International Journal of Biology Research
ISSN: 2455-6548
Impact Factor: RJIF 5.22
www.biologyjournal.in
Volume 3; Issue 1; January 2018; Page No. 169-172

Physico-chemical characteristics of Govindgarh Lake Rewa (M.P.) with special reference to Macrophytes

Dr. Manisha Shrivastava
Guest Faculty, Govt. T.R.S. College, Rewa, Madhya Pradesh, India

Abstract
Present investigations were carried out on the physicochemical characteristics of Govindgarh lake Rewa (M.P.) with special reference to macrophytes. It is a well-established fact that life in water depends upon the physicochemical conditions prevailing in that water. In the present work, a number of physico-chemical parameters were studied in Govindgarh Lake (such as temperature, dissolved oxygen, pH, alkalinity, nutrients, mineral composition etc.). Fluctuations in these parameters often create an adverse environment to organisms limiting their production. These also interfere their physiological processes, which reduce their ability to complete with the other populations within the environment. Many of the parameters were found below the permissible limits for drinking water as suggested by WHO. A total of 16 parameters were analysed and their seasonal variations in the year 2016 were discussed. During present investigation the author has listed 3 species of pteriodophytes and 16 species of Angiosperms. The *Azolla pinna,* of Pteriodphytes and *Echhornia crassipes, Nymphaea stellata, Jussia repens, Ipomoea carnea, Hydrilla verticillata, Certaphyllum demursum, Colocasia antiquorum* and *Monochoria vaginalis* of Angiosperms were observed as dominant species. These species are acts as bioindicators.

Keywords: physico-chemical, characteristics, Macrophytes, Govindgarh Lake

1. Introduction

The importance of physicochemical studies of fresh water is now being felt as never before because of the fast rate of indiscriminate exploitation of fresh water resources. Therefore small towns which are climatologically pleasant are now undergoing changes in their environment due to industrialisation (Singh and Rai 1988) [1]. It has been estimated that hardly 1% of the global water lies in the form of inland fresh waters.

Most of these fresh water environments are being eutriphied and obviously this is due to high loading of organic nutrients. Thus fresh water bodies are being unduly affected by excessive influence of human activities and urbanization.

The studies about the physico-chemical factors for a water body not only provide us the data about their seasonal and spatial variations but also help us to access the trophic status of water. According to Welch (1952) [2], each physical and chemical influence is not as a purely physical or chemical phenomena but as a contributor to the sum total of these conditions which make possible the survival and existence of the different processes in living systems. Hutchinson (1957) [4] cited that a skillful limnologist can understand more about the status of a water body only from the changes in dissolved oxygen rather than other factors.

The penetration of light or transparency of water body is also considered as a limiting factor. It is apparent that light penetration is often restricted by the suspended materials in water, that may reduce the photoyosynthetic zone for primary producers. Therefore this parameter not only affects the water temperature but also affect the rate of primary production.

The chemical composition of fresh water consists of certain inorganic salts and dissolved gases, Sodium, Calcium, Carbonate, Bicarbonate, Chloride, Oxygen, Carbondioxide, Ammonia and Nitrogen or some significant parameters which decide the water chemistry of a given aquatic ecosystem. Different fresh water environments may differ as per their physico-chemical conditions and in buffer mechanisms.

Physicochemical investigations on water bodies were aimed to assess the deterioration of water quality due to pollution. Thus it is very much essential for a healthy growth. But it may become harmful for life, if one uses water polluted with harmful or with toxic substances and poor sanitation. (Welch, 1952[2], Tewari, *et al.* 2010 [3], Hutchinson (1957) [4], Kumar and Kumar 2015) [5]. Water quality parameters provide the basis for judging the suitability of water for its designated uses and to improve existing conditions. For optimum development and management for the beneficial uses, current information is needed which is provided by water quality programmes (Lloyd, 1992) [6]. We depend on water for domestic needs, irrigation, sanitation and disposal of wastes. The quality and quantity of surface water bodies like lakes and tanks depend upon the climate, catchments, geography of the area and the inputs and outputs both natural and manmade (Gray, 1994) [7]. The water quality of lakes can be degraded due to microbiological and chemicals contaminants. In water natural impurities are in very low amounts. Lakes, dams, rivers are important source of fresh water.

2. Materials and Methods

The Govindgarh lake is one of the unique water body in India and located in south of Rewa, district in Madhya Pradesh at a distance of 20 kms. from Rewa, with a longitude 24°20'25" and latitude 81°15'20". The lake is connected with all weather Rewa-Shahdol and Satna-Sidhi road. The lake 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.

During the present investigation author has selected four study sites for Physico-chemical nature of water and macrophytes of this Govindgarh lake Rewa region in particular. This historic geographical region provides a unique environment. So far no work on these aspects was attempted and hence the present problem was undertaken.

