Physico Chemical properties of water of river Narmada at Madhya Pradesh, India

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Abstract: The river Narmada is the third holy and fifth largest west flowing river of India and biggest west flowing river of the state. The river takes its origin from Maikal hillocks from eastern highlands of Vidhyas ranges near Amarkantak and finally falls in Arabian Sea. Limnological study was carried out for the period one year from August 2010 to July 2012 to enumerate the various physico-chemical parameters of Narmada river. Water samples were collected from sampling stations every month and were analysed as per standard methods. Minimum value of Total solids, BOD and Chloride was recorded in January month and maximum value in June-July months. The results of present study indicate that physico- chemical parameters of Narmada river are within WHO limits.
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Keywords: river; Narmada; physico-chemical parameter; WHO

Introduction:

India is a unique country with great cultural diversity associated with all kinds of climates, rich flora and fauna. In spite of enormous volume of hydrosphere only a small portion of it is actually available as resource. More than 97% occurs in the form of sea, whose salinity makes it useless, while fresh water makes up only 2.6%.

Water is a basic need of life and is the foundation for human survival and development. Water is the most common substance on earth, covering seven tenths of the world's surface, and that is why earth is also called the blue planet. Life first started in water and 96% of the composition of all living cells is water. Water is one of the prime needs of life. We can hardly live for few days without water. Since time immemorial freshwater has always been of vital importance to man as his early habituations were within easy reach of rivers, tanks, dams, ponds and lakes. The importance of freshwater resources, their conservation and utilization has attained almost utmost importance during the present time.

The river Narmada is the third holy and fifth largest west flowing river of India and biggest west flowing river of the state. The river takes its origin from Maikal hillocks from eastern highlands of Vidhyas ranges near Amarkantak, district Shahdol (M. P.) at an elevation of 1051 meters (Gazetteer of Hoshangabad, 1979). Out of the total length of 1312kms, the river flows for 1077 kms in Madhya Pradesh. The whole river passes through big gorge formed by Vidhyas on one side and Sutpuras on the other side. It has only about 82 meters of fall beyond Madhya Pradesh in Gujarat and Maharashtra before it meets the Arabian Sea. Its blue water cuts on one hand through the marble rocks near Jabalpur and on the other side through the coal deposit of Madhya Pradesh. The Narmada empties itself in the Gulf of Cambay in Gujarat. Nearly 90% of the flow is in M. P. and most of the remaining is in Gujarat. It flows for a very brief stretch through Maharashtra.

Water pollution, including siltation, is endemic to almost all inhabited parts of the world and is consistently ranked as one of the major threats to freshwater ecosystems (Richter et al., 1997). Habitat loss and habitat degradation are also major reasons for worldwide biodiversity loss in aquatic ecosystems, and are caused by a multitude of anthropogenic disturbances (Allan and Flecker, 1993; Richter 1997). The threat of global climate change is pervasive across all of the Earth's ecosystems, and is also often cited as a major threat to freshwater biodiversity (Sala et al., 2000; Strayer and Dudgeon, 2010). The objectives of the present study are to study the various parameters of the Narmada river and to suggest measure to minimize the pollution, which is increasing due to anthropogenic activities.

Material and Methods:

Description of Study Area

The Narmada river is considered as the life line of Madhya Pradesh. The catchment area of the river exists in the States of Madhya Pradesh (86.18%), Gujarat (11.6%), Maharashtra (1.5%), and Chattisgarh (0.72%). During its course, the river

drops from an elevation of 1051 m to sea level, and flows through narrow gorges in the head reaches. The basin is bounded on the north by the Vindhya ranges, on the east by the Maikal range, on the south by the Satpura ranges and on the west by the Arabian Sea. Deep black soil covers the major portion of the basin. The river has 41 tributaries, of which 22 are on the left bank and 19 are on the right bank. The Barna, Tawa, Kolar, and Sukta dams have been constructed on the tributaries. The Bargi is constructed on the mainstream, while the Indirasagar, Omkareshwar, Maheshwar and Sardar Sarovar dams are under construction.

Sampling stations:

OMKARESHWAR (S-I)

Omkareshwar is a famous place of pilgrimage, situated 77 km from Indore in Khandwa District, Madhya Pradesh. Shaped like the holy Hindu Symbol 'OM' this sacred island, on the conflux of the river Narmada and Kaveri is visited by pilgrims from all over the country to seek blessing at the temple of Shri Omkar Mandhata. Millions of the pilgrims of both local & foreigners visit the place every year.

It's Latitude (DMS) 22º 15', 1"N and Longitude (DMS) 76º 8", 48"E.

