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Physico-Chemical Study of Jaisamand Lake, Alwar (Raj.)



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Abstract

This research paper deals with the physico-chemical parameters of Jaisamand Lake, Alwar. 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, Jaisamand Lake.

Introduction

Jaisamand Lake, Alwar was constructed by Maharaja Jai Singh in 1910 AD. It covers about 500 hectare productive area. This has an embankment of 1.5 kilometers, with an average depth of about 23 feet during post Monsoon period. It lies 14 kms in south west of historical city, Alwar. The lake has 1200 hectare in its full tag level (FTL). Its maximum depth measured on 1 April, 2014 was 23 feet and average rainfall during the year is 550 mm. The water of this lake is being used for irrigation and drinking purpose. Disposal of domestic wastes in this lake causes undesirable change in physico-chemical characteristics of water. The pollution of surface water by discharge from human activities is one of the major environmental problems. Organic enrichment of this water body results in to high oxygen demand which leads to low dissolved oxygen in water.

In this line, no systematic study has been made yet on the physico-chemical parameters of this lake. The present study is an attempt to find out limnological parameters of the lake water so that it would be helpful to combat the problems associated with public health.

Study Area

For analysis of quality of water, 4 sampling sites have been selected in the lake. Sampling at different sites were made at monthly intervals from July, 2014 to June 2015.

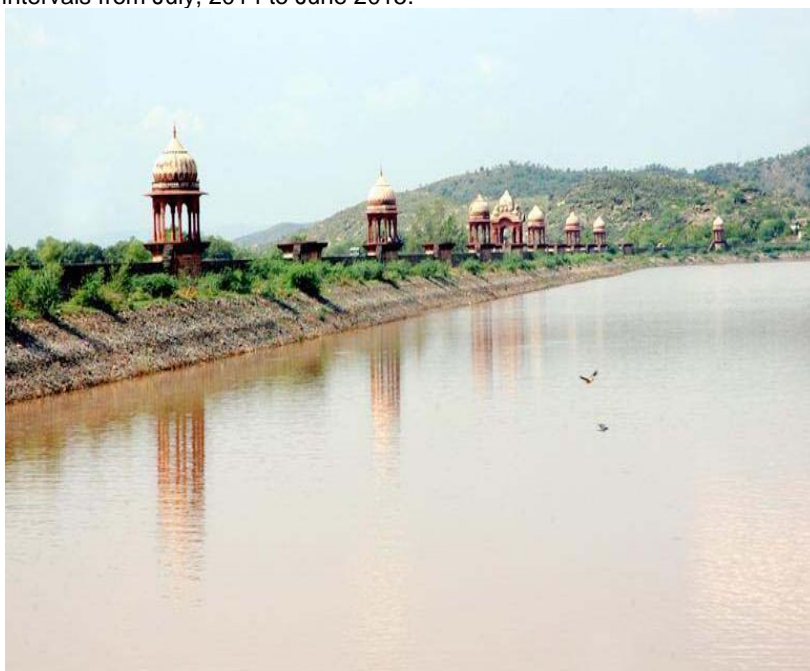


Fig.1: Jaisamand Lake, Alwar

Data Collection



Fig: 2 and 3 Author Collecting Data from Jaisamand Lake, Alwar (Rajasthan)

Material and Method

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, W_2 – weight of china dish after evaporating the total volume to dryness

W_1 – weight of empty china dish

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.

Results and Discussion

Table:1 The following data were collected from July, 2014 to Dec, 2014

Parameters→ Months↓	Temp °C	pH	TDS mg/lit.	Free CO ₂ mg/lit.	BOD mg/lit.	Alkalinity mg/lit.	Total Hardness ppm	Chlorides mg/lit	Fluorides mg/lit.
July,2014	23.2	7.2	714	8.8	3.2	366	196	512	0.012
Aug, 2014	22.6	6.8	803	6.0	3.5	445	195	549	0.001
Sept., 2014	21.6	7.3	758	22.0	10.2	788	199	455	0.012
October, 2014	20.9	7.6	685	13.2	7.6	766	169	550	0.008
November, 2014	19.2	8.1	692	15.4	6.4	486	183	590	0.005
December, 2014	18.0	6.9	733	28.6	12.2	555	198	362	0.008
January,2015	17.9	7.4	301.1	30.2	12.0	444	196	256	0.004
February,2015	21.6	7.0	1201.1	3.5	8.5	463	203	245	0.005
March,2015	28.2	8.3	1501	4.2	5.2	580	206	268	0.012
April,2015	29.9	8.2	1586	4.4	2.8	676	210	266	0.010
May,2015	31.2	8.3	1713	3.4	2.2	787	223	248	0.008
June,2015	31.7	8.3	2075	7.6	1.6	790	235	256	0.007

