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PHYSICO-CHEMICAL CHARACTERISTICS OF RIVER NARMADA AT OMKARESHWAR DAM RESERVOIR MADHYA PRADESH, INDIA

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ABSTRACT: The Narmada River is one among the most important river in central India and fifth largest river in Indian subcontinent. The river is continuously being polluted by various anthropogenic activities, which results to the threat to aquatic life. The present investigation was carried for the period of one year from August 2011 to July 2012 in five sampling stations viz, Upstream Intake S I, Intake dam site S II, Downstream Intake S III, Shallow Water Area S IV and Confluence of River Narmada and River Kaveri. Minimum value of DO, Total Nitrogen and Total Phosphorus was recorded in May month and maximum value of DO was recorded in June-July months. The results of present study indicate that Narmada River is slightly polluted and needs regular monitoring.

KEYWORDS: water quality; Physico chemical characteristics; River; Narmada; India.

INTRODUCTION

Water is one of the fundamental requirements of life that plays a significant role in sustain of a nation. The available fresh water for human consumption is hardly 0.3 to 0.5 percent of the total water (2.4%) supply on earth and therefore, its judicious use is important (Szewzyk et al., 2000). Water plays an important role in the existence of life on the earth. All life has been originated in the water. Water is one of the most important natural resource around the world (EPA 2001, Voelz et al., 2005). It is a necessity for life and provides a variety of use from drinking water in cities to the irrigation of crops in agricultural areas. Water also provides recreational use as well as habitat for wildlife. Rivers and streams are very important natural environment and linked to human lives, animals and vegetation (Hasse and Blodgett 2009).

Rivers have been the most important freshwater resources and our ancient civilizations have flourished along the banks of rivers. River water finds multiple uses like agriculture, industry, transportation, aquaculture, public water supply and they have been used for cleaning and disposal purposes. Huge loads of waste from industries, domestic sewage and agricultural practices find their way into rivers resulting in large scale deterioration of the water quality. The growing problem of degradation of our river ecosystem has necessitated the monitoring of water pollution and water quality of various rivers all over the country to evaluate their production, capacity, utility potential and to plan restorative measures. Researchers studied the physicochemical and microbiological parameters of river and found that variations were in the physic chemical and microbiological properties of the water (Maitera and Sudi 2011, Mathavan and Nambirajan 2012, Sanders et al., 2013, Sivaraja and Nagarajan 2014 and Kumawat and Sharma 2015).

The river Narmada receives 41 principal tributaries (Alvares and Ramesh 1988), each with a catchments area exceeding 500sq. kms. Out of these 22 (21 in M. P. and 1 in Gujarat) joins the river from left bank and 19 (18 in MP and 1 in Gujarat) from right bank (Ghosh et al., 2004). The total length of these principal tributaries is 3387 Km. Besides this, there are other 50 important rivulets joining the river Narmada. Most of the tributaries and some of the rivulets arise from the highlands of Vidhyas and Sutpuras ranges.

There are about seven dams constructed on Narmada River. Due to the Dam formation the ecology of Narmada River is quite degraded which results in threat aquatic biodiversity of river. The idea of damming the Narmada was discussed as far back as the late 19th century during the days of the British Raj. Of the 30 big dams proposed along the Narmada, Sardar Sarovar Project and Narmada Sagar Project are the megadams. The Maheshwar and Omkareshwar dams along with Sardar Sarovar Project and Narmada Sagar Project are to form a complex which would ultimately cater to the needs of Sardar Sarovar Project. The construction of dam in the riverine system changes the biological and ecological conditions of rivers. Alteration occurs in the floral and faunal characteristics near the dammed site (Ogbeibu and Oribhabor 2002). The developments like construction of dams and barrages along the river results in low water flow (Hassan et al., 1998a, 1998b). Dams causes physical alteration of tail waters or downstream

areas, changes in water temperature, channel morphology or stream substrates and loss of spawning and rearing habitat due to upstream flooding, thus impacting indigenous fishes (Shrestha 2001). The main purpose of this study is to assess the water quality of Narmada River and to suggest the conservative measures to increase the quality of the river.

MATERIAL AND METHODS

About the study area

The Narmada also called Rewa is a river in central India and the fifth largest river in the Indian subcontinent. It is the third largest river that completely flows within India after Ganges and Godavari. The Narmada river basin lies in the central part of India, between 72° 20" E to 81° 45" E longitude and 21° 20" N to 23° 45" N latitude with a drainage area of 98,796 sq. km and a mean elevation of 760 m. Narmada river originates in the Maikal Mountain ranges in Amarkantak in Madhya Pradesh state, and flows through west for a distance of 1312 km into the Gulf of Cambay, west of Bharuch District in Gujarat State. The source of the Narmada is a small tank called Narmada Kund located on the Amarkantak hill 1,057 m (3,467.8 ft)), in the Anuppur District of eastern Madhya Pradesh.

