ASSESSMENT OF PHYSICO-CHEMICAL CHARACTERISTICS OF SARKARI TALAB WITH REFERENCE TO POLLUTION AT GONDIA, MAHARASHTRA

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Abstract

In the present study an attempt has been made on assessment of physico-chemical characteristics of Sarkari pond, located in the heart of gondia city adjoined to railway line in Gondia district of Maharashtra State. The Pond was constructed in 1930 by the Railway Department to Supply water for Steam engines .The study was carried out for a period of one year i.e. July 2011 to June 2012. Monthly details have been collected and were represented seasonally along with standard deviation. Different parameters were taken in the study were water temperature, Transparency, pH, Total Dissolved solids, Dissolved oxygen, Biochemical Oxygen Demand, Total alkalinity, Total Hardness, Chloride, Nitrate-Nitrogen and Phosphate, The results of the present study indicated that the water of the pond is highly polluted and is leading to the stage of eutrophication due to continuous disposal of sewage and solid wastes. An anthropogenic activity is also one of the major causes of pollution. However there is an urgent need of conservation of pond for the welfare of human being.

Keywords

Physico-chemical parameters, Fresh water pond, eutrophication.

Introduction

Ponds are important wetlands located in and around human habitations as they are generally semi-natural ecosystems constructed by man in landscape suitable for water stagnation. Ecosystem services rendered by these wetlands are innumerable including tangible and non -tangible ones. Besides acting as a Source of fresh water, they lower the ambient temperature, raises the water table, increase the diversity of flora and fauna, and provide aesthetic ambience. Due to uncontrolled increase in human population and development of township at large, the demand of fresh water is increasing day by day, these freshwater bodies are under tremendous pressure owing to their overuse on one hand and enrichment due to nutrients and organic matter on the other,

leading to the cultural eutrophication. Gondia city is recognized as 'Bowl of Rice' Erosion of catchment and direct pouring of domestic effluents along with sewage are threatening these wetlands all over the world. In view of the above, the present study deals with the assessment of physico-chemical characteristics of a freshwater pond located in the middle of township of Gondia city adjacent to railway line in Gondia District of Maharashtra State, India.

Material and Methods

Study site characteristics The pond selected under investigation is known as "Sarkari Talab". It is situated on the southeast part of the city Gondia, M.S. It is located at 21°27' and 39o 18\' N and 80° 11\' and 11o 67'E longitude and is about 1022 ft. above the mean sea level. Maximum depth of the pond at full water level is about 4.0m and the average depth is about 2.0m. The surface area is about 0.09 sq.Km.

Result and Discussion

Results of physico-chemical attributes of water and a few climatic parameters are presented in table 1. Water Temperature Temperature is a physical factor that alters the water characteristics and considered as an important Factor in controlling the fluctuation of plantation and functioning of aquatic ecosystem. (Wetzel, 1975; Dwivedi and Pandey, 2002; Singh and Mathur, 2005). In the present investigation seasonal variability of water temperature have been observed. It was maximum during summer comparatively less during monsoon and minimum during winter. Kannan and Job (1980) also found similar results as observed in the present study. Interestingly the magnitudes of variation in atmospheric and water temperatures were of less during summer. Surface temperature closely reflected to ambient air temperature. This is particularly true for shallow lakes and ponds like in presents study (Efford, 1967; Moss, 1969). Transparency Water transparency is an important factor that controls

