



PHYSICO-CHEMICAL AND HEAVY METAL ANALYSIS OF WATER IN BANDHWA DAM ON MURNA RIVER IN SHAHDOL DISTRICT, CENTRAL INDIA

Zoology

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ABSTRACT

This Paper deals with the Physico - chemical Parameters and heavy metal analysis of Bandhwa Dam in Shahdol district, Madhyapradesh. Monthly Changes in Physical and Chemical Parameters Such as Water Temperature, Turbidity, Total Dissolved Solids, pH, Dissolved Oxygen, Free Carbon dioxide and Total Hardness, Chlorides, Alkalinity, Phosphate and Nitrates were analyzed for a period of one year from 2021 to 2022 simultaneously, heavy metal analysis also done in three seasons (summer, Rainy and winter) of the year. Parameters were within the permissible limits but concentration of heavy metals are not satisfactory. The concentrations of Cu, Fe, Hg and Pb are higher than prescribed limits of WHO and Indian Standard which is responsible for many health hazards related to polluted water. So, the results indicate that the Dam is polluted and cannot be used for Domestic, Irrigation and Fisheries without treatment.

KEYWORDS

Bandhwa Dam, Heavy metals; Physico-Chemical Parameters, Pollution, Health hazards, Fisheries, Irrigation.

INTRODUCTION

Bandhwa Dam is situated in Kelmaniya village near Shahdol. This dam is used for irrigation (total irrigation area 240 Ha) as well as fish culture. The water and fishes of this dam are used as a food, drinking water and other domestic purposes. That is why this study was conducted because the quality of water should be known.

As water is one of the most important compounds of the ecosystem, but due to increased human population, industrialization, use of fertilizers in the agriculture and man-made activity, the natural aquatic resources are causing heavy and varied pollution in aquatic environment leading to pollute water quality and depletion of aquatic biota. It is therefore necessary that the quality of drinking water should be checked at regular time of interval, because due to use of contaminated drinking water, human population suffers from varied of water borne diseases. It is difficult to understand the biological phenomena fully because the chemistry of water reveals much about the metabolism of the ecosystem and explain the general hydro-biological relationship.

The quality of water is described by its physical, chemical and microbial characteristics. But, if some correlations were possible among these parameters, then significant ones would be fairly useful to indicate the quality of water. This study is important, because fluctuation in the water quality has an influence on the biotic communities (Aher and Mane, 2007). This information is important to be communicated to the general public and the Government in order to develop policies for the conservation of the precious fresh water resources (Ali et al., 2000). The aims of this study were designed to monitor monthly variation in water quality parameter of Bandhwa Dam so as to assess its status and suitability through the portability and aquaculture point of view and to compare observed levels of studied parameters with the corresponding WHO and IS:10500,1992 guidelines values for drinking-water quality.

MATERIAL AND METHODS

The water samples from this site were collected in polythene bottle regularly for every month. The Water samples were immediately brought in to Laboratory for the Estimation of various Physico - chemical parameters, like water temperature and pH, TDS were recorded at the time of sample collection by using Thermometer and Pocket Digital pH & TDS Meter. While other Parameters Such as DO, Free CO₂, Total Hardness, Chlorides, Alkalinity, Phosphate and Nitrates were estimated in the laboratory using Indian standard procedures.

For the estimation of DO, Free CO₂, Total Hardness, Chlorides, Alkalinity, Phosphate and Nitrates, titration methods were used while pH, TDS and Turbidity estimated by digital devices, simultaneously heavy metals Cu, Zn, Pb, Fe and Hg concentration also measured using the Atomic Absorption Spectrophotometer (AAS model ELICO, SL-168) the obtained results were expressed as ppm.

RESULT AND DISCUSSION

Table-01:- Physical Parameters Of Bandhwa Dam

Water Quality Test	Requirement/ Acceptable limit		Results of study site
	IS 10500:2012(Indian Standard)	WHO (2017)	
pH	6.5-8.5	NAL	Under Acceptable Limit
Turbidity(NTU)	01	1.5	Under Acceptable Limit
Dissolve Oxygen(DO)	NAL	NAL	
Carbon dioxide(CO ₂)	NAL	NAL	
Total Hardness(as CaCo ₃)	200 mg/l	NAL	Above Acceptable Limit
Total Alkalinity	200 mg/l		Under Acceptable Limit
Chlorides	250 mg/l	NAL	Under Acceptable Limit
TDS	500 mg/l	NAL	Under Acceptable Limit
Calcium (Ca ++)	75 mg/l		Under Acceptable Limit
Magnesium (as Mg++)	30 mg/l		Under Acceptable Limit
Mercury	0.001 mg/l	0.006 mg/l	Above Acceptable Limit
Lead	0.01 mg/l	0.01	Above Acceptable Limit
Iron	0.3 mg/l	NAL	Above Acceptable Limit
Copper	0.05 mg/l	02	Above Acceptable Limit
Zinc	5 mg/l	NAL	Under Acceptable Limit

