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# Physico-Chemical Characteristics Of Water Of River Mandakini In Chitrakoot Region

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**Abstract** –
The river flows in Madhya Pradesh for about 25km, then makes a border of district Satna (Madhya Pradesh) and district Chitrakoot (Uttar Pradesh) for the next 25km and again enters in Madhya Pradesh just downstream of Sati Anusuiya. After flowing through about 15km more in M.P., it crosses into Uttar Pradesh near Ramghat in Chitrakoot area and later flows only in Uttar Pradesh finally it joins river Yamuna near Rajapur. The present research works identify Physico - Chemical Characteristics of water quality of River Mandakini in Chitrakoot Region. The water samples were analysed some parameter like pH, TDS, TSS, TH, Alkalinity, DO, BOD, COD, Nitrate, and Sulphate. The pH value was found between 7.49 to 8.5, TDS 290 to 470mg/l, TSS 140 to 192mg/l, TH 250 to 288mg/l, Alkalinity 175 to 198mg/l, DO 3.19 to 6.5mg/l, BOD 2.5 to 12 mg/l, COD 10 to 38mg/l, Nitrate 3 to 9mg/l, Sulphate 3 to 8mg/. Most of the sample BOD and COD are higher than the permissible limit prescribed by WHO (1994) as 6mg/l and 10mg/l respectively.TDS, TSS, TH, Alkalinity, Nitrate and Sulphate of all the results below the WHO recommended values as 500mg/l, 200mg/l, 300mg/l, 200mg/l, 45mg/l, 250mg/l.
**Keywords-** Drinking water, Physico-chemical, Surface water, Water quality, Water pollution

## I. Introduction-

Surface water is water on the surface of the planet such as in a stream, river, lake, wetland, or ocean. It can be contrasted with groundwater and atmospheric water[1].The river Mandakini originates near village Kalhaura in the majhgawan block, district Satna of Madhya Pradesh at latitude $24^0$52'N and longitude $80^0$41'E.The river flows generally in a south to north direction, through in the first and last reaches a west to east trend is also significant. The river flows in Madhya Pradesh for about 25km, then makes a border of district Satna (Madhya Pradesh) and district Chitrakoot (Uttar Pradesh) for the next 25km and again enters in Madhya Pradesh just downstream of Sati Anusuiya. After flowing through about 15km more in M.P., it crosses into Uttar Pradesh near Ramghat in Chitrakoot area and later flows only in Uttar Pradesh finally it joins river Yamuna near Rajapur[2]. Surface waters are most vulnerable to pollution due to their easy accessibility for disposal of wastewaters. River plays a major role in assimilation or carrying off the municipal and industrial wastewater and run-off from agricultural land. Pollution status of the river is generally analysed by means of Physico-chemical, bacterial, plank tonic and benthic fauna studies. River water is used as potable water by municipal supplies to the public. But high – class people use independent distilled or sterile water reservoirs. It is one of the resources for all kind of life. Comprising over 71 of the Earth surface water is unquestionable the most precious natural resource that exists on our planet [3]. Rivers play an important role not only in balancing the hydrological cycle but also for augmenting water supply for drinking, municipal, industrial and agricultural use power generation, waterway transport and other purpose. Rivers are highly complex systems influenced by several variables associated with the quality of water[4-9].

## II. Material and Methods-

Physico-chemical analysis of the River Mandakini is conducted during month of April 2014. Locations of sampling station were given in the table-1 and mass bathing activity on river Mandakini were shown in Fig.-11.

Sampling was done in accordance with Grab sampling method in polyethylene bottles of one litre capacity to avoided leaching of metals and interaction with the surface wall of the container, bottles were first cleaned with detergent and then socked in 1:1$HNO_3$ for 24hours.Finally the bottles were cleaned and rinsed with distilled water. During sampling bottles were rinsed two to three times with

the sample to be examined before filling with it. Samples were collected by immersing the rinsed bottles in river waters[10]. All the samples were labelled, showing the source date and time of collection. The samples were refrigerated at $4^0$C in the laboratory[11-18].

