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Physico-Chemical Analysis of Narmada River Water at Hoshangabad City, (M.P.)

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Abstract: ***Rivers are the most important source of fresh water for living being on earth. Since stone age, it is found that social, economic and political development takes place near river banks. Rivers are a major source for drinking, domestic, irrigation and agricultural water supply. Narmada being longest river for Madhya Pradesh is considered as drinking water source for many habitats. For this study, water samples of Narmada River from four different sites have been physico-chemically evaluated for its suitability for domestic and irrigation purposes. Study of physico-chemical parameters such as Temperature, pH, Turbidity, Electrical Conductivity (EC), Total Hardness (TH), Total Alkalinity (TA), Total Dissolved Solids (TDS), Chloride, Nitrate and Dissolved Oxygen (DO) were done. Statistical analysis was also carried out through the establishment of correlation-coefficient between studied physico-chemical parameters. The results showed that, the variation in physico-chemical parameters were within the permissible limit suggested by Indian standards (IS:10500) for drinking water quality. The physico-chemical parameters of water samples were determined as per standard methods of APHA (1998). The results of the present study showed that, during study period the Narmada River water quality was suitable and safe for domestic and irrigation purposes and may be used after some proper treatment.***

Keywords: Physico-Chemical Parameters, Water Quality, Narmada River, Hoshangabad City, Madhya Pradesh

1. Introduction

Water is a universal solvent and is one of the prime needs of life. Since time immemorial fresh water has always been of vital importance for man, as his early habituation were within easy reach of rivers, ponds, lakes and dams etc. Due to industrialization and increase in population the demand of fresh water increases in the last decades. River pollution is a global problem. For human life and agriculture purposes this demand of water is fulfilled by the river. The river water quality is deteriorated due to industrial as well as human activities. Narmada river is also known as Rewa and is the third holy and fifth largest west flowing river of India. Narmada River rises from Maikala range near Amarkantak. Narmada River drains into the Arabian sea through the Gulf of Khambat. Narmada River has 41 tributaries. Hoshangabad city is famous for its beautiful “Ghats” along river Narmada. Huge Quantity of municipal sewage, SPM wastes dumped daily in Narmada river. The present study was aimed to assess the quality of Narmada River water for its domestic and irrigation purposes.

Study Area

The Narmada River samples were collected from four main sampling stations namely S1 (Sethani Ghat), S2 (Budhni Ghat), S3 (Bandrabhandh Ghat) and S4 (Hoshangabad Railway bridge) in between the months of Jul. 2020 to Oct. 2020 on monthly basis. The sampling points were chosen considering the location of nearby villages, bathing zone area, domestic and agricultural and industrial wastes which joins the river water and are responsible for pollution load in the river water. Samples were collected in acid clean one litre polyethylene bottles in the morning hours in between 7.00 AM to 10.00 AM. Some of the studied parameters were recorded at the sampling stations whereas the analysis of other physico-chemical parameters followed by the method prescribed by APHA (1995).

2. Results and Discussion

The physico-chemical parameters such as Temperature, pH, Turbidity, Electrical Conductance, Total Hardness, Ca-Hardness, Mg-Hardness, Total Dissolve Solids, Total Suspended Solids, Total Solids, Total Alkalinity, Chloride, Nitrate, Dissolve Oxygen, were analysed for the water samples collected from the Narmada River. The results are shown by statistical evaluation as Maximum Value, Minimum Value, Average, Standard Deviation and Standard Error. The results obtain during the course of present study and the values of Correlation Coefficient (r) between various physico-chemical parameters of Narmada river water samples are tabulated in table 1, 2 and 3.

Chemical and biochemical reactions are greatly affected by temperature. During the present study, Temperature was fluctuated between 21 to 24.4^{0}c. It was found minimum as 21^{0}c at sampling station no. S2 in the month of Oct. and maximum as 24.4^{0}c at the sampling station no.S1 in the month of Jul. Temperature showed negative correlation with all studied physico-chemical parameters. The pH value indicates the alkaline nature of water body. During the present study, it varied between 7.2 to 7.8. It was found minimum as 7.2 at sampling station no. S1 in the month of Jul. and maximum as 7.8 at the sampling station no. S4 in the month of Oct. The pH showed negative correlation with Temperature. Turbidity in water is due to the presence of colloidal and extremely fine dispersion and indicates the extent of pollution in water body. It was found minimum as 15 NTU at S2 in Aug. and maximum as 20 NTU at S4 in the month of Oct. It showed positive correlation with all studied physico-chemical parameters except temperature. The electrical conductivity of water depends the present of ions in water. Electrical Conductivity was recorded varied between 128.4 to 151.6 µmhos/cm. It was recorded minimum in the month of Jul. at S1 and maximum at S4 in Oct. The total hardness values found varied between 110.1

