International Journal of Science and Research (IJSR)
ISSN: 2319-7064
SJIF (2022): 7.942

Assessment of Water Quality and Pollution Status of Machna River during Monsoon Season in District - Betul: A Physico - Chemical Analysis

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Abstract: ***In this assisment, an attempt has been made to study the water quality parameters and pollution status of Machna River during Mansoon season at District - Betul (M. P.). For this study, the water samples were collected from four preselected sampling stations during the months of Jun.2023 to Aug.2023 and analyzed some important Physico - Chemical parameters such as Temperature, pH, Turbidity, Total Hardness (TH), Total Alkalinity (TA), Total Dissolved Solids (TDS), Dissolved Oxygen (DO), Chloride and Nitrate. The result of this present study showed that, the variation in Physico - Chemical parameters was within the permissible limit suggested by BIS (IS: 10500) and WHO for drinking water quality. The results of the present study showed that, during study period the Machna River water quality was suitable and safe for domestic and irrigation purposes and may be used after some proper treatment and more efficient management and monitoring are also required to conserve the river water quality.***

Keywords: Physico - Chemical Paramertes, efficient management, Permissible Limits, Machna River, District – Betul (M. P.)

1. Introduction

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. Water is life. No life can exist without water. Water is absolutely essential not only for survival of human being, but also for animals, plants and all other living beings. Water is one of the most valuable natural resources. It is the basic element of social and economic infrastructure and is essential for healthy society and sustainable development. River pollution is a global problem. For human life and agriculture purposes this demand of water is fulfilled by the river. Pollution is generally regarded as the result of industrial revolution. The revolution introduced various industrial activities that rendered the environmental quality of the area concerned deteriorated. The activities further gave birth to different sources of pollution. The most prominent factors that elevate the level of water pollution are exploding population, increasing industrialization and urbanization. The present study is an attempt to make an assessment of the change in the physico - chemical properties of Machna River at District Betul (M. P.).

2. Study Area

The District Betul is located in the south of Madhya Pradesh and in between $21^0 22'$ to $22^0 24'$ North Latitude and $77^0 10'$ to $78^0 33'$ East Longitude. Narmadapuram (Hoshangabad) District in its North, Amravati District of Maharashtra State in the South, Chindwara District in the East and Khandwa District (East Nimad) is in the West. Betul District is situated on the height of 365 meters above sea level in Satpura Mountain ranges. According to the 2011 census, Betul District has a population of 15, 75, 362 and population density is of 157 inhabitants per square kilometer. Betul has a sex ratio of 970 females for every 1000 males and a literacy rate of 72.1%. Machna River is an important tributary of the Tawa River with a catchment area of 82 sq. km in the city Betul. The Machna River originates from Sasawad village near Amla Tehsil, District Betul. The river is lifeline of the people of Betul city and it is an important source of water supply. The river has special cultural and religious significance among the people. Due to increasing population in the region and poor management of urbanization and industrial growth, the water quality of River Machna has significantly deteriorated. The present study was aimed to assess the quality of Machna River water for its domestic and irrigation purpose.

3. Material and Methods

The Machna river samples were collected from four (04) main sampling stations named S_1 (Near Village Sasawad), S_2 (Near Village Lakhapur), S_3 (Near Village Badora) and S_4 (Near Village Bhayawadi) in between the Months of Jun.2023 to Aug.2023 on monthly basis. Samples were collected in acid clean one liter polyethylene bottles in the morning hours in between 6.00 AM to 8.00 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

Description of Sampling Stations of Machna River District - Betul (M. P.)

S. No.	Name of Sampling Station	Latitude	Longitude
01.	S1 - Near Village Sasawad	21.9080	78.1020
04.	S4 - Near Village Lakhapur	21.8365	78.4018
03.	S3 - Near Village Badora	21.8818	77.8990
02.	S2 - Near Village Bhayawadi	21.8966	77.8197

4. Result and Discussion

The results of analysis of Physico - Chemical Parameters such as Temperature, pH, Turbidity, Total Hardness, Total Dissolve Solids, Total Alkalinity, Dissolve Oxygen, Chlorides and Nitrates are shown in tabulated form in table 1, 2 and 3 and statistical evaluation as Minimum Value