Samples of the water for physicochemical characteristics were analysed according to standard methods of APHA (1998) [8] and Paka and Rao (1997) [9]. Water samples were collected during morning hours in between 8.30 to 10.30 a.m. with one litre containers from the pond in three seasons. To study the water quality and its seasonal variations, the water samples are collected during summer, monsoon and winter seasons. Some of the results were recorded at the sampling sites whereas the others were recorded in the laboratory. The parameters observed were colour, pH, total dissolved solids, carbonates, bicarbonates, non carbonates, hardness, calcium, magnesium, sodium, sulphate, potassium, DO, free CO_2, BOD, COD, nitrate and phosphate. The colour of temple pond water was observed visually. Hydrogen ion concentration was determined with the help of BDH narrow range pH strips. Later on, to confirm the results the pH was also measured in the laboratory by the phillip's digital pH meter. Total dissolved solids was measured by 100 ml of water sample (filtered) dried on a hot plate in a pre-weighed China dish. The China dish was then again weighed to calculate the total dissolved solids (TDS) per litre of sample by applying the formula

$$TDS = \frac{W_2 - W_1}{V} \times 1000$$

Where,

W2 = Weight of China dish after evaporating the total volume to dryness.

W1 = Weight of empty China dish and

V = Volume of sample evaporated to dryness.

Total hardness was measured by ammonia buffer and EDTA method.

3. Results and Discussion

Physicochemical analysis

The data of physico-chemical parameters were treated statistically to notice the significance levels (Analysis of variance) for seasonal and spatial changes and correlation occurring among them. During the present investigation the values of hydrogen ion concentration of the Govindgarh lake during the summer, monsoon and winter seasons were 6.91, 7.08 and 7.16 respectively. The variations of pH values during the study showed no remarkable significance. The highest value was noticed in monsoon season and lowest in summer season. Total dissolved solids of the pond was 120 mg/l in summer, which is the highest value and the lowest values was noticed in winter.

Table 1: Seasonal variation of physicochemical factors in Govindgarh Lake.

S. No.	Parameters	Summer season	Monsoon season	Winter season	Average
1.	pH	6.91	7.08	7.16	7.05
2.	TDS (mg/l)	120	92	36	82.67
3.	Carbonates (mg/l)	0	0	0	0.00
4.	Bicarbonates (mg/l)	57	31	20	36.00
5.	Chloride (mg/l)	16	36	8	20.00
6.	Total Hardness (mg/l)	30	12	17	19.67
7.	Calcium (mg/l)	6.3	3.3	6.7	5.43
8.	Magnesium (mg/l)	1.90	0.94	2	1.61
9.	Sodium (mg/l)	27	24	8	19.67
10.	Potassium (mg/l)	1.2	1.2	1.2	1.20
11.	DO (mg/l)	6.5	7.3	8.2	7.33
12.	Free CO_2 (mg/l)	36.0	5.6	21.5	21.03
13.	BOD (mg/l)	0.4	3.5	4.0	2.63
14.	COD (mg/l)	1.3	3.6	8.7	4.53
15.	Nitrate (mg/l)	0.37	0.32	0.06	0.25
16.	Phosphate (mg/l)	0.050	0.037	0.030	0.039

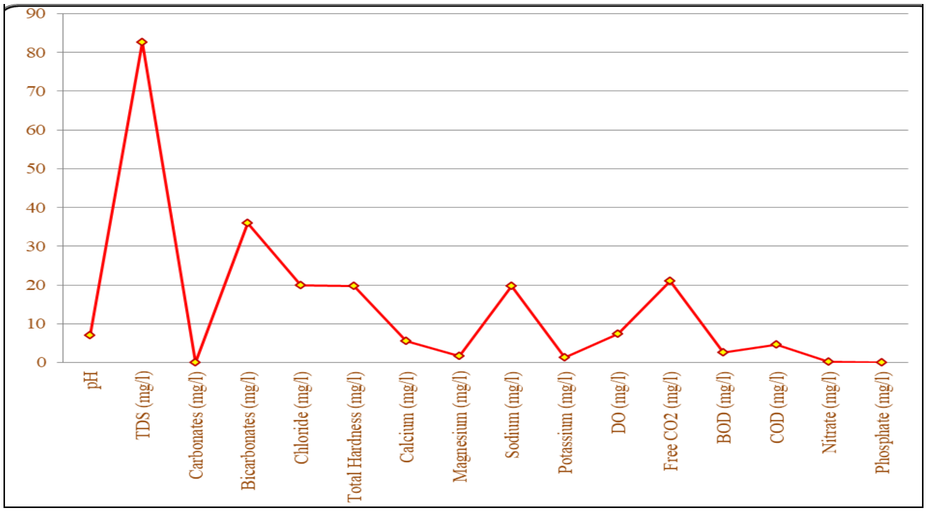

Fig 1: Graphics analysis of average Seasonal variation of physiochemical factors in Govindgharh Lake.