Table-1: Name and code of sampling stations.

| S.N. | Sampling Station Code | Description of Sampling Location |
|---|---|---|
| 1. | R1 | Near Sati Anusuiya Mandir |
| 2. | R2 | Near Sphatic Shila |
| 3. | R3 | Arogyadham, near DRI |
| 4. | R4 | Near Jankikund Hospital |
| 5. | R5 | Near Bus Stand, Pramodvan |
| 6. | R6 | Near Matyagayendranath Mandir, Ramghat |
| 7. | R7 | Near Utara bazaar bridge, Ramghat |
| 8. | R8 | Near Bude Hanuman Ji |

## III. Result and Discussion-

**Physico-Chemical Characteristics of Surface water:**

The water samples were analysed some parameter like pH, TDS, TSS, TH, Alkalinity, DO, BOD, COD, Nitrate, and Sulphate. Analysed all the results are presented in Table-2, and drinking water standard values are presented in Table-3. Graphical representations of the data were shown in Fig. -1 to Fig. -10.

The present research works identify physico-chemical characteristics of water of River Mandakini in Chitrakoot region. The results of water quality of River Mandakini in Chitrakoot are given below-

**pH:**

The values of pH were recorded ranges between 7.4-8.5. Maximum pH observed at sampling location R4 (Jankikund) at 8.5. High pH value associated with small amount of mineral acid from carbonate source or with inorganic acid and low pH value associated with small amount of mineral acid from chloride source or with organic acid.

**Total Dissolve Solid:**

Total Dissolved Solid of river water was ranged from 290-470mg/l. Minimum value of TDS 290mg/l was observed at R6 (near Matyagayendra nath mandir), while maximum value of TDS was 470mg/l at R1 (Sati Anusuiya ghat) in month of April 2014.It extent of cation and anion reach in river water through internal erosion and weathering of rocks and anthropogenic activities.

**Total Suspended Solid:-**

TSS of river water was ranged from 140-192mg/l. Minimum value of TSS 140mg/l was observed at Sati Anusuiya, while maximum value of TSS was 192mg/l at Ramghat (Near Bude Hanuman Ji).

**Total Hardness:-**

The Total Hardness was observed between 250-288mg/l during month of April 2014 in river Mandakini. The highest value of TH was recorded 288 mg/l at R1 (Sati Anusuiya ghat) and minimum value of TH was recorded 250 mg/l at R6 (near Matyagayendra nath mandir). Hardness value was depended on owing to presence of limestone rocks so the water gets more calcium and magnesium salt owing to their more solubility under anaerobic condition.

**Alkalinity:-**

Alkalinity of the sample were recorded between 175-198 mg/l. Higher alkalinity value was found 198 mg/l at R1 (Sati Anusuiya ghat).Alkalinity is increasing by occurrence of carbonate rocks.

**DO:-**

In river Mandakini dissolved oxygen (DO) was ranged from 3.19-6..5mg/l. The minimum value of DO was found 3.19mg/l at R6 (near Matyagayendra nath), oxygen demanding pollutants such as organic waste causes rapid depletion of DO from water. Oxydisable inorganic substances such as-ammonia, ferrous iron, hydrogen sulphide, nitrites, etc. are also cause decrease of DO from water. While maximum 6.5mg/l at R1 (Sati Anusuiya ghat) in month of April.

**BOD:-**

BOD was ranged from 2.5-12mg/l, the Lowest value 2.3mg/l was observed at sampling location R1 (Sati Anusuiya ghat), while highest value 12mg/l was observed at R7 (near Utara Bazaar Bridge). BOD was increased due to anthropogenic activity.

**COD:-**

The COD values ranged between 10-38mg/l as show in table-2, All the COD values are higher than the permissible limit prescribed by BIS and WHO (1994) as10 mg/l. Only one location R1(Sati Anusuiya ghat) was observed 10mg/l. COD was higher than the permissible limit because high owing to mass bathing, discharge which directly reach in river and increases the COD value.

**Nitrate:-**

The value of Nitrate was recorded in the range of 3-9mg/l. The highest value was recorded 9mg/l at sampling station R8 (near Bude Hanuman ji).

**Sulphate:-**

In the present investigation of sulphate value was ditected in the range of 3 to 8 mg/l**.** Minimum value was found 3mg/l at Arogyadham(R3).

