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Physico - Chemical Determination of Water Quality and Pollution Status of Tapti River at Multai, District - Betul (M. P.)

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Abstract: ***In the present paper, an attempt has been made to study the water quality parameters and pollution status of Tapti River at Multai, District - Betul (M. P.). For this study, the water samples were collected from four preselected sampling stations during the month of Jul.2021 to Sep.2021 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 analysed. The results showed that, the variation in physico - chemical parameters was 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 Tapti River water quality was suitable and safe for domestic and irrigation purposes and may be used after some proper treatment and more efficient management is also required to conserve the river water quality.***

Keywords: Physico - Chemical Paramertes, Water Quality Parameters, Permissible Limits, Tapti River, Multai, District Betul

1. Introduction

Water is one among the prime the necessities of life required for growth and activity of all living being on globe. Only small amount of water that occurs in fresh water rivers, dams, lakes etc. is available for the terrestrial life. Rivers and streams have become the dump yards of domestic sewage and industrial effluents. Alarming increase in human population and unethical urbanization has led to the pollution of fresh water bodies to a great extent. 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.

The water of Tapti River is used for drinking, domestic, irrigation and agricultural as well as construction purposes. The Tapti River originates in District Betul (M. P.). from a place called Multai. The Sanskrit name of Multai is Multapi and the term means the origin of Tapti Mata or the Tapti River. It is one of the major river of peninsular India with length of around 724 km. and the source is in Satpura range with longitude and latitude $78^0$21'E and $21^0$04'N respectively. This river drains into the Gulf of Khambhat (Arabian sea) after flowing through Madhya Pradesh, Maharashtra and Gujrat.

2. Study Area

In order to determine the water quality, total 04 water sampling stations where domestic activities are mainly occurs, were selected for samples collection along the stretch of the river Tapti, at Multai, District Betul (M. P.). The sampling stations were: S1 (Tapti Pond), S2 (Near Temple), S3 (100 meter east of Tapti pond), S4 (150 meter west of Tapti Pond). Water samples were collected in fresh one litre plastic bottles, previously cleaned with 1: 3 HNO_3 during the period of three months from Jul.2021 to Sep.2021 on monthly basis. Samples were collected during the first week of every month in the early hours of the day in between 6.00 AM to 11.00 AM. Analysis of physico - chemical parameters, the methods given by APHA (1992) were followed.

3. Result 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 Tapti 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 table1 and 2.

Chemical and biochemical reactions are greatly affected by temperature. During the present study, Temperature was fluctuated between 20.1 to 21.5^0c. It was found minimum as 20.1^0c at sampling station no. S2 in the month of Sep. and maximum as 21.5^0c at the sampling station no. S2 in the month of Jul. Temperature showed positive correlation with pH. The pH value indicates the alkaline nature of water body. During the present study, it varied between 7.3 to 7.8. It was found minimum as 7.3 at sampling station no. S4 in the month of Sep. and maximum as 7.8 at the sampling station no. S2 in the month of Jul. The pH showed positive 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 16 NTU at S2 in Jul. and maximum as 19 NTU

at S2 in the month of Sep. It showed negative correlation with Temperature and pH. The electrical conductivity of water depends on the present of ions in water. Electrical Conductivity was recorded varied between 129.2 to 132.1 µmhos/cm. It was recorded minimum in the month of Sep. at S2 and maximum at S1 in Jul. It showed positive correlation with temperature and pH whereas negative with Turbidity. The total hardness values found varied between 111.8 to 115.4 mg/l. It was found minimum as 111.8 mg/l at sampling station no. S2 in the month of Sep. and maximum as 115.4 mg/l at the sampling station no. S2 in the month of Jul. Total hardness showed negative correlation with Turbidity and positive with Temperature, pH and Electrical Conductivity. 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 126.1 to 132.4mg/l. It was found minimum at sampling station no. S4 in the month of Sep. and maximum at the sampling station no. S1 in the month of Jul. Total Alkalinity showed positive correlation with all studied physico - chemical parameters except Turbidity. In the present study, Total dissolved solids were found range from 145.8 to 148.5 mg/l. It was recorded minimum in the month of Sep. at S2 and maximum at S1 in Jul. Total dissolved solids showed positive correlation with all studied physico - chemical parameters except Turbidity. A large content of chloride in clean water is an indicator of organic pollution. During the study, chloride was recorded minimum as 27.2 mg/l at S3 in the month of Sep. and maximum as 28.6 mg/l at S2 in Aug. Chloride showed positive correlation with all studied physico - chemical parameters except Turbidity and Total Alkalinity. In the present study, nitrate was fluctuated between 0.66 to 0.77 mg/l. Maximum concentration of nitrate was observed in the month of Jul. at sampling station no. S1 and minimum was in Sep. at sampling station no. S2. Dissolved Oxygen was fluctuated between 6.6 to 6.8 mg/l. It was found minimum at sampling station no. S1 in the month of sep. and maximum at the sampling station no. S4 in the month of Jul. During the present study, dissolved oxygen showed negative correlation with all studied physico - chemical parameters except Turbidity.

