



Assessment of present water quality of Govindgarh Lake, Rewa (M.P.) using physico-chemical parameters

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Abstract

Present investigations were carried out on the Assessment of present water quality of Govindgarh lake, Rewa (M.P.) using physico-chemical parameters. Physico-chemical parameters were analyzed for the period of November 2014 to October 2015. Variables analyzed from surface water of the lake were Air temperature, Water temperature, Transparency, pH, Conductivity, Dissolved Oxygen, Free Carbon dioxide, BOD, COD, Alkalinity, TDS, Calcium Hardness, Magnesium, Total Hardness, Chloride, Phosphate, Nitrate and Potassium. The physicochemical parameters fluctuate throughout the study period. Studies show that the water in this lake is suitable for drinking purposes as well as for domestic use.

Keywords: water quality, physico-chemical parameters, Govindgarh Lake

1. Introduction

Inland water resources and their high productivity have a very important place in human civilization and therefore adequate knowledge of their environment is indispensable. It is estimated that the total area of freshwater in the world is 2.5 million sq km. It makes up about 0.5% of the total surface of the Earth. Water spread over 1.37 million hectares in the form of lakes and reservoirs in India.

Lakes play an important role in the country's development programs. They can serve as sources of drinking water and water for industries for agricultural power development and fisheries. Unfortunately domestic settlements pollute the prominence of our lake system with human settlements and industrial wastes. Water pollution severely affects aquatic life. Large-scale fish killing and distraction of other aquatic life due to industrial pollutants have become a common feature in many lakes in our country.

The quality and quantity of water have some valuable effects on the metabolic activities of organisms. Furthermore, it has been observed that the high specific heat of water allows it to resist seasonal changes in water temperature. It is clear that water is a poor thermal conductor and a slight change in temperature causes a rapid change in its density. Surface tension and viscosity of the water surface play a significant effect in shaping the characteristics of the respective planktonic communities and other microbes.

Water is a condition for the existence of life. Other than air, water is another important requirement for human life to exist. It is nature's gift to mankind. It is available in various forms such as rivers, lakes, streams, etc. The importance of water in human life is so high that any city in the world has developed practically near any source of water supply. It may also be noted that water is available in solid, liquid and gaseous forms. The occurrence of water in these three forms is fundamentally important for human beings for comfort, luxury and various necessities of life.

Water quality parameters provide current information about

the concentration of different solutes at a certain location and time. This gives the basis for identifying the suitability of water for its best designated uses and improving the existing conditions. For optimal development, management, and beneficial uses, current information is required that is provided by water quality programs. The present investigation has been carried out to assess the water quality status of Govindgarh Lake, Rewa (MP).

Thus, the present work is aimed at the physico-chemical parameters of Govindgarh Lake which are mainly used for irrigation purposes, commercial fishing practice and recreation.

2. Materials and Methods

The samples of water (Surface) were collected from during three sampling stations in Govindgarh Lake from November 2014 to October 2015. Before collection of the samples the clean, dried and well labeled samples bottles and high quality of plastic canes with 1 litre capacity were kept ready. Water samples for physico-chemical parameters were analyzed for urgent parameters i.e Air temperature, Water temperature, Transparency, pH, Conductivity, Dissolved Oxygen, Free Carbon dioxide, BOD, COD, Alkalinity, TDS, Calcium Hardness, Magnesium, Total Hardness, Chloride, Phosphate, Nitrate and Potassium in the field only and then kept in the icebox to be transported to the laboratory. In laboratory the samples were stored in a refrigerator at 4°C. For analysis of physico-chemical parameters the book follows as Adoni (1985)^[1], APHA, (1998)^[2] and Trivedy and Goel (1984)^[3].

3. Results and Discussion

The abiotic environment of the freshwater ecosystem affects the biological component of the ecosystem. If there is a change in the physico-chemical characteristics of water, it has a direct effect on the biotic data. Therefore, knowledge of the physico-chemical characteristics of water is essential for proper exploitation of the aquatic environment (Kumar

et al., 2004) ^[4]. The monthly variation of physico-chemical factors at all four sampling sites during the various months

under observation is shown in Table 1.

