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Physico-chemical parameters assessment of dams water in Shahdol division of Madhya Pradesh

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Abstract

The quality of water is of main role for man since it is directly linked to human health. The quality of water varies widely with respect to its various uses and the water quality suitable for one purpose may not satisfactory for another. The present investigations of the comparative study of physico chemical parameters of Johila dam, Sarfa dam and Birsinghpur (MPSEB) dam in Shahdol division of Madhya Pradesh. Four samples were collected in the Nov. 2022 to Oct. 2023. Physical and chemical parameters such as pH, TDS, Free CO₂, Alkalinity, Chlorides, Total Hardness, Calcium Hardness, Magnesium hardness, Dissolve Oxygen, BOD and COD were studied. The result indicates that there is marked variation in physico chemical parameters of that dam water. The observed values of various physicochemical parameters from water samples have been compared values recommended by World Health Organization

Keywords: Birsinghpur (MPSEB) dam, Johila Dam, Physico chemical analysis

Introduction

The prosobranch molluscs are much economic. The quality of ground water depends on various chemical constituents and their concentration, which are mostly derived from the geological data of the particular region. Industrial waste and the municipal solid waste have emerged as one of the leading cause of pollution of surface and ground water. The quality of water is of vital concern for man since it is directly linked to human health (Odum, 1971) ^[1]. The presence of safe and reliable source of water is an essential prerequisite for the establishment of a stable community. The quality of water varies widely with respect to its various uses and the water quality suitable for one purpose may not satisfactory for another. Chemical contamination of drinking water either naturally or by anthropogenic sources is a matter of serious concern as the toxic chemicals do not show acute health effects unless they enter into the body in appreciable amounts but they behave as a cumulative poison showing the adverse health effects after a long period of exposure.

Water plays an important role of human life. It is necessary for industry and living thing resistance. All living organisms on the earth need water for their survival and growth, on our earth having about 70% of water (Kaswanto *et al.* 2012) ^[3]. Though water is abundant on earth it is precious for living organisms because out of total water reservoir of the world about 97% is salty and only 3% is fresh water (Khanna *et al.*, 2003) ^[4]. The healthy water reservoir is dependent on the physicochemical and biological characteristics. Although statistics the WHO (Geneva, 1983) ^[2] report that approximately 36% of urban and 65% of rural Indian were without access to safe drinking water.

The water of good quality is required for living organisms. The quality of water resources is usually described according to its physical, chemical, and biological characteristic for the good quality of water resources large numbers of physicochemical and biological parameters are to be studied and must be found in normal range.

Materials and methods

Three districts under Shahdol division are Shahdol, Umaria and Anuppur. Since Shahdol district is located in the middle of Umaria and Anuppur, Shahdol division has been made the headquarters. Division Features.

District Shahdol is situated between the latitudes of 23°15' N to 24° N and longitudes of 81° E to 81°45' E. Spanning an area of approximately 5642 sq. km, the district measures 110 km in the north-south direction and 30 km in the east-west direction. This accounts for a mere 1.83% of the total area of Madhya Pradesh.

Umariya district is located to the North East of Madhya Pradesh. Mathematically the coordinates of the District extend from 23°38' to 24°20' North and 80°28' to 82°12' East. It has geographical area of 4548 sq.km. The greatest length of the district is about 150 km.

District Anuppur is situated in the south-eastern part of Madhya Pradesh. On 15th August, 2003, Anuppur district has been formed from the district of Shahdol. Total area of newly formed Anuppur district is 3746.71 sq. Km. It is 1.2 percent of the state. In the east of the district, Chhattisgarh is in the state of Korea, Dindori in the south and Bilaspur in Chhattisgarh state and Shahdol district in the north and west. This district is located between 23.10 north latitude 35.36 north latitude and 41.40 to 82.10 east longitude.

Samples were taken at the following points

Johila Dam

The dam located at 23.6°N 81.41°E. It has an average elevation of 505 metres (1,657 feet). This dam was built across the Johila River near village Pushprajgarh in Anuppur District, Madhya Pradesh. The construction of the dam was completed in 1978. The maximum height of the dam is 30.28meters and length of top is 1234.7 meters. The dam water has been used for drinking and irrigation purpose by the people of the Pushprajgarh, Anuppur district.

