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Statistical Analysis of Potable Water Quality Status of Machna River at District-Betul (M. P.)

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Abstract: ***In this paper, an attempt has been made to study the water quality parameters and pollution status of Machna River at District-Betul (M. P.). For this study, the water samples were collected from six pre selected sampling stations during the month of Nov.2021 to Feb.2022 and important 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 analyzed. The physico-chemical parameters of water samples were determined as per standard methods of APHA (1998) and BIS. The results of study showed that, during study period the Machna River water quality was suitable and safe for domestic and irrigation purpose and may be used after some proper treatment and more efficient management is also required to conserve the river water quality.***

Keywords: Physico-Chemical Parameters, Water Quality Parameters, Permissible Limits, Machna River, Betul

1.Introduction

Water is considered to be the main requirement for the human and industrial growth. Increase in population and industrialization the demand of fresh water increases in the last decades. This demand fulfilled by the water sources as rivers, dams, well and ponds which provide the water for human life, agriculture and irrigation purposes. Due to the waste discharged from the industrial and human activities, the quality of ground water has deteriorated, which affects human as well as aquatic life. Rivers are the major sources of drinking water, besides their usage in agriculture, washing, bathing etc. Pollution of these may invite unhygienic conditions and water born infectious diseases not only for humans but also the biota depending and living in it. Now-a-days, water quality assessment has become an important exercise to evaluate the nature and extent of pollution in order to take appropriate control measures. The present study was aimed to assess the quality of Machna River water for its domestic and irrigation purpose.

2.Study Area

The Machna River samples were collected from six main sampling stations namely S_1 (At Staff Dam), S_2 (At Vivekananda Ward), S_3 (At Lohiya Ward, Ganj), S_4 (At Badora), S_5 (Near Hanuman Temple, Karbala) and S_6 (5.0 Kms away from S_5) in between the Months of Nov.2021 to Feb.2022on 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 liter polyethylene bottles during the first week of every month in the morning hours in between 6.00 AM to 9.00 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).

3.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 analyzed 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 Machna River water samples are tabulated in table 1 and 2.

Temperature-Chemical and biochemical reactions are greatly affected by temperature. During the present study, temperature was fluctuated between 16.4 to 21.8^{0}c. It was found minimum at sampling station no. S1 in the month of Feb. and maximum at the sampling station no. S2 in the month of Nov. Temperature showed negative correlation with Turbidity, Electrical Conductance and Dissolve Oxygen.

pH-The **pH** value indicates the alkaline nature of water body. During the present study, it varied between 7.1 to 7.8. It was found minimum at sampling station no. S2 in the month of Jan. and maximum at the sampling station no. S5 in the month of Nov. The pH showed negative correlation with Turbidity, Electrical Conductance and Total Dissolve Solids.

Turbidity-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 4.2 NTU at S6 in Nov. and maximum as 4.8 NTU at S4 in the month of Feb. It showed positive correlation with all studied physico-chemical parameters except Total Hardness, Total Alkalinity, Chloride and Nitrate.

Electrical Conductivity-The Electrical Conductivity of water depends on the present ions in water. Electrical

Conductivity was varied between 147.5 to 151.9 µmhos/cm. It was recorded minimum in the month of Dec. at S1 and maximum at S1 in Feb. It showed positive correlation with Turbidity.

Total Hardness-The Total Hardness values found varied between 121.5 to 124.5 mg/l. It was found minimum at sampling station no. S1 in the month of Nov. and maximum as 124.5 at the sampling station no. S4 in the month of Feb. It showed negative correlation with Total Dissolve Solids and Dissolve Oxygen.

Total Alkalinity-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 119.1 to 122.1 mg/l. It was found minimum at sampling station no. S3 in the month of Feb. and maximum at the sampling station no. S6 in the month of Dec. Total Alkalinity showed positive correlation with all studied physico-chemical parameters except Total Dissolve Solids.

Total dissolved solids-It were found range from 148.4 to 151.8 mg/l. It was recorded minimum in the month of Feb. at S1 and maximum at S2 in Nov. Total dissolved solids showed negative correlation with Chlorides and Nitrates.

Chloride-A large content of chloride in clean water is an indicator of organic pollution. During the study, chloride was recorded minimum as 46.9 mg/l at S3 in the month of Feb. and maximum as 49.2 mg/l at S5 in Nov. Chloride showed positive correlation with all studied parameters except DO.

Nitrate-Nitrate was fluctuated between 36.6 to 39.1 mg/l. Maximum concentration of nitrate was observed in the month of Dec. at sampling station no. S4 and minimum was in Feb. at sampling station no. S4.

Dissolved Oxygen-Dissolved Oxygen was fluctuated between 7.2 to 7.8 mg/l. It was found minimum at sampling station no. S2 in the month of Nov. and maximum at the sampling station no. S3 in the month of Feb. During the present study, dissolved oxygen showed positive correlation with pH, Turbidity, Total Alkalinity and Total Dissolve Solids.

