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Research Article

PHYSICO-CHEMICAL CHARACTERIZATION OF PONDS IN KATNI, MADHYA PRADESH

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ABSTRACT

Water is a valuable natural resource very important for sustaining all life on the planet earth and is in continuous circulatory movement as hydrological cycle. The surface water bodies which are the most important source of water for human activity are unfortunately under several environmental stresses and are being treat ended as a consequence of development activity. The present work highlights the water quality index of sanjay nagar pond in katni. Water quality index (W.Q.I.) of this pond was calculated by some physicochemical parameters such as Temperature, Chloride, Alkanity, hardness, pH, Total dissolved solid, Turbidity, Chloride, DO, BOD and COD. The analysis shows that the water of study pond polluted due to the sewage water which have been coming from the nearby residential and factory areas. Application of Water Quality Index (WQI) in this study has been found useful in assessing the overall quality of water and to get rid of judgment on quality of the water. This method appears to be more systematic and gives comparative evaluation of the water quality of sampling site.

INTRODUCTION

Water is an essential constituent or intergradient of all the animal and plant life. We depend on water for drinking, domestic needs and irrigation. Typically water in nature is never unadulterated in chemical sense. It contains impurities of various kinds such as dissolved gases, dissolved minerals and suspended matters. These natural impurities are in very low amounts. But due to anthropogenic activities and urbanization many unwanted substances are introduced in to water and it is polluted.

Surface waters refer to rivers, streams, lakes, ponds and reservoirs. Lakes or ponds form where surface runoff accumulates in a flat area, relative to the surrounding land and the water entering the lake or pond comes in faster than it can escape, either via outflow in a river, seepage to groundwater or by evaporation (Karl *et al.,* 2009). Surface waters in India are increasingly under the pollution-stress due to rapid urbanization and increased industrialization. The ease of the accessibility of the surface water makes them the best choice for wastewater discharge (Edokpayi *et al.,* 2014).

Physico-chemical conditions prevailing in water body is important for the assessment of water quality and extent of pollution. The parameters which are generally altered by pollution and for which one wishes to specify quantitative standards may be physico-chemical such as Temperature, pH, Turbidity, Dissolved Oxygen and Inorganic nutrients or biological such as counts of potentially pathogenic bacteria, population densities of sensitive species and species diversity of specified community.

METHODOLOGY

The present study was conducted to explore the physico-chemical properties of Sanjay Nagar pond which is a lentic water body of Katni (M.P.). Sanjay Nagar pond is 3 km away from the Katni Railway Station and from Bus Stand it is 5 km away. This pond is nearer to Katni–Jabalpur Rail line. This pond comes in Sanjay Nagar area and also comes in Madhavnagar police station area and its area is about triangular in shape. The area of this pond is approximately 20 hectares and its depth is 4.50 m. The depth of the pond changes in the nature of season.

To assess the impact, the sampling was done on a seasonal basis during rainy (July–August), winter (November - December) and summer (March-April) seasons over the period of one year 2015-2016.

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SAMPLING AND ANALYSIS

For the present study three stations was selected at the pond to study physio-chemical parameters. Samples were collected from year 2015 to 2016 from the surface and bottom of the pond at the fixed stations to assess the physico-chemical and biological parameters of the aquatic body.

Samples were collected by using one litre capacity of modified Hales' sampler and collected samples were transferred to one liter plastic bottles for physico-chemical analysis as per methods given by APHA (1985) and Adoni (1985). Some of the parameters like pH and temperature were analysed directly at the site only using a pH meter and a digital thermometer.

Following parameters were analysed in the present study.

Temperature

The water temperature was recorded with the help of a digital temperature meter. The reading was recorded once the reading is stabilized.

pH

The pH of the water was measured using a handheld portable pH meter (Hanna, Germany), duly calibrated. For this, the probe of the meter was dipped into the water and the pH meter reading was noted once the reading is stabilized.

Total Dissolved Solids (TDS)

$$\text{Total Dissolved Solids (TDS) mg/L} = \frac{(A-B) \times 1000 \times 1000}{V}$$

A = final weight of beaker after drying
B = initial weight of clean beaker
V = volume of sample taken in ml

Turbidity

Nephelometric turbidity units (NTU) = A × (B+C) / C

A = NTU found in diluted sample,
B = volume of dilution water, mL, and
C = sample volume taken for dilution, mL

Alkalinity

$$\text{Alkalinity mg/lit.} = \frac{\text{ml of titrant} \times 1000}{\text{ml of sample}}$$

Total Hardness

$$\text{Total Hardness mg/L} = \frac{\text{ml of titrant} \times 1000}{\text{ml of sample}}$$

Dissolved Oxygen

$$\text{Dissolved oxygen mg/Lit} = \frac{(8 \times 1000 \times N) \times v}{V}$$

V= volume of sample taken
v= Volume of the titrant
N= normality of titrant

Biological Oxygen Demand (BOD)

BOD mg/L = (Initial DO – DO_3)

Chemical Oxygen Demand COD

COD mg/Lit = (A–B) x M x 8000 / mL sample
A = volume of FAS used for blank (mL)
B = volume of FAS used for sample (mL)
M = molarity of FAS
8000 = milli equivalent weight of oxygen (8) ×1000 mL/L.

