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Studies on physicochemical factors on Papara Dam, Satna (M.P.)

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Abstract
Water is indispensable to life on earth. It is a precious gift of nature which is essential for the survival of plants, animals and human beings. Present investigations were carried out on the Physicochemical aspects of Papara dam in district Satna. 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: Physicochemical, Factors, Papara dam, Satna

1. Introduction
The aquatic ecosystem is extremely important to mankind as they have various uses, including drinking water supply, irrigation, navigation, recreation etc. and are also source of organic productivity. Man is dependent for his food supply entirely on the products of land, water, plants and animals of the earth. Ever since the turn of this century progress in limnology has been rapid and for reaching, as a result of which it has become as integrated and coherent branch of science (WHO 2004)[1]. A study of freshwater habitat with special reference to its physico-chemical, geological and biological characteristics is termed as limnology. The study of limnology is of great importance to human race as the biological and physico-chemical date of this branch can be useful for quick development and growth of fishes. The importance of primary productivity is also well realised practically in fish culture programmes. Besides that, elucidation of the physico-chemical conditions in lakes, reservoirs, ponds and rivers are utilized for tiding over difficulties in filtration of drinking water. 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. Mishra, *et al.* 2009, Tewari, *et al.* 2010, Sirajudeen, *et al.* 2014, Kumar and Kumar 2015) [2-5] 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
Geographical distribution of plankton plays an important role in the aquatic ecosystem. For the convenience of the description of the Dam, the planktonological biomass with special reference to zooplankton, it is essential to give the geographical status of Papara Dam, Satna (M.P.). The district Satna 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. Satna district is a pilgrim and an industrial place and area rich in Limestone, Bauxite, White clay, Geru, Ramraj and Flagstones. It is also famous for its religious places of Chitrakoot. The district Satna is the central part of Vindhya region which is surrounded by the boundaries of Rewa and Satna on the North, Bilaspur district on the South and Jabalpur on the West side. Satna district comprises of five tehsils namely Raghuraj Nagar, Rampur Baghelan, Nagod, Amarpatan and Maihar.
The underlying rock is stratified sandstone exposed on hill slopes and plateau. Soil type is almost sandy loam and is poor in depth due to soil erosion. The climate of district determined by a subtropical standard is mild and healthy. The Satna district is located in the nitron of Subtropical Indian Continent and are characterized by monsoon type of climate. Rainfall and temperature exhibit well marked variations with season to season. Author has confined his research work to the Papara Dam, Satna the site of research work. For the convenience of the description of Dam, it is essential to give the geographical status of the area.
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 dam 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 dam 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

During the present investigation the values of hydrogen ion concentration of the Papara dam during the summer, monsoon and winter seasons were 6.86, 7.3 and 7.14 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 dam was 114 mg/l in summer, which is the highest value and the lowest values was noticed in winter.

Table 1: Average seasonal variation of physicochemical factors in Papara Dam during 2012-2013.

S. No.	Parameters	Summer season	Monsoon season	Winter season	Mean	SD
1.	pH	6.86	7.3	7.14	7.10	±0.223
2.	TDS (mg/l)	114	91	37	80.67	±39.526
3.	Carbonates (mg/l)	1	1	1	1.00	±0.000
4.	Bicarbonates (mg/l)	55	33	22	36.67	±16.803
5.	Chloride (mg/l)	19	37	6	20.67	±15.567
6.	Total Hardness (mg/l)	29	11	16	18.67	±9.292
7.	Calcium (mg/l)	6.1	3.5	6.9	5.50	±1.778
8.	Magnesium (mg/l)	1.92	0.92	3	1.95	±1.040
9.	Sodium (mg/l)	32	25	8	21.67	±12.342
10.	Potassium (mg/l)	1.0	1.0	1.0	1.00	±0.000
11.	DO (mg/l)	6.6	7.3	8.4	7.43	±0.907
12.	Free CO_2 (mg/l)	34.1	6.1	21.7	20.63	±14.030
13.	BOD (mg/l)	0.9	3.6	4.4	2.97	±1.834
14.	COD (mg/l)	1.6	3.7	8.8	4.70	±3.703
15.	Nitrate (mg/l)	0.34	0.28	0.13	0.25	±0.108
16.	Phosphate (mg/l)	0.051	0.036	0.033	0.04	±0.010

Absence of carbonates was noticed and the bicarbonate alkalinity varied from 22 to 55 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 6 to 37 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. The concentration of chloride is directly correlated to the pollution level (Munnavar 1970) [10].

Total hardness value of the dam was 11 to 29 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. Same result are also founded by Nagraj and Goudappa (2008) [21].
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].

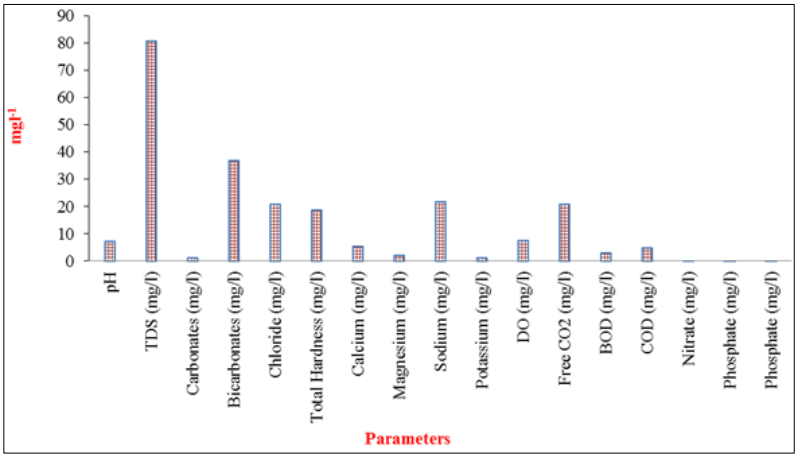

Fig 1: Graphics analysis of average seasonal variation of physicochemical factors in papara Dam during 2012-2013

Sodium quantities varied between 8 to 32 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 dam water.

Potassium content (1.0 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 dam exhibited maximum carbon dioxide as 36.0 mg/l during summer whereas the lowest concentration of carbon dioxide (6.1 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 dam water ranged between 0.9-4.4 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 dam water ranged between 1.6-8.8 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 dam effluent, etc. High amounts of nitrates in dam water are indicative of pollution. The nitrates concentration of water lies in the range of 0.13-0.34 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) [16-18].

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 and Ghavzan *et al.*, 2006) [19, 20].

4. Conclusion

In the present investigation results of physicochemical parameters of Papara dam water were within desirable limits. The results obtained from the present investigation shall be useful in future management of the dam. The physico-chemical characteristics of dam water suggested that there was no harmful to pisiculture, irrigation and drinking water. So there is a need of proper treatment and restoration for humans and environment.

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