Table 1: Average variation of Physico-chemical parameters at three sampling stations in Govindgarh Lake from November 2014 to October 2015

Parameters	Unit	Station A	Station B	Station C	Average	SD
Air temperature	°C	29.53	29.39	29.71	29.54	0.160
Water temperature	°C	29.88	29.58	29.83	29.76	0.161
Transparency	cm	34.34	34.27	33.92	34.18	0.225
pH	-	7.91	7.88	7.86	7.88	0.025
Conductivity	µmhos/cm	233.42	233.33	235.75	234.17	1.372
Dissolved Oxygen	mg/L	9.54	9.47	9.45	9.49	0.047
Free Carbon dioxide	mg/L	2.08	2.07	2.09	2.08	0.010
BOD	mg/L	6.84	6.77	6.86	6.82	0.047
COD	mg/L	21.33	21.48	21.48	21.43	0.087
Alkalinity	mg/L	73.875	73.983	74.425	74.094	0.291
TDS	mg/L	611.58	612.58	613.75	612.64	1.086
Calcium Hardness	mg/L	84.64	84.61	84.29	84.52	0.194
Magnesium	mg/L	19.95	20.29	20.48	20.24	0.269
Total Hardness	mg/L	104.59	104.90	104.78	104.76	0.156
Chloride	mg/L	34.78	34.79	34.65	34.74	0.078
Phosphate	mg/L	0.054	0.053	0.049	0.052	0.003
Nitrate	mg/L	0.21	0.22	0.21	0.21	0.006
Potassium	mg/L	4.17	4.14	4.06	4.12	0.057

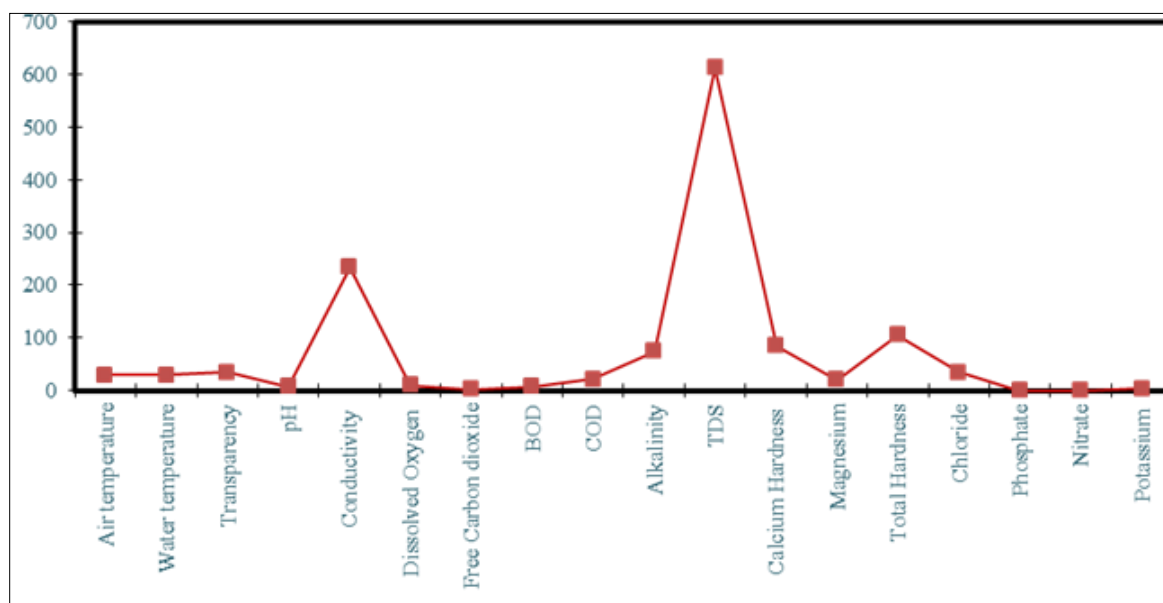


Fig 1: Average of physico-chemical parameters at Govindgarh Lake from November 2014 to October 2015

Temperature

In the present investigation the air temperature ranged between 29.39-29.71°C while water temperature ranged from 29.58 to 29.88°C. The mean \pm SD values of air temperature were recorded as 29.54 \pm 0.160mg/l & water temperature 29.76 \pm 0.161 during study period. This variation is mainly related with the temperature of atmosphere and weather conditions. Atmospheric and water temperature both play an important role in the physico-chemical and physiological behavior of the aquatic system. It also exerts profound direct or indirect influence on metabolic and physiological behavior of aquatic ecosystem (Welch, 1952) ^[5]. Water temperature exerts a major influence on the biological activity and growth of aquatic organisms. Higher the water temperature, the greater is the biological activity. Mosely (1983) ^[6] reported that the variation water temperature at different times were probably due to surface

heating during the day and cooling during night, a phenomenon commonly met within tropical water bodies.

