



## Physico chemical analysis and role of Phytoplanktons in Govindgarh Lake

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### Abstract

Water is a prime natural resource, a basic human need and a precious national asset. Planning development and management of water resources need to be governed by national perspectives. The Govindgarh dam is one of the unique water body in India and located in south of Rewa, district in Madhya Pradesh at a distance of 20 km. from Rewa, with a longitude 24°20'25" and latitude 81°15'20". The dam is connected with all-weather Rewa-Shahdol and Satna-Sidhi road. The dam was formed by impounding of small nalla originating from Kaimore hill. With a view to storing rain water, the Maharaja of Rewa at that time built a bandh across the nalla to form a tank in the year 1958. The shows that the lake is functioning as a carbon and nitrate removal system. Major untreated sewage influx is removed by the bio diversity of the lake. There are three major sinks namely bacterial, algal, dominated by *Microcystis* in summer and before winter and in winter it is dominated by *Chlorella* followed by *Euglenophyceae* member. The third sink is the macrophyte water Hyacinth, followed by Alligator weed (*Alternanthera philoxeroides*). Thus we can see that the surrounding borewell has 3 to 4 times increase in pollutants in ground water compared to surface water. Since there is no vegetation to remove the influx in ground water which gets all the pollutant leaching through the sediments into the water table.

**Keywords:** dissolved oxygen, conductivity, chloride, phosphates, nitrates, *Microcystis*, *chlorella*

### 1. Introduction

Water pollution has been a major issue as water forms an important component of our day-to-day activity. Contamination of fresh water by sewage is a common occurrence. Excess nutrients either from sewage discharge industrial discharge or agriculture run-off add to the imbalance in the dynamics of water quality. Heavy metals, which are also one of the main causes of pollution, gain entry into the water body through untreated industrial effluents. Run-off from the agricultural land such as pesticides, also pose a serious threat to the water quality as the chemical constituent gets bio-accumulated and magnified along the food chain.

Among the various sources of water, especially groundwater should be the safest water for drinking and domestic purposes. Nevertheless, several factors like improper discharge of agricultural, domestic and industrial waste waters, haphazardly land use practices, geological formation as well as rainfall patterns and also infiltration rate are reported to effect the quality of groundwater in an area (Mishra, *et al.* 2009, Tewari, *et al.* 2010, Sirajudeen, *et al.* 2014, Kumar and Kumar 2015 and Subba and Suba, 1995, Helen Roselene and Paneerselvam, 2007) [1-6].

The lake is a big water body and rich in its flora and fauna. Lake water is used for various purposes like Pisciculture, irrigation, horticulture, water supply to Rewa city, recreation and for drinking, bathing, washing clothes, cattle swallowing and vehicle servicing etc. The lake has been providing irrigation facilities since the year 1956. The lake was designed to provide irrigation to 1000 acres in the village Amin, Dhobahat and Parasia of Satna district and Nakta, Semaria and Kolwaru in Rewa district.

The Govindgarh Lake was constructed by late his highness, Maharaja Raghuraj Singh Judeo in the memory of his father

maharaja Vishwanth Singh during middle of Nineteenth century on the request of his maharani, who was a princess of Udaypur.

This lake was named previously as Vishwanath Sagar. It was further extended by his son maharaja Venkatraman Singh and was further renovated by Maharaja, Sir Gulab Singh.

The poor and the labour class people use the lake water for washing and bathing leading to pollution and also affect the aesthetic environment. The socio-economic conditions of the people must be improved for a better infrastructure and lake restoration. Govindgarh lake is also under serious threat due to damaging land use practice in the catchments area. The lake choking with weeds, silting and encroached from all sides is shrinking in size with deterioration in its quality and loss of its varied flora, fauna and other resources.

### 2. Methodology

For phyto plankton study the lake water was filtered through plankton net and the water was centrifuged and wet mount (temporary) was to studied for algal diversity for major physico chemical analysis listed below were followed (APHA, 1998 and Burman *et al.* 1996) [7-8].