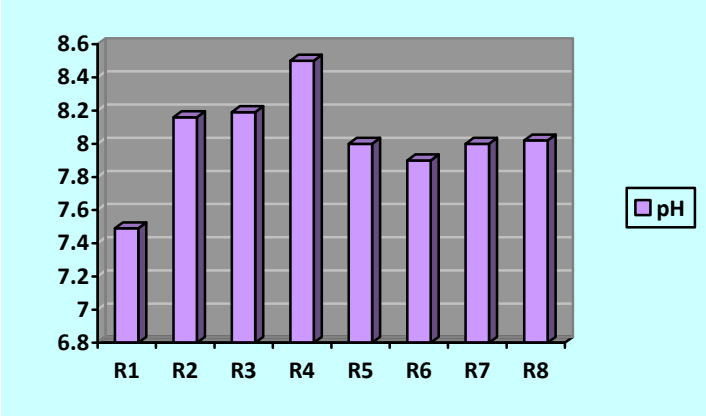


Fig. - 1. pH at various station of River Mandakini

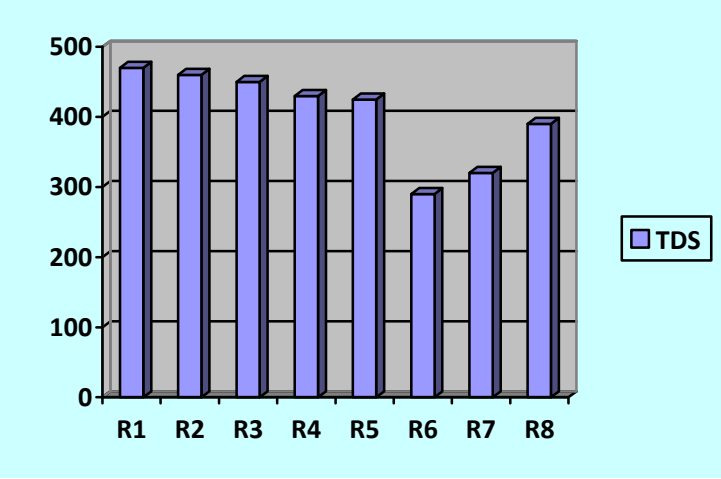


Fig. - 2. TDS at various station of River Mandakini.

