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Analysis of Physico-Chemical and Microbiological Parameters of Chandrakeshar Dam Kantaphod,Dewas, M.P.

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Abstract - In the last decades, a new crisis has arisen in front of the people of the whole world, which can also be estimated as one reason for the future tragedy and that is the availability of clean drinking water. Keeping such concerns in view, this study has been done. The Physico Chemical Properties of this Dam water were assessed during January 2017 to December 2018 by monitoring the water quality at Five different locations. In this study I found that the parameters taken to determine the water quality like BOD, COD, DO, Total Hardness, Ph, Temperature, Chloride, Phosphate etc. were found in the standard given by Who and BIS whereas in microbial study Coliform The number of bacteria was found to be high, which shows that the water of this water source is not to be used without water treatment.

Keywords - Colliform Bacteria , Alkalinity, DO , Chandrakeshar Dam, Satwas, TDS.

Introduction

Dams are a kind of obstacle for rivers in their fluvial system, which creates discontinuity in the river flow. Various dams and reservoirs are being constructed in our country continuously due to the increase in demand of water and energy. Various dams are built over the rivers to meet the requirements of water supply, irrigation and household purposes for the local people of that area. Generally this kind of dam construction can influence the quality of river water (King *et al*. 2003).

Physico-chemical properties of drinkable water are among much influential parameters. Any kind of fluctuations observed in the constituents of the former parameters can generate harmful impacts on organisms residing that particular environment. It can also limit the production and restrict the physiological process of those organisms. Water reservoirs like lakes, rivers and dams were observed anthropogenic activities which impacts on water quality of the reservoirs (Sood *et al.*, 2008). Usually the determination of water quality is characterized by microbial presence, some fecal coliform bacteria and physic-chemical parameters (EPA, 1999). Some external and internal factors can affect the parameters. A kind of complicated relationship lies between these extrinsic and intrinsic factors of aquatic ecosystem. Physico-chemical parameters such as water temperature, pH, BOD, DO,

TDS, COD, transparancy, total hardness and phosphate can easily be get affected by meteorological conditions and pollution factors.

All the above parameters can affect the biochemical reactions occur in water. The change in constituents can indicate the changes in water conditions. The intrinsic factors are biotic which includes the population of planktons and bacteria within the water body (Bezuidenhout *et al*., 2002). The higher level of indicator bacteria indicates the higher level of fecal matter in the water which creates the higher risks of water generated diseases (Pipes, 1981; Sood *et al*., 2008). The dam construction and the modification in the massive land bring about hydraulic disturbances which is the determining factor of biotic community within the region (Grabowski *et al*., 2017). A lot of information and literature is available regarding the impact of dams and the regulating structures of aquatic system (Walker, 1985; Agarwal *et al*., 2011, 2018a and b; Ayoade and Agarwal, 2012).

The drinkable water which is used for human consumption should be unimpeded from such undesirable substances which are harmful for human health. The drinking water must be purified to certain level and harmful infectious bacteria eliminated.

Materials and methods

Site Selection - Chandrakeshar Dam is situated at about 20 Km from Satwas town of Dewas District of Madhya Pradesh. The dam is located on Chandrakeshar River which is a tributary of river Narmada. Purpose of the construction of this dam was mainly for irrigation in nearby villages. Moreover irrigation, the water is also used for drinking purpose and fish culture by local fishermen.

Parameters -The monitoring of water was done for the period of 2 years (Jan.2017- Dec.2018). For the site selection, five stations at the reservoir were made to collect samples. Sampling was done in the morning hours. The five sampling stations were selected to represent usual water quality of the dam water. The water samples collection was done according to the methods recommended by American public health association (1998). A variety of water samples were collected from the stations to measure physical and chemical parameters. The parameters analyzed in this study were temperature, pH, total dissolved solids, total suspended solids, transparency, carbonate alkalinity, bicarbonate alkalinity, total hardness, DO, COD, BOD, chloride, phosphate, sulphate, and total coliform. Samples were collected in the sterile bottles from the surface of each site. Some parameters were on the spot evaluated as temperature, Transparency, PH and DO undergo quick changes. The various parameters were analysed using standard methods by (APHA, 1999) and (NEERI, 1986).

Observations and results-

For the two years continuous monitoring was done to the dam region and water samples were analysed in particular intervals. The observed data were-

Water temperature- It is the most common ecological factor. The range of temperature varies greatly in different environment. Such as fresh water bodies, marine and terrestrial. In the present study water temperature ranges from 17-41^{o}C. The minimum water temperature was recorded 17^{o}C at station I in winter and maximum value was recorded 41^{o}C at station III in summer.

pH-pH indicates the concentration of hydrogen ions. Natural waters generally have been found to have pH values from 5.5 to 8.6 because of the presence of bicarbonates and carbonates of alkaline earth metals. Drinking water with a pH range from 6.5 to 8.3 is necessary. It is greatly affected by photosynthetic activity of aquatic plants by exposure of air temperature disposal of sewage and disposal of industrial water. pH fluctuated between 7 to 9. The minimum pH was recorded 7 at station I in summer season and the maximum pH was recorded 9.0 at station III.

