Available online at http://www.journalcra.com

International Journal of Current Research
Vol. 7, Issue, 12, pp.24073-24076, December, 2015

INTERNATIONAL JOURNAL OF CURRENT RESEARCH

ISSN: 0975-833X

RESEARCH ARTICLE

ANALYSIS OF WATER QUALITY OF RIVER NARMADA

***Pawan Kumar Singh and Pradeep Shrivastava**

Depatment of Environmental Sciences and Limnology, Barkatullah University, Bhopal (M.P)

ARTICLE INFO

Article History:
Received 07th September, 2015
Received in revised form
09th October, 2015
Accepted 15th November, 2015
Published online 30th December, 2015

Key words:
Water quality,
Physico-chemical parameters,
Narmada river,
Water pollution.

ABSTRACT

Water quality analysis is one of the most important aspects in surface water studies. Assessment of water quality is a critical factor for assessing the pollution level. Water sample were collected from 12 disfferent sampling stations for evaluate the water quality status of river Narmada during September-2010. A total 16 water quality parameters were analyzed. During the present investigation the minimum and maximum value of air temperature, water temperature, turbidity, pH, electrical conductivity, total dissolved solids, free carbon dioxide, total alkalinity, chloride, total hardness, Calcium Hardness dissolved oxygen, nitrate, orthophosphate, biochemical oxygen demand, chemical oxygen demand were noted as 25 and 31.3 °C; 22.4 and 29 °C ; 8.6 and 40.2 NTU; 7.63 and 8.76; 230 and 398 µs/cm; 146 and 274 mg/l; 4 and 22.4 mg/l; 112 and 226 mg/l; 12.38 and 44.56 mg/l; 104 and 212 mg/l; 63.84 and 118.44 mg/l; 4.16 and 8.8 mg/l; 0.542 and 4.824 mg/l; 0.112 and 0.546 mg/l; 4.16 and 19.2 mg/l; 10.4 and 46 mg/l respectively. The objective of present study was to understand the water quality of river Narmada at Hoshangabad District. (M.P).

***Citation*: Pawan Kumar Singh and Pradeep Shrivastava, 2015.** "Analysis of water quality of river narmada", *International Journal of Current Research*, 7, (12), 24073-24076.

INTRODUCTION

Water is an elixir of life. It is precious natural resource and important component for human survival. It's found abundant amount on the earth. Out of the total water reserves of the world, about 97% is salty water (marine) and only 3% is fresh water. Even this small fraction of fresh water is not available to us as most of it is locked up in polar ice caps and just 0.003% is readily available to us in the form of groundwater and surface water. Due to its unique properties water is the multiple uses of all living organisms. Water is absolutely essential for life. Most of the life processes take place in water contained in the body. Human beings depend on water for almost every development activity.

Water is used for drinking, irrigation, and transportation, washing and waste disposal for industries and used as a coolant for thermal power plants. Water shapes the earth's surface and regulates our climate. With increasing human population and rapid development, the world water withdrawal demands have increased many folds and a large proportion of the water withdrawal is polluted due to atmospheric activities. Rivers are the most important water resources. It has long been used for discharging the wastes. Unfortunately the rivers are being polluted by indiscriminate disposal of sewage, industrial wastes and by human activities.

****Corresponding author: Pawan Kumar Singh,***
Depatment of Environmental Sciences and Limnology, Barkatullah University, Bhopal (M.P).

Pollution of the river first affects its physico-chemical quality and hen systematically destroys the community disrupting the delicate food web. The objective of the present study is to assess the water quality of river Narmada.

MATERIALS AND METHODS

Study area

The Narmada is a river in central India and the fifth largest river in the Indian subcontinent. It forms the traditional boundary between North India and South India and flows westwards over a length of 1,312 km before draining through the Gulf of Cambey (Khambat) into the Arabian Sea, 30 km west of Bharuch city of Gujarat. It flows through the states of Madhya Pradesh (1,077 km), Maharashtra, (74 km), (35 km) border between Madhya Pradesh and Maharashtra and (39 km) border between Madhya Pradesh and Gujarat and in Gujarat (161 km). There are 41 tributaries, out of which 22 are from the Satpuda range and the rest on the right bank are from the Vindhya range. In order to determine the water quality, twelve stations were chosen for sample collection in the study area along the stretch of the river Narmada, at Hoshangabad district of about 20 km stretch in september-2010. The sampling stations were: station-1(Shahganj), station-2 (Chandani nala), station-3(Bandrabhan), station-4 (Tawa confluence), station-5 (Kothi bazar), station-6 (Sethani ghat), station-7 (Lendia nala), station-8 (Hoshangabad bridge), station- 9 (SPM nala), station-10 (Dongarwada), station-11 (Hasilpur), station-12 (Randhal).