Sarfa Dam

Sarfa dam is made on the river near to Navalpur village (Latitude: 23°16'57.68" Longitude: 81°28'11.26"). The Sarfa river origin at PATHE HILLS 15-16 Km away from Sarfa Dam and mix in Sone river near Navalpur village. Width of Sarfa Dam is about 150 to 100 feet and deepest length is

about 20-25. On the edge of Sarfa river 15 to 30 villages such as Kanchanpur, Navalpur, Lalpur, Harri, Dhurwar etc. are situated and the villagers uses the river water for drinking, irrigation and other livelihood purpose. Sarfa dam water is filtrate by bleaching powder and Alum, after filtration it is supplied to urban area Shahdol for drinking purpose. The river is polluted by the people by bathing, washing clothes, utensils, and bathing animals and the garbage thrown by villagers near river.

Birsinghpur (MPSEB) Dam

The dam located at 23.35°N 81.05°E. It has an average elevation of 450 metres (1,476 feet). This dam was built across the Johila River near village Birsinghpur in Umariya District, Madhya Pradesh. The construction of the dam was completed in 1988. The maximum height of the dam is 42meters and length of top is 47.5 meters. The area of foreshore at F.R.L. (Th. Hect.) 18500. The dam water has been used for Hydroelectric, drinking and irrigation purpose by the people of the Birsinghpur, Umariya district.

Sampling methods

Standard procedures (APHA, 1985) ^[1] were followed throughout the process of collecting the water samples, preserving them, transporting them to the lab and conducting the analysis.

Average collection of samples in three dams. The samples were collected in sterilized polythene bottles of one liter capacity monitoring were done during Nov. 2022 to Oct. 2023. Samples were analysis of physico chemical parameters in laboratory.

Results & Discussion

The pH, Alkalinity, Calcium, Magnesium, Chloride, Total Hardness, Do and COD were measured within few hours from sampling. The parameters were analysed by prescribed standard method. The variation in various parameters of different samples is shown in Table-1.

Table 1: Water quality parameter at different water bodies of Shahdol division from Nov. 2022 to Oct. 2023

Parameters	Birsinghpur (MPSEB) Dam			Sarfa Dam			Johila Dam		
	Winter	Summer	Rainy	Winter	Summer	Rainy	Winter	Summer	Rainy
pH	7.07	7.11	7.52	7.01	8.06	7.00	7.24	8.08	7.77
DO	6.94	10.81	5.07	11.06	10.22	6.90	8.12	11.64	6.88
Alkalinity (Mg/l)	166	134	148	158	150	141	172	128	165
Calcium (Mg/l)	15.14	18.32	16.14	15.20	16.77	16.84	16.42	15.12	17.02
Magnesium (Mg/l)	4.12	5.44	5.62	4.16	5.10	6.01	4.85	5.66	6.08
Chloride (Mg/l)	154	166	132	158	147	135	164	152	146
Total hardness	160	166	162	154	163	157	174	169	173
TDS	167	312	216	176	325	270	184	346	245
BOD	4.07	5.16	5.88	4.12	5.26	7.45	4.02	6.18	7.22
COD	6.11	6.34	7.12	6.22	7.34	6.68	6.46	5.35	6.74
Free CO ₂	7.07	6.08	6.16	6.92	6.30	5.95	6.88	6.46	5.88