Total Dissolved Solids-TDS is a measure of the combined content of all inorganic and organic substances contained in liquid. It is used as an indication of aesthetic characteristics of drinking water and as an aggregate indicator of the presence of a broad array of chemical contaminants. The value of total dissolve solid (TDS) is fluctuated from 35-260 mg/l. The minimum value was recorded 35 mg/l at station III in summer. The maximum value was recorded 260 mg/l at station IV in rainy season.

Total Suspended Solid-The suspended solids determination is particularly in the analysis of sewage and other waste waters and is as significant as BOD determination. It is used to evaluate the strength of domestic waste water and efficiency of treatment units. The value of total suspended solid (TSS) is fluctuated from 40-280 mg/l. The minimum value was recorded 40 mg/l at station I .. The maximum value was recorded 280 mg/l at station III in rainy season.

Transparency-Transparency of the water body is mainly affected by the suspended particles and other factors like plankton growth, rain fall, nature of water and weather conditions. In general, transparency varied from 12 - 65 cm. The minimum transparency was recorded 12cm. at station I. This was due to the increased amount of particles which were added by surface runoff. The maximum transparency was recorded 65 cm. at station I and II in summer. This was due to settling of particles.

Carbonate Alkalinity-Carbonate alkalinity or Carbonate hardness is a measure of the alkalinity of water caused by the presence of carbonate (CO_3^{2-}) anions. The value of carbonate alkalinity was fluctuated from 12- 60 mg/lit. The minimum value of carbonate alkalinity was recorded 12 mg/l at station-III in rainy and the maximum value of was recorded 60 mg/l at station IV in summer season.

Bicarbonate Alkalinity-It is a measure of the alkalinity of water caused by the presence of bicarbonate (HCO^{3-}) Anions. The value of Bicarbonate alkalinity was fluctuated from 79- 220. The minimum value of carbonate alkalinity was recorded station-II and the maximum value of was recorded at station IV.

Total Hardness- It shows quality of water supplies. The hardness is governed by contents of calcium and magnesium salt, largely combine with bicarbonates and carbonates, and with sulphate, chloride and other anions. The total hardness varied between 98 - 318 mg/l. The minimum total hardness was recorded 98 mg/l at station I in winter and maximum total hardness was recorded 318 mg/l at station IV in April (summer month). This maximum value is due to continuous leaching an accumulation of salts in the absence of flow in summer months.

Dissolved Oxygen-Dissolved Oxygen is important for aquatic system and also essential for the metabolism in the organisms. There are two main sources of dissolved oxygen in water i.e. by diffusion from air and photosynthetic activity. In general dissolved oxygen varied between 5.3 – 9.4 mg/l. The minimum value was recorded 5.3 mg/l at station III in summer and the maximum dissolved oxygen value was recorded 9.4 mg/ l at station III in winter.

Biochemical Oxygen Demand-Biochemical oxygen demand is an index of organic pollution and help in deciding the suitability for water consumption. The biochemical oxygen demand value fluctuated between 1.5 – 4.5 mg/l. The minimum biochemical oxygen demand value was recorded 1.5 mg/l at station III and the maximum value was recorded 4.5 mg/l at station IV in May (summer month) due to increased temperature which in turn promotes microbial activities.

Chemical Oxygen Demand-Chemical oxygen demand (COD) gives us a reliable parameter for judging the extent of pollution in water. COD is the measure of the oxygen required for chemical oxidation of organic matter. This also provides a direct measure of state of pollution in water bodies. The value of chemical oxygen demand fluctuated between 18-68 mg/l. The minimum chemical oxygen demand was recorded 18 mg/l at station-I in winter and the maximum value was recorded 68 mg/l at station-III in summer.

Chloride-Chloride is present in fresh water in the form of calcium, magnesium and sodium salts. The concentration of chloride content is also used as an indicator of pollution in fresh water. In the present study, chloride varied from 15–150 mg/l. The minimum value was recorded 15 mg/l at station II in rainy and maximum value was recorded 150 mg/l at station IV in summer seasons.

Phosphate-Phosphate is the important nutrient necessary for the production growth of aquatic organisms. The major sources of phosphorus are domestic sewage detergents, agricultural effluents with fertilizers and industrial waste water. In the present study, phosphate values varied between 0.2 – 145 mg/l. The minimum value was recorded 0.2 mg/l at station IV and the maximum value was 145 mg/l due to the influx of rain water also at station IV.

Sulphate-Sulphate is ecologically important for growth of plants and its short supply may inhibit the development of plankton. It is utilized by all living organisms, in the form of both mineral and organic sulphate. In the present study, the value of sulphate varied from 3.6–120 mg/l. The minimum value was recorded 3.6 mg/l at station I in month of May (summer) and maximum value recorded 120 mg/l at station IV in summer.