(Min), Maximum Value (Max), Average Value (AV), Standard Deviation (SD), Standard Error (SE) and Coefficient of Variance (CV) are also calculated and shown to evaluate the water quality - Results showed that the Temperature was found min. as 21.3 ^{O}C at sampling station S1 and max. as 25.1 ^{O}C at S3 with an average value of 23.2 ^{O}C. pH fluctuated in between the range of 7.2 to 7.6 with an average value of 7.41. Turbidity was found min as 3.4 mg/l at S1 and max. as 4.5 mg/l at S4 having the average value of 3.99 mg/l. Total Hardness ranged in between 130.5 mg/l at sampling station no. S1 in the month of Jun.23 to 134.9 mg/l at station no. S4 in Aug.23 with the average value of 132.96 mg/l. Total alkalinity showed the min. value of 141.3 mg/l at S1 and max. as 147.8 mg/l at S4 having the average value of 145.26 mg/l. Total Dissolve Solids found in between the range of 154.3 mg/l to 169.1 mg/l with an average value of 163.47 mg/l. Dissolve Oxygen fluctuated in between 8.1 mg/l to 8.6 mg/l and showed the average value of 8.36 mg/l. Chlorides shown the min value of 36.5 mg/l and max. as 38.5 mg/l having the average value of 37.86 mg/l. Nitrates varied in between 28.7 mg/l at sampling station no. S1 in the month of Jun.23 to 29.9 mg/l at S4 in Aug.23 with an average value of 29.46 mg/l.

Table 1: Standard Permissible Limit of various Physico - Chemical Parameters suggested by WHO and BIS: 10500

S. No.	Parameters	unit	Permissible Limit	
			WHO	BIS: 10500
1	Temperature	^{O}C	-	-
2	pH	-	7.5 – 8.5	6.5 – 8.5
3	Turbidity	NTU	5.0	5 - 10
4	Total Hardness (TH)	mg/l	1000	200 - 600
5	Total Alkalinity (TA)	mg/l	120	200 - 600
6	Total Dissolved Solids (TDS)	mg/l	1000	500 - 2000
7	Dissolved Oxygen (DO)	mg/l	-	>5
8	Chloride (CI^{-})	mg/l	250	250 - 1000
9	Nitrate (NO_3^{-})	mg/l	5.0	45

Table 2: Monthly Statistical Variation in Studied Physico - Chemical Parameters of Machna River in Jun.23 to Aug.23

S. No.	Month	Parameter	Unit	Sampling Stations			
				S1	**S2**	**S3**	**S4**
1.	**Jun.23**	Temp.	^{O}C	24.3	24.7	25.1	24.8
		Tur.	NTU	3.4	3.7	3.8	3.9
		pH	-	7.2	7.3	7.4	7.5
		TH	mg/l	130.5	131.4	131.6	131.3
		TA	mg/l	141.3	142.3	141.8	142.6
		TDS	mg/l	154.3	155.6	158.1	158.4
		DO	mg/l	8.4	8.2	8.2	8.1
		Chloride	mg/l	36.5	37.3	37.7	37.9
		Nitrate	mg/l	28.7	29.3	29.5	29.2
2.	**Jul.23**	Temp.	^{O}C	23.5	23.2	23.4	23.5
		Tur.	NTU	3.6	3.8	3.8	3.9
		pH	-	7.3	7.4	7.4	7.5
		TH	mg/l	132.6	133.5	133.7	133.8
		TA	mg/l	145.3	146.4	147.1	146.9
		TDS	mg/l	165.1	165.3	164.7	164.8
		DO	mg/l	8.5	8.3	8.4	8.3
		Chloride	mg/l	37.5	37.8	38.2	38.1
		Nitrate	mg/l	29.3	29.5	29.6	29.8
3.	**Aug.23**	Temp.	^{O}C	21.3	21.5	21.6	21.7
		Tur.	NTU	4.1	4.3	4.4	4.5
		pH	-	7.4	7.5	7.5	7.6
		TH	mg/l	133.1	134.5	134.6	134.9
		TA	mg/l	147.2	147.3	147.5	147.8
		TDS	mg/l	168.5	169.1	168.6	169.1
		DO	mg/l	8.6	8.4	8.4	8.5
		Chloride	mg/l	38.4	38.2	38.3	38.5
		Nitrate	mg/l	29.4	29.6	29.7	29.9