Absence of carbonates was noticed and the bicarbonate alkalinity varied from 20 to 57 mg/l in three seasons, during which minimum value was observed in winter season and the maximum in summer season. Larger quantities of bicarbonates during summer may be due to the liberat ion of CO_2 in the process of decomposition of bottom sediments with resultant conversion of carbonates to bicarbonates.

Chloride values were found ranging between 8 to 36 mg/l of which maximum value was noticed in monsoon and the lowest value in winter may be due to dilution effect in post monsoon period. Pandey and Tiwari (2016) [10] also found similar behavior of chlorides in their studies on Govindgarh lake with summer maxima and P mansoon.

Total hardness value of the pond was 12 to 30 mg/l of which higher value was in summer while the lowest in monsoon season. The maximum premissible limit for this parameter for drinking water standards is 500 mg/l.

Calcium is found in greater abundance in all natural water as its main source is weathering of rocks from which it leaches out. Calcium was found in the same quantity and comparatively higher both in summer and winter seasons while lower in monsoon seasons. Magnesium values are poor. Same result are also founded by Rao *et al.* (2010) [11] and Jena *et al.* (2013) [12].

Sodium quantities varied between 8 to 27 mg/l with its summer maxima and winter minima. High sodium content in the form of chloride and sulphate makes the salty taste of water, making it unfit for human consumption but these three parameters were found in lower quantities indicating potability of the pond water.

Potassium content (1.2 mg/l) was also low in all the three seasons. Throughout the investigation period, high dissolved oxygen contents was noticed during winter season.

Carbon dioxide is one of the essential constituents of an aquatic ecosystem. The abundance of carbon dioxide exerts certain specific effects on aquatic bioata. The pond exhibited maximum carbon dioxide as 36.0 mg/l during summer whereas the lowest concentration of carbon dioxide (5.6 mg/l) was recorded during monsoon season. Cole (1975) [13] noted that free CO_2 supply rarely limits the growth of phytoplankton. Alternately, the bicarbonates are utilized as a source of carbon by the photosynthetic activity of phytoplankton.

BOD is found to be more sensitive test for organic pollution. BOD value of pond water ranged between 0.4-4.0 mg/ l. Highest BOD value was observed in winter season. Increased temperature and sedimentation load reduce BOD (Pyatkin and Krivoshein, 1980) [14]. The estimation of COD is of great importance for waters having unfavourable conditions for the growth of microorganism, such as presence of toxic chemicals (Saxena, 1994) [15]. COD value of pond water ranged between 1.3-8.7 mg/l. Highest COD value was observed in winter season.

The most important source of nitrates is biological oxidation of nitrogenous substances present in sewage, industrial wastes, chemical fertilizers, decayed vegetables, animal feed lots, leachates from refuse dumps, septic tank effluent, etc. High amounts of nitrates in pond water are indicative of pollution. The nitrates concentration of water lies in the range of 0.06-0.37 mg/l. Although all the samples have nitrate concentration with in the permissible limits prescribed by Bureau of Indian Standards, the presence of nitrates in the water samples is suggestive of some bacterial action and bacterial growth. These findings support to the observations of several workers (Hussainy, 1967; Singh, 1991; Majumder *et al.*, 2006) [16, 17, 18].

It is evident from the present study that the phosphate concentration was higher during summer and lower in winter season. It was quite opposite in relation to dissolved oxygen and phytoplankton population. Many earlier workers have also reported similar findings (Marshal and Falconer, 1973; Ghavzan *et al.*, 2006 and Shrivastava, 2010) [19, 20, 10].

Macrophytes

Many aquatic plants have played fascinating roles in the life of man from the primitive times in one form or the other. For instance, the fruits of *Trapa natans var, bispinosa (singhara, paniphal, waterchestnut) and of Nelumbo nucifera (kamal-gatta);* corms, rhizomes, and tubers of *Colocasia esculenta* (taro), *Eleocharis dulcis* (Chinese waterchestnut), *Nelumbo nucifera (kamalkakri or bhen*), *Scirpus grossus* and *S. lacustris (keseru);* and the seeds of *Nelumbo nucifera* *(makhana*) and *Euryale ferox* Salisb (prickly *makhana*, Gorgannut) are very well known for their delicacies and economic vlaues in India and elsewhere. Besides, several aquatic plants like *Ipomoea aquatica, Nasturtium officinale, Neptunia oleracear*, *Limnocharis flava*, *Ottelia alismoides*, and *Ceratopteris thalictriodes* form nutritious pot herbs (Mazid, 1992; and Seidal, 1971) [21-22]. The little plants of duckweeds form preferred food of ducks, geese, swan and poultry (Coquery and Welbourn, 1994) [23]. Pigs too consume and grow on some aquatic plants, particularly the waterhyacinth.