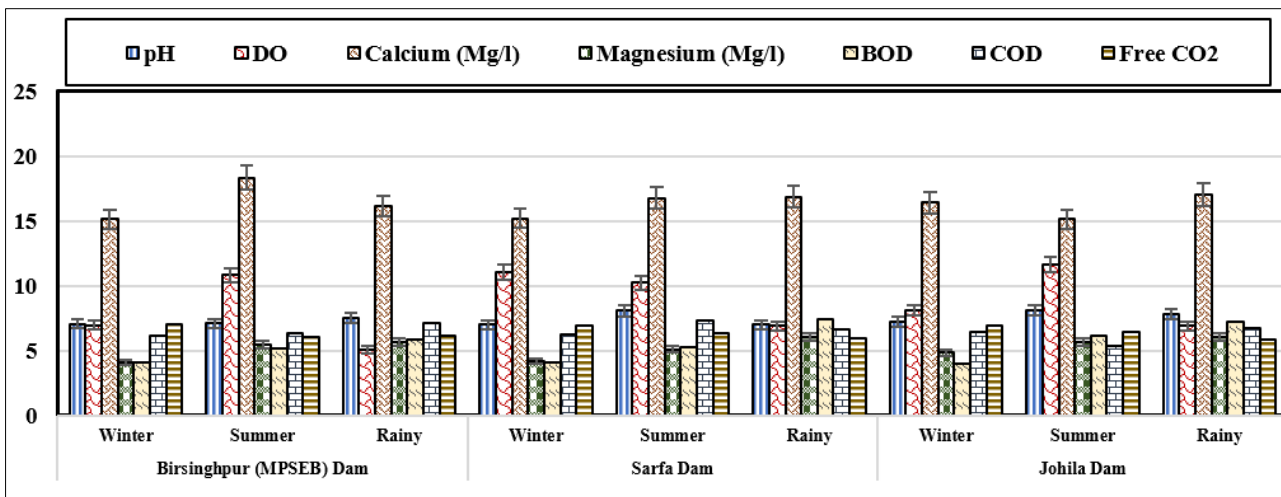


Fig 1: Graph analysis of Water quality parameter at different water bodies of Shahdol division from Nov. 2022 to Oct. 2023

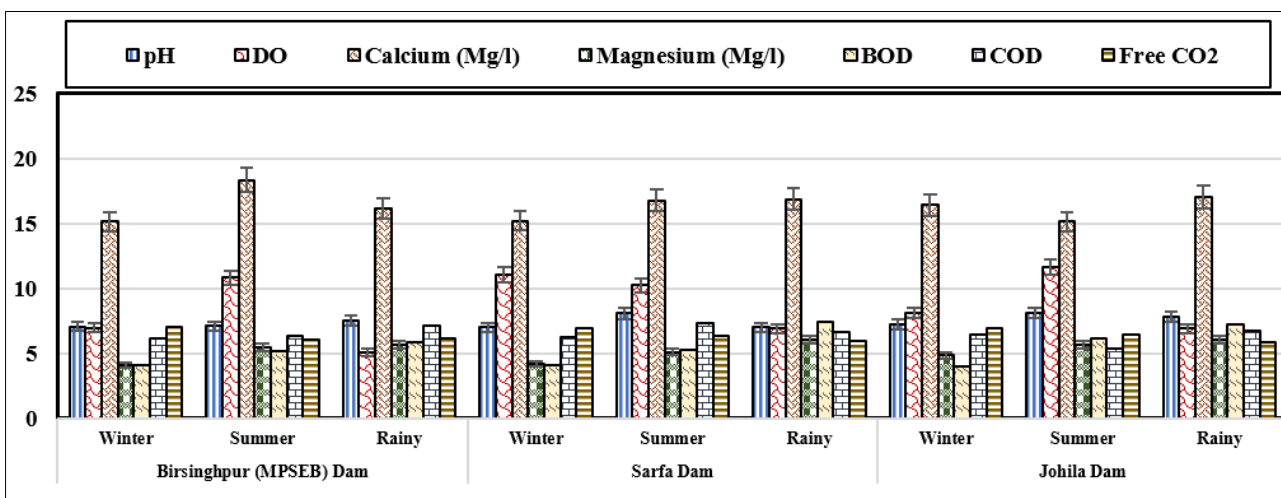


Fig 2: Graph analysis of Water quality parameter at different water bodies of Shahdol division from Nov. 2022 to Oct. 2023

pH: Observation reveals that, (Table 1 & Fig. 1) the pH of Birsinghpur (MPSEB) Dam water is 7.07 to 7.52, Sarfa dam 7.00 to 8.06 and Johila dam is 7.24 to 8.08. Johila dam water is highly alkaline than Birsinghpur (MPSEB) dam water. The higher pH may due to photosynthetic activity in water body and helps in photosynthesis of phytoplanktons. As also from Govindgarh lake (Patel and Dubey 2019a) [7].

Dissolved Oxygen: During the study, the concentrations of DO recorded are 5.07 to 10.81 mg/l for Birsinghpur (MPSEB) dam, 6.90 to 11.06 mg/l for Sarfa dam and 6.88 to 11.64 mg/l for Johila dam water (Table 1 & Fig. 1). It is observed that Johila dam water has higher value of dissolve oxygen than Sarfa dam and Birsinghpur (MPSEB) dam water. Similar findings were projected by other workers like (Shukla and Shukla, 2022) [9].

Alkalinity: The alkalinity of Birsinghpur (MPSEB) dam water varied between 134 to 166 mg/l, Sarfa dam 141 to 158 and Johila dam water varied between 128 to 172 mg/l. (Table 1 & Fig. 2). Total alkalinity of Johila dam is higher than Birsinghpur (MPSEB) dam.

Calcium: The water above Calcium values 25 mg/l are classified as ‘Calcium rich’. The present investigation shows that the concentration of calcium of the Birsinghpur (MPSEB) water is 15.14 to 18.32 mg/l, Sarfa dam 15.20 to

16.84 mg/l and Johila dam water is 15.12 to 17.02 mg/l. Birsinghpur (MPSEB) dam water contains high concentration of calcium than Johila and Sarfa dams (Table 1 & Fig. 1). All the water samples are Calcium deficient.

