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Physico-chemical study of Mohan Ram Lake Shahdol (M.P.)

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Abstract

This research paper deals with the physico-chemical parameters of Mohan Ram Lake, Shahdol. The physico-chemical quality of water of this lake has been assessed by observing temperature, pH, TDS, Free CO₂, BOD, Alkalinity, Hardness, Chloride, and Fluoride. Extreme values of these parameters give clear indication of contamination of water.

Keywords: Physico-chemical parameters, Mohan Ram Lake, Shahdol district.

1. Introduction

Water plays an important role in human life. It is the most basic and vital resource of our planet. In India it is reported that about 70% of the available water is polluted. The chief source of pollution is identified as sewage constituting 84 to 92 percent of the waste water (Agrawal & Rajwar 2010^[1] and Khan, *et al.* 2013^[5]). The maintenance of a healthy aquatic ecosystem is dependent on the physicochemical properties of water and the biological diversity. The physico-chemical means are useful in detecting effects of pollution on the water quality but changes in the Trophic conditions of water are reflected in the biotic community-structure including species pattern, distribution and diversity (Sharma & Sharma, 1992)^[9].

2. Material and methods

District Shahdol lies between 23°15' N latitude to 24° N Latitude and 81°E longitude to 81°45' Longitude. District Shahdol lies in the heart of the country. Mohan Ram Lake is one of the oldest and holy lake of Shahdol city. It is located in the heart of the city. According to the geological survey the Mohan Ram Lake is situated at 23°18' North latitude and 81°22' East longitude at about 459 meters above means sea level. The temple and lake both are marvelous gift to Shahdol city by late Shri Mohan Ram. According to revenue record and local inhabitant it is 106 years old. It was built in the year 1894. The total area of the lake is more than 5 acres.

The water samples from the lake were collected in pre-washed and well dried glass bottles. The bottles were rinsed three times with sample water. The sample water were taken from the surface at a depth of 6-9 inches from four Different points and an integrated and representative sample was drawn. The samplings were carried out in the every months of July, 2014 to June, 2015. The temperature of the water was measured with mercury thermometer. The water samples were immediately brought in to laboratory for the estimation of various physico-chemical parameters. The pH was measured in laboratory by the Philips digital pH meter. Total dissolved solids (TDS) were measured by 100 ml of water sample dried on a hot plate in a pre-weighed china dish. The china dish was again weighted to calculate the total dissolved solids per litre of sample by applying the formula

$$TDS = \frac{W_2 - W_1}{V} \times 1000$$

Where, W₂ – weight of china dish after evaporating the total volume to dryness

W₁ – weight of empty china

V - Volume of sample evaporated to dryness

Total hardness, chloride and alkalinity were determined with titration with EDTA, silver nitrate and hydrochloric acid. Free CO₂ and fluoride were determined by titrimetric method in laboratory.

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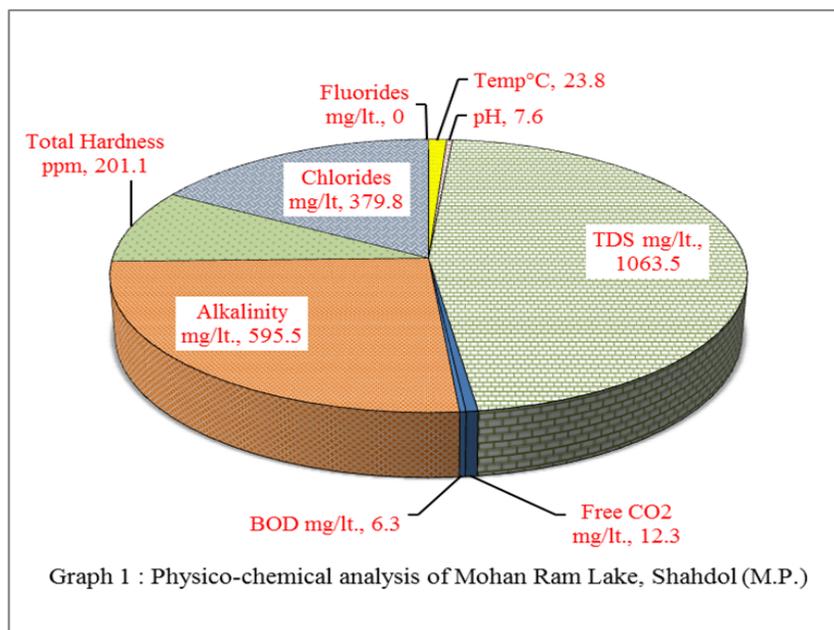
3. Results and Discussion

Table 1: The following data were collected from July, 2014 to Jun., 2015

Parameters	Jul.14	Aug.14	Sept.14	Oct.14	Nov.14	Dec.14	Jan.15	Feb.15	Mar.15	Apr.15	May15	Jun.15	Mean
Temp °C	23.2	22.6	21.6	20.9	19.2	18.0	17.9	21.6	28.2	29.9	31.2	31.7	23.8
pH	7.2	6.8	7.3	7.6	8.1	6.9	7.4	7.0	8.3	8.2	8.3	8.3	7.6
TDS mg/lt.	714	803	758	685	692	733	301.1	1201.1	1501	1586	1713	2075	1063.5
Free CO ₂ mg/lt.	8.8	6.0	22.0	13.2	15.4	28.6	30.2	3.5	4.2	4.4	3.4	7.6	12.3
BOD mg/lt.	3.2	3.5	10.2	7.6	6.4	12.2	12.0	8.5	5.2	2.8	2.2	1.6	6.3
Alkalinity mg/lt.	366	445	788	766	486	555	444	463	580	676	787	790	595.5
Total Hardness ppm	196	195	199	169	183	198	196	203	206	210	223	235	201.1
Chlorides mg/lt	512	549	455	550	590	362	256	245	268	266	248	256	379.8
Fluorides mg/lt.	0.012	0.001	0.012	0.008	0.005	0.008	0.004	0.005	0.012	0.010	0.008	0.007	0.0