Chloride

Chloride (mg/L) = [(V1 - V2) x N x 71,000] / S
V1 = mL of standard $AgNO_3$ solution added in titrating the sample.
V2 = mL of standard $AgNO_3$ solution added in titrating the blank
N = mL of standard $AgNO_3$ solution.
S = mL of original sample in the 50 mL test sample prepared

Water Quality Index (WQI)

The water quality index for the year 2015-16 was calculated using the online water quality index calculator available on the internet (https://www.water-research.net). For this, the average seasonal values of temperature, pH, turbidity, TDS, DO, Hardness, Chloride, BOD and COD were used as indicator parameters. The WQI was interpreted as follows:

Range Quality

90-100	Excellent
70-90	Good
50-70	Medium
25-50	Bad
0-25	Very bad

Observation

Table 1 Water quality analysis for the year 2015-16 of Sanjay Nagar pond

S.No.	Physico-chemical parameter	Winter	Summer	Rainy
1.	Temperature (°C)	25.66	35.33	24.66
2.	pH	7.1	7.1	8.4
3.	TDS(mg L^{-1})	200	200	342
4.	Turbidity (NTU)	1.18	1.39	2.63
5.	Alkalinity(mg L^{-1})	135.37	158.61	178.74
6.	Total hardness (mg L^{-1})	367.66	274.7	301.44
7.	Dissolvedoxygen (mg L^{-1})	2.95	1.55	6.75
8.	Biological Oxygen Demand(mg L^{-1})	7.23	10.49	3.35
9.	Chemical oxygen demand C	84.99	93.51	109.10
10.	Chlorine (mg L^{-1})	39.44	23.97	63.26

RESULT AND DISCUSSION

Based on the various physico-chemical parameters of Sanjay Nagar pond during 2015-16, the Water quality Index (WQI) was calculatedon the basis of various physico-chemical parameters, the water during the winter season of 2015-16 shows the water quality index as 41.36, which is below 50, and hence considered as poor quality. Table shows that Sanjay Nagar pond has a WQI of 50.39 during summers. Although the value shows that water quality is medium, it is very marginal to poor quality. The WQI during rainy season was also calculated as 46.47, as poor.

The water quality index (WQI), when calculated on a seasonal basis, showed that the WQI was in the range of 35-50. Since WQI<50 is considered as poor, the quality of pond water can be declared as poor. Even during rainy season, when large amount of freshwater enters into the pond, the WQI could not be improved much, the reason being the continuous industrial and domestic discharges to the water., SanjayNagar pond, has

reached the eutrophication level, as evident from the lower DO, higher BOD, COD, phosphate and chloride level.

Kesavan and Parameswari (2005) analyzed groundwater quality near the textiles industries of Kancheepuram. Physico-chemical parameters like colour, odour, turbidity, total dissolved solids, total hardness, pH, calcium and chloride were analyzed. This study revealed that the textile effluent was the main cause of pollution of groundwater in Kancheepuram.

Singh and Kumar (2000) studied hydrogen ion concentration one of the important chemical properties of natural water is its alkalinity or acidity. Oxygen is a needed for the respiration of all heterotrophs, especially the aquatic organisms. Frequent entry of cattle and domestic sewage into the ponds are attributed to high organic load, causing higher level of BOD

(Bhatnagar and Devi, 2013). According to Bhatnagar *et al*. (2004) the BOD level between 3.0-6.0 mg L^{-1} is optimum for aquatic ecosystem, 6.0-12.0 mg L^{-1} is sublethal to zooplankton and fishes and >12.0 mg L^{-1} is alarmingly high and can be lethal to the aquatic life. The present study showed that the pond has sublethal concentrations of BOD.

CONCLUSION

The Sanjay Nagar pond under the present study were small water bodies that receive industrial waste from the refractories, as well as domestic waste. In order to assess the impact of pollution on these water bodies, the physico-chemical parameters were assessed for the period of oneyear. The water quality index was found consistently on a poor side (<50). The results showed that these water bodyhas reached the eutrophic level of pollution, and if serious measures are not taken in time, the pond and its ecosystem will completely destroyed. Since, it was not possible to assess the type of industrial waste, the refractories are dumping into the water body, there is a possibility of water toxicity due to presence of toxic heavy metals and/or other chemical hazards. It was also noted that as per the interviews with local residents, the refractories have stopped dumping their waste since 2018 (after the study period).

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