



Research Paper

Water quality of River Tamus, Satna Madhya Pradesh, India

Rama Sharma* and Shivesh Pratap Singh

Department of Agriculture science and technology, Amicable Knowledge Solution (AKS)
University, Satna 485001 India

Department of Zoology, Government (Autonomous) Post Graduate College, Satna (MP) India

*Corresponding author; Email: rama81093@gmail.com

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Abstract: River Tamus originated from Kaimour ranges and passes through Maihar and goes towards Satna near Belhata the water sample were collected from Belhata (Near Bardighat) and near PHED station. The water samples were analyzed for Temperature, Turbidity, Colour and Odor, pH, Specific Conductivity, Total Solids, Chloride, Total alkalinity, Total hardness, Dissolve oxygen, Chemical Oxygen Demand, Total coliform and Fecal coliform. The observed values of physicochemical parameters were compared with World Health Organization and ISI standard values. The result shows that the permissible limit were observed for pH, Total solids and Total hardness after comparison with standard values, whereas Total alkalinity, Total coliform and fecal coliform were observed higher than desirable standards.

Keyword: Physico chemical parameters, monthly variation, Tamus River.

Abbreviations: United Nations General Assembly (UNGA), American Public Health Association (APHA), National Environmental Engineering Research

Institute (NEERI), World Health Organization (WHO), Indian Standard Institute (ISI), Chemical Oxygen Demand (COD).

INTRODUCTION

Water is most important abiotic natural resource which is abundantly available in many forms such as cloud, rain, fog, ice snow dew etc. in nature. It is absolutely true that no life without water means that mans, plant, animal as well as microorganisms depends on water for survival. It is principal raw material for food production.

Government of India many social works and NGO's have to take preventive measures to avoid careless use, pollution and contamination of available water resources. Global literature survey reveals that 70% earth surface covered by water but it is true that in spite of such abundance of water there is shortage of soft, pure fresh water in the world. Out of total water on the earth, 93.7% water marine which is unsuitable for human being. There is rivers, lake, swamps etc is fresh and soft for human consumption.

Trivedi, 1998 estimated that only 0.00192% of total water on earth is available for human consumption and about 70% of the world's population survives without clean and fresh water. In India 50% population is not served by requisite amount of water and sanitation. UNGA celebrated decay 1981-1990 as international drinking water supply and sanitation decade. India is mainly depending upon the monsoon rains for fresh water. Fresh water bodies are endangering due to numerous anthropogenic activities which threatened environmental health of both surface and ground water. NEERI estimated the 70% total fresh bodies of India are polluted (Agrawal, 1999). The hydrobiology (Physical, chemical and biological) is most important the level of water pollution F. A. Forel (1841-1912) and Pruthi (1933) carried out much work in limnology.

The present study emphasized on the assessment of water quality of Tamus River is necessary of many resources. Main objective is to provide information on hazardous pollutants in the water. The present study will also be helpful to provide data bank for hydrobiological studies which can increase environmental awareness all over the world.

This is drained water is used by the people in the form of domestic as well as in irrigation and industries. The study was carried out at Madhavgarh (Satna) from March 2010 to June 2010 and the water samples were collected in the morning between 6.30-8.30 a.m.

Different parameters like Temperature, Turbidity, Colour, and Odor, pH, Specific Conductivity, Total Solids, Chloride, Total alkalinity, Total hardness, Dissolve oxygen, Chemical Oxygen Demand, Total coliform and Fecal coliform were carried out by different means. Two sites of Tamus River

were selected for present study of the water quality.

MATERIALS AND METHODS

Description of study area:

Satna: The District of Satna is situated between latitudes 23° 58' and 25° 12' north and longitude 80° 21' and 81° 23' east in mid northern part of Rewa Commissioner's Division in Madhya Pradesh state of India. The district takes its name from Satna.

The Tamus River originated from Kaimor ranges. It altimetry passes through the Maihar and goes towards Satna near Belhata. There is Anicate at Madhavgarh from it goes to Goraiya and Bakiya (There is a Baraj) from here it enter to Rewa District ultimately It reach Chakghat. Near Chakghat from here it joins Ganga nearby Naini.

