



Physico- chemical Evaluation of Water Quality of Narmada River From Omkareshwar to Barwani, MP, India

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Abstract

River Narmada is one of the 13 prominent rivers of India, which covers 98,797 sq km of total water-shed area. Narmada is considered to be the lifeline of Madhya Pradesh and most important west flowing river of India.

The monitoring of water quality of Narmada River was carried out for One year August 2009 to July 2010. Four sampling stations were selected at downstream of Narmada River. The water samples collected were analyzed, as per standard methods parameters such as pH, Turbidity were measured in-situ. Raised values of physico-chemical parameters indicate the pollution of riverine ecosystem due to domestic wastes, municipal sewage, industrial effluent from Security Paper Mill (SPM) and agricultural run-off that influence the water quality directly or indirectly. Statistical analysis carried out through correlation method and also evaluates Average values (AV), Standard Deviation (SD), Standard Variance (SV), Standard Error (SE) and 95% Confidence Limit (CL) to assess the pollution load assessment. The results revealed that most of the water samples were below or out of limited; according to the WHO, BIS standards.

key Words: Statistical analysis, Narmada river, Water pollution, River water quality, Omkareshwar, Mandleshwar, Maheshwar and Barwani, Physico- chemical analysis.

Introduction

Natural surface water bodies like rivers and streams are subjected to pollution comprising of organic and inorganic constituent. River Narmada is the largest river of the India, which is also a holy place. Narmada is the largest west-flowing river in India and originates from Amarkantak at an elevation of 900m in the Mekhala range of Shadol district, Madhya Pradesh. It is the seventh largest among the fourteen major river basins in the country. The river Narmada drains the catchment between the Vindhyan mountains to the

north of the river stretching east-west in general, and the Satpura mountain ranges to the south. It flows through the undulating plains of omkareshwar about 300m high, dotted with occasional low hills. It has a total course of 1312 km before joining the Gulf of Cambay in the Arabian Sea and total basin of 98,796,80 sq km. Its First 1,077 km length is in Madhya Pradesh and the last 161 km. is in Gujarat. Of the remaining length, 35 km forms a common boundary between Madhya Pradesh and Maharashtra. The strength of waste water is expressed in terms of BOD level. Microbial examination of water is a direct measurement of deleterious effects of pollution. The aim of this study was to ascertain the impact of several physico-chemical parameters on water quality of Narmada River and to assess further its nature in terms of microbial growth. Assessment of water quality is done to analyse the physico-chemical and biological characteristics of water.

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) 22° 15', 1"N and Longitude (DMS) 76° 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 where in 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) 22°10', 60"N and Longitude (DMS) 75°40', 0"E.

Maheshwar (S-III)

Maheshwar culturally rich town, is located in north western part of Khargone district of Madhya Pradesh state. This holy town is situated on north bank of sacred river Narmada, formerly known as Mahishmati. Maheshwar was the capital city of Ahilya bai Holkar state and finds mention as an important city in the Ramayana and the Mahabharata. Latitude (DMS) 22°18', 60" N and Longitude (DMS) 75°34', 60"E.

