

Physico–Chemical Study of Tapti River Water at Multai, District - Betul (M.P.)

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Abstract: *Tapti, a holy river is the key source for drinking, domestic and irrigation purpose in Madhya Pradesh. In the present study water samples of Tapti River from Multai have been studied physico-chemically to evaluate its suitability for drinking, domestic and irrigation purpose in the month of Jul., Aug. and Sept-2019. Monthly variation in important parameters taken into consideration as Temperature, Turbidity, pH, Specific Conductivity, Total Alkalinity, Total Hardness, Calcium Hardness, Magnesium Hardness, Total Dissolved solids, Suspended Solids, Chlorides, Nitrates, DO, BOD, and COD were determined. These physico-chemical parameters were determined as per standard methods of APHA (2012). Results revealed that Tapti River water quality is suitable and safe for domestic and irrigation purposes.*

Keywords: Tapti River, Physico-Chemical Parameters, Multai, Quality of water

1. Introduction

Water is god's gift to all living creatures from unicellular to multicellular and from plants to animals on earth. The quality of water is of vital concern for human beings, since it is directly linked with human health. Water plays an important role in various life processes in the human body. In our daily life, water is used for drinking, bathing, cooking and washing purposes. But relentless increase in the demand of water for multipurpose brought about by the two interdependent and parallel lines of forces i.e. industrialization and urbanization, which is one hand usually reflects the all around development and progress but on the other hand poses strong concern about the fate of fresh water habitate. The requirement of water in all lives, from microorganisms to human beings, is increased day-by-day but it is a serious problem to provide a safe drinking water because all water resources have reached to a point of crises due to unplanned urbanization and industrialization. Water is the best solvent also called a universal solvent and the most abundant component on earth's surface comprising about 70% of earth's surface in solid, liquid and gaseous state. The impact of rapid urbanization on the water front is of great concern. Millions of people all over the World, particularly in the developing countries are losing their lives every year from water borne diseases. Numbers of observations are reported on the pollution of water resources. The anthropogenic activities and population pressure are the major cause of the degradation of water quality.

The objective of the present study is to provide information on the physico-chemical characteristics of river Tapti to assess the quality of river water as well as to discuss its suitability for human consumption and irrigation purposes.

2. Study Area

Multai is a Tehsil place and a small town. Actually the name Multai was derived from Multapi, which is the origin place of Tapti river. Now-a-days, Tapti river and its ponds located in Multai have been polluted by immersion of lord Ganesha and Durga's idols, washing and cleaning of cloths, domestic sewage and other recreational activities. It has a total length

of around 724kms. Its catchment area in Multai is about 8.0 sq. kms and the longitude and the latitude are 78°21'00" and 21°04'00" respectively. The water of this river is supplied to the people of the city Multai for drinking and irrigation purposes. The deterioration of water quality of river has posed a serious problem for human beings, animals and plants.

3. Material and Methods

The present study was carried out at Tapti river water in Multai, district– Betul (M.P.), India. The study was conducted between the months of Jul; Aug. and Sept-2019. Samples were collected from six main sampling points, where various pollution activities have large impact on water quality. For water collection acid cleaned plastics containers were utilized. Parameters like Temperature and pH were measured at sampling sites while remaining parameters were analyzed immediately after reaching in laboratory. For analysis of water samples standard methods of Trivedi and Goyal and APHA (2012) were followed.

4. Results and Discussion

The mean data of the present study of physico-chemical analysis of Tapti river water have been given in Table 1.

Temperature: Temperature is one of the most important factors. The water temperature followed the change in solar radiation and ambient air temperature. The temperature of surface water was found 23.3°C in Jul; 22.8°C in Aug. and 22.5°C in Sept.-2019 respectively. Temperature has been considered as an important factor in aquatic environment (Singh R.P.et. al, 2005).

Turbidity: The clarity of water is an important factor for determining its health and productivity. Turbidity in water is caused by suspended and colloidal matter such as clay, slit, finely divided organic and inorganic matters, paints and other microscopic organisms. The turbidity was found 4.8 NTU in Jul; 5.6 NTU in Aug. and 6.1 NTU in Sept.-2019 respectively.

pH values: pH is also an essential parameter of water quality which is governed by the carbon dioxide and bicarbonate equilibrium. The pH recorded as 7.8 during Jul; 8.1 in Aug. and 8.4 in Sept- 2019 respectively. High values of pH during rainy season may be due to the excess of carbonates and bicarbonates in water body. (Mishra et. al, 2011).

Specific Conductivity (SC): Specific Conductivity (SC) reflects the capacity of water to conduct electrical current and it is directly related to the concentration of salts dissolved water. Variation in SC in collected water samples was recorded 628.4 μ mhos/cm in Jul; 710.2 μ mhos/cm in Aug. and 912.6 μ mhos/cm in Sept-2019 respectively.

Total Alkalinity (TA): Total Alkalinity (TA) increases due to various religious activities, domestic waste and especially due to soap and detergents, as also reported by Patil et. al, (2003). The Total Alkalinity was observed 210.6 mg/l in Jul; 254.7 mg/l in Aug. and 308.4 mg/l in Sept- 2019 respectively.