to 123.8 mg/l. It was found minimum as 110.1 mg/l at sampling station no. S1 in the month of Jul. and maximum as 123.8 at the sampling station no. S4 in the month of Oct. Total hardness showed negative correlation with temperature. Total Alkalinity is the sum of total carbonate and bicarbonate ions present in water. In the present study, Total Alkalinity was recorded in the range between 114.2 to 123.6 mg/l. It was found minimum at sampling station no. S1 in the month of Jul. and maximum at the sampling station no. S3 in the month of Oct. Total Alkalinity showed positive correlation with all studied physico-chemical parameters except Temperature. In the present study, Total dissolved solids were found range from 146.2 to 162.6 mg/l. It was recorded minimum in the month of Jul. at S2 and maximum at S4 in Oct. Total dissolved solids showed negative correlation with Temperature. A large content of chloride in clean water is an indicator of organic pollution. During the study, chloride was recorded minimum as 28.1mg/l at S1 in the month of Jul. and maximum as 34.4 mg/l at S4 in Oct. Chloride showed positive correlation with all studied physico-chemical parameters except temperature. In the present study, nitrate was fluctuated between 0.74 to 0.97 mg/l. Maximum concentration of nitrate was observed in the month of Oct. at sampling station no.S4 and minimum was in Jul. at sampling station no.S2. Dissolved Oxygen was fluctuated between 6.6 to 7.9 mg/l. It was found minimum at sampling station no. S3 in the month of Jul. and maximum at the sampling station no.S4 in the month of Oct. During the present study, dissolved oxygen showed positive correlation with all studied physico-chemical parameters except temperature.

Table 1: Stastical Analysis of monthly Variation in various physico-chemical parameters during study period

S.No.	Month	parameter	Sampling Stations				MIN.	MAX.	AV.	S.D.	S.E.
			S1	S2	S3	S4					
1	Jul.	Temp.	24.4	24.3	24.1	24.3	24.1	24.4	24.275	0.1258	0.0398
		pH	7.3	7.2	7.3	7.4	7.2	7.4	7.3	0.0816	0.0258
		Tur.	16	17	18	17	16	18	17	0.8165	0.2582
		EC	128.4	130.2	131.4	134.5	128.4	134.5	131.13	2.5656	0.8113
		TH	110.1	111.4	112.2	114.2	110.1	114.2	111.98	1.7173	0.5431
		TA	114.2	115.2	115.3	115.8	114.2	115.8	115.13	0.6702	0.2119
		TDS	148.3	146.2	147.3	148.5	146.2	148.5	147.58	1.0563	0.334
		Chloride	28.1	28.3	28.2	28.4	28.1	28.4	28.25	0.1291	0.0408
		Nitrate	0.76	0.74	0.75	0.76	0.74	0.76	0.7525	0.0096	0.003
		DO	6.8	6.7	6.6	6.7	6.6	6.8	6.7	0.0816	0.0258
2	Aug.	Temp.	22.2	22.4	22.3	22.5	22.2	22.5	22.35	0.1291	0.0408
		pH	7.4	7.5	7.6	7.6	7.4	7.6	7.525	0.0957	0.0303
		Tur.	15	15	16	17	15	17	15.75	0.9574	0.3028
		EC	132.1	133.4	134.2	134.8	132.1	134.8	133.63	1.1673	0.3691
		TH	112.3	114.5	114.8	115.4	112.3	115.4	114.25	1.3528	0.4278
		TA	114.3	115.5	116.1	116.3	114.3	116.3	115.55	0.9	0.2846
		TDS	150.2	151.3	152.6	152.8	150.2	152.8	151.73	1.2148	0.3842
		Chloride	29.2	29.3	29.4	29.6	29.2	29.6	29.375	0.1708	0.054
		Nitrate	0.81	0.82	0.83	0.84	0.81	0.84	0.825	0.0129	0.0041
		DO	7.1	7.2	7.2	7.3	7.1	7.3	7.2	0.0816	0.0258
3	Sep.	Temp.	21.2	21.4	21.3	21.4	21.2	21.4	21.325	0.0957	0.0303
		pH	7.6	7.6	7.8	7.7	7.6	7.8	7.675	0.0957	0.0303
		Tur.	19	18	18	19	18	19	18.5	0.5774	0.1826
		EC	141.4	143.4	144.5	144.6	141.4	144.6	143.48	1.4863	0.47
		TH	120.2	121.4	122.4	122.6	120.2	122.6	121.65	1.1	0.3479
		TA	120.1	122.6	122.4	123.3	120.1	123.3	122.1	1.388	0.4389
		TDS	154.5	155.6	157.8	158.1	154.5	158.1	156.5	1.7378	0.5495
		Chloride	32.5	32.3	33.1	33.4	32.3	33.4	32.825	0.5123	0.162
		Nitrate	0.88	0.89	0.89	0.9	0.88	0.9	0.89	0.0082	0.0026
		DO	7.6	7.7	7.7	7.8	7.6	7.8	7.7	0.0816	0.0258
4	Oct.	Temp.	21.1	21	21.2	21.3	21	21.3	21.15	0.1291	0.0408
		pH	7.6	7.7	7.7	7.8	7.6	7.8	7.7	0.0816	0.0258
		Tur.	20	19	20	20	19	20	19.75	0.5	0.1581
		EC	148.2	150.1	151.2	151.6	148.2	151.6	150.28	1.5218	0.4812
		TH	122.8	123.1	123.4	123.8	122.8	123.8	123.28	0.4272	0.1351
		TA	123.4	123.6	123.6	123.4	123.4	123.6	123.5	0.1155	0.0365
		TDS	160.2	161.8	162.3	162.6	160.2	162.6	161.73	1.0689	0.338
		Chloride	34.1	34.2	34.3	34.4	34.1	34.4	34.25	0.1291	0.0408
		Nitrate	0.94	0.96	0.96	0.97	0.94	0.97	0.9575	0.0126	0.004
		DO	7.8	7.9	7.8	7.9	7.8	7.9	7.85	0.0577	0.0183

