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Study of Chemical Parameters in Bichhiya River and Govindgarh Lake of District Rewa (M. P.) India

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Abstract

Water is one of the abundantly available substances in nature. It is an important and life sustaining drinks to human and is essential for the survival of all the organisms. Living organisms require large quantities of water for their sustenance. In this study we are analyzed to seasonal variation in chemical parameters like Dissolved Oxygen, Free CO_2, Total alkalinity and Chloride in Bichhiya River and Govindgarh Lake of Rewa (M. P.) in all months of year 2009 and 2010.

Key words: Bichhiya River, Govindgarh Lake and Chemical parameters

Introduction

Water is a vital natural resources, rapidly becoming scare in quantity, quality and unpredictable supply in many places of the globe. The enormous quantity of water covers most of the globe and riddles the continents with lakes and river, water is the medium, participant in all of the chemical reactions occurring in the environment, including the life processes. Indeed water is an important condition of life. Water is essential for all socioeconomic development and for maintaining healthy ecosystems. Natural surface water bodies like rivers and streams are subjected to pollution comprising of organic and inorganic constituent. [1]

Rivers are the most important sources of water to global population. Rivers provide water for industry, agriculture, commercial, aquaculture and domestic purposes. Unfortunately this important source of water is being polluted by indiscriminate disposal of sewage, industrial wastes and plethora of human activities. The significant role played by river in almost in every development programm of country hardly needs many elaborations. Peoples living along bank of these rivers largely depends on them for their water needs for everyday for living.

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Lakes play an important role in the development programmes of country. They can serve as sources of drinking and for industries, for agriculture, power development and fisheries. Unfortunately domestic wastes from human settlement and industrial effluents pollute majorities of our lakes and river system. Water pollution severely affected aquatic life. Massive fish killing and distraction of other aquatic life due to industrial pollutants has become a common feature in many lakes and rivers of country. [2]

The chemical properties influence its suitability of specific application and also affect the general condition of the aquatic environment and its biota. The rise and fall of these factors very frequently affect the fauna altering their number of diversity. In this reference the chemical parameters of Bichhiya River and Govindgarh Lake such as Water Dissolved Oxygen, Free CO_2, Total alkalinity and Chloride were seasonally determined. [3]

The present study aims at acquiring the first hand knowledge of the water quality of Bichhiya River and Govindgarh Lake in order to assess its production potential.

Material and Methods

Study sites

The study area is situated between 81^0-$18^,$ east longitude and 28^0-$32^,$ north latitude and is situated on Vindhya plateau at the height of 318 meter above m. s. l. The climate is mainly sub tropical and sub humid. The average annual rainfall of the region is 82.953 mm and relative humidity is 79.36 %. Two water bodies namely Bichhiya River and Govindgarh Lake were

selected for study, because of their contribution to the development of fresh water culture fishery of Rewa district. The Govindgarh Lake is located 24^0-20' 25'' longitude and 81^0-15' 20'' latitude of Rewa district while Bichhiya River is located on 24^0-10' N and 81^0-15' longitude east of Rewa town.

Sampling Station
Four sampling station were selected for chemical analysis of river. They are-
Station 1st - The Ist station was Gurh where the river Bichhiya originated. It is about 27k.m. away From Rewa town.
Station 2nd - The 2nd station was established at Laxman Bag Mandir 6 km away from Rewa District.
Station 3rd - The 3rd station was established before Rajghat the characteristics of the station is PHE Deptt. Pumping.
Station 4th - The 4th station was marked on Chhotipul which is half km from Old Rewa Bus Stand.
The four sampling station were selected after preliminary observation of Lake for the purpose of present study. The four sampling site for present investigation as A, B, C and D water sample were collected from all these four station,
1st Sampling station A - Fort - This is a point located cast of the lake.
2nd Sampling station B – Corner of Lake
3rd Sampling station C - Gopal Bag - This site is situated at centre of the lake.
4th Sampling station D - Fish form

Chemical conditions of water
Dissolved oxygen
Dissolved oxygen was analysed by winkler's method with Azide modification. The water sample were collected in 125ml ground glass stoppered bottles without bubbling and were immediate fixed by addition of 1 ml. Each of managanous sulphate and alkaline codida azide respectively. The resultant brown precipitatate was dissolved by adding 1 ml. conentrated sulphuric acid filling the bottle upside down at least 5-6 times. 50 ml. aliquet was titrated against 0.025 N solution of sodium thiosulphate titrated against 0.025 N solution of sodium thiosulphate titrant upto the disappearance of blue colour using starch as an indicator (APHA, 2005)[4] . The dissolved oxygen content was calculated using the following formula.