Transparency

Solar radiation is the major source of light energy in an aquatic system, governing the primary productivity. Transparency is a characteristic of water that varies with the combined effect of colour and turbidity. The transparency values as interpreted Secchi's dis-changed from 37.6 to 53.2 cm. The mean \pm SD values of transparency were recorded as 34.18 \pm 0.225mg/l during study period. According to Boyd (1981) ^[7] the apparent colour of water is caused by suspended matter, which interferes with light penetration. The lower values of transparency at station C and station B were possibly due to more turbidity of water, which was further confirmed from the higher values of suspended matters. These results were in line with the findings of

Mahboob (1992) ^[8].

PH

Ph is a measure of acidity or alkalinity of water which is expressed in terms of hydrogen ion concentration. Small variations in pH do not have any effect on aquatic life. The desirable limit of pH for drinking water is between 6.5-8.5 (BIS, 1992) ^[9]. In the present study pH values ranged from 7.86 and 7.91 (acidic to alkaline). The lowest pH was recorded at station C while station A recorded the highest pH. The mean \pm SD values of pH were recorded as 7.88 ± 0.25 during study period. Carre *et al.*, (1983) ^[10] reported that the lower pH values may affect distribution of organism in the system.

Conductivity

Conductivity is a measurement of the ability of an aqueous solution to carry an electric current. The conductivity value was ranged between 233.33-233.75 μ mhos/cm. highest value of conductivity observed at station C may be attributed to increased concentration of salts at the bottom by siltation and sedimentation. The mean \pm SD values of Conductivity were recorded as 234.17 ± 1.372 μ mhos/cm during study period. This finding is in agreement with that in Vellayani lake (Radhika *et al.*, 2004) ^[11]. The conductivity value found all the sampling sites are within the permissible limit indicating water is not polluted with respect to conductivity.

Dissolved oxygen

Dissolved Oxygen is a very important parameter in water analysis as it serves as an indicator of the physical, chemical and biological activities of the water body. Higher concentration of dissolved oxygen was observed at the station A, which is subjected to minimum discharge of effluent while the lowest value of dissolved oxygen was recorded at stations C where maximum discharge of sewage effluents was observed. Dissolved oxygen is essential and in some cases even limiting factor for maintaining aquatic life; its depletion in water is probably the most frequent result of certain forms of water pollution (Srivastava *et al.*, 2009) ^[12].

Free Carbon dioxide

The amount of free CO₂ in stagnant water is generally maintained by diffusion from atmosphere, respiration by animals along with plants and bacterial decomposition of organic matter (Mishra *et al.*, 1993) ^[13]. The excessive amount of carbon dioxide exerts certain specific effects on aquatic biota. In the present investigation, value of CO₂ varied between 2.07 to 2.09 mg/l. The mean \pm SD values of CO₂ were recorded as 2.08 ± 0.010 mg/l during study period. Cole (1975) ^[14] viewed that free CO₂ supply rarely limits the growth of phytoplankton. Alternately, the bicarbonates are utilized as a source of carbon by the photosynthetic activity of phytoplankton.

BOD

The minimum values of BOD were recorded in the station B and maximum in the month of station C during study period. The mean \pm SD value of BOD were estimated as 6.82 ± 0.047 mg/l during study period. Boyd (1998) ^[15] described the optimum level of BOD <10 mg/l for fresh water aquaculture. BOD values in Govindgarh Lake is more than 6.0 mg/l in some months of summer and rainy season, but below 10 mg/l (the optimum level of boyhood).

COD

COD was ranged between 21.33 to 21.48 mg/l. The mean \pm SD values of COD were recorded as 21.43 ± 0.087 mg/l during study period. APHA (1998) ^[2] reported the appropriate level of COD <20 mg/l for drinking water. Shinde *et al.* (2010) ^[16], during the monsoon season, the high prices of COD and the decrease in the summer season were reported.

