

Studies on physico-chemical parameters and phtoplanktonabundance in Mallasandra tank, Tumkur, Karnataka, India

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ABSTRACT

The present study deals with the abundance of phytoplankton and physico-chemical characteristics of water ecosystem in Mallasandra tank. The present work is carried out to know the seasonal variations in the pollutants during 2015-16 and 2016-17. Physico-chemical characteristics like, TDS, Sulphate, BOD and Phosphate and Phytoplanktons like 4 genera of Bacillariophyceae, 2 genera of Chlorophyceae and 1 genera of Cyanophyceae indicate the serious threat in the future for the water ecosystem.

1. Introduction

The main purpose of analyzing physico-chemical parameters of water was to determine nutrients status, as the limnological and limnochemical components of the ecosystem are interacting with each other (Kumawat and Borse 2010).

Planktons are very sensitive to the environment they live in with any alteration in the environment leads to the change in the plankton communities in terms of tolerance, abundance, diversity and dominance in the habitat. Therefore, plankton population observation may be used as a reliable tool for biomonitoring studies to assess the pollution status of aquatic bodies (Mathivan and Jayakumar, 1995). Distribution of phytoplankton and their variations at different zones of water body was known to be influenced by physico-chemical parameters of water (Shinde, 2012). Several plankton species served as bioindicators (Vareethiah and Haniffa, 1998; Bianchi *et al.*, 2003; Tiwari and Chauhan, 2006; Hoch *et al.*, 2008). Keeping this view in mind, the present study was undertaken to assess seasonal variations of phytoplankton abundance with relation to pollution profile in aquatic system of Mallasandra tank, Tumkur.

2. Study Area

Mallasandra is a large village located in Tumkur Taluk of Tumkur district, Karnataka with total 783 families residing. The Mallasandra village has population of 3120 of which 1537 are males while 1583 are females as per Population Census 2011. Mallasandra tank is one of the most important tank situated near Tumkur in the state of Karnataka. Annual average rain fall 540 mm. It has the sub-tropical kind of climate. Therefore, the seasonal changes in the climatic conditions can be found out.

3. Materials and Methods

The water samples were collected for two years and segmented with respect to seasons like monsoon, post-monsoon and pre-monsoon seasons, to study the periodicity of algae with respect to physico-chemical parameters.

In the present study, sampling was taken for two years during monsoon (June, July, August and September), post-monsoon (October, November, December, January) and pre-monsoon (February, March, April, and May) seasons of the year 2016 and 2017. Samples were collected in pre-sterilized two liter polythene screw bottles for quality analysis. Physico-chemical parameters like temperature, pH, conductivity, DO, BOD, COD, turbidity, total alkalinity, TDS, sulphate, phosphate, Ammonical Nitrogen and nitrate of water samples were determined following the analytical techniques described in the standard methods. The sensitive parameters like, temperature was determined directly in the field and DO was fixed with manganous sulphate and alkali-iodide-azide solutions and immediately brought to the laboratory for subsequent analysis. Samples were collected for Phytoplankton identification in polythene bottles early in the morning using plankton net, which was made up of bolten silk (mesh size 50 µm) and were preserved with 10 ml of 4 % Formaldehyde solution and 5 ml of Lugol's Iodine solution. Samples were allowed to settle down at the bottom of the bottle. Supernatant plankton free water was removed and the samples were reduced to desired volume and were identified by drop count method using 400X magnification of LYNX Trinocular Microscope (model LM-52-4000), using digital camera. Counting and identification were done as per APHA (1995), Trivedy and Goel (1986).

4. Results and Discussion

Seasonal variations in physico-chemical characteristics of water quality are shown in Table 1, Abundance of phytoplankton species in the study area is shown in Table 2.

Table 1. Seasonal variations in physico-chemical parameters of Mallasandalake.

Parameters	2015-16			2016-17		
	Monsoon	Post-monsoon	Pre-monsoon	Monsoon	Post-monsoon	Pre-monsoon
Temperature	22	20	26	22	21	27
pH	7.3	7.2	7.5	7.4	7.3	7.2
Conductivity	320	262	446	333	283	453
Turbidity	8.0	4.0	5.0	8.5	4.5	5.2
DO	5.8	6.2	5.5	5.6	6.0	5.0
BOD	3.0	3.0	3.0	3.2	3.0	3.5
COD	28	30	36	31	31	38
TDS	212	176	253.7	239	182	261
Chloride	24	12	24	26	14	26
TSS	8.0	4.0	4.0	8.5	4.5	4.2
T. Hardness	110	82	110	118	86	130
Calcium	65	48	65	66	47	68
Magnesium	45	34	45	46	32	47
T. Alkalinity	42	32	42	40	38	38
Sulphate	26	18	26	30	21	31
Ammonical Nitrogen	1.5	0.5	1.2	1.8	0.5	1.2
Nitrate	1.5	1.0	1.5	1.4	1.0	1.5
Phosphate	3.0	1.0	3.0	3.2	1.2	3.5

Note: All units are expressed in mg/L, except Temp. °C, pH, EC ($\mu\text{mhos/cm}$), Turbidity (NTU).