Laboratory methods

Samples were collected in acid wash 1 litre plastic canes and brought to the laboratory for further analysis. The sampling was done 9 a.m.-3 pm. Physico-chemical parameters like water temperature, pH, conductivity, DO, free Carbon-dioxide and total alkalinity were measured in the field. Other parameters were mostly tested within 24 hrs of collection. Preservation of water samples was done at 4°C temperature. The water quality parameters were analyzed by standard methods given in APHA (1998) and Trivedi and Goel (1987).

RESULTS AND DISCUSSION

The results of water quality parameters are depicted in table 1a and table 1b

Table 1a. Variation in physico-chemical parameters of river Narmada at different sampling stations in Sep.-2010

Parameters	S-1	S-2	S-3	S-4	S-5	S-6
Air Temperature (°C)	26	28.6	26.8	25	31.3	27
Water Temperature (°C)	23.4	26.2	24	22.4	29	24.5
Turbidity (NTU)	10.2	21.2	8.6	9.2	17.6	9.6
pH	8.31	7.78	8.62	8.41	7.98	8.31
Conductivity (µs/cm)	266	334	240	230	288	270
TDS (ppm)	158	228	170	150	214	160
Free CO_2 (mg/l)	0	14.4	0	0	11.2	0
Total Alkalinity (mg/l)	130	170	124	112	160	138
Chloride (mg/l)	20.37	30.76	17.58	15.18	27.97	21.17
Total Hardness (mg/l)	138	160	128	120	154	130
Calcium Hardness (mg/l)	75.6	90.72	71.4	63.84	79.8	74.76
Dissolved Oxygen (mg/l)	8.32	4.96	8.48	8.64	5.44	8.48
Nitrate (mg/l)	0.684	2.384	0.568	0.642	1.872	0.914
Orthophosphate (mg/l)	0.184	0.316	0.152	0.112	0.302	0.198
BOD (mg/l)	7.04	12	6.08	4.96	10.4	6.08
COD (mg/l)	17.8	28.2	15.4	11.6	25.2	16.4

Table-1b. Variation in physico-chemical parameters of river Narmada at different sampling stations in Sep.-2010

Parameters	S-7	S-8	S-9	S-10	S-11	S-12
Air Temperature (°C)	29.5	27.8	31	26	29.5	27.8
Water Temperature (°C)	27.2	25	28.6	23.5	27	25
Turbidity (NTU)	40.6	12.4	35.4	11.2	14.6	8.8
pH	7.63	8.76	7.82	8.62	8.31	8.41
Conductivity (µs/cm)	398	244	362	250	270	240
TDS (ppm)	274	150	260	160	170	146
Free CO_2 (mg/l)	22.4	0	18.6	0	4	0
Total Alkalinity (mg/l)	210	118	226	122	130	118
Chloride (mg/l)	44.56	12.38	39.16	17.98	22.7	14.78
Total Hardness (mg/l)	198	104	212	116	138	110
Calcium Hardness (mg/l)	111.72	63.84	118.44	67.2	85.68	74.76
Dissolved Oxygen (mg/l)	4.16	8.8	4.96	8.48	8.16	8.8
Nitrate (mg/l)	4.824	0.542	4.246	0.756	0.926	0.598
Orthophosphate (mg/l)	0.492	0.122	0.546	0.162	0.212	0.136
BOD (mg/l)	19.2	4.16	16	5.6	7.84	4.96
COD (mg/l)	46	10.4	38.2	13.6	18.8	11.8

Air Temperature

In the present higher air temperature was observed 31.3 °C at station-5 while lowest 25 °C was at station-4. The fluctuations of air temperature are more evident in fresh water habitats. Flowing waters, however, lack wide fluctuations in temperature (Leonard, 1971).

Water Temperature

Temperature is one of the most important parameter of water as it affects the biotic as well as abiotic component of the ecosystem. It is a critical water quality parameter, since it directly influences the amount of dissolved oxygen that is available to aquatic organisms. During the present study water temperature varied from 22.4 to 29 °C. The fluctuation in river water temperature usually depends on the season, geographic location, sampling time and temperature of effluents entering the river (Ahipathy and Puttaiah, 2006).