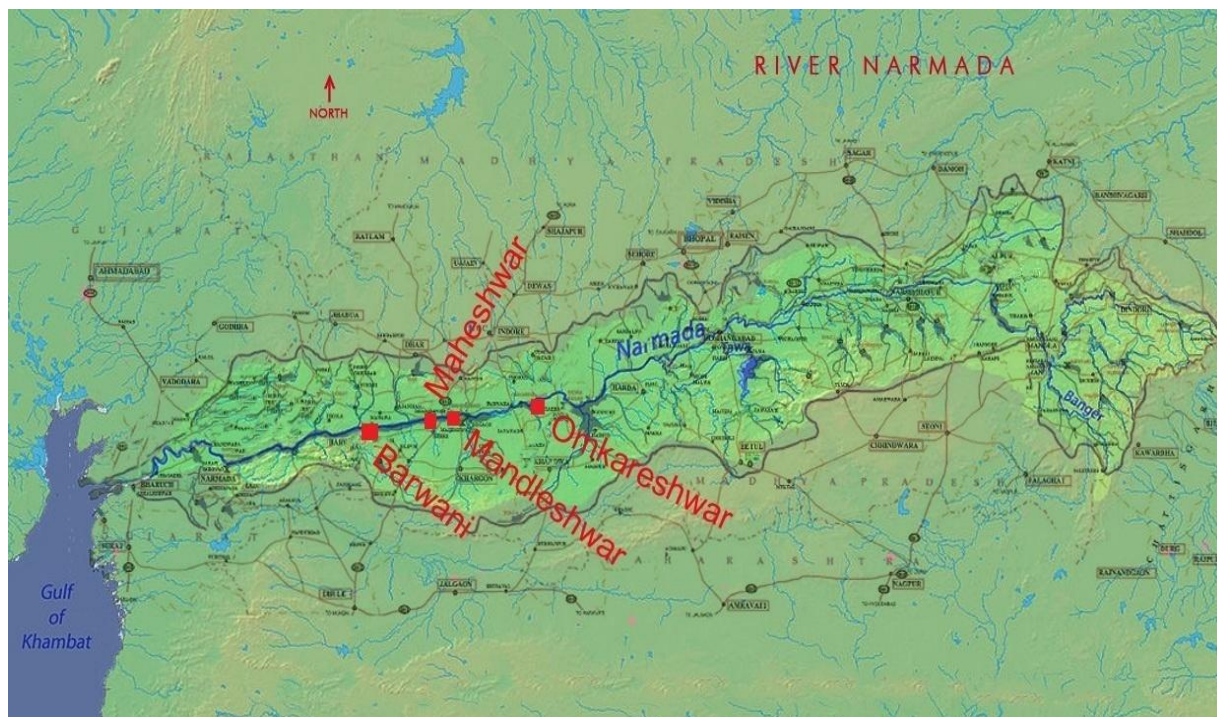
BARWANI (S-IV)

Barwani, also known as Siddh Nagar, is an important city and a municipality in Barwani district in the state of Madhya Pradesh, India. The place is also famous for chool giri, Jain pilgrimage center of Bawangaja. The town is situated near the left bank of the Narmada river. Latitude (DMS) 22° 10', 60"N and Longitude (DMS) 74° 54', 0" E.

Physico chemical analysis of water

The water samples were collected from the sampling stations viz, Omkareshwar and Mandleshwar Maheshwar and Barwani for the period of 12 months from August 2009 to July 2010. 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 (2005), Welch (1998), Golterman (1991).

Narmada River



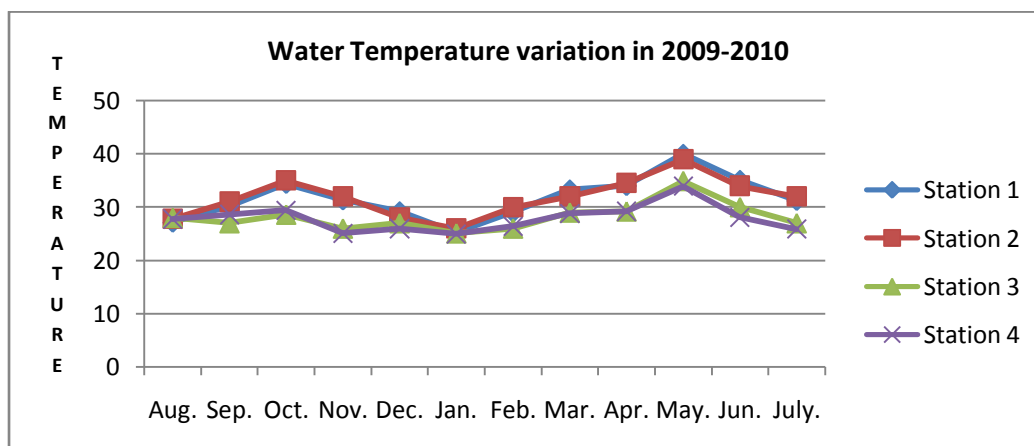
Results and Discussion

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. Temperature fluctuation during August 2009 to July 2010 was as follows.