Total Hardness (TH): It has been specified the Total Hardness (TH) of water to be within 300 mg/l of CaCO₃. TH values observed of Tapti river ranges 124.5 mg/l in Jul; 118.1 mg/l in Aug. and 108.2 mg/l in Sept. respectively. Calcium (Ca) and Magnesium (Mg) Hardness are also determined. The range of Ca-Hardness is recorded as 78.4 mg/l in Jul; 76.2 mg/l in Aug; 67.5 mg/l in Sept-2019 and Mg-Hardness was found 46.1 mg/l in Jul; 41.9 mg/l in Aug. and 40.7 mg/l in Sept-2019 respectively. (Soni V. et al; 2013)

Total Dissolved Solids (TDS): Total dissolved solids were found 542.6 mg/l during Jul; 584.1 mg/l in Aug. and 627.4 mg/l in Sep- 2019 respectively.

Total Suspended Solids (TSS): Total suspended solids represents impurities present in water. TSS has been recorded as 52.3 mg/l, 67.6 mg/l and 72.5 mg/l respectively.

Chlorides: The chlorides are present in all natural waters, mostly at low concentrations. It is highly soluble in water and is important in detecting the contaminations of ground water by waste in water. The Permissible limit for Chlorides is 250 mg/l as suggested by WHO and BIS. The presence of chloride in higher amounts may be due to natural process such as passage of water through natural salt formation in the earth or it may be the indicator of pollution from domestic use. The value of chloride determined is 248.7 mg/l in Jul; 276.1 mg/l in Aug. and 282.3 mg/l in Sept- 2019 respectively. (Kumar P. et al; 2005)

Nitrates: The concentration of different forms of nitrogen gives a useful indication of the level of micronutrients in water and hence their ability to support plant growth. Higher value of nitrates can lead to eutrophication, which increases algal growth and ultimately reduces dissolved oxygen in the water. The concentration of nitrate was recorded 42.3 mg/l in Jul; 43.2 mg/l in Aug. and 40.1 mg/l in Sept-2019. (Singh R.P; et al; 2005)

Dissolved Oxygen (DO): The dissolved oxygen (DO) plays an important role in survival of aquatic organisms. There

was a slight changes observed in DO during the study period. It was found 3.8 mg/l, 3.2 mg/l and 2.8 mg/l in Jul; Aug. and Sept -2019 respectively.

Biological Oxygen Demand (BOD): The BOD value of water samples under present investigation varied 2.8 mg/l during Jul; 3.8 mg/l in Aug. and 4.2 mg/l in Sept -2019. BOD indicates the amount of oxygen required for stabilizing biological decomposable organic matter in waste under aerobic condition by micro organisms. The reason of high value of BOD could be due to fact that several microbes accelerated their metabolic activities with concentrated amount of organic matter discharged due to human activities, and hence required more amount of oxygen. (Kumar P. et. al, 2005).

Chemical Oxygen Demand (COD): Chemical Oxygen Demand (COD) is measure of oxygen demand consumed for oxidation of oxidizable organic matter present in water sample by strong oxidizing agents, thus it is an indicator of pollution strength of water. The COD values of studied water samples were found 10.2 mg/l during Jul; 8.4 mg/l in Aug. and 8.6 mg/l in Sept -2019. The sources of COD in Tapti river water may be due to the input of domestic wastes and the use of soap and detergents for washing and bathing by common man, as suggested by Mathur et. al, 2008.

Table 1: Mean data of physico-chemical analysis of surface water quality of Tapti River water in Multai, District - Betul (M.P.) in Jul; Aug. and Sept. -2019

S.No.	Parameters	Unit	Results		
			Jul - 2019	Aug - 2019	Sept - 2019
1.	Temperature	$^{\circ}$ C	23.3	22.8	22.5
2.	Turbidity	NTU	4.8	5.6	6.1
3.	pH	-	7.8	8.1	8.4
4.	Specific Conductivity	μ mhos/cm	628.4	710.2	912.6
5.	Total Alkalinity	mg/l	210.6	254.7	308.4
6.	Total Hardness	mg/l	124.5	118.1	108.2
7.	Ca - Hardness	mg/l	78.4	76.2	67.5
8.	Mg - Hardness	mg/l	46.1	41.9	40.7
9.	Total Dissolved Solids	mg/l	542.6	584.1	627.4
10.	Total Suspended Solids	mg/l	52.3	67.6	72.5
11.	Chlorides	mg/l	248.7	276.1	282.3
12.	Nitrates	mg/l	42.3	43.2	40.1
13.	DO	mg/l	3.8	3.2	2.8
14.	BOD	mg/l	2.8	3.8	4.2
15.	COD	mg/l	10.2	8.4	8.6

5. Conclusion

Present study provides an informative data and helps to understand water characteristics and indicates that the water of Tapti River can serve as a good habitat. The pH value indicates the alkaline water which may be due to the solubility of carbon dioxide in water. The overall analysis of quality of water of Tapti River in Multai, District Betul (M.P.) shows that various physico-chemical parameters studied during Jul; Aug. and Sept-2019 are within permissible limit suggested by WHO and BIS:10500 and the river water is suitable for drinking and irrigation purposes and may be used after proper treatment.

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