Temperature The most common physical assessment of water quality is the measurement of temperature. Temperature impacts both the chemical and biological characteristics of surface water. The temperature of this lake

was fluctuated between 17.9 (in January) to 31.7 °C (in June) Higher temperature in June was probably due to the increase load of suspended solids, soil particles and decomposed organic matter in the lake because they absorb more heat.



pH: The pH ranged between 6.8 to 8.3 °C. pH was observed around 7 (minimum 6.8) whereas in summer season it was slightly alkaline (maximum 8.3) This was probably due to much more concentration of OH⁻ ions released from the dissociation of alkaline salts. High pH induces the formation of tri halomethane which are toxic (Kumar, *et al.* 2010) [6].

TDS (Total Dissolved Solids): Water, the universal solvent has large number of salts dissolved in it, which largely govern the physicochemical properties and inturn have an indirect effect on aquatic organisms. The total dissolved solids fluctuated in this lake were between 301.1 (Jan, 2015) to 2075 mg/litre (in June, 2015) which show hard water character. This observation is supported by the study of Sumitra *et al.* (2007) [10]. Higher concentration of TDS may also due to discharge sewage and organic matter by interference of man. WHO has 500 mg/l as maximum tolerance limit for TDS.

Free Carbon Dioxide: Free CO₂ is one of the essential constituents of an aquatic ecosystem. The abundance of CO₂ exerts certain specific effects on aquatic biota. During the

study period, the value of free Carbon dioxide varied between 3.4 (May, 2015) to 30.2 mg/litre (Jan., 2015). Carbon dioxide exhibited an inverse relation with dissolved oxygen. A gradual rise in dissolve oxygen and fall of free carbon dioxide level had probably disrupted the equilibrium between these two gases. Cole (1975) [2] noted that free CO₂ supply rarely limits the growth of phytoplanktons. Alternately the bicarbonates are utilized as a source of carbon by the photosynthetic activity of phytoplanktons (Singh, 2014) [11].

BOD (Biological Oxygen Demand): BOD represents the amount of oxygen that microbes need to stabilize biologically oxidizable matter. It is found to be more sensitive test for organic pollution. BOD value of the lake water ranged between 1.6 to 12.2 mg/lit. Highest BOD (12.2mg/lit.) was observed in winter (Dec, 2014) and Lowest was in summer (June, 2015) Increased temperature and sedimentation load reduce BOD (Pyatkin and Krivoshein, 1980) [7]. According Indian standards, desirable limit of BOD is 4.0 mg/l. and permissible limit is 6.0 mg/l. Biological oxygen demand below 3 mg/l or less is required for the best use.

Alkalinity: The total alkalinity fluctuated between 366 to 790 mg/ litre throughout the year, with the highest value in the month of June 2015. According to ISI, permissible limit of alkalinity in the water is 600 mg/l. The alkalinity in water is caused by carbonate, bicarbonate and hydroxyl ions. Carbonate alkalinity is an environmentally critical parameter in maintenance of buffering capacity of aquatic life forms. It had been assumed that in tandem with pH which has a complex interrelationship, is responsible for poor species diversity in aquatic life forms, including total absence of large crustaceans, brachiopods, decapods (Prawn, Shrimp etc.). Due to alkalinity value correlate positively with the pattern of rainfall and this implies that surface run-off from the Silisher Lake contains substances which contribute to alkalinity (Singh, *et al.* 2014) ^[12].

Total Hardness: The mean value of total hardness has been found to vary between 169 (October, 2014) to 235 ppm (June, 2015) which show in the desirable limit as per Indian standard (ICMR, 2006) ^[3]. Total hardness of water is due to the presence of bicarbonate, sulphate, chloride, and nitrates of calcium and magnesium. The permanent hardness is mainly caused by chloride and sulphates (Roy and Kumar, 2002) ^[8]. Limit for total hardness is 600 mg/l as per Indian standard. The higher hardness may be ascribed to accumulation of dissolved materials due to increasing pollution from tourist wastage of eatables and surrounding domestic sewage. Hardness has got no adverse effect on human health. Water with hardness above 200 mg/l may cause scale deposition in the water distribution system and more soap consumption (Singh, 2014) ^[11].

Chloride: The mean value of chloride content in the lake is 379.8 mg/litre. The peak chloride values during the early monsoon tend to increase sharply till the post monsoon approaches. The peak chloride value can be attributed to the surface run off, rich in animal origin and organic waste. Kavita Sahni and Pooja Sulotiya (2011) ^[4] have also found similar results during the study on Mansagar Lake, Jaipur.

Fluoride: In the present study, the values of fluoride varied between 0.001 to 0.012 mg/l. The fluoride level is very low in the lake water. This level is not harmful to the aquatic life which is much less than normal level of fluoride standard (1.5ppm) determined by WHO. Fluoride showed positive correlation with depth of visibility, pH, dissolved oxygen, total hardness, nitrate, phosphate, GPP (Gross Primary Production) and NPP (Net Primary Production). Trophic status of an ecosystem depends upon rate of energy flow which may be assessed by estimating primary production (Singh, 2014) ^[11].

4. Conclusion

The conclusion from the present investigation may be drawn that the most of the parameters were found beyond the permissible limit of ISI, ICMR, and WHO for human use. Mohan Ram Lake is going to be contaminated day by day with human activities and ultimately eutrophication affects aquatic life, excessive silting reducing depth of the lake. Therefore water of the lake is Very unsafe for human use must be used only after suitable treatment process.

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