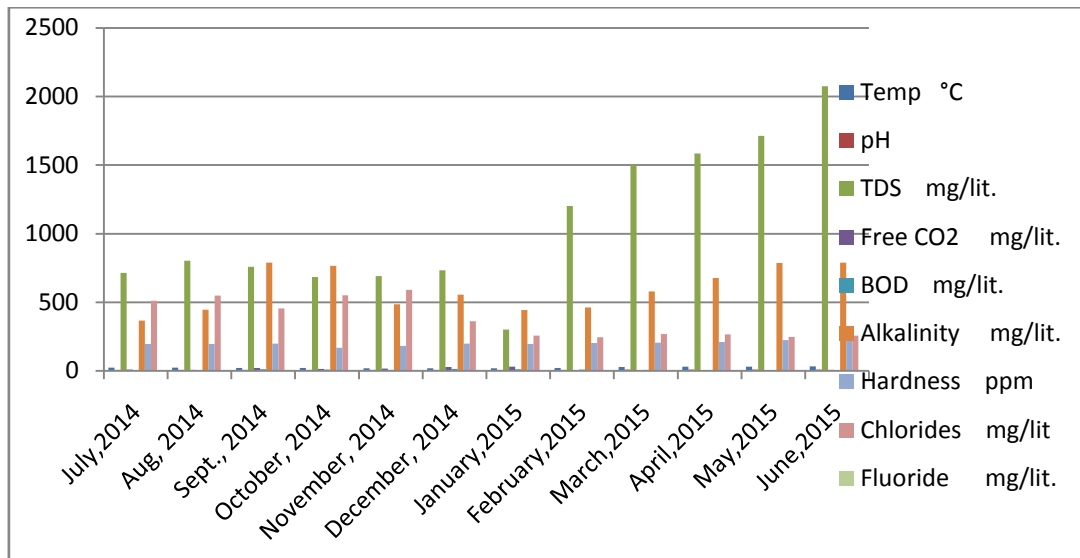


Fig 4: Representation of Data with Column Graph

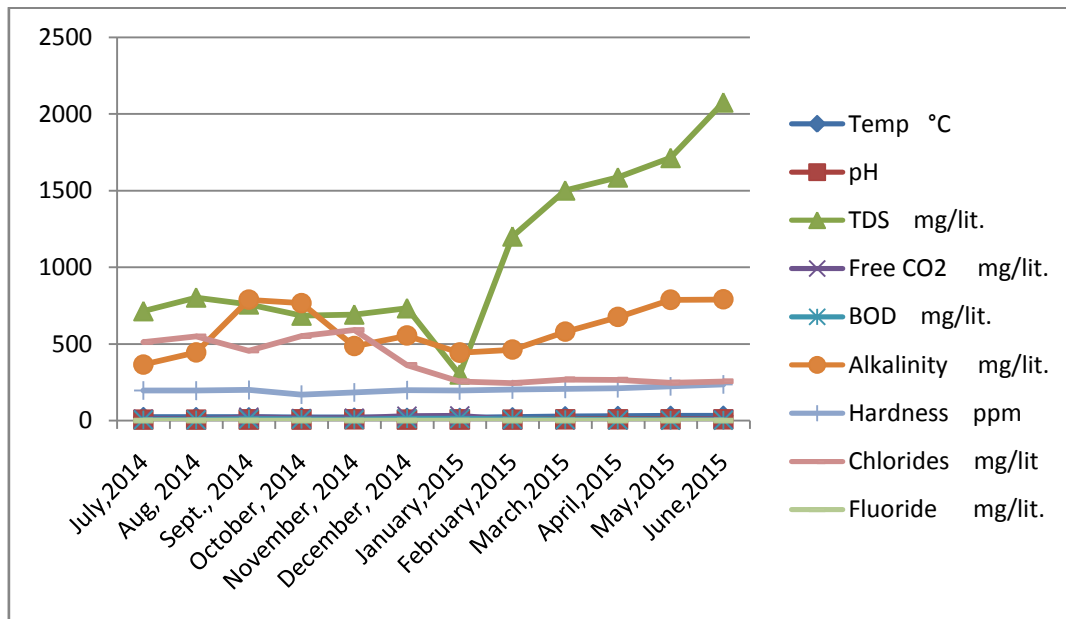


Fig 5 Linear Graphical Representations of the Data.

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 17.0 (in January) to 28.9 °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).

TDS (Total Dissolved Solids)

Water, the universal solvent has large number of salts dissolved in it, which largely govern the physicochemical properties and intum have an indirect effect on aquatic organisms. The total dissolved solids fluctuated in this lake were between 302(Jan, 2015) to 2085 mg/litre (in June, 2015) which show hard water character. This observation is supported by the study of Sumitra et al.(2007). 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.

Asian Resonance

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) 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.

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). 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 368.5 to 789 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 tandom 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.

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). 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). 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.

Chloride

The mean value of chloride content in the lake is 379.75mg/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) 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.

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. Jaisamand 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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