Mon th	Odor	Temperature (°C)	Turbidity (NTU)	TDS(mg/l)	pH
Jan	Unobjectionable	15	001	240	7.9
Feb	Unobjectionable	18	002	238	8.2
Mar	Unobjectionable	27	011	250	8.3
Apr	Unobjectionable	28	010	249	8.3
May	Unobjectionable	31	011	248	8.4
June	Unobjectionable	31	012	250	8.2
July	Unobjectionable	29	012	252	8.2
Aug	Unobjectionable	28	011	362	8.0
Sept	Unobjectionable	26	001	400	7.9
Oct	Unobjectionable	26	001	382	8.2

Nov	Unobjectionable	25	002	375	7.9
Dec	Unobjectionable	15	002	250	7.8

Table-02:- Chemica Parameters Of Bandhwa Dam, (values Are In mg/l).

Month	Free CO ₂	DO	Hardness	Alkalinity	Chloride	Calcium	magnesium
Jan	0.3	6.4	203	180	100	0.401	19.119
Feb	0.1	10.5	209	180	100	0.400	20.286
Mar	0.1	11.2	214	182	100	0.403	20.621
Apr	0.2	11.6	210	185	100	0.474	23.260
May	0.1	10.2	212	186	100	0.330	23.350
Jun	0.1	10.5	211	181	100	0.340	20.929
July	0.2	9.8	208	180	100	0.336	22.603
Aug	0.1	9.3	216	185	100	0.346	21.477
Sept	0.2	4.0	218	144	100	0.345	20.620
Oct	0.2	5.9	212	142	100	0.375	20.434
Nov	0.1	5.6	212	145	100	0.392	19.987
Dec	0.1	5.7	213	144	100	0.396	19.462

Table-03:- Table showing mean (±SD) Concentrations Of Heavy Metals (ppm) In Water Collected From Bandhwa Dam, Shahdol Division

Heavy Metals	Cu	Zn	Fe	Pb	Hg
Summer	0.787±0.002	0.080±0.000	0.493±0.002	5.838±0.000	0.846±0.003
Rainy	0.679±0.001	0.121±0.001	0.773±0.001	2.838±0.000	0.309±0.010
Winter	0.780±0.000	0.081±0.010	0.713±0.000	0.827±0.001	0.300±0.001
Permissible limits (WHO) 2017	2	NG	No Guideline	0.01	0.006
IS(2012)	0.05	5.0	0.3	0.01	0.001

Climate

This area is a semi dry zone, there is a rapid increase in temperature after the month of January and April-May is the hottest month. The climate of the year is divided into four seasons viz hot season from March to May; monsoon from June to September; Post-monsoon from October to November; winter from December to February.

Water Temperature

The water temperature plays an important factor which influences the chemical, bio-chemical characteristics of water body. The maximum temperature of 32 was recorded in June and a minimum of 14 was recorded in month of January. Water temperature in summer was high due to low water level and high environmental temperature.

Turbidity

The turbidity of water fluctuates from 001 to 012 NTU. The maximum value of 012 was recorded in the months of summer and monsoon; it is due to low water volume and the mixing of mud and other garbage with rain water.

Total Dissolved Solids

The total dissolved solids fluctuate from 400 mg/l to 238 mg/l. The maximum value was recorded in the month of September. It also due to rain, Heavy Rain is responsible for the soil erosion, resulting soil and mud mix with water which increases the TDS of Water bodies. The minimum value was recorded in the month of February.

pH

pH was alkaline values ranges from 7.8 to 8.4. The maximum pH value was recorded in the month of May (8.4) and minimum (7.8) in the month of December. Most of bio-chemical and chemical reactions are influenced by the pH. The low oxygen values coincided with high temperature during the summer.

Hardness

Hardness of water ranges from 218 mg/l to 203 mg/l. The maximum value was recorded in the month of September (218 mg/l), during summer can be attributed to decrease in water volume and increase of rate of evaporation of water and minimum value was in the month of January, may be due to heavy rain and dilution of water.