S.No.	Station name	Range of temperature Min – Max in °C
01	Station I	25.2° C to 40° C
02	Station II	26° C to 39° C
03	Station III	25.1° C to 34.9° C
04	Station IV	25° C to 33°

Among all studied stations, The minimum water temperature was 25.1°C in January 2010 at station-III and the maximum was reported 40°C in May 2010 at station-I. The same observation were also reported by R.Bhutaiani et al (2016), Sharma et al (2011) and Shraddha et al (2008) in Narmada river, while studying the hydrological parameters of Narmada river at Hoshangabad recorded water temperature between 27.6°C to 38.4°C.

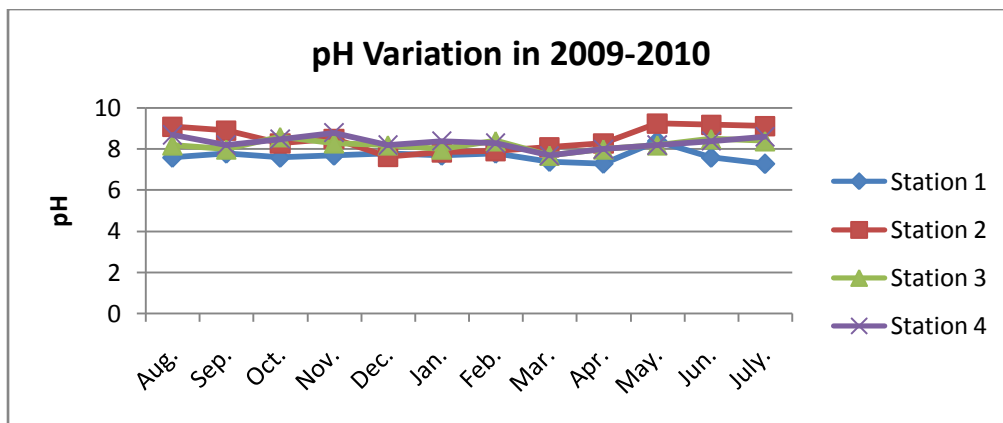


pH Range

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 2009 to July 2010 the pH was fluctuated as follows.

S.No.	Station name	pH Range Min – Max
01	Station I	7.3-8.4
02	Station II	7.63-9.26
03	Station III	7.7-8.6
04	Station IV	7.7-8.8

The minimum in July 2010 at station-I and the maximum in May 2010 at station-II. 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.

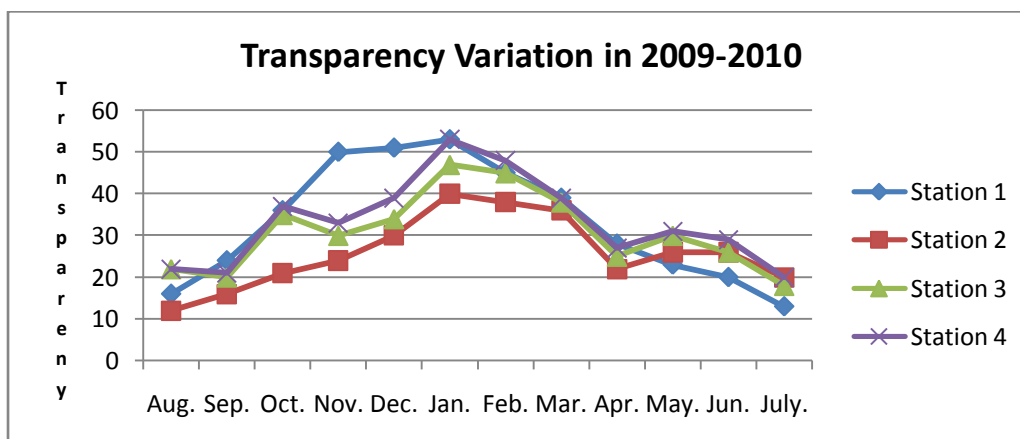


Transparency.