Alkalinity

The minimum values of alkalinity were recorded in the station A and maximum in the station C during observation. The mean \pm SD values of alkalinity were calculated as 74.094 ± 0.291 mg/l in the study period. Saksena *et al.* (2006) ^[17] recorded total alkalinity of water between 5.0 to 142.0mg/l in Ratnagiri (Maharashtra) ponds.

TDS

TDS is a common indicator of polluted waters (Tay, 2007) ^[18]. It is the term used to describe the inorganic salts and small amounts of organic matter present in solution of water. There is no serious effect of high TDS on aquatic life. However TDS cause toxicity through increase in salinity, changes in ionic composition of water that become a cause of shift in biotic communities, limit biodiversity and cause acute or chronic effect at specific life stages. In the present study TDS ranges between 94-158 ppm. The mean \pm SD values of TDS were recorded as 612.64 ± 1.086 mg/l during study period.

Calcium

The minimum and maximum values of calcium hardness ranged between 84.29 to 84.64mg/l at all station. The mean \pm SD values of calcium hardness recorded as 84.52 ± 0.194 mg/l during study period. Boyd (1998) ^[15] described the optimal level of calcium between 75-150mg/l for fresh water aquaculture.

Magnesium

The concentrations of magnesium were varied from 19.95 to 20.48mg/l at all station. The mean \pm SD values of magnesium were recorded as 20.24 ± 0.269 mg/l during study period. Magnesium values were always recorded less than calcium. Mishra *et al.* (1993) ^[19] reported the values of magnesium hardness between 13.5 to 45.0mg/l in Hirkud reservoir.

Total Hardness

The total hardness ranged from 104.59 to 104.90mg/l at all station. The mean \pm SD values of total hardness were computed as 104.76 ± 0.156 mg/l during study period. Shinde *et al.* (2010) ^[20] reported the total hardness limit between 350.0 to 554.0mg/l in Harsol-Savandi Dam, Aurangabad (M.S.).

Chloride Content

The presence of Chlorides in natural waters can mainly be attributed to dissolution of salt deposits in the form of ions (Cl⁻). In the present observation Chloride value ranged between 34.65-34.79 mg/l respectively. Similar observation was made by Vass and Zutshi (1983) ^[21] in Kashmir Himalayan Lake who reported that higher the Chloride value may be due to organic wastes of animal origin and

domestic wastes.

Phosphate content

The minimum and maximum values of phosphate were ranged between 0.049 to 0.053 mg/l at all stations. The mean \pm SD values of phosphate content were recorded as 0.052 ± 0.003 mg/l during study period. Phosphate is a major source of inorganic phosphorus in the pond and it has great importance in plant metabolism. Dillon (1975) ^[22] stated that due to its low volume phosphorus often acts as the limiting factor for plant growth in aquatic ecosystem.

Nitrate

Nitrate represents the product of oxidation of nitrogenous matters and its concentration may depend on the nitrification and denitrification activities of micro-organisms. The presence of little higher value in water is an indication of pollution in the water body and will cause eutrophication as a nutrient, hence reducing water quality. The Nitrate content at the sampling sites fluctuated between 0.21-0.22 mg/l. The mean \pm SD values of Nitrate were recorded as 0.21 ± 0.006 mg/l during study period. This is may be because much of their input resulted from land drainage and urban runoff. High level of nitrate in drinking water was due to excessive use of fertilizers in agriculture, decayed vegetable, animal matter, domestic effluents, sewage or sludge disposal, industrial discharges, leachable from refuse dumps, atmospheric washout and precipitation has become serious problem (Makhijani and Manoharan, 1999) ^[23].

Potassium

Potassium is an important element and found in low concentrations (<10 mg/l) in natural waters. Its play a vital role in the metabolism of freshwater environments. During the present study period potassium varied from 4.06-4.17 mg/L. The mean \pm SD values of potassium were recorded as 4.12 ± 0.057 mg/l during study period. Potassium and sodium are one of the major quotes in water and soil. Fish ponds are usually supplied with Potassium (Dwivedi and Pandey, (2002) ^[24] and Chattopadhyay, (1998) ^[25].

4. Conclusion

The present study elucidated that the analysis of various physico-chemical parameters of Govindgarh Lake, Rewa. However overall of these parameters were found to be within the permissible limits. To improve the quality of water there should be continuous monitoring of pollution level and maintain the favorable conditions essential for domestic purposes; fish survival, growth and reproduction in Govindgarh Lake, Rewa.

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