The Tamus River originated from kaimour ranges. The Tamus River is the lifeline of Satna. There are three seasons of i.e. hot summer, rainy and chilled winter. The average rainfall of Satna has been recorded 1136 mm most of the rain water drains out in Tamus River due to the topography of Satna. The sites selected for the present investigation in Madhavgarh of District Satna in Summer Season March 2010 to first week of June 2010. The study was carried out with sample collected from river in the morning between 6.30 am to 8.30 am. The samples were collected for Physico-chemical and biological analysis. Physico-chemical and Biological parameters measured by the standard methods of APHA (1989), NEERI (1986), Trivedi and Goel (1984). The data obtained was finally calculated and tabulated.

RESULTS

Various physico-chemical & biological parameters studies showed variations in summer season and inter-relationship among

© Copyright 2014 | ijgsr.com | All Rights Reserved themselves and their effect on biota inhabiting in the Tamus River revealed. During the present study the water sample were collected early mornings between 6.30 to 8 a.m. in the Ist, IInd, IIIrd week of each month of summer season (March 2010 to June 2010). Two site of Tamus River was selected for sampling.

1. **Water temperature:** The temperature is one of the most important factors in an aquatic environment and profoundly influences the nature of water body. Temperature was ranging 23⁰C-30⁰C in sampling site A (Village Belhata). It was lowest in March 23⁰C and highest 30⁰C June 2010. In Site B (Near P.H.E.D. Station) was ranging 25⁰C-32⁰C. It was lowest during March 2010 25⁰C and highest 32⁰C in June 2010.
2. In colour, odor and appearance of water have no more differences in summer season water was clear and odorless.
3. **Hydrogen Ion Concentration (pH):** pH is greatly affected by photosynthetic activity of aquatic plants, exposure of air temperature, disposal of sewage and disposal of Industrial water etc. The higher values of pH during the month of may 2010 are attributed to high photosynthetic activity pH was ranging in sampling site A (Village Belhata) 7.5-8.2 It was observed lowest average 7.5 in April 2010 and highest average 8.2 in May 2010. In sampling site B (P.H.E.D. Station) was ranging 7.8-8.6 It was recorded lowest average 8.1 in April and highest average 8.4 in May.

4. **Specific Conductivity:** Specific conductivity was ranging in Site A 1.107 to 1.89 $\mu\text{mho}/\text{c.m.}$ and it was recorded lowest average in March 1.107 $\mu\text{mho}/\text{c.m.}$ and highest average in Jun 1.89 $\mu\text{mho}/\text{c.m.}$ In sampling site B specific conductivity was ranging 0.167 to 1.197 $\mu\text{mho}/\text{c.m.}$ and it was found lowest average 0.168 $\mu\text{mho}/\text{c.m.}$ in May and highest average 1.194 $\mu\text{mho}/\text{c.m.}$ in March 2010.
5. **Total Solids (T.S.)** Total Suspended Solids (TSS): These two (TS and TSS) together make the solids in water. The presence of solids in water vary greatly vary at different time and affect the density of water and thereby the quality of aquatic environment. Total Solids was ranging in Site A 989-1315mg/liter and it was noted lowest average in March 990 mg/liter and Highest average in June 1314 mg/liter. In Site B Total solids was ranging 1068-1270 mg/liter and it was observed lowest average 1070 mg/liter in March and Highest average 1269 mg/liter in June 2010.
6. **Chloride:** Chloride is present in fresh water in the form of calcium, Magnesium and sodium salts. The concentration of chloride content is also used as an indicator of pollution in fresh water. Chloride was ranging in Site A 48-84.9 mg/liter and it was recorded lowest average value in April 49 mg/liter and highest average value 84.7 mg/liter in June 2010. In Site B Ranging of chloride 48.8-74.9 mg/liter and it were noted lowest average 49.5 mg/liter in April and highest average 74.7 mg/liter in June 2010.

7. Total Alkalinity: The alkalinity of natural water is caused by carbonates of calcium and magnesium. In Site A -It was ranging 246-304mg/liter. It was recorded lowest average value 247 mg/liter in March 2010 and highest average value 303 mg/liter in May 2010.

In Site B was ranging 221-320 mg/liter and It was noted found lowest average value 222 mg/liter in March and highest average value 319 mg/liter in June 2010.