MANDLESHWAR (S-II)

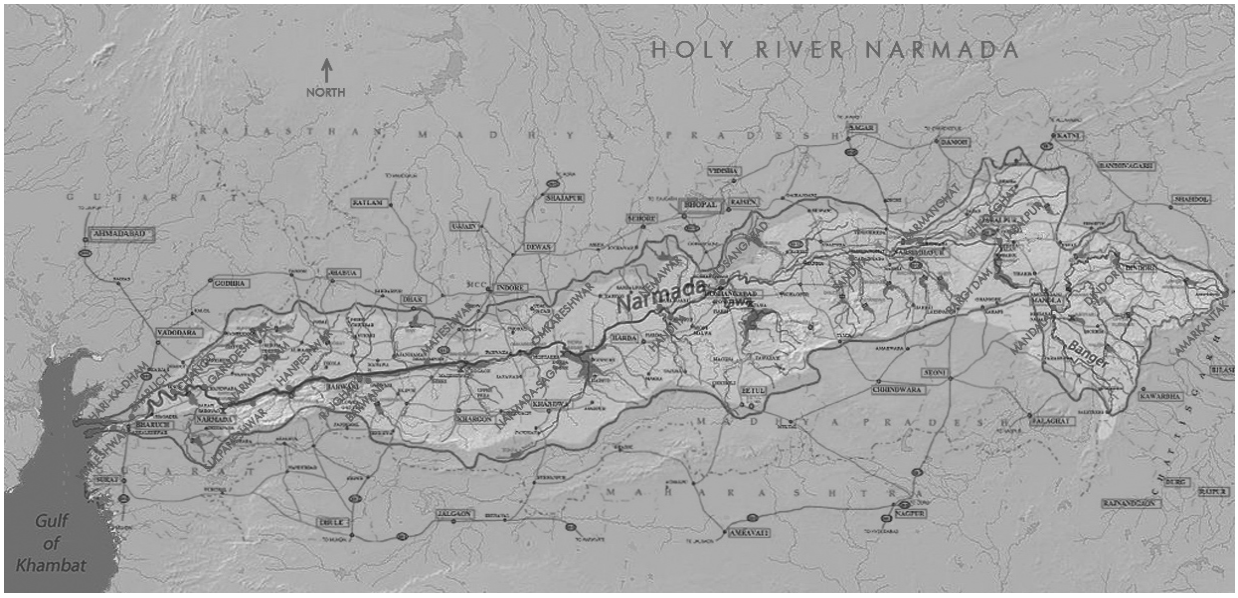
Mandleshwar is a town and a Nagar Panchayat in Khargone district of Madhya Pradesh. It is a town of historical and religious importance situated on the bank of Narmada river, 8 km east of Maheshwar, and 99 km south of Indore. Mandleshwar in Central India is on the bank of the Narmada River at a narrow point wherein the monsoon the stream often rises 60 feet above its normal level becoming a roaring torrent. It has an average elevation of 153 metres (501 feet).

It's latitude (DMS) 22º10", 60"N and Longitude (DMS) 75º40', 0"E.

Physico chemical analysis of water

The water samples were collected from the sampling stations viz, Omkareshwar and Mandleshwar for the period of 12 months from August 2010 to July 2011. In the analysis of the Physico-chemical properties of water, standard methods prescribed in limnological literature were used.

Parameters like Temperature, pH and Turbidity were determined at the site, while other parameters like Biochemical oxygen demand, Chloride, Alkalinity, total Solids were determined in the laboratory. The Physico- Chemical parameters of water were determined as per standard methods of APHA (2002), Welch (1998), Golterman (1991).



Results and Discussion

Water Temperature

The oxidation of organic matter is highly influenced by the temperature of water. Temperature of river water depends upon the season, climatic zone, where river is flowing, time of sampling and also upon the temperature of the effluents, which are being added in the river. During August 2010 to July 2011 temperature fluctuation was between 24 °C and 35 °C at station I and from was 22 °C and 33 °C at Station II. The minimum temperature was recorded in Jan 2011 at station II and maximum in May 2011 at station I (Figure 1). The same observations were also reported by Sharma et al (2011) and Shraddha et al

(2008) in Narmada river. Shraddha et al (2008) while studying the hydrological parameters of Narmada river at Hoshangabad recorded water temperature between 27.6°C to 38.4°C.