Turbidity

Turbidity of water is actually the expression of optical property in which the light is scattered by the particles present in the water. Clay, slit, organic matter, phytoplankton and other microscopic organisms cause turbidity in water (Das *et al*., 2003). In the present study turbidity values varied from 8.6 NTU to 40.2 NTU. Higher values of turbidity at station-7 may be attributed to the comparatively higher suspended and colloidal matter such as clay, silt, finely divided organic and inorganic matter (Sadar, 1996).

pH

pH, or the "potential of hydrogen" is a measure of the concentration of hydrogen ions in the water. This measurement indicates the acidity or alkalinity of the water. On the pH scale of 0-14, a reading of 7 is considered to be "neutral". Readings below 7 indicate acidic conditions, while readings above 7 indicate the water is alkaline or basic. Naturally occurring fresh waters have a pH range between 6 and 8. The pH of the water is important because it affects the solubility and availability of nutrients, and how they can be utilized by aquatic organisms. It is one of the important factors that serve as an indicator of pollution of water body. Highest pH value of the sample was recorded as 8.76 at station-8 and that of minimum 7.63 at station-7. The difference in the pH value of the sample might be due to fact that the accumulation of domestic sewage. Similar findings were also made by Patil (1982).

Electrical Conductivity

Conductivity value ranged from 230-398 µs/cm at different sampling sites of the river Narmada. The minimum and maximum value obtained was 230 µs/cm and 398 µs/cm respectively at station-4 and station-8. This indicated that the river water had different quality at different stations. Usually higher EC value indicate the presence of higher content of dissolved salts in river water (Abdullah and Musta, 1999) and the EC values are a good measure of the relative difference in water quality between different aquifers.(Roscoe,1990).

Total Dissolved Solids

The term TDS describes all solids (usually mineral salts) that are dissolved in water. Desirable limit of TDS is 500 mg/l (ICMR, 1975). TDS of the water sample varied from 146 ppm to 274 ppm. Variations of dissolved solids in water could affect conductivity measurements, but provides no indication of the relative quantities of the various components. There is a relationship between conductivity and total dissolved solids in water. As more dissolved solids are added, water's conductivity increases (McNeely *et al*., 1979).

Free Carbon dioxide

The amount of free CO_2 in water is generally maintained by diffusion from atmosphere, respiration by animals along with plants and bacterial decomposition of organic matter (Mishra *et al*., 1993). During the present study free CO_2 fluctuated between 4-22.4 mg/l, highest being recorded at site-7 and lowest at site-11. Higher value of free CO_2 recorded at site-7 could be assigned to higher amount of organic and inorganic wastes disposed at this site. These observations are referable to the results obtained by Cooum river from Madras by Jabanesean *et al.,* (1994) Bahini river and Brahmputra river of Guwahati by Das *et al.,* (2003).

Total Alkalinity

Total alkalinity is caused by bicarbonates, carbonates, OH ions, borates, silicates and phosphates (Kataria *et al.,* 1995). Alkalinity is a measure of buffering capacity of water and is important for aquatic life in a freshwater system because it equilibrates the pH changes that occur naturally as a result of photosynthetic activity of phytoplankton (Kaushik and Saksena, 1989). Total alkalinity values in the present observations fluctuated from 98 to 248 mg/l. Minimum total alkalinity 112 mg/l was observed at station-1 while maximum 226 mg/l at station-9. Upadhyay and Rana, (1991) were reported the higher value of alkalinity indicates the pollution of river water by sewage.

Chloride

Chloride concentration is one of the most indicators of water pollution (Munawar, 1970). It is one of the major anions found in water and are generally combined with calcium, magnesium or sodium. During the study period Chloride value ranged from 12.38-44.56 mg/l. Chloride content of different Indian rivers were studied by various workers. Singh (2010) reported chloride 8.2 to 81.5 mg/l in river Ganga. Singh and Hasnain (1999) noted chloride 1.2-62.8 mg/l in Damodar river basin. Koshy and Nayar (1999) found chloride 110-176.6 mg/l in river Pamba. Sharma and Pande (1998) reported chloride ranges from 12-24 mg/l for winter, 10-40 mg/l during summer and 10 to 18 mg/l during rainy seasons in river Ramganga at Moradabad (U.P.). Raised value of chloride at station-7 is due to mixing of municipal sewage and domestic waste in river water. Similar observation was made by Dwiwedi and Odi (2003) from Dickrong river.