Table 2: Monthly range of various physico-chemical parameters during study period

S.No.	Range of Physico-Chemical Parameters	Jul.	Aug.	Sep.	Oct.
1	Temp.	24.1-24.4	22.2-22.5	21.2-21.4	21.0-21.3
2	pH	7.2-7.4	7.4-7.6	7.6-7.8	7.6-7.8
3	Tur.	16-18	15-17	18-19	19-20
4	EC	128.4-134.5	132.1-134.8	141.4-144.6	148.2-151.6
5	TH	110.1-114.2	112.3-115.4	120.2-122.6	122.8-123.8
6	TA	114.2-115.8	114.3-116.3	120.1-123.3	123.4-123.6
7	TDS	146.2-148.5	150.2-152.8	154.5-158.1	160.2-162.6
8	Chloride	28.1-28.4	29.2-29.6	32.3-33.4	34.1-34.4
9	Nitrate	0.74-0.76	0.81-0.84	0.88-0.90	0.94-0.97
10	DO	6.6-6.8	7.1-7.3	7.6-7.8	7.8-7.9

Unit of various parameters: Temp.= 0c, Tur. = NTU, EC = µmhos/cm, (TH,TA, TDS,Chloride, Nitrate, Do) = mg/l

Table 3: Correlation-Coefficient between various physico-chemical parameters of Narmada River water

Parameters	Temp.	pH	Tur.	EC	TH	TA	TDS	Chloride	Nitrate	DO
Temp.	1									
pH	-0.98	1								
Tur.	-0.61	0.65	1							
EC	-0.86	0.9	0.91	1						
TH	-0.91	0.92	0.87	0.97	1					
TA	-0.85	0.85	0.92	0.97	0.99	1				
TDS	-0.91	0.95	0.83	0.98	0.96	0.94	1			
Chloride	-0.9	0.92	0.89	0.99	0.99	0.98	0.98	1		
Nitrate	-0.94	0.97	0.8	0.97	0.97	0.94	0.99	0.98	1	
DO	-0.98	0.96	0.75	0.94	0.97	0.93	0.96	0.97	0.98	1

3. Conclusion

Present study revealed that, during the study period, the Narmada River water parameters were found within the permissible limit prescribed by WHO and BIS (IS:10500) and a positive correlation- coefficient (r) was also found between various studied physico-chemical parameters. Hence, on the basis of obtained results it was concluded that the quality of Narmada River water of examined area was not much affected and may be used for drinking and various domestic as well as irrigation purposes after some proper treatment. A public awareness programme should also be initiated about water pollution and the conservation of water sources to assess and maintain the quality of water sources.

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