$$\text{Dissolved oxygen mg / lit.} = \frac{\text{ml. of Titrant} \times N \times E \times 1000}{\text{ml. of sample}}$$

N = Normality of titrant
E = Equivalent weight of oxygen

Free CO₂ (Carbon dioxide)
50 ml. of sample was taken in a conical flask and 3 drop of phenoptelene was added to it as indicator. This sample was titraed with N/44 N_a OH and quantity required to turn the sample pink was noted.
Calculation

$$\text{Free carbon dioxide mg / lit.} = \frac{\text{ml. of Titrant}}{\text{ml. of sample}}$$

Total Alkalinity
Bicarbonate alkalinity is determined as the second end point by adding to drops of methyl orange as indicator in the sample and titrated it with diluted H_2SO_4 (0.02N) till change of colour from yellow to orange. The following formula was used for computing the total alkalinity of the water sample.

$$\text{Total alkalinity (T) as mg / lit.} = \frac{\text{ml. of titrant} \times 100}{\text{ml. of sample}}$$

Chloride
Chloride concentration was estimated by titrating 50 ml water sample with 0.014 N Silver nitrate titrant up to a Pinkish Yellow end point using potassium dromate solution indicator. The value of chlorides were computed as:

$$\text{Chloride mg / lit.} = \frac{\text{ml. of Titrant} \times N \times 35.46 \times 1000}{\text{ml of sample}}$$

where, N= Normality of silver nitrate solution.

Results and Discussion
Water is an incredibly important aspect of our daily life. Every day we drink water, cook with water, bath in water and participate in many activities involving water. It is essential for all dimensions of life. Table 1 and 2 shows the range of different chemical parameters.

Dissolved Oxygen (DO)
DO is required for the metabolism of all aquatic organisms. It is important index of water quality, it provide valuable information above the biological and biochemical reaction on going in water. Verma et. al. (1967) [5] showed that the favorable range of dissolved O_2 lies between 3.6 to 4.8 ppm.
In the present work the value of dissolved O_2 in river water is S_1 6.5 to 8.1 mg./l., S_2 6.3 to 7.5 mg./l., S_3 6.5 to 8.6 mg./l., S_4 3.5 to 8.1 mg./l. In lake recorded **A** 5.2 to 14.9 mg./l., **B** 5.1 to 15.2 mg./l., **C** 4.9 to 14.8 mg./l., **D** 4.8 to 15.1 mg./l.
In the present investigation there is no direct relation between temperature and dissolved oxygen. Ganpati (1962) [6] has reported that, it increased photosynthetic activity is the main source for the increases oxygen contents.

Free carbon-di-oxide (Free CO_2)

Oxygen and CO_2 are reciprocal and directly influence the ecology of water. It is assumed that these are interrelated in mainting their balance in any living sphere. CO_2 dissolved in water is the source of carbon which can be assimilated and incorporated into the living matter of all the aquatic autotrophs[7]. The major sources of free CO_2 in water are directly from the atmosphere, respiratory activities of animals and decomposition of organic matter. The free CO_2 is directly proportional to carbonates and bicarbonates. The concentration of carbonates and bicarbontes of calcium are influenced by the presence or absence of this gas. Thus it seems that waters rich in CO_2 are comparatively less alkaline, where as waters deficient in this gas are more alkaline.

In the present observation free CO_2, shows an inverse relationship with dissolved O_2. A similar trend was reported by Odum (1971) [8]. During monsoon, free CO_2 was mostly present in the bottom samples, where low rate of photosynthesis, respiratory activities of aquatic organisms and high rate of decomposition of organic matter was observed. The free CO_2 values on the surface water were generally lower as compared to bottom water and showed an inverse relationship with dissolved O_2.

In the present observation the value of CO_2 in Bichhiya river is, **S₁** 2.0 to 6.0 mg/lit. **S₂** 2.3 to 5.2 mg/lit., **S₃** 2.0 to 5.3 mg/lit., **S₄** 2.1 to 5.1 mg/lit. In Govindgarh lake **A** 2.8 to 7.0 mg/lit., **B** 3.0 to 6.7 mg/lit, **C** 2.8 to 6.8 mg/lit., and **D** 3.2 to 6.5 mg/lit.

