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Limnological investigations of Amara Pond (Raipur Karchuliyan) Rewa (M.P.)

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Abstract: Present investigations were carried out on the limnological aspects of Amara pond in district Rewa. 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 2015 were discussed.

Keywords: Limnological, investigation, Amara pond.

I. INTRODUCTION

Limnological 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. (Gupta and Gupta, 1997^[1], Mishra, *et al.* 2009^[2], Tewari, *et al.* 2010^[3], Sirajudeen, *et al.* 2014^[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.

II. MATERIALS AND METHODS

The district Rewa of M.P. is located on the South West part of Madhya Pradesh. It is an important district of ex-Vindhya Pradesh state and part of Baghelkhand rule of second century A.D. Rewa district is a pilgrim and an industrial place and area rich in Limestone, Bauxite, White clay, Geru, Ramaraj and Flagstones. It is also famous for its religious places of Distt. The district Rewa is the central part of Vindhya region which is commissioner head quarter, situated at 24° 32' N latitude and 81° 18' E longitude. It is 365.7 above the mean sea level. surrounded by the boundaries of Satna on the West, Sidhi district on the South, Allahabad on the North and Mirzapur on the East side.

During the present investigation author has selected four study sites for Physico-chemical nature of water and Zooplankton of this Amara Pond (Raipur Karchuliyan) 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 CO₂, 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

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

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

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W1 = Weight of empty China dish and

V = Volume of sample evaporated to dryness.

Total hardness was measured by ammonia buffer and EDTA method.

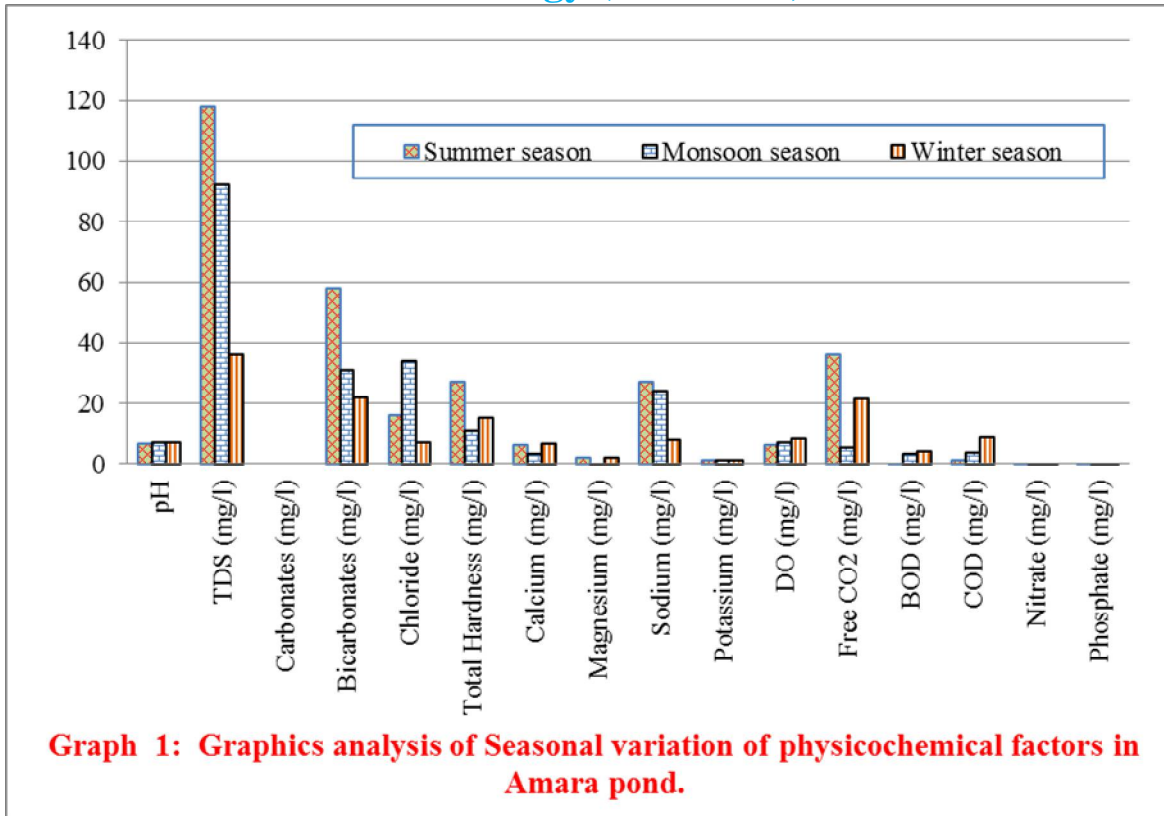
III. RESULTS AND DISCUSSION

During the present investigation the values of hydrogen ion concentration of the Amara pond during the summer, monsoon and winter seasons were 6.92, 7.0 and 7.15 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 118 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 Amara pond.

S.No.	Parameters	Summer season	Monsoon season	Winter season
1.	pH	6.92	7.0	7.15
2.	TDS (mg/l)	118	92	36
3.	Carbonates (mg/l)	0	0	0
4.	Bicarbonates (mg/l)	58	31	22
5.	Chloride (mg/l)	16	34	7
6.	Total Hardness (mg/l)	27	11	15
7.	Calcium (mg/l)	6.3	3.3	6.7
8.	Magnesium (mg/l)	1.90	0.94	2
9.	Sodium (mg/l)	27	24	8
10.	Potassium (mg/l)	1.1	1.1	1.1
11.	DO (mg/l)	6.5	7.3	8.2
12.	Free CO ₂ (mg/l)	36.0	5.6	21.5
13.	BOD (mg/l)	0.4	3.5	4.0
14.	COD (mg/l)	1.3	3.6	8.7
15.	Nitrate (mg/l)	0.37	0.32	0.06
16.	Phosphate (mg/l)	0.050	0.037	0.030

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Absence of carbonates was noticed and the bicarbonate alkalinity varied from 22 to 58 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 liberation of CO₂ in the process of decomposition of bottom sediments with resultant conversion of carbonates to bicarbonates.

Chloride values were found ranging between 7 to 34 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 Amara pond with summer maxima and P monsoon.

Total hardness value of the pond was 11 to 27 mg/l of which higher value was in summer while the lowest in monsoon season. The maximum permissible 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 (1.1 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 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 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

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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 within 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^[16]; Singh, 1991^[17]; Majumder *et al.*, 2006^[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^[19]; Ghavzan *et al.*, 2006^[20] and Pandey and Tiwari, 2016^[10]).

IV. CONCLUSION

All the physical and chemical properties of Amara pond water were within desirable limits. The results obtained from the present investigation shall be useful in future management of the pond. The physico-chemical characteristics of pond water suggested that there was no harmful to pisciculture, irrigation and drinking water.

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