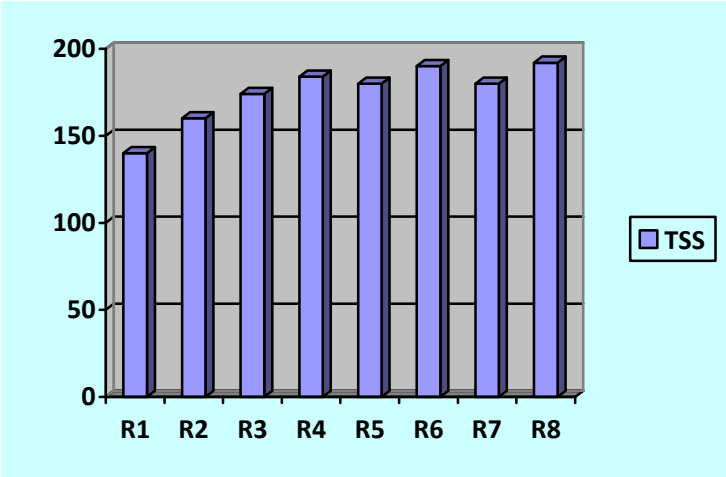


Fig. - 3. TSS at various station of River Mandakini

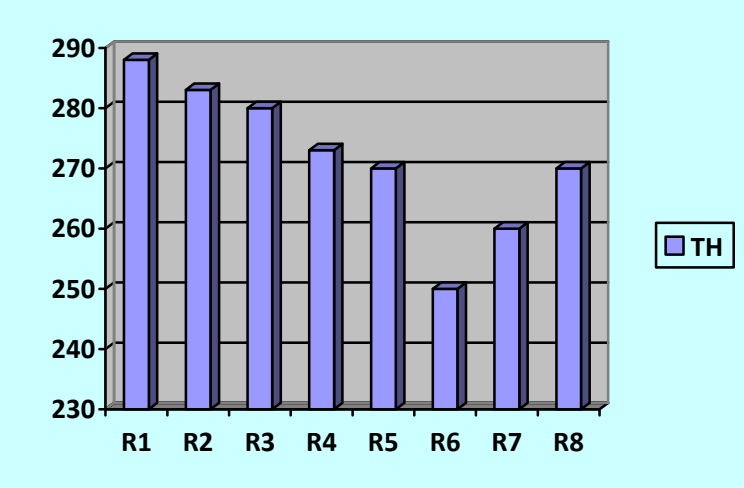


Fig. - 4. TH at various station of River Mandakini

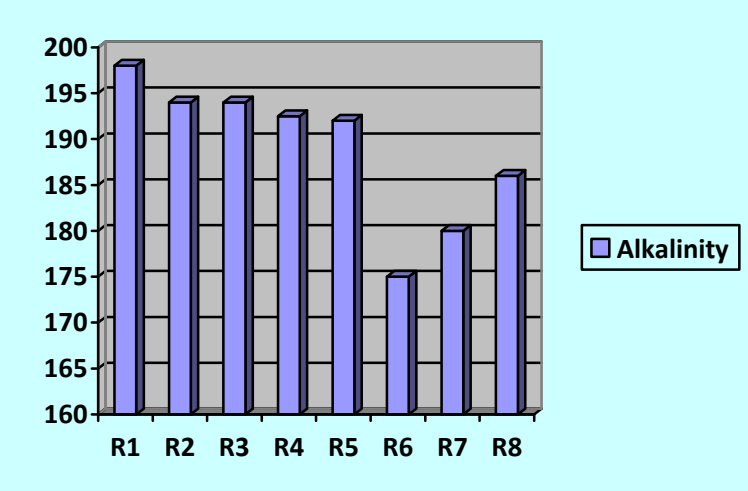


Fig. - 5. Alkalinity at various station of River Mandakini

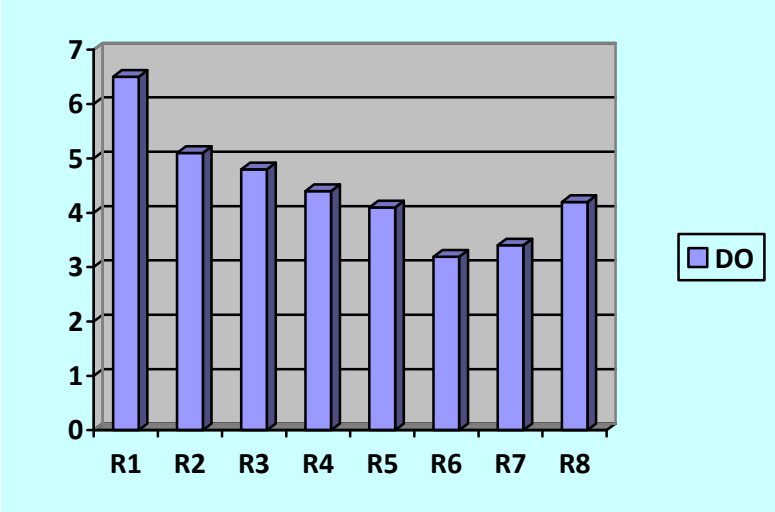


Fig. - 6. DO at various station of River Mandakini

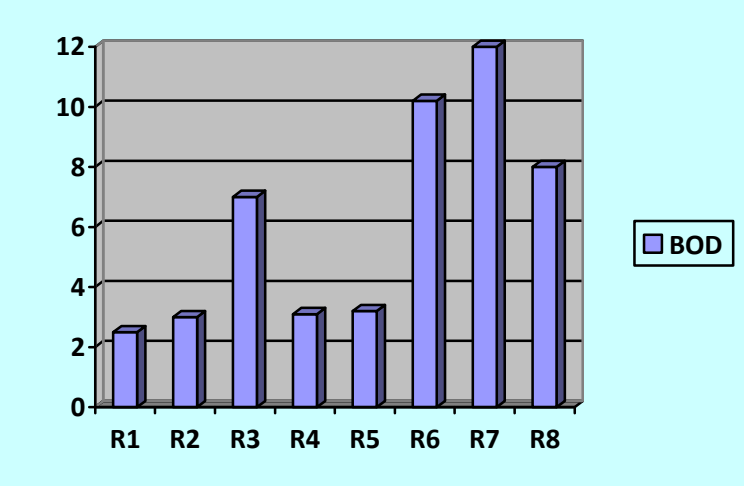


Fig. - 7. BOD at various station of River Mandakini

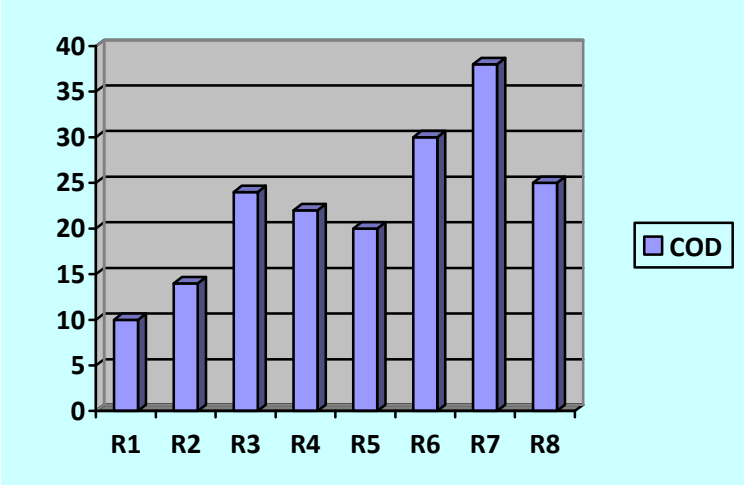


Fig. - 8. COD at various station of River Mandakini

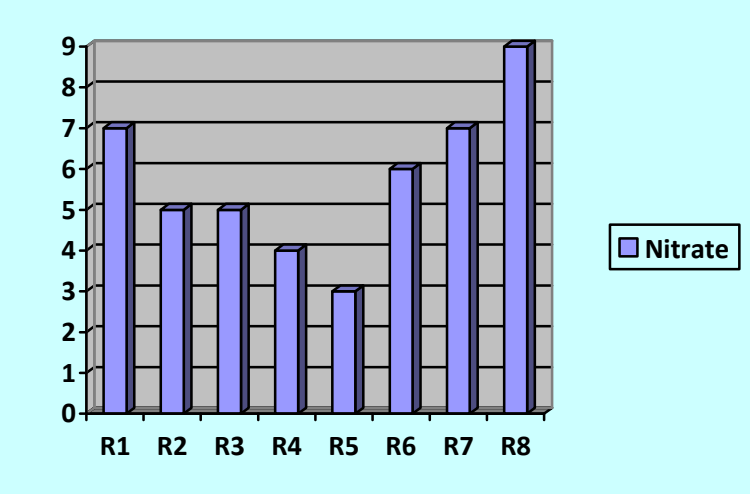


Fig. - 9. Nitrate at various station of River Mandakini

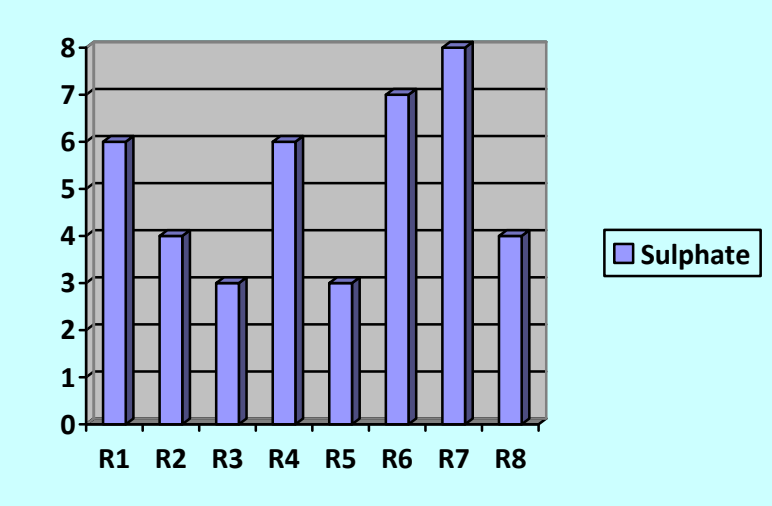


Fig. - 10. Sulphate at various station of River Mandakini

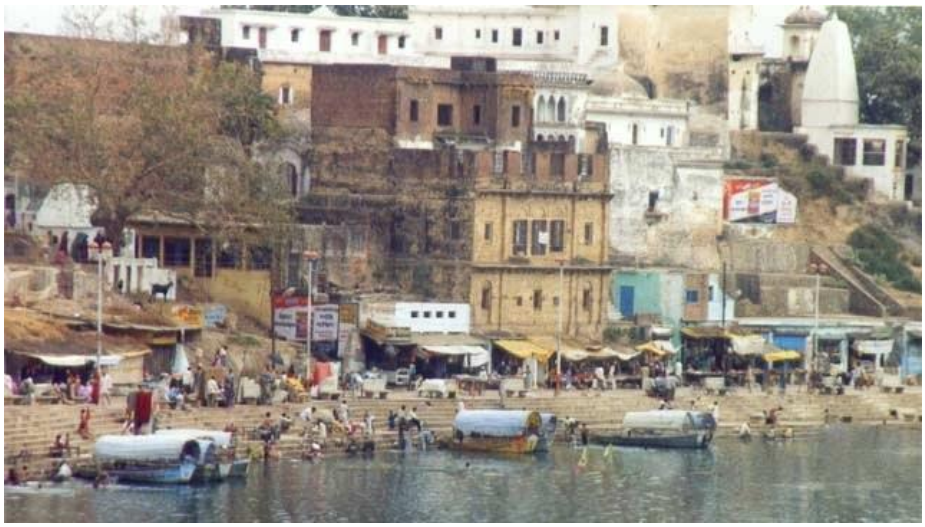

Fig. - 11. Mass bathing and human activities at Ramghat.

**Table-2.** Physico-chemical characteristics of water of River Mandakini in Chitrakoot.

| S N. | Parameter | Sampling Stations | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | **R1** | **R2** | **R3** | **R4** | **R5** | **R6** | **R7** | **R8** |