Table 1: Stastical Analysis of monthly Variation in physico chemical parameters of Tapti River

S. No.	Month	parameter	Sampling Stations				MIN.	MAX.	AV.	S. D.	S. E.
			S1	**S2**	**S3**	**S4**					
1	Jul.	Temp.	21.4	21.5	21.3	21.2	21.2	21.5	21.35	0.1291	0.0408
		pH	7.7	7.8	7.6	7.5	7.5	7.8	7.65	0.1291	0.0408
		Tur.	17	16	17	18	16	18	17	0.8165	0.2582
		EC	132.1	130.3	131.5	130.5	130.3	132.1	131.1	0.8485	0.2683
		TH	114.1	115.4	114.2	113.2	113.2	115.4	114.23	0.9032	0.2856
		TA	132.4	131.6	131.5	131.8	131.5	132.4	131.82	0.4031	0.1274
		TDS	148.5	146.3	147.3	148.2	146.3	148.5	147.58	0.9912	0.3134
		Chloride	28.3	28.4	28.1	28.3	28.1	28.4	28.275	0.1258	0.0398
		Nitrate	0.77	0.76	0.74	0.75	0.74	0.77	0.755	0.0129	0.0041
		DO	6.7	6.7	6.7	6.8	6.6	6.8	6.7	0.0816	0.0258
2	Aug.	Temp.	21.1	20.8	21	20.6	20.6	21.1	20.875	0.2217	0.0701
		pH	7.5	7.4	7.5	7.4	7.4	7.5	7.45	0.0577	0.0183
		Tur.	17	16	18	17	16	18	17	0.8165	0.2582
		EC	131.2	130.2	131	131.4	130.2	131.4	130.95	0.526	0.1663
		TH	113.4	112.6	112.1	114.2	112.1	114.2	113.08	0.9215	0.2914
		TA	130.4	129.8	130.5	130.1	129.8	130.5	130.2	0.3162	0.1
		TDS	148.3	146.2	147.5	148.5	146.2	148.5	147.63	1.0436	0.33
		Chloride	28.5	28.6	28.5	28.4	28.4	28.6	28.5	0.0816	0.0258
		Nitrate	0.76	0.77	0.75	0.76	0.75	0.77	0.76	0.0082	0.0026
		DO	6.8	6.8	6.6	6.7	6.6	6.8	6.725	0.0957	0.0303
3	Sep.	Temp.	20.3	20.1	20.4	20.3	20.1	20.4	20.275	0.1258	0.0398
		pH	7.4	7.3	7.4	7.3	7.3	7.4	7.35	0.0577	0.0183
		Tur.	18	19	19	18	18	19	18.5	0.5774	0.1826
		EC	130.4	129.2	130.1	130	129.2	130.4	129.93	0.5123	0.162
		TH	112.1	111.8	112.5	114.5	111.8	114.5	112.73	1.2176	0.385
		TA	128.6	127.5	127.1	126.1	126.1	128.6	127.32	1.0340	0.3261
		TDS	146.7	145.2	145.5	146.1	145.2	146.7	145.88	0.6652	0.2104
		Chloride	27.8	27.3	27.2	27.5	27.2	27.8	27.45	0.2646	0.0837
		Nitrate	0.66	0.72	0.71	0.7	0.66	0.72	0.6975	0.0263	0.0083
		DO	6.6	6.7	6.8	6.7	6.7	6.8	6.75	0.0577	0.0183

