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The Study of Physico-Chemical Analysis of Narmada River Water (M.P.) India

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Abstract:
River Narmada is of great importance as it is being used as water resources for drinking, agriculture, industrial, outdoor bathing uses. During the study paper deals with physico-chemical analysis of Narmada River water. The qualities of water sample were compared with standard value gives by W.H.O. for drinking, fisheries and irrigation purposes. We advocate habitat conservation and ecological studies with special reference to management the quality of Narmada rive waters. Number of 16 water samples were collected and analyzed for physico- chemical parameters such as Water Temperature, pH, Transparency, Total Alkalinity, Dissolved Oxygen, Total Solid, Total Dissolved Solids, Total Suspended Solids, Biological Oxygen Demand, Chemical Oxygen Demand, Nitrate, Chloride, Phosphates, Sulphate, Calcium Hardness, Total Hardness. This river water can be used for drinking purpose after purification treatment.

Keywords: Physico-chemical parameters, Narmada River.

Introduction

Water is not only essential to life but is predominate inorganic constituent of living matter forming nearly three quarters of the weight of a living cell. In living tissue water is the medium for many biological reactions and extraction processor of inorganic nutrients photosynthetic ingredients and minerals etc. are transported in aqueous medium. In short water is essential for life and plays a unique role virtually as medium in all biological process.

Physico-chemical analysis is the prime consideration to assess the quality of water for its best utilization like drinking, irrigation, fisheries, industrial purpose etc. and helpful in understanding the complex processes, interaction between the climatic and biological processes in the water.

During the study paper deals with physico-chemical analysis of Narmada River water.

Materials and Methods

The Narmada River, hemmed between Vindya and Satpuda ranges, extends over an area of 98,796 km². and lies between east longitudes 72 degrees 32' to 81 degrees 45' and north latitudes 21 degrees 20' to 23 degrees 45' lying on the northern extremity of the Deccan Plateau. The basin covers large areas in the states of Madhya Pradesh (86%), Gujarat (14%) and a comparatively smaller area (2%) in Maharashtra. There are 41 triburaries, out of which 22 are from the Satpuda range and the rest on the right bank are from the Vindhya range.

The water samples were collected between 7:00 AM to 12:00 Noon from the five selected sampling station viz., Station I, station II, station III, station IV and station V in the Narmada River for the period of one year from October 2009 to September 2010. In the analysis of the physico-chemical properties of water, standard method prescribed in limnological literature was used. The temperature, pH and transparency were determined at the site while other parameters like Total Alkalinity, Total solid, Total dissolved solid, Total suspended solid, Dissolved oxygen, Biochemical oxygen demand, Chemical oxygen demand, Nitrate, Phosphate, Chloride, Sulphate, Calcium, Total Hardness, were determined by standard methods of Golterman (1978), Welch (1998), APHA (2005).

Results and Discussion

The study period was conducted in one year i.e. from October 2009 to September 2010. Five study station of Narmada River was selected for the research work. For the convenience of study, five study stations of Narmada River were selected as under:

Station-I MORTAKKA
Station-II MAHESHWAR UPSTREAM NEAR HOMATHERAPY CENTRE
Station-III KHALGHAT
Station-IV BRAHMANGAON
Station-V KOTESHWAR

Water temperature

During the study water temperature varied between 16ºC to 31ºC. The minimum temperature of 16ºC was recorded at station –IV in January 2010 and maximum temperature 31ºC was recorded in station-I in May & V in April 2010 (Table 01 and 05). The same observations were also reported by Sharma et al (2011) and Shraddha et al (2008) in Narmada River. Imtiyaz Tali et al., (2012) while studying the Physico Chemical properties of water of River Narmada recorded water temperature between 24 ºC to 35 ºC. Jain and Sharma (2001), Yogesh and Pendse (2001) also reported the same type of fluctuation in various fresh water body.
Temperature in the water is important for its effects on the chemistry and biochemical reactions in the organisms. Pir et al., (2012) was obtained water temperature ranged from 22ºC to 33ºC on Narmada River. Rajendra kumar Chaurasia (2013) was obtained water temperature ranged from 16ºC to 43ºC on Kunda River Khargone District.

pH

During the study pH was showed variation between 7.4 to 9. The minimum pH of 7.4 was recorded at station –IV in October 2009 and September 2010 & station V in August 2010 and maximum pH 9 was recorded in station-I & II in January 2010 (Table 04 & 05and 01& 02**)**.The pH of Narmada River is in accordance with the finding of Ghose and Sharma (1988), Singh and Ray (1995) and perking (1976).