the energy relationship at different trophic levels. The results of transparency ranged between 10 cm. to 16 cm. during the study period. It was low during the summer and higher during the winter season. The transparency was lower in the summer season due to high planktonic population, while it was low in the rainy season because of increase in the suspended matter brought in through surface run off. The maximum transparency was recorded in winter season attributed to the sedimentation of suspended matter (Chaurasia and Adoni, 1985; Sinha et al., 2002; Kadam et al., 2007; Shah and Pandit, 2012). PH Welch (1952) states that the limnological value of pH is a limiting factor and works as an index of general environmental condition. The pH value of the pond showed alkaline trend with a few variations. The maximum pH value were in the month of April i.e. 9.4 and minimum in the month of October i.e. 8.88. It is evident from the data that the pH declines during the rainy and increases during summer. Sharma et al., (1984) states that in India, many small confined water pockets are particularly alkaline in nature. Seasonal fluctuations are small indicating good buffering capacity. It has been suggested that the high pH is normally associated with a high photosynthetic activity in water (Goel et al., 1986; Wani and Subla, 1990). High value also promotes the growth of algae and results heavy bloom of phytoplankton (George, 1962; Nandan and Patel, 1992). Total dissolved solids Water is a universal solvent and has a large number of salts dissolved in it which largely governs in physico-chemical properties. The maximum values of total dissolved solids were recorded in July (1449.50mgl-1) and minimum were recorded in January (816.50 mgl-1). Seasonal variations showed maximum values in summer followed by rainy season and minimum during the winter season. The high value of TDS during rainy may be due to addition of domestic waste water, garbage and sewage etc. in the natural surface water body (Verma et al., 2012). Increased high concentration of TDS increases the nutrient status of water body which was resulted into eutrophication of aquatic bodies (Swarnlata and Narsigharao, 1998; Singh and Mathur, 2005). The water containing more than 500 mgl-1 of

TDS does not qualify for drinking purposes. Hence, 500mgl-1 is desirable limit and 1500 mgl-1 maximum possible limit for domestic use (ICMR, 1975). Dissolved Oxygen Oxygen content is important for direct needs of many organisms and affects the solubility of many nutrients and therefore the periodicity of aquatic ecosystem (Wetzel, 1983). Fritsch (1907) stated that the oxygen contents in tropical water would be low considering their high temperature. The results of the present study showed that highest peak value of dissolved oxygen was recorded during the month of January i.e. 6.2 mgl-1 and least in the month of June i.e. 3.55 mgl-1. The value increased from July to January and then decreased from February to June. Results of the present study are similar to those reported by other (Prasad et al., 1985; Hulyal and Kaliwal, 2011; Ramulu and Benarjee, 2013). Biochemical Oxygen Demand BOD is dissolved oxygen required by micro organism for aerobic decomposition of organic matter present in water. Jain and Dhanija (2000) have considered BOD as an important parameter in aquatic ecosystem to establish the status of pollution. The observation of present study showed that highest value of BOD (22.21 mgl-1) during the winter and lowest (10.27 mgl-1) in summer. Seasonally, the BOD was highest during late summer /early rainy season. High BOD during late summer / early rainy season may be due to the presence of several microbes in water bodies which accelerate their metabolic activities with the increase in concentration of organic matter in the form of municipal and domestic waste pouring into the pond with run off (Kaushik and Saksena, 1999). Prasanna Kumari et al., (2003) also stated that the higher values of BOD during rainy was also due to input of organic wastes and enhanced bacterial activity. High temperatures do play an important role by increasing rate of oxidation. The fluctuation of BOD in the present study shows pond is highly polluted. COD Chemical oxygen demand was also recorded maximum during winter and minimum during summer. Total Alkalinity Alkalinity in most natural water is the function of bicarbonate and carbonates. Their salts get Hydrolyzed in solution and produced hydroxyl ion. It is also used as a measure

of productivity (Jhingran, 1982; Hulyal and Kaliwal, 2011). Natural water bodies in tropics usually show wide range of fluctuations in their total alkalinity value depending upon the geography and season. In the present study the total alkalinity ranged between 418.25 to 583.01 mgl-1. It is gradually decreased from July to September and then increased in the month of October reaching to 549.90 mgl-1 again followed by a decrease in November and December. Seasonally highest value was recorded during rainy and lowest during the summer season. Increases in total alkalinity during rainy season were due to input of water and dissolution of calcium carbonate ion in the water column (Padma and Periakali, 1999). The value of calcium during winter season. The decrease in the amount of calcium may be due to its absorption by living organism. Hulyal and Kaliwal (2011) found that the calcium content was higher in summer and lower in monsoon season. However, Verma et al., (2012) observed maximum calcium content in the water of Chandlodia lake during monsoon and minimum during winter. Goldman and Horne (1983) reported that any value above 25 mgl-1 indicate calcium rich water. Higher calcium content in drinking water cause incrustation in water supply structure and adversely affect on domestic used (Raghvendra, 1992). The values of present study are found to desirable limit for the domestic use. Total Hardness Hardness of water is principally due to salts of Ca++ and Mg++ mainly the carbonates and sulphates (Wadia, 1961). In the present study the total hardness of water ranged from 236.57 mgl-1 to 290.25 mgl-1 seasonally, highest value was recorded during summer and lowest during the rainy season. Similar observations were found by various workers (Kaur et al., 2000; Nair, 2002). Kiran (2010) reported that water can be categorised according to degree of hardness as soft (0-75 mgl-1) moderately (75-150 mgl-1) hard, hard (150- 300 mgl-1) and above 300 mgl-1 as very hard. On the basis of the observation, the water of the present pond appears to be hard. Chloride In the present study chloride content ranged between 74.40 mgl-1 to 128.62 mgl-1. Variations in Chloride content were irregular as they declined from July to