Transparency has been long known to hinder disinfection by shielding microbes, some of them perhaps pathogens. This is most important significance of transparency monitoring and therefore it has been an indication of effectiveness of filtration of water supplies (Hauser 2001). During August 2009 to July 2010 transparency was fluctuated as follows.

S.No.	Station name	Range of Transparency Min – Max in mg/l
01	Station I	12-52
02	Station II	13-40
03	Station III	18-47
04	Station IV	21-53

The minimum in July 2010 at station I and maximum in January 2010 at station IV. These observations were also supported by Prasanna and Panda (2010), Shraddha et al (2008) Tiwari, M and Dwivedi, A(2016) and Trivedi et al (2009).

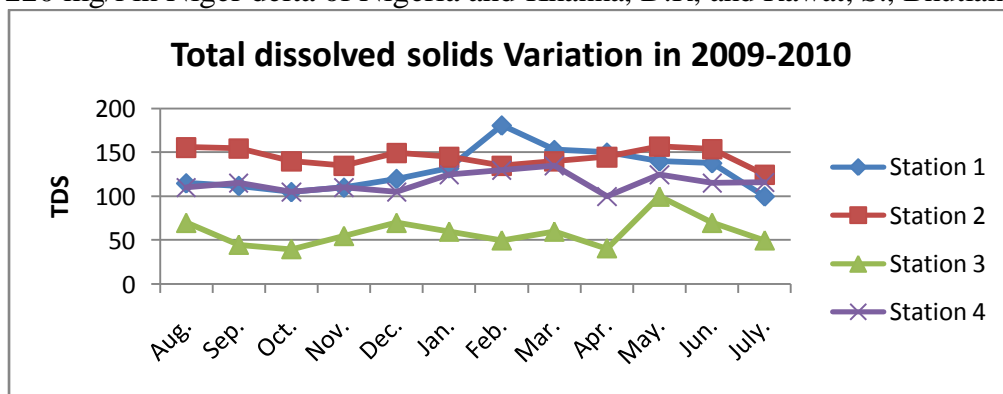


Total dissolved solid

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 2009 to July 2010 the value of total solids varied as follows.

S.No.	Station name	Range of Total dissolved solid Min – Max in mg/l
01	Station I	100-181
02	Station II	125-157
03	Station III	40-100
04	Station IV	100-135

The minimum value was recorded in October 2009 at station-III and maximum in February 2010 at station I. Nduka et al (2008) also recorded total solids between 100 to 220 mg/l in Niger delta of Nigeria and Khanna, D.R, and Rawat, S., Bhutiani ,R.,(2014)

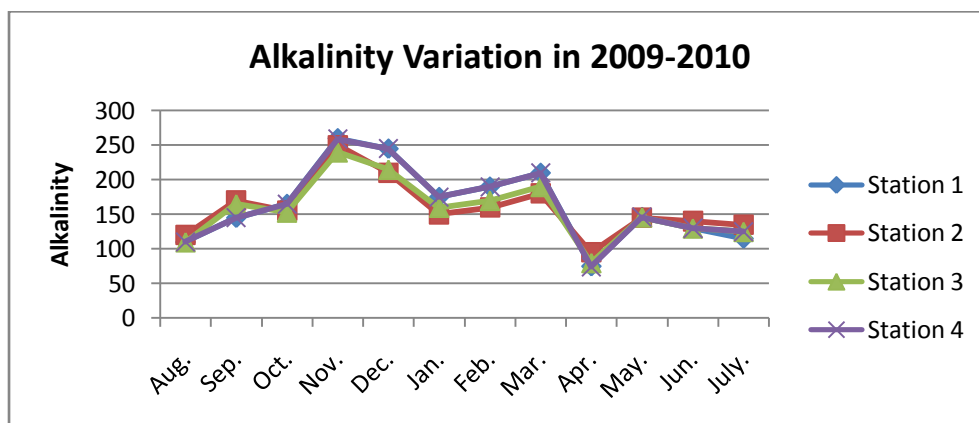


Alkalinity

Alkalinity measures the buffering capacity of water and content of CO₂ in its various forms are involved in this carbonate-bicarbonate carbonic acid buffering system. In the present study the value of Alkalinity varied as follows.