Seasonal variations of water quality characteristics are shown in the Table 1. Temperature was basically important for its effects on the chemistry and biochemical reactions in water body. The lowest temperature of 20°C was recorded during post-monsoon season. The highest temperature of 27°C was recorded during pre-monsoon season of 2017. Highest temperature in water might be due to more penetration of solar radiations. The seasonal average of pH in all the seasons show slightly alkaline condition for the tank. Conductivity measures the capacity of a solution to conduct electrical current. The lowest EC of 262 $\mu\text{mhos/cm}$ was recorded during post-monsoon season. The highest conductance of 446 $\mu\text{mhos/cm}$ was recorded during pre-monsoon. High EC shows a large amount of ionic substances.

DO is the regulator of metabolic activities of organisms. Lowest DO of 5.0 mg/l was recorded during pre-monsoon season of 2017. The lower DO indicate the presence of high organic pollutants (Kumara and Belagali, 2010). Lower BOD of 3 mg/L was recorded in most of the seasons. High BOD (3.5 mg/L) was recorded during pre-monsoon, which may be due to discharge of sewage water. Low COD (28 mg/L) was recorded for monsoon season during 2016. High COD (38 mg/L) was recorded for pre-monsoon during 2017 due to effluents discharge and agricultural runoff. Low TDS of 176 mg/L was for post-monsoon season during 2016. High TDS (261 mg/L) was recorded during pre-monsoon season, presence of insoluble organic matter from the domestic waste water. Low concentration of chloride (12 mg/L) was recorded during post-

monsoon season. High concentration of chloride (26.0 mg/L) was recorded during post-monsoon season. Higher values of chloride were due to the discharge of sewage and domestic waste in the river water (Jindal and Sharma, 2011). Higher concentration of chloride in fresh water was an indication of organic pollution (Venkatasubramani and Meenambal, 2007). Low concentration of total alkalinity (32 mg/L) were recorded during post-monsoon season. High concentration of total alkalinity (42 mg/L) were recorded during pre-monsoon season. The alkalinity in natural water was generally imparted by the hydrolysis of salts such as carbonates, bicarbonates, phosphates and nitrates. Low concentration of sulphate 18 mg/L was recorded for pre-monsoon season during 2016. High concentration of sulphate (31 mg/L) was recorded for pre-monsoon season during 2017, which might be due to laundering process, runoff from agricultural area. Low concentration of phosphate (1.0 mg/L) was noticed during post-monsoon season. High concentration of phosphate (3.5 mg/L) was noticed for pre-monsoon season during 2017, which might be due to the sources of phosphate in the effluent from phosphoric acid, phosphate salts and detergents used in the canteens of the industries. Low concentration of Ammonical nitrogen (0.5 mg/L) was recorded in pre-monsoon seasons of both the years. High concentration of Ammonical Nitrogen were recorded during monsoon season of 2017. Low concentration of nitrate (1.5 mg/L) was recorded in all the seasons. Nitrate and its derivatives contributed by nitrogenous fertilizers, organic manures, human and animal wastes and industrial effluents.

Table 2. Abundance of phytoplankton species in the study area.

Name of the organisms	2015-16			2016-17		
	Monsoon	Post-monsoon	Pre-monsoon	Monsoon	Post-monsoon	Pre-monsoon
<i>Navicula sp.</i>	+	-	+	-	-	-
<i>Synedra sp.</i>	-	+	-	-	-	+
<i>Gomphonema sp.</i>	-	-	+	-	+	-
<i>Cymbella sp.</i>	-	-	-	-	-	+
<i>Closterium sp.</i>	-	-	-	-	-	-

<i>Spirogyra</i> sp.	-	-	-	-	-	-
<i>Microcystis</i> sp.	-	-	-	-	-	+

Note: + → abundant; - → absent.

Detailed microscopic examination of phytoplankton revealed 3 families consisting of 7 genera in the order: 4 genera of Bacillariophyceae (species of *Navicula*, *Synedra*, *Gomphonema*, *Cymbella*), 2 genera of Chlorophyceae (species of *Closterium*, *Spirogyra*), 1 genera of Cyanophyceae (species of *Microcystis*). The degree of phytoplankton abundance in entire study period, recorded in the order of Bacillariophyceae>Chlorophyceae>Cyanophyceae. Where as number of species in the entire study period was recorded in the order of Bacillariophyceae>Chlorophyceae>Cyanophyceae.

Bacillariophyceae were dominant over Chlorophyceae. High pH, Nitrate, Sulphate, Phosphate promote the growth of Phytoplankton, higher EC favor the group of green algae (Kumawat, 2010).

Increasing temperature enhances the rate of decomposition, due to which the water becomes nutrient rich (Santhanam and Perumal, 2003). Cyanophycean members were recorded at sampling station during pre-monsoon season, which was the influx point for sewage, effluent, agricultural runoff and laundry activities constantly going on in this region. Maximum number of Cyanophycean members which indicate that, the water body may lead to eutrophication (Leela et al., 2010).

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