Turbidity

Turbidity has been long known to hinder disinfection by shielding microbes, some of them perhaps pathogens. This is most important significance of turbidity monitoring and therefore it has been an indication of effectiveness of filtration of water supplies (Hauser 2001). During August 2010 to July 2011 turbidity was fluctuated between 3.9 NTU and 22.8 NTU at station I and from 3.5 NTU and 23.8 NTU at station II, with minimum in May 2011 at station II and maximum in July at station II (Figure 2). These observations were also supported by Prasanna and Panda (2010), Shraddha et al (2008) and Trivedi et al (2009).

pH

pH is an important parameter which is important in evaluation the acid base balance of water. Natural waters generally have been found to range 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 has been necessary. During August 2010 to July 2011 the pH was fluctuated between 7.6 to 9.3 at station I and was 7.3 to 8.8 at station II, with minimum in minimum in August 2010 and maximum in May 2011 (Figure 3). Sharma et al (2011) observed pH fluctuation between 7.6 to 9.9 in Hoshangabad area of Narmada river. Prasanna and Ranjan (2010) observed pH value between 7.5 to 8.5 in Dharma estuary.

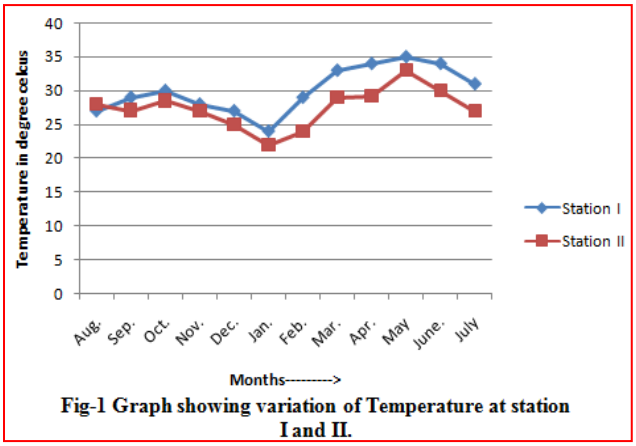


Fig-1 Graph showing variation of Temperature at station I and II.

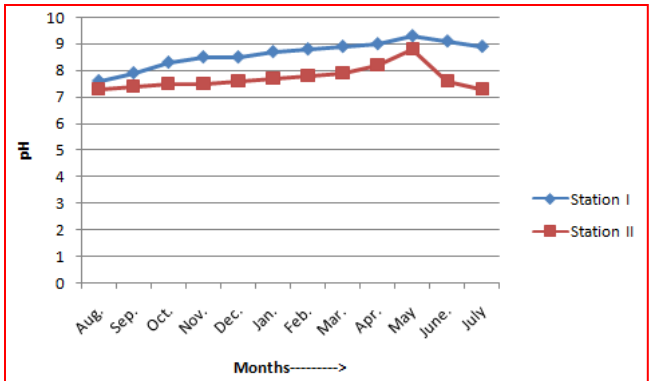


Fig-3 Graph showing variation of pH at station I and II.

Biochemical Oxygen Demand

Biochemical oxygen demand is the amount of oxygen utilized by microorganism in stabilizing the organic matter in aerobic condition. DO measurement forms the basis of BOD analysis. It gives an indication of load of biodegradable organic material present in the water body. During the present study the BOD was fluctuated between 0.31 mg/l to 1.05 mg/l at station I and between 0.33 mg/l and 1.3mg/l (Figure 4). The minimum BOD was recorded January 2011 at station I and maximum in May 2011 at station II. Same observations were also recorded by Nnaji et al (2010) and Mary et al (2008).

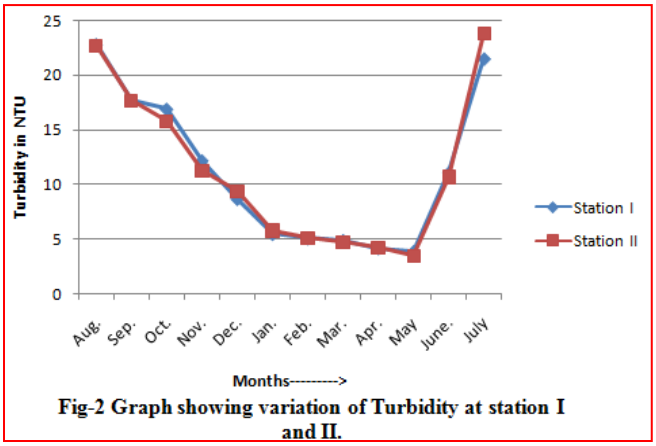


Fig-2 Graph showing variation of Turbidity at station I and II.