Total Coli form-The coliform group of bacteria is the principal indicator of suitability of water for domestic uses. The density of coliform group is the criteria for the degree of contamination and has been the basis for bacteriological water quality standard. From public health standpoint the bacteriological quality of water is an important as the chemical quality. The value of Total Coli form was fluctuated from 250-590 MPN/100 ml. The minimum value of Total coli form was recorded station-I in September and at Station-I & IV and the maximum value of was recorded at station III in May.

Discussion

Water temperature- Muhammad *et al*., (2008) recorded temperature between 10 º C to 49 º C in Manchar lake, Pakistan. Burdi *et al*., (2009) showed temperature variation between 16.5 º C to 32.9 º. Sharma *et al*., (2008) recorded water temperature between 20.6 º C to 38.4 º C while studying the hydrological parameters of Narmada river at Hoshangabad.

pH - Chaudhari *et al*., (2001) recorded pH ranged between 7.6 to 9.8 from Chatri lake. Sharma *et al*., (2008) observed pH value between 6.8 to 9.3 in Hoshangabad area of Narmada river. Sharma *et al.,* (2013) recorded pH varied between 7.61 to 9.22 in Kunda river, Khargone (M.P.).

Total dissolved solids- Singh *et al*., (2010) recorded the total dissolved solid value between 308 miligram per litre to 648 mg/l. from Manipur river. Prasanna & Panda (2010) reported the TDS value ranged between 12.5 mg/L to 63.8 mg/L.

Total suspended solids- Manjare *et al*., (2010) recorded Total suspended solids value ranged between 48.8 mg/l to 145.7 mg/l. In Kolhapur district Maharashtra. Sharma *et al*., (2012) recorded total suspended solids value ranged between 40 mg/l to 133 mg/l. in Narmada river.

Transparency - Sharma & Chowdhary (2011) observed transparency ranged between 20cm to 112 cm in the river Tawi. Sharma *et al*., (2013) recorded transparency fluctuating from 15 cm to 53 cm in Kunda river, Khargone (M.P.).

Carbonate alkalinity- Jain & Shrivastava (1998) reported the Cabonate alkalinity ranges between 0.00 to 88.00mg/l in Bharar river basin, district chhatarpur.

Bicarbonate alkalinity- Mariappan *et al*., (2002) recorded the Bicarbonate alkalinity rages between 2.5 mg/l. to 8.5 mg/l. at Sivakasi Town. Jain & Shrivastava (1998) recorded the value of bicarbonate alkalinity ranges from 124 mg/l. to 239 mg/l. at Bharar river basin, district Chhatarpur.

Total hardness- Nnaji *et al*., (2010) recorded total hardness between 60 to 172 mg/l from river Galma, Nigeria. Murhekar (2011) observed the total hardness value ranged between 312 to 687 mg/l in and around Akot city.

Dissolved oxygen- Murhekar (2011) recorded DO ranged between 4.9 to 8.2 mg/l in different locations around Akola city. Yadav & Srivastava (2011) observed DO variation from 1.2 to 9.9 mg/l in river Ganga at Ghazipur.

Biochemical oxygen demand- Mohanta & Patra (2000) recorded BOD value ranged between 1.2 to 3.6 mg/l from Sanamachhakandana river at Orrisa. Pandey (2007) recorded BOD value from 2 to 5.7 mg/l in Yeshwant sagar reservoir, Indore.

Chemical oxygen demand Mariappan *et al*., (2002) Recorded the COD value ranges between 99 mg/l to 487 mg/l. in Sivakasi.

Chloride - Siraj *et al*., (2010) observed value of chloride ranged between 16 to 45 mg/l in wetlands of Kashmir. Chandhra *et al*., (2010) observed value of chloride between 8 to 58 mg/l in various river water of India.

Phosphate- Sharma *et al*., (2008) while studying on Narmada river recorded value of phosphate ranged between 6.2 to 21 mg/l. Singh *et al*., (2010) observed the value of phosphate between 0.2 to 0.5 mg/l in Manipur river system.

Sulphate- Chandra *et al*., (2011) recorded sulphate values ranged between 2 to 57 mg/l from various rivers in India. Krishna (2012) recorded sulphate value between 38.13 to 68.65 mg/l in Kaveri river, Kudige, Kodagu, Karnataka.

Total coliform- Jain (2002) was done bacteriogical analysis of the water samples of District Dehradun, Uttranchal. The study shows bacterial contamination at several places. In the case of spring samples, most of the samples are showing bacterial contamination with more than 60 % of the samples exceeding the permissible limit of 10 coliforms per 100 ml.

Conclusion-

It may be concluded that the water of chandrakeshar dam is moderately polluted in respect to physicochemical analysis. Bacteriological studies shows dam water contains higher coliform counts. Treatment process of water is needed before use as it is moderately polluted and an awareness program is needed to educate local villagers.

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