September (128.62 to 74.40 mgl-1) and then Increased in October and again gradually decreased from November reached to 80.10 mgl-1 during January. The chloride content showed marked seasonal variation being maximum during rainy and minimum during winter season, which is the agreement with the observation made by Saha and Pandit, (1985). However, higher concentration of chloride during the summer and lower during the winter was also reported (Sharma et al., 2007; Verma et al., 2012). Higher concentration of chloride content was found during the rainy season may be attributed to increasing the organic waste of human origin with runoff water. Higher concentration also be associated with frequently runoff loaded with contaminated water from surrounding. Nitrate- Nitrogen Nitrates are contributed to fresh water through discharge of sewage, industrial wastes and runoff from agricultural fields. The concentration and rate of supply of nitrate in the land use practices of the Surrounding watershed. Results of the present study envisaged that the value of NO3-N varied from 0.69 Mgl-1 to 3.08 mgl-1. Lower values were recorded during rainy and higher values were found during summer season. Higher concentration may be due to influx nitrogen rich flood water and bring about large amount of sewage. The rainy season was period with the highest nitrate-nitrogen concentration which is known to support the formation of blooms (Anderson, et al., 1998). Degradation of plants and other organism and organic waste might also be one of the reason for the increase in carbonate and bicarbonate thereby the alkalinity. Phosphate Phosphate is the key nutrient also causing eutrophication leading to extensive algal growth. The results of present study showed that maximum phosphate concentration was observed in the month of August i.e. 0.061 mgl-1 and minimum in January i.e. 0.020 mgl-1. It is evident from the data that seasonally phosphate concentration in the pond was more in summer followed by rainy followed by a decline inw inter season. Highest seasonal values were reported during rainy and lowest during winter is in the conformity with the findings of various workers (Khurshid et al., 1997). The increase in the concentration of

phosphate during rainy season is the results of incoming water from the catchment area of human settlements and the entry of domestic sewage. The occurrence of less nutrients during winter may be due to their utilization in macrophytic growth. Increase in nutrients during summer is related with the decrease in water level effecting concentration and the release of nutrient during decomposition, which increases with rise in temperature (Chaurasia and Adoni, 1985). Comparatively higher values of total alkalinity may be attributed to the hardness. Ponds receiving effluents have been reported to show alkalinity from 462 to 505 mgl^{-1}. He further endorsed that polluted ponds may have even higher alkalinity. . Similarly Kumari et al. (2007) obtained remarkable differences in the total alkalinity in different months (140-370mgl^{-1}) in two tropical ponds of India. They have further correlated the higher pH values with alkalinity. Higher levels of chlorides in the present investigation are unusual. However even greater concentrations of chlorides have been reported by Chowdhury and Mamun (2006). . It has also been observed during the present investigation that the pond under observation has been under constant pressure of animal bathing, receives a variety of effluents from municipal discharge, as well as organic and inorganic wastes .

Conclusion

Present study provides a base line data for the conservation and monitoring of the pond. Data envisaged that the current status of the pond leads the levels of eutrophication. A few efforts like diversion of sewage, presentation of leaching of nutrients from catchment area through plantations would definitely yield good results.

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