8. Total Hardness: It shows quality of water supplies, the hardness is governed by content of calcium and magnesium salt, largely combined with bicarbonates and carbonates and with sulphate, chloride and other anions. In Site a total Hardness was ranging 361-508mg/liter and it was noted lowest average value 363 mg/liter in April and highest average value 507mg/liter in June. In site B was ranging 298-496mg/liter and it was recorded lowest average 299mg/liter in June and highest 495 May 2010.

9. D.O. (mg/lit): Dissolved oxygen is important for aquatic system and also essentials for the metabolism in the organisms. There are two main sources of D.O. in water *i.e.* by diffusion from air and photosynthetic activity.

In site A D.O. was ranging 6.8-8.20 mg/lit. and it was lowest 6.9 mg/l in March and highest in 8.19 mg/l in April.

In site B was ranging 5.5-7.1 and it

was found lowest average value in 5.8 mg/lit. June and highest average value 6.9 mg/lit. in March 2010.

10. C.O.D. (mg/lit): In site A C.O.D. was ranging 37.15-67.20 mg/l. It was

noted lowest average value 37.44 mg/l in April and highest average value 67.19 mg/l in June. In site B was ranging 30-48.mg/lit. It was recorded lowest average value 31 mg/lit. in May and highest average value 47 mg/lit. in June 2010.

11. Total Coliform: In Site A Total coliform was ranging 124-147 mpn/100ml. and it was observed lowest average value 125 mpn/100ml. in March and highest average value 146 mpn/100ml in April.

In site B Ranging 117-250 mpn/100ml and it was recorded lowest average value 172 mpn/100ml in March and highest average value 249 mpn/100ml in June 2010.

12. Fecal coliform (mpn/100ml): Fecal coliform was measured in site A. It was ranging 3-12 mpn/100ml and it was recorded lowest average value 4 mpn/100ml in May and highest average value 11 mpn/100ml in March.

In site B was ranging 16-30 mpn/100ml and it was noted lowest average value 17 mpn/100ml in April and highest average value 28 mpn/100ml June 2010.

The above comparative variations are shown in table 1 and table 2.

Table No. 1. Monthly Variations of Physico-chemical Parameters of Tamus River at Village Belhata Satna (M.P.) Sampling Site A- Near Bardhiaghat.

| S. No. | Parameters | March | | April | | May | | June | |
|--------|-----------------------------------|-------------|---------|-------------|---------|-------------|---------|-------------|---------|
| | | Range | Average | Range | Average | Range | Average | Range | Average |
| 1. | Temperature (0 ^o) | 24.8-25.0 | 24.9 | 27.5-28.5 | 28 | 28.1-28.5 | 28.3 | 30.1-32 | 31.2 |
| 2. | Turbidity (ppm/ntu) | 185-187 | 186 | 190-192 | 191 | 224-226 | 225 | 227-230 | 220 |
| 3. | Appearance | Clear | - | S/Turbid | - | S/Turbid | - | Turbid | - |
| 4. | Colour | colourless | - | greenish | - | greenish | - | Yellowish | - |
| 5. | Odors | odorless | - | odorless | - | odorless | - | odors | - |
| 6. | pH | 8.0-8.3 | 8.1 | 7.1-8 | 7.5 | 8.0-8.5 | 8.2 | 7.9-8.2 | 8.0 |
| 7. | Specific Conductivity (µmho/c.m.) | 1.105-1.109 | 1.107 | 1.190-1.192 | 1.191 | 1.180-1.182 | 1.181 | 1.87-1.91 | 1.89 |
| 8. | Total Solid (Mg/l) | 989-991 | 990 | 1102-1104 | 1103 | 1184-1186 | 1185 | 1313-1315 | 1314 |
| 9. | Chloride(Mg/l) | 58-60 | 57 | 48-50 | 49 | 53-55 | 54 | 82.8-84.9 | 84.7 |
| 10. | Total Alkaline (Mg/l) | 246-246 | 247 | 286-288 | 287 | 302-304 | 303 | 286-288 | 287 |
| 11. | Total Hardness (Mg/l) | 410-412 | 411 | 361-364 | 363 | 445-448 | 446 | 506-508 | 507 |
| 12. | Dissolve Oxygen (Mg/l) | 6.8-7.00 | 6.9 | 8.17-8.20 | 8.19 | 7.48-7.50 | 7.49 | 8.8-8.10 | 8.9 |
| 13. | C.O.D. (Mg/l) | 55.1-56.00 | 55.5 | 37.15-38.00 | 37.44 | 47.90-48.00 | 47.95 | 67.18-67.19 | 67.19 |
| 14. | Total Coliform (mpn/100ml) | 124-126 | 125 | 145-147 | 146 | 126-128 | 127 | 138-140 | 139 |
| 15. | Fecal Coliform (mpn/100ml) | 10-12 | 11 | 8-12 | 10 | 3-6 | 4 | 6-10 | 8 |