#### Physical

- Turbidity, NTU Turbidity meter
- Water temperature, °C Mercury thermometer
- EC, m/ S/cm conductivity meter method
- TDS, mg/L Gravimetric method

#### Chemical

- pH Electrometric methods
- DO, mg/L Winkler's iodometric methods
- C. hlorides, mg/L Titrimetric method

- Total alkalinity, mg/L Titrimetric method
- Total hardness, mg/L Titrimetric method
- Sulphates, mg/L Spectrophotometric method
- Nitrates, mg/L Spectrophotometric method
- Phosphates, mg/L Spectrophotometric method
- Potassium, mg/L Flame photometric method
- Chromium, mg/L Spectrophotometric method
- Iron, mg/L Spectrophotometric method
- Biological : Coliforms MF Technique

### 3. Results & Discussion

Bio-monitoring and Physico-chemical analysis of Govindgarh lake was analysed based on parameters like pH, temperature, conductivity, turbidity, total solvents, BOD, COD, alkalinity etc. The readings of such parameters help us to determine the condition of the lake compared to the standard values of the parameters. The readings of such parameters help us to determine the condition of the lake compared to the standard values of the water sample were high during the months August and September, indicating

the favourable conditions for the growth of algae such as *Microcystis*. Later in the months of October and November, when analyzed, the readings were slightly high than the standard values; indicating the presence of certain micro-organisms which could thrive in such conditions like, *Spirulina*, *Diatoms*, *Microcystis*, *Oscillatoria*, *Chlorella*, *Anhistrodesnus*, *Scenedesmus* and so on. Presence of these algae indicates that the quality of water is unfit for basic requirements of human beings since these organism are indicators of organic pollution or sewage pollution. In August the water also showed maximum hardness 1362 mg/L and sulphate content is 1902 mg/L, presence of iron is (0.7 mg/L). In September there is decrease in pollutant which could be attributed to dilution by rainfall. There is steady increase in pollutants in December, the BOD and COD is also very high which could be attributed to the influx of untreated or partially treated sewage water. The above results (table-1), where the contaminants from lake have leached the water table.

**Table 1:** Physico-chemical analysis of Govindgarh lake.

Parameters	Months Standards	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
Temperature	°C	28	26	31	25	22	21	20	23.5
pH	6.5-8.5	7.03	7.71	7.12	8.4	7.5	7.1	7.2	7.7
Conductivity	300	842	990	860	710	680	737	940	860
Turbidity	5NTU	12	10	33	12	22	17	11	17
Total Solid	500 mg/L	410	570	680	665	725	582	540	405
DO	0.5 mg/L	0.4	0.3	1.7	1	0	1	1	1
BOD	30 mg/L	27	205	230	275	310	315	401	385
COD	250mg/L	140	602	526	634	712	765	782	693
Alkalinity	200 mg/L	552	42	134	672	432	306	184	196
Chloride	250 mg/L	126	135	130	124	117	126	140	122
Hardness	300 mg/L	1362	92	410	385	468	355	382	290
Phosphate	0.1mg/L	7	11	1.6	2	4	1.65	0.91	1.65
Nitrate	45 mg/L	4.6	7.7	1.03	4	4.9	1.4	1.2	4.4
Sulphate	200 mg/L	1902	182	126	224	480	122	104	52
Iron	0.3 mg/L	0.7	BDL	BDL	BDL	0	0	0.93	0.64
Total Coliform		>1500	>1500	>1500	>1500	>1500	>1500	>1500	