An Omkareshwar dam reservoir is a man made fresh water resource which nourishes its own aquatic life. Omkareshwar dam reservoir is an important fresh water reservoir situated in East Nimar. This reservoir is used for Generation of Electricity, irrigation, domestic and drinking purpose and fish culture. The limnological studied on this reservoir. The aims of undertaken study were to investigate seasonal variation in physic-chemical characteristics of Narmada River at Omkareshwar dam reservoir. The reservoir is situated in East Nimar which is 32.1miles or 51 Km. and 718.33 meters away from tribal district headquarter Khandwa. This reservoir Height is 33 meter or 108 ft. and Omkareshwar Major Irrigation Project called Omkareshwar (NHDC) Dam, this dam Height 64meter and cultivable Land affected is 2.727 Th Ha. It's located at a latitude- (DMS) 220 15' 1" N and longitude- (DMS) 760 8' 48" E. This reservoir is situated 54 Km. away from Tehsil Punasa and 10 Km. from adjacent town Sukwa. The study was carried out from August 2011 to July 2012 and for the present investigation. "PHYSICO-CHEMICAL CHARACTERISTICS OF RIVER NARMADA AT OMKARESHWAR DAM RESERVOIR MADHYAPRADESH, INDIA" has been completed. Five sampling stations marked Site I, Site II, Site III, Site IV and Site V were selected after preliminary Observations for the purpose of present investigations. The water sample was collected on monthly basis at 09:00 am. The Physico- Chemical parameters were determined by standard methods of Golterman (1991), Welch (1998), APHA (2005).

RESULTS AND DISCUSSION:

1. TEMPERATURE:-

Temperature is one of the most important ecological factors, which has profound influence on the abiotic and biotic components of the environment. It never remains constant in rivers due to changing environmental conditions. It indicates the quality of water, influencing aquatic life and concentration of dissolved gases and chemical solutes.

The water temperature of Omkareshwar dam reservoir range between 23oC to 34.4oC August 2011 to July 2012.The minimum water temperature recorded in the month of December 2011 at S-V and maximum in the month of June 2012 at S-I. The maximum water temperature was recorded in summer season to be followed by rainy season and winter season. Jain and Sharma (2001), Yogesh and Pendse (2001) also reported the same type of fluctuation in various freshwater bodies.

Ayodele and Ajani (1999) reported that tropical freshwaters had temperature values ranging from 21oC to 32oC. Duran (2006) observed temperature value between 6.1(Winter) to 22.3 (Summer) in Behzat Stream of Turkey. George et al., (2009) observed water temperature value between 28.90oC to 34.40oC in Okpoka Creek sediments, Niger Delta, Nigeria. Kudthalang and Thanee (2010) observed the mean of water temperature ranged from 27.3±0.9oC to 30.4±1.7oC in the upper part of the Chi Basin. Varunprasath and Daniel (2010) observed temperature variation between 22oC to 29.5oC in Bhavani river Tamilnadu, India.

2. CONDUCTIVITY:-

Conductivity reflects the amount of total soluble salts in Water. The Conductivity of Omkareshwar dam reservoir range between 230µS/cm to 269µS/cm.The minimum Conductivity recorded in the month of December 2011at S-I and maximum in the month of August 2011 at S-III. The highest values of conductivity were recorded in summer season moderate in winter and lower in rainy season. Dissolved solids (nutrient load) measurable as conductivity of the water. Navneet Kumar et al., (2010) suggested that the underground drinking water quality of study area can be checked effectively by controlling

conductivity of water and this may also be applied to water quality management of other study areas.

3. TOTAL DISSOLVED SOLIDS:-

In the study period from August 2011 to July 2012, the Total Dissolved Solids varied between 120mg/l. to 217mg/l, minimum in May2012 at S-V and maximum in March 2012 at S-III. According to Wilcox (1955) aquatic media classified based on the concentration of TDS. Water found desirable for drinking up to permissible limit of 500 mg/L, hence it can be said that river water is safe for drinking purpose. TDS in water found due to content of carbonates, bicarbonates, chlorides, phosphates and nitrates of calcium, magnesium, sodium, potassium, manganese, organic matter salt and other particles (Fakayode, 2005). Saksena et al., 2008 recorded in Chambal river Minimum total dissolved solids (260 mg/l.) were recorded at Station-B and Station-C, while maximum value (500mg/l.) was recorded at Station-C in the month of September.