Table 1: Statistical Analysis of monthly Variation in various physico-chemical parameters during Nov.21 to Feb.22

S. No.	Month	Para-meters	Sampling Stations						MIN.	MAX.	AV.	S. D.	S. E.
			S1	S2	S3	S4	S5	S6					
1	Nov.	Temp.	21.5	21.8	21.6	21.5	21.1	21	21	21.8	21.42	0.31	0.10
2		pH	7.3	7.4	7.5	7.4	7.5	7.6	7.3	7.6	7.45	0.10	0.03
3		Tur.	4.3	4.3	4.4	4.4	4.3	4.2	4.2	4.4	4.32	0.08	0.02
4		EC	148.4	151.6	149.5	150.1	151.2	151.4	148.4	151.6	150.37	1.26	0.40
5		TH	124.5	123.2	122.2	123.4	123.8	123.1	122.2	124.5	123.37	0.77	0.24
6		TA	120.6	119.8	120.6	121.2	121.8	121.8	119.8	121.8	120.97	0.78	0.25
7		TDS	148.4	149.2	150.5	151.1	149.6	148.8	148.4	151.1	149.60	1.03	0.33
8		Chloride	48.1	48.2	47.8	48.1	48.9	48.4	47.8	48.9	48.25	0.37	0.12
9		Nitrate	37.8	38.1	38.3	38.8	38.2	38.4	37.8	38.8	38.27	0.33	0.11
10		DO	7.4	7.2	7.3	7.5	7.4	7.6	7.2	7.6	7.40	0.14	0.04
1	Dec.	Temp.	20.3	20.5	20.6	20.4	20.2	20.1	20.1	20.6	20.35	0.19	0.06
2		pH	7.4	7.5	7.3	7.6	7.4	7.5	7.3	7.6	7.45	0.10	0.03
3		Tur.	4.3	4.4	4.5	4.5	4.5	4.4	4.3	4.5	4.43	0.08	0.03
4		EC	147.5	148.2	148.6	149.3	150.2	150.8	147.5	150.8	149.10	1.25	0.39
5		TH	122.8	122.9	123.1	123.2	123.1	122.9	122.8	123.2	123.00	0.15	0.05
6		TA	119.6	120.2	121.5	121.7	121.6	122.1	119.6	122.1	121.12	0.98	0.31
7		TDS	148.8	150.3	151.2	151.5	151.3	151	148.8	151.5	150.68	1.01	0.32
8		Chloride	48.5	47.8	48.3	48.4	49.2	48.8	47.8	49.2	48.50	0.47	0.15
9		Nitrate	38.4	38.1	38.5	39.1	38.6	38.5	38.1	39.1	38.53	0.33	0.10
10		DO	7.5	7.2	7.8	7.6	7.5	7.8	7.2	7.8	7.57	0.23	0.07
1	Jan.	Temp.	17.5	17.7	17.9	17.4	17.3	17.2	17.2	17.9	17.50	0.26	0.08
2		pH	7.2	7.1	7.3	7.4	7.6	7.8	7.1	7.8	7.40	0.26	0.08
3		Tur.	4.5	4.8	4.7	4.6	4.8	4.5	4.5	4.8	4.65	0.14	0.04
4		EC	151.2	150.3	149.4	150.1	149.5	149.6	149.4	151.2	150.02	0.68	0.21
5		TH	121.7	122.1	123.2	121.5	121.9	122.1	121.5	123.2	122.08	0.59	0.19
6		TA	120.3	119.5	119.7	120.1	120.3	119.6	119.5	120.3	119.92	0.36	0.11
7		TDS	150.5	149.2	150.7	150.2	150.7	150.5	149.2	150.7	150.30	0.57	0.18
8		Chloride	47.6	47.5	46.9	47.1	47.4	47.6	46.9	47.6	47.35	0.29	0.09
9		Nitrate	37.1	36.6	36.9	37.2	37.7	37.4	36.6	37.7	37.15	0.38	0.12
10		DO	7.4	7.5	7.5	7.6	7.6	7.7	7.4	7.7	7.55	0.10	0.03
1	Feb.	Temp.	16.4	16.8	16.7	16.6	16.6	16.4	16.4	16.8	16.58	0.16	0.05
2		pH	7.4	7.3	7.4	7.2	7.3	7.4	7.2	7.4	7.33	0.08	0.03
3		Tur.	4.5	4.6	4.4	4.5	4.7	4.5	4.4	4.7	4.53	0.10	0.03
4		EC	151.9	151.4	150.6	151.8	151.2	151.3	150.6	151.9	151.37	0.47	0.15
5		TH	122.5	122.7	122.8	121.6	122.1	122.5	121.6	122.8	122.37	0.45	0.14
6		TA	119.3	119.7	119.1	120.4	119.9	120.1	119.1	120.4	119.75	0.49	0.15
7		TDS	151.8	151.4	150.2	150.9	151.5	150.8	150.2	151.8	151.10	0.58	0.18
8		Chloride	47.9	47.5	47.8	48.1	47.6	47.4	47.4	48.1	47.72	0.26	0.08

9		Nitrate	37.7	37.1	38.2	38.1	37.6	37.2	37.1	38.2	37.65	0.45	0.14
10		DO	7.4	7.2	7.4	7.5	7.6	7.6	7.2	7.6	7.45	0.15	0.05

MIN.-Minimum, MAX.-Maximum, AV.-Average, S. D.-Standard Deviation, S. E.-Standard Error

Table 2: Correlation-Coefficient between various physico-chemical parameters of Machna River water

Parameters	Temp.	pH	Tur.	EC	TH	TA	TDS	Cl^-	No_3^-	DO
Temp.	1.00									
pH	0.92	1.00								
Tur.	-0.86	-0.59	1.00							
EC	-0.56	-0.81	0.14	1.00						
TH	0.93	0.72	-0.99	-0.30	1.00					
TA	0.96	0.91	-0.81	-0.69	0.89	1.00				
TDS	-0.71	-0.70	0.49	0.22	-0.55	-0.49	1.00			
Cl^-	0.82	0.66	-0.86	-0.49	0.89	0.92	-0.19	1.00		
No_3^-	0.81	0.64	-0.88	-0.45	0.90	0.90	-0.18	1.00	1.00	
DO	-0.18	0.16	0.54	-0.71	-0.42	0.02	0.39	-0.08	-0.12	1.00

4.Conclusion

Present study revealed that, during the study period, the Machna 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 Machna River water of examined area was not much affected and may be used for 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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