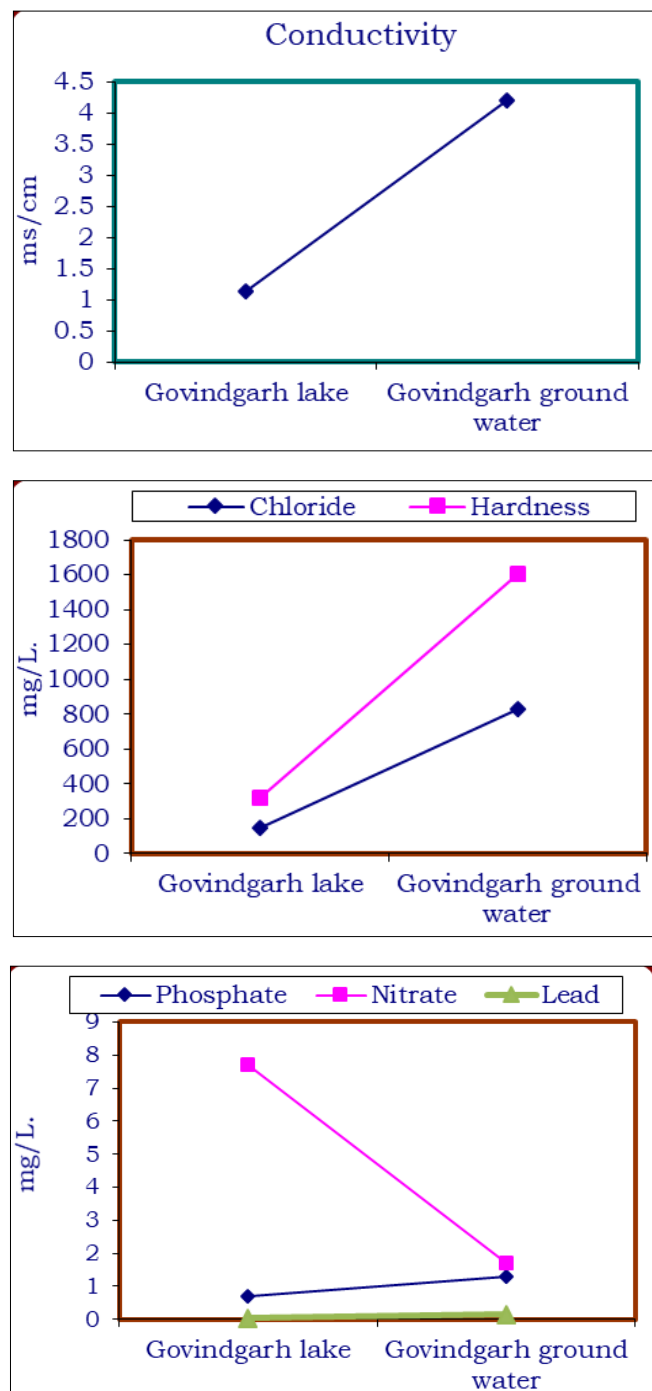
**Table 2:** Physico-chemical analysis of Govindgarh lake and ground water of Govindgarh village

S. No.	Parameters	Govindgarh lake	Govindgarh ground water
1.	Conductivity	1.13 ms/cm	4.2 ms/cm
2.	Chloride	148.2 mg/L	828.741 mg/L
3.	Hardness	318 mg/L	1601 mg/L
4.	Phosphate	0.7 mg/L	1.3 mg/L
5.	Nitrate	7.7mg/L	1.7 mg/L
6.	Lead	0.04 mg/L	0.14 mg/L

The comparative analysis of ground water has pollutants three times more than lake water. In the month of June 2018, the hardness of lake was 318 mg/L and the bore well water had a hardness of 1601 mg/L. Phosphate content is 0.7 mg/L and bore well water has phosphate content of 1.3 mg/L. Nitrate content 1.7 mg/L and bore well water has nitrite content of 7.7 mg/L and surprisingly the analysis by AAS done by dept of mines of geology, Rewa also shows that Govindgarh lake has a lead content of 0.04 mg/L and Govindgarh village bore well water shows lead content of

0.14 mg/L. The study is shocking since Govindgarh village has fallen a prey to this slow chronic poison (bore well water) as the water, the Elixir of life, is contaminated and village has no other source of drinking water. This impact can be related to the health condition (swollen legs). There are also cases of scabies in men and their children who work using the lake water for construction purpose.

This shows that the lake is functioning as a carbon and nitrate removal system. Major untreated sewage influx is removed by the bio diversity of the lake. Three major sinks namely bacterial, algal, dominated by *Microcystis* in summer and before winter and in winter it is dominated by *Chlorella*, followed by *Euglenohycaeae* member. The third sink is the macrophyte water hyacinth followed by Alligator weed (*Alternanthera philoxeroides*). Thus we can see that the surrounding borewell has 3 to 4 times increase in pollutants in ground water compared to surface water (Govindgarh lake). Since there is no vegetation to remove the influx in ground water which gets all the pollutant leaching through the sediments into the water table.



**Fig 1:** Graphical representation of Physico-chemical analysis of Govindgarh lake and ground water of Govindgarh.

The present work carried out is a stepping-stone for bioremediation where the algae isolated has a potential for advanced engineered biological system for large-scale bioremediation of pollutants.

#### Future research design

Our present study was to find out a co relation of the physical and chemical parameters of the water body and solate the algae and macrophyte for further phytoremediation study it and study the organism for furter ccumulation of the nutrients.

#### Future scope of the study (Importance of the study)

The immediate importance of the study to alert the local eople about the need to save the water body and explain the leaching and accumulation of nutrients. The research carried

out would enable the potential for advanced engineered biological system for large scale bioremediation of pollutants. If successfully studied in Ex-Situ condition this technique could be applied in other areas of treatment of industrial effluents

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