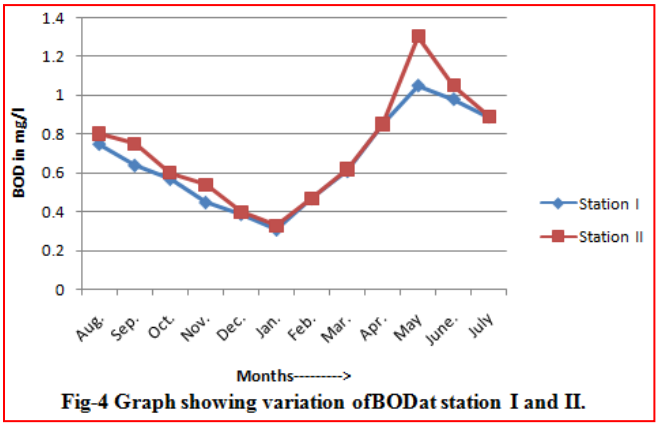


Fig-4 Graph showing variation ofBODat station I and II.

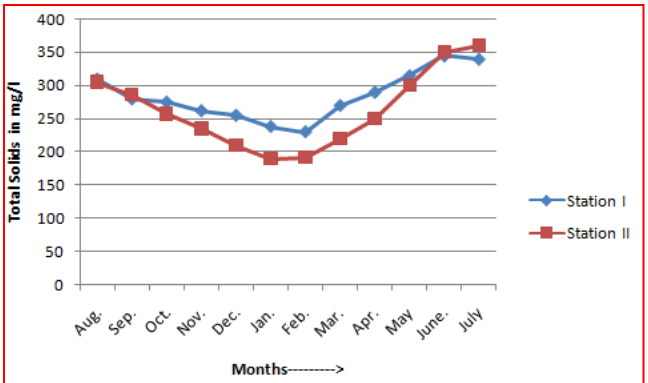


Fig-5 Graph showing variation of Total Solids at station I and II.

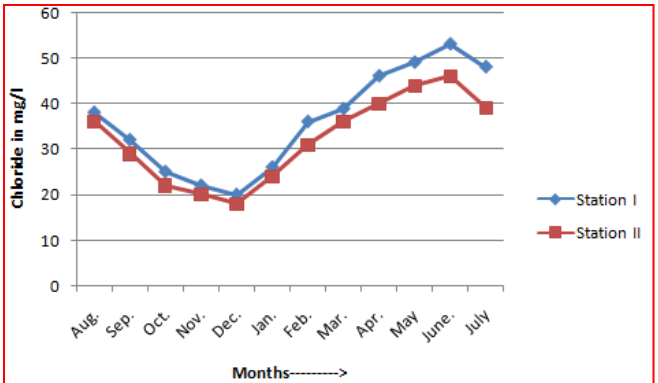


Fig-7 Graph showing variation of Chloride at station I and II.

Total Solids

The total solids are the total amount of chemical substance present in the water. The total dissolved solids and total suspended solids together make the total solids in the water. The presence of solids in water vary greatly at different times and affect the density of water and there by the quality of aquatic environment. During August 2010 to July 2011 the value of total solids varied from 230 mg/l to 345 mg/l at station I and 190 mg/l to 360 mg/l at station II. The minimum value was recorded in January 2011 and maximum in July 2011 at station II (Figure 5). Nduka et al (2008) also recorded total solids between 100 to 220 mg/l in Niger delta of Nigeria.

Alkalinity

Alkalinity measures the buffering capacity of water and content of CO_2 in its various forms are involved in this carbonate-bicarbonate carbonic acid buffering system. In the present study the value of Alkalinity varied from 95 mg/l and 235 mg/l at station I and from 80 mg/l and 240 mg/l at station II, with minimum value in April 2011 and maximum in September 2010 at both stations (Figure 6). Trivedi et al (2009) also observed the same value in Ganga river India.

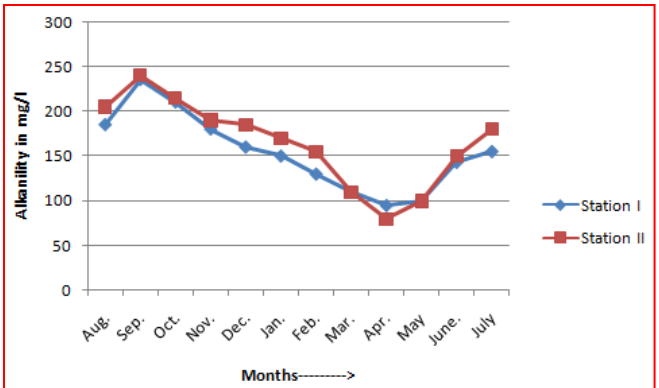


Fig-6 Graph showing variation of Alkanility at station I and II.

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. In the present study the value of Chloride varied from 20 mg/l and 53 mg/l at station I and 18 mg/l and 46 mg/l at station II, with minimum in December 2010 and maximum in June 2011 at both stations (Figure 7). Similar results have been observed by Chowdhary (2011) and Siraj et al (2010).

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