Total Hardness

Total hardness is the parameter of water quality used to describe the effect of dissolved minerals (mostly Ca and Mg), determining suitability of water for domestic, industrial and drinking purposes and attributed to presence of bicarbonates, sulphates, chloride and nitrates of calcium and magnesium (Taylor, 1949). Total hardness varies from 104 to 212 mg/l all selected sampling sites.

The maximum total hardness was recorded at station-9 may be attributed to the mixing of domestic sewage and industrial effluents into the river water (Radhakrishnan *et al.* 2007).

Calcium Hardness

Calcium ions are important components of plant tissues and participate in various cellular functions. It is also required as a nutrient for various metabolic processes and assists in proper translocation of carbohydrates that facilitates the availability of other ions (Wetzel, 1975). During the present study period Calcium hardness varied from 63.84-118.44 mg/l. The lowest Calcium hardness 63.84 mg/l was observed at station-8 while maximum 118.44 mg/l at station-9. Khadse (2008) reported maximum value of calcium content in Kanhan river which might be due to higher calcium content in city sewage.

Dissolved Oxygen

The dissolved oxygen concentration of river water varied from maximum 8.8 at station-12 and a minimum of 4.16 at station-7. The change in dissolved oxygen content was mainly due to the solubility of dissolved oxygen increased with decreased in water temperature. The change in the content was mainly due to the utilization of these molecules by the aerobic bacteria present in the sample and release free CO_2 as a result of decomposition. This was accordance to the findings of Moss (1972).

Nitrate

Nitrate represents the end product of oxidation of nitrogenous matters and its concentration may depend on the nitrification and denitrification activities of micro-organisms. Domestic sewage contains very high amount of nitrogenous compounds. Atmospheric nitrogen fixed into nitrates by the nitrogen fixing organism is also a significant contributor to nitrates in the water (Trivedy and Goel, 1987). In the present investigation, nitrate content varied between 0.542 mg/l to 4.824 mg/l throughout the study period. The maximum values of nitrate were recorded at station-9 due to influx of nitrogen rich flood water that brings large amount of contaminated sewage water.

Orthophosphate

Phosphate determination is useful in measuring the water quality since it is an important plant nutrient and play a role of a limiting factor among all other essential plant nutrients (Dugan, 1972). During the present study minimum orthophosphate 0.112 mg/l was recorded at station-4 while maximum 0.546 mg/l was noted at station-9. Rajeshwari and Saraswathi (2009) reported phosphate concentration in Tungbhadra river varied from 0.001 to 2.1 mg/l and contamination is mainly due to washing clothes with detergents.

Biochemical Oxygen Demand

BOD is the amount of oxygen required by the bacteria in stabilizing the decomposable organic matter. The aim of BOD test is to determine the amount of bio chemically oxidizable carbonaceous matter (Gupta *et al*., 2003). During the study BOD measured in the range of 4.16 to 19.2 mg/l. Maximum BOD was recorded at station-7 which could be due to the influence of sewage. Higher values of BOD and lower values of DO indicate more amount of organic matter present in sewage (Vaishali, 2005).

Chemical Oxygen Demand

Chemical oxygen demand (COD) is a measure of the oxidation of reduced chemicals in water. It is commonly used to indirectly measure the amount of organic compounds in water. In the present study COD varies from 10.4 to 46 mg/l. The maximum value of COD 46 mg/l was observed at station-7 which indicates to increase the pollution level of the river Narmada. Koshy and Nayar (1999) found that the river Pamba receives large quantities of hospital and domestic wastes which may contribute to the high COD level.

Conclusion

The present study reveals that the water quality of river Narmada is deteriorated. It was due to directly mixing of the domestic sewage and industrial effluents in river Narmada. To improve the quality of water, sewage treatment plants are essential. Therefore the discharged of effluents before treatment and other waste into the River Narmada should be controlled and enforced.

REFERENCES

Abdullah, M.H. and Musta, B. 1999. Phreatic water quality of the turtle island of west Malaysia: Pulau Selingan and Pulau Bakungan Kechil. *Boreneo Science*, 6: 1-9.

Ahipathy, M.V. and Puttaiah, E.T. 2006. Ecological characteristics of Vrishabhavathy river in Bangalore (India). *Environ. Geol*., 49: 1217-1222.

Das, A.C., Baryagam, B.K., Baruah, D. and Sengupta, S. 2003. Study of wetland of Guwahati city: 2 water quality of rivers and drains. *Pollution Research*, 22(1): 117-119.