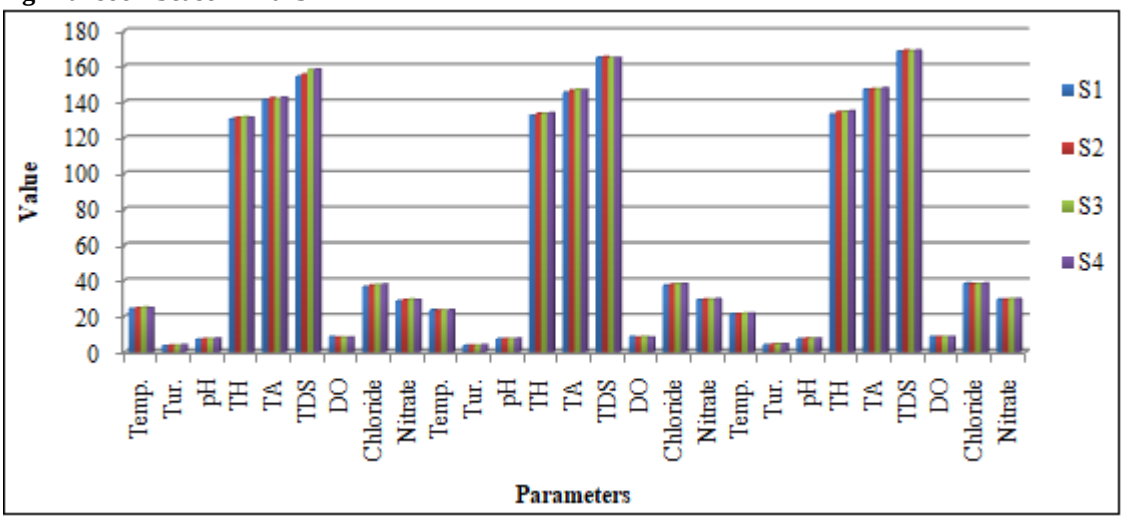
(MIN: Minimum, Max: Maximum, AV: Average Value, SD: Standard Deviation, SE: Standard Deviation, CV: Co - efficient of Variance)

Table 2: Description of variation in statistical parameters of studied Physico – Chemical parameters of Machna River water during Mansoon season – 2023

S. No.	Month	Parameter	MIN.	MAX	AV	SD	SE	CV
1.	Jun.23	Temp.	24.3	25.1	24.73	0.33	0.17	1.34
		Tur.	3.4	3.9	3.70	0.22	0.11	5.84
		pH	7.2	7.5	7.35	0.13	0.06	1.76
		TH	130.5	131.6	131.20	0.48	0.24	0.37
		TA	141.3	142.6	142.00	0.57	0.29	0.40
		TDS	154.3	158.4	156.60	1.98	0.99	1.27
		DO	8.1	8.4	8.23	0.13	0.06	1.53
		Chloride	36.5	37.9	37.35	0.62	0.31	1.66
		Nitrate	28.7	29.5	29.18	0.34	0.17	1.17
2.	Jun.23	Temp.	23.2	23.5	23.40	0.14	0.07	0.60
		Tur.	3.6	3.9	3.78	0.13	0.06	3.33
		pH	7.3	7.5	7.40	0.08	0.04	1.10
		TH	132.6	133.8	133.40	0.55	0.27	0.41
		TA	145.3	147.1	146.43	0.81	0.40	0.55
		TDS	164.7	165.3	164.98	0.28	0.14	0.17
		DO	8.3	8.5	8.38	0.10	0.05	1.14
		Chloride	37.5	38.2	37.90	0.32	0.16	0.83
		Nitrate	29.3	29.8	29.55	0.21	0.10	0.70
3.	Aug.23	Temp.	21.3	21.7	21.53	0.17	0.09	0.79
		Tur.	4.1	4.5	4.33	0.17	0.09	3.95
		pH	7.4	7.6	7.50	0.08	0.04	1.09
		TH	133.1	134.9	134.28	0.80	0.40	0.60
		TA	147.2	147.8	147.45	0.26	0.13	0.18

		TDS	168.5	169.1	168.83	0.32	0.16	0.19
		DO	8.4	8.6	8.48	0.10	0.05	1.13
		Chloride	38.2	38.5	38.35	0.13	0.06	0.34
		Nitrate	29.4	29.9	29.65	0.21	0.10	0.70

Graphical representation showing monthly variation of statistical data of Physico - Chemical parameters of Machna River during Mansoon Season - 2023



5. Conclusion

In the present study, the obtained results revealed that, except little variation all the studied physico - chemical parameters were in permissible limit at the study site of Machna River and it is suggested that proper measures are necessary to avoid contaminations and concluded that during the study period, the river water is suitable and safe for domestic and irrigation purposes and may be used after proper treatment to avoid contaminations.

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