Table-2. Monthly Variations of Physico-chemical Parameters of Tamus River at Village Madhavgarh Distt. - Satna (M.P.). Sampling Site B- Near P.H.E.D. Station

| S.No. | Parameters | March | | April | | May | | June | |
|-------|-----------------------------------|-------------|---------|-------------|---------|-------------|---------|-------------|---------|
| | | Range | Average | Range | Average | Range | Average | Range | Average |
| 1. | Temperature (0°) | 24.5-25.1 | 25.0 | 26.5-27.5 | 27.0 | 28.0-29.0 | 28.5 | 29.1-30 | 29.5 |
| 2. | Turbidity (ppm/ntu) | 182-184 | 183 | 268-271 | 269 | 276-278 | 277 | 267-269 | 268 |
| 3. | Appearance | Clear | - | S/Turbid | - | S/Turbid | - | Turbid | - |
| 4. | Colour | colourless | - | Greenish | - | Greenish | - | Yellow | - |
| 5. | Odour | odourless | - | Fishes | - | Fishes | - | Odourless | - |
| 6. | pH | 8.0-8.5 | 8.2 | 7.8-8.5 | 8.1 | 8.3-8.5 | 8.4 | 8.0-8.5 | 8.2 |
| 7. | Specific Conductivity (µmho/c.m.) | 1.190-1.197 | 1.194 | 0.196-0.198 | 0.197 | 0.167-0.169 | 0.168 | 0.175-0.180 | 0.177 |
| 8. | Total Solid (Mg/l) | 1068-1072 | 1070 | 1185-1188 | 1186 | 1178-1180 | 1179 | 1268-1270 | 1269 |
| 9. | Chloride(Mg/l) | 69.5-70.1 | 69.5 | 48.8-50 | 49.5 | 58-60 | 59 | 74.6-74.9 | 74.7 |
| 10. | Total Alkaline (Mg/l) | 221-224 | 222 | 282-284 | 283 | 310-312 | 311 | 318-320 | 319 |
| 11. | Total Hardness (Mg/l) | 346-348 | 347 | 338-340 | 339 | 494-496 | 495 | 298-300 | 299 |
| 12. | Dissolve Oxygen (Mg/l) | 6.8-7.1 | 6.9 | 5.5-6.5 | 6 | 5.7-5.9 | 5.8 | 5.5-6.0 | 5.8 |
| 13. | C.O.D. (Mg/l) | 46-48 | 47 | 34-36 | 35 | 30-32 | 31 | 46-48 | 47 |
| 14. | Total Coliform (mpn/100ml) | 171-173 | 172 | 210-212 | 211 | 232-234 | 233 | 248-250 | 249 |
| 15. | Fecal Coliform (mpn/100ml) | 20.1-21 | 20.5 | 16-18 | 17 | 23-26 | 24 | 27-30 | 28 |

DISCUSSION

According to Lund and Talling (1957) and Odum (1975) temperature as one of the most significant factors, which not only affects the thermal stratification and distribution of aquatic organism but also influences the geochemical aspect of a water body. According to Prasad (1916) it controls the growth and diversity of planktonic population. The maximum temperature of water was registered during summer seasons. Hydrogen ion concentration is an important limiting factor for a water body.

Its measurement reflects the intensity acidic or basic character of water.