Dwiwedi, P. and Odi, P. 2003. Evaluation of potable water quality in streams and the Dickrong in the district Papum Pore, Arunachal Pradesh (India). *Eco. Envi. and Cons*., 9(4): 437-440.

Gupta, S., Bhatnagar, M. and Jain, R. 2003. Physico-chemical characteristics and analysis of Fe and Zn in tube well water and sewage water of Bikaner City. *Asian J. Chem.,* 15: 727.

ICMR, 1975. Manual of standards of quality for drinking water supplies. ICMR, New Delhi.

Jabanesean, A. and Selvanyagam, M. 1994. Pollution dynamics of aquatic Hemipterans in the river Cooum, Madras. *Journal of Environmental Biology*, 15(3): 123-220.

Kataria, H.C., Iqubal, S.A. and Sandilya, A.K. 1995. Limnochemical studies of Tawa Reservoir. *Indian J., of Envtl. Prtcn*., 16(11): 841-846.

Kaushik, S. and Saksena, D.N. 1989. Physico-chemical factors and the aquatic density of a pond receiving cotton mill effluence at Gwalior, M.P State, India. *Acta Botanica Indica,* 19: 113-116.

Khadse, G.K., Patni, P.M., Kelkar, P.S. and Devotta, S. 2008. Qualitative evaluation of Kanhan river and its tributaries flowing over central Indian plateau. *Environmental Monitoring and Assessment*, 147: 83-92.

Koshy, M. and Nayar, T.V. 2000. Water quality of river Pamba at Kozhencherry. *Pollution Research*, 19(4): 665-668.

Leonard, L.C. 1971. Water and water pollution vol.1 Marcel Dekker, Inc. New York.

McNeely, R.N., Neimanis, V.P. and Dweyer L. 1979. Water Quality Source Book: A Guide to Water Quality Parameters. Inland Waters Directorate, Water Quality Branch Ottawa, Canada, pp: 88.

Mishra, S., Panda, D., Panigraphy, R.C. 1993. Physico-chemical characteristics of the Bahuda estuary (odissa), East cost of India. Indian J. Mar. Sci., 22: 75-77.

Moss, B. 1972. Studies on Gull Lake, Michigan, 1: seasonal and depth distribution of phytoplankton, freshwater biology, 2: 289-307.

Munawar, M. 1970. A limnological study of fresh water ponds of Hyderabad, India. 1-The biotope. Hydrobiologia, 35: 127-162.

Patil, P. 1982. An ecological study of the algal flora of the lakes of Bhopal. Ph.D thesis, Bhopal university, Bhopal, pp-310.

Radhakrishnan, R., Dharmaraj, K. and Kumari, R. 2007. A comparative study on the physico-chemical and bacterial analysis of drinking,borewell and sewage water in the three different places of Sivakasi, *Journal of Environmental Biology*, 28(1): 105-108.

Rajeshwari, C.V. and Saraswathi, B. 2009. Assessment of water quality of rivers Tungbhadra and Hundri, India. *Pollution Research*, 28(3): 499-505.

Roscoe, M.C. 1990. Handbook of Ground Water Development. John Wiley and Sons, New York.

Sadar, M.J. 1996. Understanding turbidity science, Technical Information Series, Booklet II. Hach Co., Loveland, Co.

Sadar, M.J. 1996. Understanding turbidity science, Technical Information Series, Booklet II. Hach Co., Loveland, Co.

Sharma, S.D. and Pande, K.S. 1998. Pollution studies of Ramganga river at Moradabad-Physico-chemical characteristics and toxic metals. *Pollution Research*, 17(2): 201-209.

Singh, A.K. and Hasnain, S.I. 1999. Environmental geochemistry of Damodar river basin, east coast of India. *Environmental Geology*, 37(1-2): 124-136.

Taylor, E.W. 1949. The examination of water and water supplies. J. and A Churchill Ltd, London.

Trivedi, R.K and Goel, P.K, 1987. Chemical and Biological Methods for Water Pollution Studies. Environmental publications Karad, India.

Upadhyay, R.K. and Rana, K.S. 1991. Pollutional status of river Yamuna at Mathura. Nat. Enviro., 8:33-37.

Vaishali, W., Aher, H.R, Kuchekar, S.R 2005. Determination of physico-chemical characteristics of sewage water from Loni village, *Indian Journal Environ and Ecoplan.,* 10 (2):419-421.

Wetzel, R.G. 1975. Limnology, W. B. Saunders Co., Philadelphia, U.S.A., pp: 743.

****