Magnesium: The observed value of Magnesium in Birsinghpur (MPSEB) dam is 4.12 to 5.62 mg/l, Sarfa dam 4.16 to 6.01 mg/l and Johila dam is 4.85 to 6.08 mg/l. The observed value of Magnesium of Johila dam is higher than Sarfa dam and Birsinghpur (MPSEB) dam (Table 1 & Fig. 1). The present investigations shows that the Magnesium content in majority of samples does not exceed the limit as prescribed by ISI as well as WHO (Geneva, 1983) [2].

Chloride
The suitability of water resource for the irrigational use in agricultural is depends on its salt concentrations, especially Chloride contents. In the present investigation Chloride concentration is in the range of 132 to 166 mg/l in Birsinghpur (MPSEB) dam and 146 to 164 mg/l, Sarfa dam 135 to 158 mg/l in Johila dam water. Chloride value is much higher in Birsinghpur (MPSEB) dam water than Johila dam water (Table 1 & Fig. 2). According to WHO (Geneva, 1983) [2] maximum permissible limit for Chloride is 500 mg/l. the value observed in present study are well below the permissible limit.

Total Hardness: Total hardness of water is caused by the presence of Calcium and Magnesium salts. Hardness has no known adverse effect on health. However, maximum permissible level has been prescribed for drinking water is 500mg/l, by WHO (Geneva. 1983) [2]. According to some classifications water having Hardness up to 75 mg/l is classified as soft, 76 to 150 mg/l is moderately soft, 151-300 mg/l as hard and more 300 mg/l as very hard. In present investigation Hardness of various samples of Birsinghpur (MPSEB) dam water is in the range of 160 to 166 mg/l. The result shows that, this water is moderately soft. Sarfa dam water in the range 154 to 163 mg/l, this water is moderately soft. Hardness of Johila dam water is in the range 169 to 174 mg/l, reveals that, this water is hard (Table 1 & Fig. 2). So all the water samples have values within the permissible limits.

TDS: The TDS fluctuated between 167 to 312 mg/l in Birsinghpur (MPSEB) dam, 1766 to 325 mg/l in Sarfa dam and 184 to 346 mg/l in Johila dam. TDS value is much higher in Sarfa dam water than Sarfa dam and Birsinghpur (MPSEB) dam water (Table 1 & Fig. 2). As also reported aquatic bodies of Vindhyan region (Mishra and Singh, 2022b) [5] and from Govindgarh lake (Patel and Dubey 2019a) [7].

BOD: Biochemical oxygen demand (BOD) is the amount of dissolved oxygen needed by aerobic biological organisms to break down organic material present in a given water sample at certain temperature over a specific time period. The study showed that BOD ranged from 4.07 mg/l to 5.88 mg/l in Birsinghpur (MPSEB) dam, 4.12 to 7.45 mg/l in Sarfa dam and 4.02 to 7.22 mg/l in Johila dam *i.e.*, minimum in winter and maximum in rainy season (Table 1 & Fig. 1). During monsoon, higher BOD values attributed to the enhanced biological activity at higher temperature. This investigation is also close conformity with finding of Shukla and Shukla (2022) [9].

COD: C.O.D. is the major of oxygen consumed during the oxidation of oxydisable organic matter present in the water. C.O.D. of Birsinghpur (MPSEB) dam water is in the range 6.11 to 7.12 mg/l, Sarfa dam 6.22 to 7.34 mg/l and Johila dam water is 5.35 to 6.74 mg/l (Table 1 & Fig. 1). It is observed that Sarfa dam water has higher value of dissolve oxygen than Birsinghpur (MPSEB) dam and Johila dam water and below the permissible limit. Similar findings (Prajapati, 2016) [8].

Free CO₂: Free carbon dioxide in a water body is generally derived from the atmospheric sources, biotic respiration and decomposition of organic matter by saprophytes. In the present study, the FCO₂ was ranged between 6.08 to 7.07mg/l in Birsinghpur (MPSEB) dam, 5.95 mg/l to 6.92mg/l in Sarfa dam and 5.88 to 6.88 mg/l in Johila dam (Table 1 & Fig. 1). The FCO₂ concentration in the dams was maximum during rainy season and minimum during winter season.

Conclusion

In the present study most of the parameters are found within the prescribe limit of IS and WHO.

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