8.4	7.4	8.7	12.1	7.3	7.6

All values are expressed in mg/1 except pH, temperature (°C) and turbidity (NTU)

Biological Oxygen Demand: BOD is the measure of degradable organic matter present in water. BOD and other microbial activities generally increase by the introduction of sewage [15]. In the present study BOD values ranged between 6.1 to 8.4mg/L. The minimum value was noticed in the month of January while maximum in September. They were found above the permissible limit of 6.5mg/L [16].

Carbon dioxide: Free carbon dioxide values fluctuated between 14.9 to 28.9 mg/L. The highest and the lowest values were recorded in August and January, respectively. The variation of CO_2 was due to the absorption by plants for photosynthesis and activity of other living organisms.

Alkalinity: Alkalinity in the water samples is primarily a function of carbonate, bicarbonate and hydroxide content. In the present study total alkalinity ranged from 40.2mg/L (October) to 68.4mg/L (February). It is within permissible limit of 600mg/L [13]. Surface alkalinity may result from the discharge of domestic wastes.

Total Dissolved Solids: TDS values ranged from 31.3 to 57.3mg/L, the minimum was recorded in October and maximum in February. The minimum value may be due to the stagnant condition of the water body. The values are within permissible limits of 1500 mg/L [13].

Total Hardness: Total hardness of water is not a pollution parameter but indicates water quality mainly in terms of Ca^{2+} and Mg^{2+} contents. Total hardness values observed are 68 to 107mg/L. The minimum value was recorded in November and maximum in May.

Chloride: Chloride is an important anion found in variable amounts in water bodies. Chlorides increase the degree of eutrophication [17]. In the present study, chloride values fluctuated between 62.2mg/L (September) to 82.9mg/L (May). High Chloride content indicates the deterioration of water quality usually linked with sewage load [18]. The most important sources of chlorides in the fresh water are the discharge of domestic sewage and farm drainage. The concentration of chlorides is thus the indicator of pollution.

Phosphate: Phosphorus occurs in natural water as various types of phosphates. The most important sources of phosphates are the discharge of domestic sewage,

detergents and agricultural runoff. Values of phosphates ranged from 1.1 to 1.7 mg/L with the minimum value in January and maximum in December.

Nitrates: Most of the unpolluted sources of water are deficient of nitrates because it exists only in few natural sources [19]. In the present study, nitrate values ranged from 3.7 to 7.8mg/L. The minimum value of nitrate was noticed in the month of December while maximum in May.

Sulphate: Sulphate is one of the major onions occurring in natural waters. It may enter natural waters through weathering of sulphate bearing deposits. The values fluctuated between 7.1 to 11.3mg/L. The minimum value was recorded in July and maximum is January. The relationship between various physico-chemical parameters of water samples were analyzed statistically conducting the Pearson correlation analysis (Table 3). Correlation analysis is an important part of bivariate analysis which is concerned with the relation between two variables.

Planktonic composition: A total of 25 Phytoplaktons, 04 Zooplanktons and 08 Macrophytes were identified, which are given in **Table 2** & **3**. Among phytoplanktons, members of Cyanophyceae and Chlorophyceae appear to be dominant as compare to other classes. The acidic pH favors the abundance of chlorophycean members. The presence of Euglenophycean members indicate that the water is organically polluted as the Euglenoids are the bioindicators of pollution. *Karatella* and *Daphni* were noted among zooplanktons. *Ipomea aquatica* and *Eichhornea crassipes* were dominant among the macrophytes.

Table 2 List of Phytoplankton in Naganur tank water

	Chlorophyceae
01	*Tetraedon minimum*
02	*Tetraedon muticum*
03	*Eudorina legans*
04	*Oocystis gigas*
05	*Pediastrum simplex*
06	*Scenedesmus dimorphos*
07	*Selanastrum westii*
08	*Tetraedon longispinum*
	Cyanophyceae
09	*Anacystis sp.*
10	*Gloecapsa* sp.
11	*Merismopedia glauca*
12	*Merismopedia tenuissima*
13	*Nostoc microscopium*
14	*Oscillatoria formosa*
15	*Phormidium* sp.
16	*Rivuleria* sp.
	Euglenophyceae
17	*Euglena gracile*
18	*Euglena elongata*
19	*Phacus curvicauda*
20	*Phacus truqueter*
21	*Strombomonas gibberosa*
	Bacillariophyceae
22	*Diatoma vulgare*
23	*Fragillaria crotonensis*
24	*Gomphonema abbreviatum*
25	*Gomphonema lanceolatum*

The water samples from Naganur tank was collected and analyzed for various physico-chemical parameters to study the extent of pollution. Planktonic composition was also studied. DO was very low and BOD, CO_2, Phosphate and Nitrogen values were significantly higher than the permissible level for domestic consumption. The presence of bioindicators of pollution (phytoplanktons and zooplanktons) indicates the occurrence of organic pollution. In the light of standard of water quality recommended by WHO, the tank water should not be used by human beings especially for drinking purpose and cooking.

Table 3 List of Zooplanktons and Macrophytes in Naganur tank

	Zooplanktons
01	*Cyclopes* sp
02	*Daphnia* sp
03	*Keratella* sp.,
04	*Paramoecium caudata*
	Macrophytes
01	*Azolla pinnata*
02	*Jussiaea repens*
03	*Ipomoea aquatica*
04	*Nelumbo nucisera*
05	*Nympea nouchali*
06	*Salvinia natans*
07	*Trapa bipinosa*
08	*Eichhornea crassipes*

4. Conclusion and Control Measures

Precautionary measures should be taken before the water is consumed. In order to maintain the health of the tank with respect to water quality it is essential that authorities should take immediate step on the following points.

1) People should not be allowed to discharge domestic wastes directly in to the tank.

2) Avoid washing of clothes.

3) Awareness should be created regarding the impact of water pollution on the human health.

4) People should be advised to avoid dumping of agricultural waste.

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