Dissolved Oxygen

The value of DO fluctuates from 11.6 mg/l to 4.0 mg/l. The maximum value was recorded in the month of April and minimum values in the

month of September. The amount of oxygen that dissolves in water can vary in daily and seasonal patterns, and decreases with higher temperature, salinity, and elevation. The maximum solubility of oxygen in water at 1 atm pressure (standard air pressure at sea level) ranges from about 15 mg/L at 0°C to 8 mg/L at 30°C—that is, ice-cold water can hold twice as much dissolved oxygen as warm water (Wetzel 2001).

Free Carbon Dioxide

The value of free CO₂ ranges from 0.3 mg/l to 0.1 mg/l. CO₂ may fluctuate according to environmental condition, alkalinity and Hardness of water.

Alkalinity

Total alkalinity ranges from 186 mg/l to 142 mg/l, the maximum value of 186 mg/l and minimum value of 142 mg/l were recorded in the month of May and October respectively. The alkalinity was maximum value in the summer and rainy due to increase in bicarbonates in water. (Hujare, M. S. 2008)

Chlorides

The value of chlorides 100mg/l was constant during year.

Phosphate, Nitrates, Ca and Mg

Ca and Mg Concentration were higher in summer season whereas lowest were found during winter. Concentration were higher during summer can be attributed to decrease in water volume and increase of rate of evaporation of water and minimum value was during winter may be due to heavy rain and dilution of water. There was no phosphate and nitrates recorded in Dam water.

Heavy Metals Analysis

The Lead and Mercury concentrations in the water are highest in the summer season whereas lowest concentrations are found in winter season. Iron and Zinc are found in highest concentration in Rainy while lowest in summer. Copper (Cu) is one of the metal, which are essential to human health. Its presence in the aquatic environment may be due to accumulation of domestic and agricultural wastes, Cu is found in highest concentration in summer whereas lowest in rainy season. The concentration of Zn in this site is under permissible limit. It is an essential mineral of importance to both plants and animals.

In this study, lead levels were above the recommended limits (0.01ppm) for water. Pb is a toxic element, which has no significant biological function and shows their carcinogenic effects on aquatic biota and humans even at low exposures. Pb exposure is known to cause musculo-skeletal, renal, ocular, neurological, immunological, reproductive and developmental effects. Mercury is a highly toxic element that is found both naturally and as an introduced contaminant in the environment. The concentration of Hg in water is highest than prescribed limits by WHO (0.006), Indian Council of Medical Research (mg/l) and BIS, IS: 10500- Desirable (mg/l) (0.001ppm). According to Indian standards Fe and Cu concentrations are also higher than desirable limits. In present study mining, fertilizers, domestic waste products and activities of boats are main reasons of heavy metal contamination, which is responsible for the many health hazards in population living across the Dam.

CONCLUSION

Because of contamination of heavy metals (Pb & Hg), without treatment Dam water is not suitable for drinking and cooking.

SUGGESTIONS

There is much human interference in respect to water degradation by which pollution are increasing, as Washing clothes, Taking bath, Worship for different spiritual purpose, immersion of statues, industrial waste, domestic waste and mining. these activities should be banned by the authority because some peoples are using its water for drinking also, which is not good for their health as well as aquatic animals.

REFERENCES

1. Aher, S.K. Mane, U.H. and Pawar, B.A. A study on physico-chemical parameters of Kagdipura Swamp in the relation to pisciculture near Aurangabad, Maharashtra (2007)
2. Ali M. A., Salam A., Azeem M., Shafique and Khan, B.A. Studies on the effect of seasonal variations on physical and chemical characteristics of mixed water from Rivers Ravi and Chenab at union site in Pakistan. J. Res. B. Z. Univ. Multan, 2: 1–17 (2000).
3. Hujare, M. S.: Seasonal variation of physico-chemical parameters in the perennial tank of Talsande, Maharashtra. Ecotoxicol. Environ. Monitor. 18(3): 233-242 (2008)
4. Krishnamurthy R: Hydro-biological studies of Wohar reservoir Aurangabad

- (Maharashtra State) India. J. Environ Biol. 11(3), 335-343 (1990).
5. Swaranlatha, S. and A. Narsingrao: Ecological studies of Banjara lake with reference to water pollution. J. Envi. Biol. 19(2):179-186 (1998).