4. pH:-

The water of Omkareshwar dam reservoir was found slightly alkaline in nature which is suitable for fish culture. In the study period from August 2011 to July 2012, the pH varied between 6.9 to 8.6 minimum in July 2012 at S-V and maximum in January 2012 at S-III. Seasonal variation in pH was observed to be minimum in rainy season followed by winter season. According to Fakayode (2005), the pH of a water body has importance in determination of water quality as it chemically reacts with remaining factors. Aquatic organisms are sensitive to pH fluctuations and their biological treatment requires pH control or monitoring. Significant difference was not found in pH during the assessment period. The pH value was between 7.3 to 7.43 at both the sites which was within the range of WHO as standard of 6.50–6.9.

5. DISSOLVED OXYGEN:-

Dissolved oxygen (DO) has been a fundamental requirement of life for plant and animal population in any given body of water. Dissolved oxygen of water is an important test to study the quality of water. Its optimum value for good quality water has been 4 to 6 mg/lt of DO which is able to maintain aquatic life in a water body. The Dissolved Oxygen content in Omkareshwar dam reservoir was found to range between 5.1 to 8.2mg/l. during the period of August 2011 to 2012. The minimum dissolved oxygen of 5.1 mg/l. was recorded at station-III in the month of July 2012 and maximum of 8.2 mg/l. at station-I in the month of October 2011. Seasonal variation of dissolved oxygen content in Omkareshwar dam reservoir was recorded to be higher in rainy and summer season. High content of dissolved oxygen in winter season is due to low temperature. Maximum temperature and increased decomposition of dead aquatic vegetation in summer brought in down the level of oxygen in water. The seasonal variation of DO in water depends upon the temperature of the water body which influences the oxygen solubility in water. This present result was in conformity with Mohan et al., 2013 in River Tawi in vicinity of udhampur city (J & K) India.

6. BIOCHEMICAL OXYGEN DEMAND:-

The Biochemical oxygen demand is one of the important factors to determine the quality of water and processes occurring in water body. The values of BOD fluctuated between 0.6 to 4.0 during the study period of August 2011 to July 2012. The minimum Values of BOD were observed at Station-I in the month of October 2011 and maximum values at Station-V in the month of December 2011. The maximum values of BOD were recorded in summer season to be followed by rainy and winter season. According to WHO (1982) the minimum limit of BOD for pollution in 6.4 mg/l thus the present finding reveal that water of

Omkareshwar dam reservoir has not organic pollution. This present result was in conformity with Sisodiya and Moundiotiya (2006) in Kalakho Lake, Rajasthan; Chandra et al., (2011) in various river water in India; Balachandran et al., (2012) in Banglore Lake at Karnataka; Efe Ogidiaka 2012 recorded in Ogunpa River at Bodija, Ibadan, Oyo state and Prabhakar et al., (2012) in Palar River, Vellore district Tamilnadu.

7. CHEMICAL OXYGEN DEMAND:-

In the study period from August 2011 to July 2012, the COD varied between 08mg/l. to 32mg/l, minimum in February 2012 at S-V and maximum in June 2012 at S-III. Karuppaiah and Ramesh (2016) observed Chemical oxygen demand value was ranging from 173 to 299 mg/l in the sampling point Anna Nagar. In the Arapalayam COD value was ranging from 160 to 250 mg/l. In the sampling point Vaigai Dam the COD value was ranging from 12 to 62 mg/l. In the Annaipatti solavanthan, the value of COD was ranging from 110 to 150 mg/l. The minimum COD value of (12 mg/l) was recorded in the sampling unit Vaigai Dam and the maximum COD value of (426 mg/l).

8. CALCIUM AND MAGNESIUM:-

In the study period from August 2011 to July 2012, the Calcium varied between 39mg/l. to 160mg/l, minimum in August 2011at S-V and maximum in June 2012 at S-I. During the study period from August 2011 to July 2012 this fluctuation was 16mg/l. to 59mg/l., minimum in August 2011 at S-III and maximum in February 2012 at S-IV. Total hardness of water is due to the presence of bicarbonate, sulphates, chloride, and nitrates of Ca and Mg (Kumar et al., 2010). The hardness of water depends on the dissolved minerals present in it which determines water quality for all purposes. Hardness ranged as maximum in summer at both the sites showing 302 mg/L at Sangli site and 269 mg/L at Mhaishal site may be due to low level of water and lower in winter at Mhaishal site i.e. 212 mg/l due to increased inflow of water.

CONCLUSION

In conclusion, the results showed that water from River Narmada at Omkareshwar dam reservoir having passed majority of the tests, is fit for irrigation and can be used as source water for water treatment plant for drinking water. However, further study is recommended to determine heavy metals and bacterial constituents of the river water to further ascertain its safety.

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