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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 Jaisamand Lake is the source of irrigation and drinking water for nearby rural areas of Alwar. The physico-chemical quality of water of this lake has been assessed by observing temperature, pH, TDS, Free $CO_2$, 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 1200 hectare and 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. its productive area is of 500 hectare The water of this pond 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**

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**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, integrated and a 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

$$TDS = \frac{W2-W1}{V} X\ 1000$$

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. | Hardness ppm | Chlorides mg/lit | Fluoride 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 |

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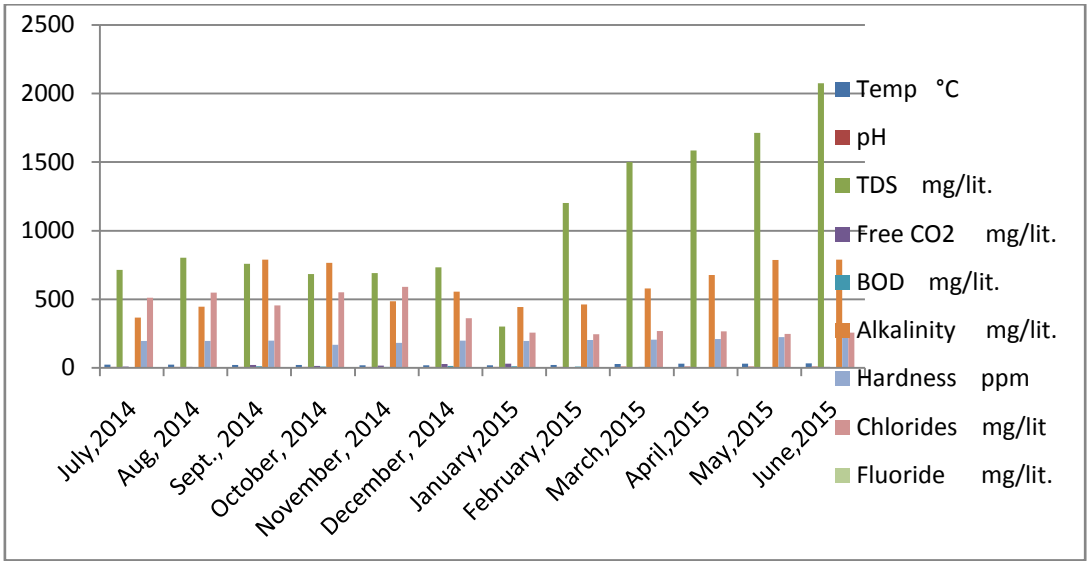


**Fig: 4 Columnar Graphical Representations of The Data.**

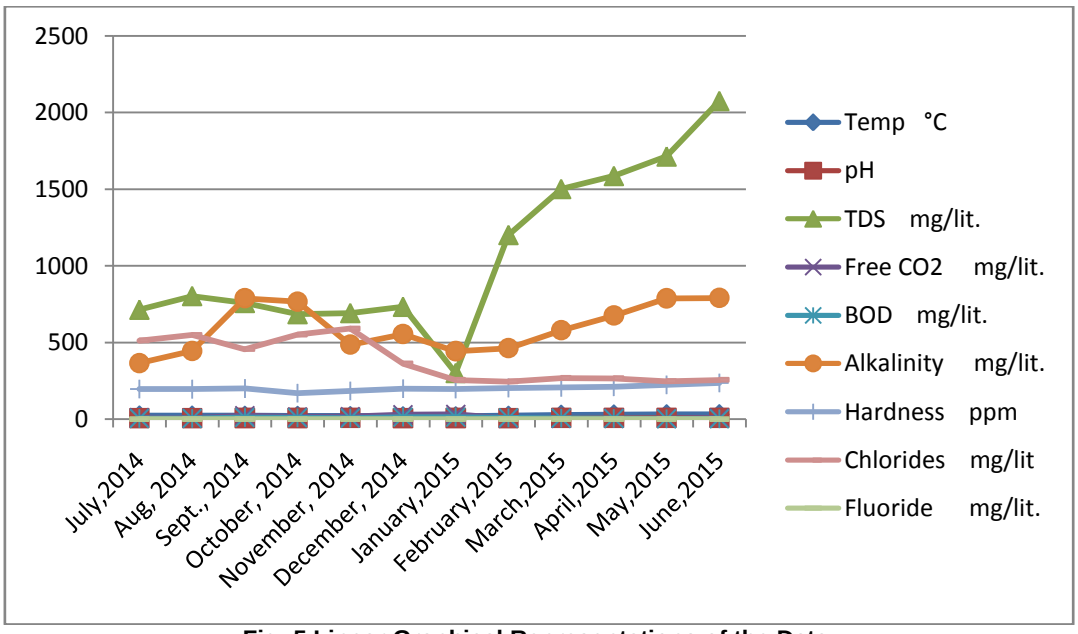


**Fig: 5 Linear Graphical Representations of the Data.**

**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 inturn 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.

**Free Carbon dioxide**

Free $CO_2$ is one of the essential constituents of an aquatic ecosystem. The abundance of $CO_2$ 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 $CO_2$ 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 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 tendom 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.

**Hardness**

The mean value of 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 (Kumar et al. 2010). Maximum permissible 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. Gupta and Verma (2007) in their study on Deeg town, Bharatpur, observed fluoride to range between 2.11 to 2.27 mg/l in PHED water supply. Fluoride showed positive correlation with depth of visibility, pH, dissolved oxygen, total hardness, nitrate, phosphate, GPP and NPP. 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, unsafe for human use and excessive silting reducing depth of the lake. Therefore water of the lake is very unsafe and must be used only after suitable treatment process.

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