Now it comes clear that the concentration of free CO_2 had fluctuated in a great amount and in different seasons at the different sampling stations, but it is significantly high during summer and low during winter seasons. In the study area the free CO_2 shows inverse relation with pH. when free CO_2 is absent pH is high. It agrees with the work of Sreenivasan (1974) [9].

Total Alkalinity

The alkalinity in water in the presence of salt in natural water these are monthly bicarbonate and possibly carbonate and to laser extent hydro-oxide and silicate. Water more than 8.3 pH comes in range of alkaline.

The alkalinity values have been found to fluctuate in river between min. 116.0 and max. 165. In lake min. 62.0 max. 214.0.

In the present study in river water **S₁** 121.0 to 152.0 mg./l., **S₂** 121.0 to 156.0 mg./l., **S₃** 116.0 to 160.0 mg./l., **S₄** 126.0 to 165.0 mg./l. In Govindgarh lake it is in **A** 65.0 to 201.0 mg./l., **B** 63.0 to 209.0 mg./l., **C** 62.0 to 210.0 mg./l. and in **D** 64.0 to 214.0 mg./l.

In the present findings surface total alkalinity values were found to be lower than the bottom values. This may be due to the presence of dissolved oxygen at the surface and the low or sometimes absence of the same in the bottom water. This observation is in accordance with that of Sreenivasan (1974) [9].

Chloride

Chloride is a natural constituent of all water. Domestic sewage contain chloride which is a major source in aquatic system. In potable water balty test produce by chloride concentration is variable and depend on the chemical composition of water for the chloride concentration in raw water.

Chloride contain of water system is tolerable upto a concentration limit of 1500 P/L beyond that it is harmful in the present work. The min. and max. chloride concentration has been recorded min. 20.0 - max. 50.0 at station **S₁, S₂** min. 19.0 - max. 64.0, **S₃** min. 17.0 - max. 41.0, **S₄** min. 25.0 - max. 63.0. In lake varied from **A** min. 22.0 - max. 30.2, **B** min. 22.5 - max. 30.5, **C** min. 22.2 - max. 30.6, **D** min. 22.7 - max. 30.8.

The least value in river of chloride 17.0 was recorded in the season of winter 2009 at station S₃. In lake the least value 22.0 was recorded in the season of winter 2009 at station **A**.

The highest value in river of chloride 64.0 was recorded in the season of summer 2010 at station **S₂** and in lake the highest value 30.8 was recorded in the season of rainy 2010 at station **D.**

Tamot (1997) [10] commented that high values of chloride give indication of pollution due to sewage.

Table 1: Chemical Parameters of Bichhiya River (Oct. 2009 to Sep. 2010)

Station No.	Dissolved Oxygen (in mg/l)		Free CO_2 (in mg/l)		Total Alkalinity (in mg/l)		Chloride (in mg/l)	
	Min	Max	Min	Max	Min	Max	Min	Max
S1	6.5	8.1	2.0	6.0	121.0	152.0	20.0	50.0
S2	6.3	7.5	2.3	5.2	121.0	156.0	19.0	64.0
S3	6.5	8.6	2.0	5.3	116.0	160.0	17.0	41.0
S4	3.6	8.1	2.1	5.1	126.0	165.0	25.0	63.0

Table 2: Chemical Parameters of Govindgarh Lake (Oct. 2009 to Sep. 2010)

Station No.	Dissolved Oxygen (in mg/l)		Free CO_2 (in mg/l)		Total Alkalinity (in mg/l)		Chloride (in mg/l)	
	Min	Max	Min	Max	Min	Max	Min	Max
A	5.2	14.9	2.8	7.0	65.0	202.0	22.0	30.2
B	5.1	15.2	3.0	6.7	63.0	209.0	22.5	30.5
C	4.9	14.8	2.8	6.8	62.0	210.0	22.2	30.6
D	4.8	15.1	3.2	6.5	64.0	214.0	22.7	30.8

Conclusion

This study provides an informative data and helps to understand water characteristics and indicate that the water of Bichhiya River and Govindgarh Lake can serve as a good habitat. All the parameters are quite suitable for growth of Fish. Finally, it is concluded that the water of Bichhiya River and Govindgarh Lake are quite suitable for human consumptions.

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