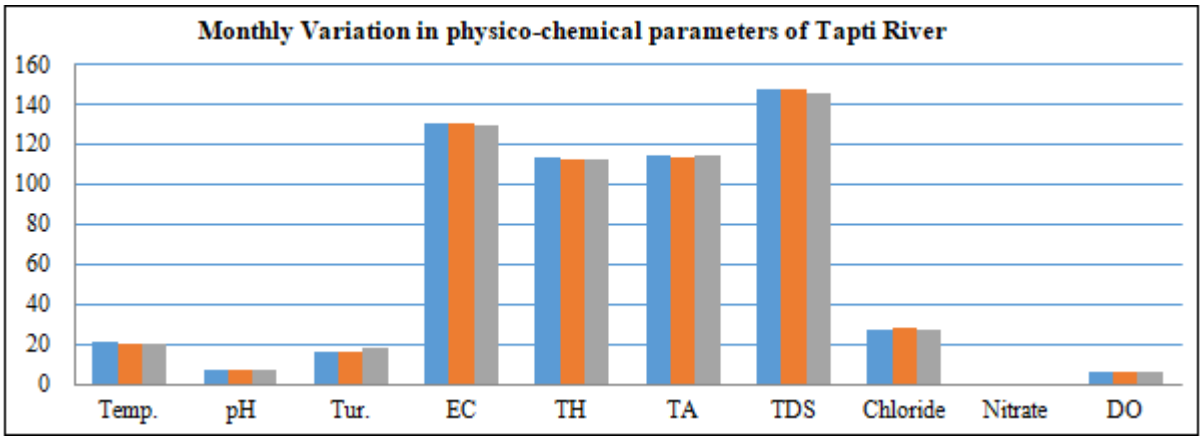
Table 1: Standard permissible limit of various physico - chemical parameters suggested by WHO and IS: 10500

S. No.	Parameters	unit	Permissible Limit	
			WHO	IS 10500: 2012
1	Temperature	^{O}C	-	-
2	pH	-	7.5 – 8.5	6.5 – 8.5
3	Transparency	cm	5.0	5 - 10
4	Electrical Conductivity (EC)	µmhos/cm	1400	-
5	Total Hardness (TDS)	mg/l	1000	200 - 600
6	Total Alkalinity (TA)	mg/l	120	200 - 600

7	Total Dissolved Solids (TDS)	mg/l	1000	500 - 2000
8	Chlorides ($CI^{-)}$	mg/l	250	250 - 1000
9	Nitrates ($NO_3^{-)}$	mg/l	5.0	45
10	Dissolved Oxygen (DO)	mg/l	-	>5

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

Parameters	Temp.	pH	Tur.	EC	TH	TA	TDS	Chloride	Nitrate	DO
Temp.	1									
pH	0.96	1								
Tur.	- 0.89	- 0.75	1							
EC	0.94	0.82	- 0.99	1						
TH	0.93	0.99	- 0.68	0.76	1					
TA	0.99	0.93	- 0.93	0.96	0.89	1				
TDS	0.88	0.73	- 0.99	0.98	0.66	0.92	1			
Chloride	0.78	0.6	- 0.97	0.94	0.51	- 0.84	0.98	1		
Nitrate	0.82	0.66	- 0.99	0.96	0.57	0.87	0.99	0.99	1	
DO	- 0.99	- 0.95	0.91	- 0.95	- 0.91	- 0.99	- 0.9	- 0.81	- 0.85	1



4. Conclusion

The present study concludes that the Tapti River water is not much polluted. All the studied parameters are within permissible limits of Indian standards except Alkalinity which was slightly higher in Jul. On the basis of present study and established correlation - coefficient between various studied physico - chemical parameters, we conclude that, During the present study Tapti River water was fit for drinking, domestic, irrigation and fish production purposes. Although, it need some proper treatment to minimize the contamination specially Alkalinity. Present investigation is helpful to create the awareness among the people and Government authorities to maintain the Tapti River quality at its highest quality and purity levels.

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