The pH range at present Tamus River from 7.5 to 8.2°C indicates its alkaline nature. High pH values during summer may be due to high photosynthesis of micro and macro vegetation resulting in high production of free carbon dioxide during the equilibrium towards alkaline side. Similar results were reported by Singh (1960), Zutshi and Khan (1977), Bagde and Verma (1984), Takamura Sugaya (1989). According to Schindler et al. (1978) some carbon dioxide is derived from

atmosphere. However it is less soluble in water. Sreenivasan (1965) started that free carbon dioxide was either consumed completely by autotrophs or it was inhibited in the bicarbonates. Carbonates and bicarbonates and hydroxide components not only contribute the major part or total alkalinity but also affect the primary production and other metabolic process of aquatic organism. Carbonate and bicarbonate alkalinity present Tamus River from 246 to 304 mg/lit. The Occurrence of high carbonates alkalinity and low carbonate alkalinity during summer may be due to high uptake of free carbondioxide from bicarbonates during rapid photosynthesis, resulting in the conversion of bicarbonates to carbonates in water. Similar findings have also been observed by Wetzel (1975), Goltman et al. (1978).

The maximum alkalinity during summer night have been noted due to the increased rate of photosynthesis which increase the conversion of bicarbonates in to free carbon dioxide Lauff, (1953), George (1962).

According Jhingran (1965) the hardness in fresh water is mainly important due to presence of salts of calcium and magnesium that may exist in the form of carbonates, bicarbonates, sulphates and chlorids etc. Of course the hardness due to bicarbonates and carbonates is called as temporary hardness, where as the hardness due to sulphates and chlorides is knows as permanent hardness (APHA, 1989). The values of total hardness have been observed high during summer. This may have been observed due to high rate of evaporation and low water level.

The estimation of dissolved oxygen from a fresh water body is considered a key test to evaluate pollution. Concentration of dissolved oxygen depends on the physico-chemical condition of water, as it is less soluble at high temperature. Present water body was recorded to have dissolved oxygen form 6.8 mg/lit. to 8.2 mg/lit. with minimum concentration during summer.

The occurrence of low oxygen during summer probably was due to its low solubility at higher temperature and higher rate of aquatic degradation. The degradation of organic substance is an importance parameter in consumption of dissolved oxygen, which is to be more rapid at high temperature. The estimation of C.O.D. values varied between 37.15 mg/lit. and 67.20 mg/lit. with the minimum during summer. According to Trivedi and Goel (1986), the value of C.O.D. does not indicate the degree of degration of organic matters. More or less similar trends for the value of C.O.D. were also noted by Wadhvani (1989), Bagde and Verma (1984), Miller et al (1986) Jukka Sarkka (1989).

The observed values of physico-chemical parameters were comparing with WHO and ISI standard values. Permissible limit were observed for pH, Total solids and Total hardness after cooperation with standard value, whereas Total alkanity, Total coliform and Fecal coliform were observed higher than desirable standards. (Table No. 3)

Table: 3. Comparison of Different Water Quality Parameters at Tamus River to Standard Suggested By WHO/ISI

| Criteria | Desirable Standard | | Range in Water Body under investigation | | Remarks |
|----------------------------------|--------------------|------------|---|-------------------|---------|
| | WHO | ISI | Site A Mean Value | Site B Mean value | |
| Temperature (0 ⁰) | - | - | 26.7 | 25.0 | - |
| Turbidity ppm/ntu | - | - | 207.5 | 249.2 | - |
| pH | 7.0 to 8.5 | 6.5 to 8.5 | 7.9 | 8.2 | 3 |
| Specific Conductivity (µmho/cm.) | - | - | 1.342 | 0.434 | - |
| Chloride (mg/lit.) | 200 | 250 | 61.17 | 63.17 | 2 |
| Total Solids (mg/lit.) | 1000 | 5000 | 1148 | 1176 | 3 |
| Total Hardness (mg/lit.) | 500 | 300 | 431.75 | 370 | 3 |
| Total Alkaline (mg/lit.) | - | 200 | 281 | 283 | 1 |
| DissolveOxygen (mg/lit.) | - | - | 7.87 | 6.12 | - |
| C.O.D. (mg/lit.) | - | - | 52.02 | 40 | - |
| Total Coliform (mpn/100ml.) | >10 | >10 | 134.2 | 216 | 1 |
| Fecal Coliform (mpn/100ml.) | Nil | Nil | 8.2 | 22.3 | 1 |

1. Higher than desirable standard
2. Lower range than desirable standard.
3. Permissible Limit.

* No remarkable change was observed in colour, odour and appearance of the water during summer season.

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