Coming back to the true water plants, of recent, waterhyacinth (*Eichhornia crassipes*) has been found capable of demolishing heavy metal pollution caused by industrial releases carrying Cd, Pb, Cr, Ni and the like in waterbodies. Similarly, this floating plant, alongwith other plants like hydrilla, salvinia, duckweeds, parrotfeather, and elodea are known to scavenge upon large quantities of N, P and K from waterbodies overenriched with these elements due to regular discharge of night sewage in them (Coquery and Welbourn, 1994; Moenandir and Murgito, 1994) [23-24].

4. Acknowledgement
The author is greatly indebted to Principal of Govt. Girls P.G. College, Rewa (M.P.) who permitted to carry out this work at the centre.

5. References

1. Singh DF, Rai MK. Studies on the Limnology of Bada talab. Chhindwara, M.P. J Environ-Biol. 1988; 9(1):69-71.
2. Welch PS. Limnological methods (2nd Edn.) Mc. Graw-Hill Book Co., New York, NC. New York, 1952, 381.
3. Tewari, Anurag, Dubey, Ashutosh, Trivei, Aviral. A study on Physico-chemical characteristics of ground water quality. J Chem. Pharm. Res. 2010; 2(2):510-518.
4. Hutchinson GE. A Treatise on Limnology New York : John Wiley and Sons Inc, 1957, 1.
5. Kumar, Ravindra, Jha, Arvind Kumar. Physico-chemical studies on Kamla River Water, IJARCSSE. 2015; 5(5):1411-1415.
6. Lloyd R. Pollution and Fresh Water Fish, Fishing News Books, 1992.
7. Gray NF. Drinking water quality problems and solutions Chichester, UK: John Wiley and Sons, 1994.
8. APHA. AWWA, WPCF. Standard methods for the estimation of water and waste water. American public health association. American waste water association and water pollution control federation. 20th Edition Washington. DC, 1998.
9. Paka S, Rao AN. Interrelationship of physicochemical factors of a pond. J Environ. Biol. 1997; 18:67-72.
10. Shrivastava, Manisha. Ecological study of Govindgarh lake with special reference to phytoplanktons and macrophytes, Ph.D. Thesis, Unpublished, A.P.S. University, Rewa M.P, 2010.
11. Rao CS, Rao BS, Hariharan AVLNSH, Bharathi MN. Determination of water quality index of some areas in Guntur District Andhra Pradesh. International Journal of Applied. Biol. Pharma. Technol, 2010, 79-86.
12. Jena V, Dixit S, Shrivastava R, Gupta S. Study of Pond water quality by the assessment of physico-chemical parameters and water quality index. International Journal of Applied Biology and Pharmaceutical Technology. 2013; 4(1):47-52.
13. Cole GA. Text book of limnology. C.V. Mosby. Co., St. Lois, Sanfransisco, 1975.
14. Pyatkin KD, Yu S. Krivoshein: Microbiology Eds: Trans. Aksenova and V. Lisovskaya. Mir Publishers, Moscow, 1980, 133-135.
15. Saxena MM. Environmental analysis, water, soil and air. Agro-botanical Publishers, Bikaner, India, 1994.
16. Hussainy SV. Studies on limnology and primary production of a tropical lake. *Hydrobiologia*. 1967; 30:335-352.
17. Singh P. Seasonal variation in the macrophytic biomass production and its effects on the water chemistry of Kawar lake, Begusarai, Bihar. Environ. Ecol. 1991; 9:72-76.
18. Majumder S, Gupta S, Saha RN, Datta JK, Mondal N. Eutrophication potential of municipal sewage of Burdwan Town, West Bengal, India. Pollut. Res. 2006; 25(2):299-302.
19. Marshal BE, Falconer FC. Eutrophication of tropical African impoundment lake (Me ilwaine, Rhodesia). *Hydrobiologia*. 1973; 43(1-2):109-123.
20. Ghavzan NJ, Gunale VR, Trivedy RK. Limnological evaluation of an urban fresh water river with special reference to phytoplankton. Pollut. Res. 2006; 25(2):259-268.
21. Mazid FJ. Aquatic weed-utility and development. Agro Bot. Pub., 1992, 96.
22. Seidal K. Macrophytes as functional elements in environment of man. *Hydrobiologia*. 1971; 12:121-130.
23. Coquery M, Welbourn PM. Mercury uptake from water and sediment by the rooted and submegred aquatic macrophytes, Archives of Env., Contaminant and Toxicology. 1994; 26(3):335-341.
24. Moenandir J. Murgito. Heavy metal adsorption by aquatic weeds. Agrivita. 1994; 17(2):61-64.