Transparency

During the study transparency value was shown variation between 11 cm. to 48 cm. The minimum transparency of 11 cm was recorded at station – V in August 2010 and maximum transparency 48 cm was recorded in station-I in February 2010.(Table 05 and 01**)**. Similar result show Sharma and Chowdhary (2011) observed transparency variation between12.5 to 40.75cm in Tawi River of Jammu and Kashmir. Mohan et al., 2013 observe the transparency in River Tawi in vincinity of udhampur city (J&K) India fluctuated in between 45.0cm to 423cm.Yadav and Srivastava (2011) recorded the transparency ranged between 25 cm to 110 cm of the river Ganga at Ghazipur. Zahoor et al., (2012) observed the same values while studying the physico-chemical parameters of Narmada River.

Total alkalinity

During the study total alkalinity value was shown variation between 90 mg/l to 240 mg/l. The minimum total alkalinity of 90 mg/l was recorded at station – III in October 2009 and maximum total alkalinity 240 mg/l was recorded in station-II in March 2010. (Table 03 and 02**)**. Trivedi et al (2009) also observed the same value in Ganga River India. Singh et al., (2010) observed total alkalinity values fluctuated between 123.00 mg/l to 240.00 in manipur river system, India. Sisodiya and Moundiotiya (2006) observed total alkalinity values fluctuated between 98 to 276 mg/l, indicating that the water is hard.

Dissolved oxygen

During the study dissolved oxygen was shown variation between 6.8 mg/l to 9.4 mg/l. The minimum dissolved oxygen of 6.8 mg/l was recorded at station –V in May 2010 and maximum Dissolve Oxygen 9.4 mg/l was recorded in station-II in January 2010. (Table 05 and 02**)**.
Sharma et al., (2011) revealed a dissolved oxygen range of 5.0 milligram per litre in Narmada River Hoshangabad (M.P.). The seasonal variation of Dissolve Oxygen in water depends upon the temperature of the water body which influences the oxygen solubility in water.

Total solid

During the study total solid was shown variation between 180 mg/l to 450 mg/l. The minimum total solid of 180 mg/l was recorded at station –III in December 2009 and maximum total solid 450 mg/l was recorded at station-V in August 2010. (Table 03 and 05**)**.

Imtiyaz Tali et al., (2012) observed the value of total solid was fluctuated between 230 mg/l to 345 mg/l. in Narmada River. Pir Zahoor et al., (2012) also observed the value of total solid was fluctuated between 180 to 360 mg/l. in River Narmada.

Total dissolved solid

During the study of total dissolved solid value was shown variation between 40 mg/l to 300 mg/l. The minimum total dissolved solid of 40 mg/l was recorded at station –III & IV in December 2009, Jun 2010 and maximum total dissolved solid 300 mg/l was recorded in station-V in November 2009 and July, August 2010. (Table 03,04 and 05**)**.

The high amount of Total dissolved solid adversely affects the quality of running water. The observed value is in contrast with the one reported by Zafar and Sultana (2003) where the Total dissolved solid values of river Ganga at Kanpur ranges from 200 to 640 mg/l. having maximum values in winter and minimum values in monsoon. The observed values was found below the WHO permissible limit of 500 mg/l. Kumari M. et al.,(2012) observed the value of Total dissolved solid were fluctuated between 136 to 360 mg/l. in Narmada River. Verma dinesh (2006) noted that in Narmada water 990 mg/lit Total dissolved solid was the highest value recorded in August and 123 mg/lit was the lowest value noted in September.

Total suspended solid

During the study Total suspended solid was shown variation between 50 mg/l to 250 mg/l. The minimum total suspended solid of 50 mg/l was recorded at station –I & II in December 2009 and maximum total suspended solid 250 mg/l was recorded in station-III & IV in August 2010 and October 2009. (Table 01,02 and 03 04**)**.