S.No.	Station name	Range of Alkalinity Min – Max in mg/l
01	Station I	75-260
02	Station II	95-250
03	Station III	80-240
04	Station IV	74-259

The minimum value in November 2009 at station IV and maximum in April 2010 at stations I. Trivedi et al (2009) also observed the same value in Ganga river India.

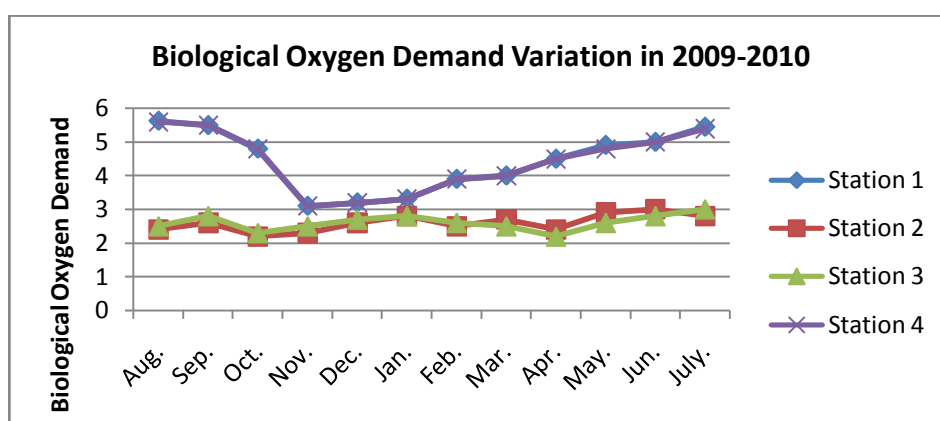


Biochemical Oxygen Demand

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 as follows.

S.No.	Station name	Range of Biochemical oxygen demand Min – Max in mg/l
01	Station I	3.1-5.63
02	Station II	2.4-3.1
03	Station III	3-5.60
04	Station IV	2.9-5.50

The minimum BOD was recorded April 2010 at station-II and maximum in August 2009 at station I. Same observations were also recorded by Nnaji et al (2010) Katakwar, M (2014) and Mary et al (2008).

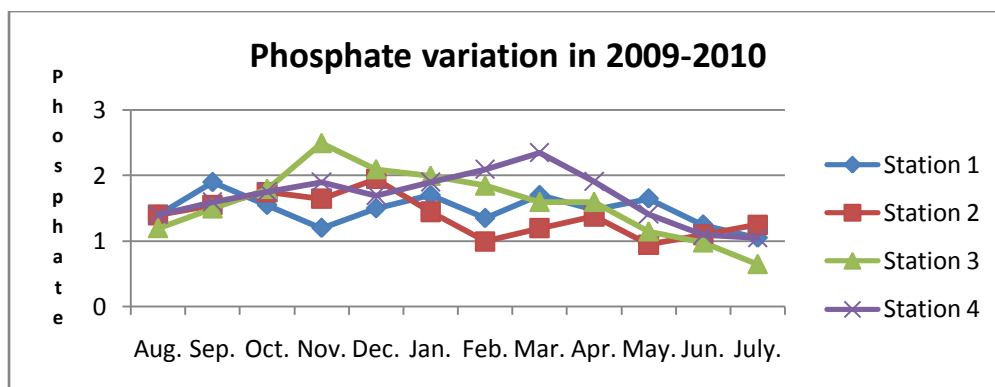


Phosphate:

The increased application of fertilizers, use of detergents and domestic sewage greatly contribute to the heavy loading of phosphorous in the water. In the present study the value of phosphate varied as follows.

S.No.	Station name	Range of Alkalinity Min – Max in mg/l
01	Station I	0.16-0.50
02	Station II	0.15-0.52
03	Station III	0.02-0.81
04	Station IV	0.14-0.55

The minimum in August 2009 at station-III and maximum in October 2009 at stations IV. Similar results have been observed by Chowdhary (2011), Akhand., A and Srivastava, S. (2015) and Siraj et al (2010).



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