| 1 | pH | 7.49 | 8.16 | 8.19 | 8.50 | 8.00 | 7.90 | 8.00 | 8.02 |
| 2 | TDS | 470 | 460 | 450 | 430 | 425 | 290 | 320 | 390 |
| 3 | TSS | 140 | 160 | 174 | 184 | 180 | 190 | 180 | 192 |
| 4 | TH | 288 | 283 | 280 | 273 | 270 | 250 | 260 | 270 |
| 5 | Alkalinity | 198 | 194 | 194 | 192.5 | 192 | 175 | 188 | 186 |
| 6 | DO | 6.5 | 5.1 | 4.8 | 4.4 | 4.1 | 3.19 | 3.4 | 4.2 |
| 7 | BOD | 2.5 | 3.0 | 7.0 | 3.1 | 3.2 | 10.2 | 12 | 8 |
| 8 | COD | 10 | 14 | 24 | 22 | 20 | 30 | 38 | 25 |
| 9 | Nitrate | 7 | 5 | 5 | 4 | 3 | 6 | 7 | 9 |
| 10 | Sulphate | 6 | 4 | 3 | 6 | 3 | 7 | 8 | 4 |

All the parameter is expressed in mg/l except pH.

**Table -3**. WHO guideline for drinking water quality[12].

| **Parameters** | **WHO Standard values** |
|---|---|
| pH | 6.5 to 8.5 |
| TDS | 500mg/l |
| TSS | 200mg/l |
| TH | 300mg/l |
| ALKALINITY | 200mg/l |
| DO | 4.6-6.0mg/l |
| BOD | 6mg/l |
| COD | 10mg/l |
| NITRATE | 45mg/l |
| SULPHATE | 250mg/l |

## IV. Conclusion -

From the results of the studies it is concluded that the physico-chemical characteristics of water of river Mandakini water covering various inorganic non- metallic constituents pH, TDS, TSS, TH, Alkalinity, DO, BOD, COD, Nitrate and Sulphate.
The pH values were found between 7.49 to 8.5, TDS 290 to 470mg/l, TSS 140 to 192mg/l, TH 250 to 288mg/l, Alkalinity 175 to 198mg/l, DO 3.19 to 6.5mg/l, BOD 2.5 to 12 mg/l, COD 10 to 38mg/l, Nitrate 3 to 9mg/l, Sulphate 3 to 8mg/. Most of the samples BOD and COD are higher than the permissible limit prescribed by WHO (1994) as 6mg/l and 10mg/l respectively.TDS, TSS, TH, Alkalinity, Nitrate and Sulphate of all the results below the WHO recommended values as 500mg/l, 200mg/l, 300mg/l, 200mg/l, 45mg/l, 250mg/l.

It is concluded that the water of river is not highly polluted but there is an indicating of increasing pollutant due to anthropogenic activities. There is considerable need for better understanding so that one can be manage safe water quality affectively making it suitable for drinking purpose

and it is advised not to consume water without pre - treatment.

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