Garnaik Bamakanta et al., (2013) observed the value of total suspended solid was fluctuated between 44 to 115 mg/l., 82 to 142 mg/l. and 38 to 125 mg/l. in Nagavali River Odisha, India. Biplab Kumar Das et al., (2014) observed the value of total suspended solid was fluctuated between 101.8 to 129.3 mg/l.in River Siang in Arunachal pradesh. Karim A. A, Panda R. B. (2014) observed the value of total suspended solid were fluctuate between 118 to 148 mg/l. in Subarnarekha River Odisha, India.

Biochemical oxygen demand

During the study of Biochemical oxygen demand was shown variation between 2.0 mg/l to 6.2 mg/l. The minimum biochemical oxygen demand of 2.0 mg/l was recorded at station –II, III, V in January 2010, December 2009, March, September 2010 and maximum biochemical oxygen demand 6.2 mg/l was recorded in station-V in Jun 2010. (Table 02,03,05 and 05**)**.

This result was in conformity with Prabhakar et al., (2012) in Palar River, Vellore district Tamilnadu, India. Same observations were also recorded by Nnaji et al (2010) and Mary et al., (2008), (Abida 2008). BOD is an indicator of organic pollution. The BOD of water samples fluctuates from 1.51 mg/l to 10.65 mg/l. The highest value of BOD i.e. 10.65 mg/l was found from the village of Karang in the month of February. It was found to be higher in pre- monsoon and low in monsoon. The higher values of BOD in pre-monsoon may be due to high pollutant load drained from rivers of the urban areas of Imphal. Pathak, et al., (2012) recorded higher values of BOD in monsoon compared to post monsoon. Gupta, et al., (2011) reported values of biological oxygen demand of river Chambal was varied from 1.20 to 12.20 mg/l. Observed values clearly indicate that the river water is moderately polluted by organic wastes. The values of BOD are above the standards limit of 5 mg/l laid by W.H.O.

Chemical oxygen demand

During the study of Chemical oxygen demand was shown variation between 28 mg/l to 52 mg/l. The minimum chemical oxygen demand of 28 mg/l was recorded at station –I in November 2009, August 2010 and maximum chemical oxygen demand 52 mg/l was recorded in station-IV in May 2010. (Table 01 and 04**)**.

Gupta et al., (2011) observed the value of COD fluctuated between from 7.40 to 38.80 mg/L. High values of COD at some location indicate that river water was highly contaminated with chemically oxidisable inorganic

and organic substance. The measure of COD determines the quantities of organic matter found in water. This makes COD useful as an indicator of organic pollution in surface water (King et al.,2003). COD pointing to a deterioration of the water quality likely caused by the discharge of municipal waste water (Mamais et al.,1993). Vinit Kumar et al., (2011) observed the value of COD was fluctuated between 11 mg/l. to 24 mg/l. in Yamuna River.

Nitrate

Nitrate-nitrogen is present in appreciable concentration in the river water and the major sources appear to be fertilizers and domestic sewage.

During the study of Nitrate was shown variation between 0.075 mg/l to 30 mg/l. The minimum nitrate of 0.075 mg/l was recorded at station –IV & V in February 2010 and maximum nitrate 30 mg/l was recorded in station-II in September 2010. (Table 04,05 and 02**)**. Nitrate is attributed mainly due to anthropogenetic activities such of run of water from agricultural lands, industrial waste, discharge of house hold and municipal sewage from the market place and other effluents containing nitrogen, such observation were also reported by Royer et al., 2004. Nitrate concentration is indicates organic pollution in an area.

Prabhakar et al., (2012) observed nitrate value between 5.90 to 14.30 mg/l. in Palar River, Vellore district Tamilnadu. Mohan et al., (2013) observe the nitrate in River Tawi in vincinity of udhampur city (J&K) India fluctuated in between 0.109 to 0.300 mg/l. Generaly important source of nitrate is the biological oxidation of organic nitrogenous substances. Very also nitrate in River Narmada may result from point and non point sources such as sewage disposal system, faulty septic tanks, soil erosion, livestock wading, bathing and cloths washing in river banks. Avnish and Saksena (2010) reported lowest value of nitrate 0.10 milligram per litre, it during winter and highest value 4.50 milligram per litre, it during summer in river Kalpi (Morar) Gwalior.

Chloride

Chlorides occur naturally in all types of waters, in Natural freshwaters, however, their concentration remains quite low and generally less that of sulphate and bicarbonate. Higher concentration of chlorides is considered to be the indicator pollution due to higher organic waste of the animal origin or industrial effluents.

During the study of Chloride value was reported between15.60 milligram per litre to 125.5 milligram per litre. The minimum value 15.60 milligram per litre was recorded at station III in the month of Janaury 2010 and the maximum value 125.5 milligram per litre was recorded at station V in the month of May 2010. (Table 03 and 05**)**.

Nnaji et al., (2010) found the concentration of chloride within 34.1 milligram per litre to 58.5 milligram per litre from downstream and upstream respectively from river Galma Nigeria. Sulekh et al., (2011) observed value of chloride between 0.51 milligram per litre to 32.5 milligram per litre while studied physico-chemical characteristics of various rivers of India.

Phosphate

During the study of Phosphate value varied from 0.07 milligram per litre to 1.9 milligram per litre. The minimum value 0.07 milligram per litre was recorded at station IV in the month of November 2009 and the maximum value 1.9 milligram per litre was recorded at station IV in the month of July 2010. (Table 04 and 04**)**.

Nnaji et al., (2010) recorded phosphate values ranged between Nil to 2.38 milligram per litre from downstream and upstream respectively from river Galma Nigeria. Francis and Muller (2010) recorded phosphate values ranged between 0.1 milligram per litre to 0.5 milligram per litre from river Niger Delta, Nigeria. Avnish and Saksena (2010) recorded a phosphate values ranged between 0.01 milligram per litre to 0.18 milligram per litre from river Kalpi (Morar) Gwalior.

Sulphate

During the study of Sulphate value was observed between 3.6 milligram per litre to 51.0 milligram per litre. The minimum value was 3.6 milligram per litre recorded at station IV in the month of April 2010 and the maximum value 51.0 milligram per litre was recorded at station I in the month of July 2010. (Table 04 and

01**)**. Sulekh et al., (2011) recorded sulphate values ranged between 2 milligram per litre to 57 milligram per litre from various rivers in India.

Calcium

Calcium is an important micronutrient in an aquatic environment. Calcium is found in abundance in all type of natural water bodies and its source lies in rocks from which it is leached. Calcium being an important contributor to hardness in water and it appears to be reduced the utility of water for domestic use.

During the study of Calcium value varied from 18 milligram per litre to 50.90 milligram per litre. The minimum value 18 milligram per litre was recorded at station II in the month of September 2010 and the maximum value 50.90 milligram per litre was recorded at station III & IV in the months of July 2010.(Table 02 and 03,04**)**.

Choudhary R. et al.,(2011) the value of Calcium was found in the range of 60 mg/l to 112 mg/ l. which is slightly higher than the permissible limit as prescribed by W.H.O. but well within the permissible limits as prescribed by BIS standards.

Total Hardness

During the study of Total Hardness value varied from 40.0 milligram per litre to 210.0 milligram per litre. The minimum value 40 milligram per litre was recorded at station III in the month of April 2010 and the maximum value 210.0 milligram per litre was recorded at station I in the month of November 2009. (Table 03, and 01**)**.

Manjare et al., (2010) recorded total hardness values between 70 milligram per litre to 179 milligram per litre with minimum of 70 milligram per litre in October and maximum of 179 milligram per litre in the month of April from Tanbalge tank Kolhapur, Maharashtra. Nnaji et al., (2010) recorded were total hardness values between 60 milligram per litre to 172 milligram per litre from river Galma, Nigeria. Sulekh et al., (2011) recorded total hardness values ranged between 40 milligram per litre to 440 milligram per litre while studyied physico-chemical characteristics of various river water in India.

Recommendation:-

1. A continuous monitoring of the physico-chemical, parameters of this river is needed for drinking, agriculture, industrial, outdoor bathing etc.
2. The Water Quality Indices are among the most effective ways to communicate the information on water quality trends to the general public or to the policy makers and water quality management.

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