

PARAMETRIC VARIATIONS IN WATER QUALITY OF MAHANADI RIVER AT CUTTACK TOWN, ODISHA

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The water quality of Mahanadi River at Cuttack are studied by analysing the Physico-chemical parameters to assess the suitability for consumption. The sampling is done on monthly basis and study period is divided in three parts, i.e., pre-monsoon, monsoon and post-monsoon. These parameters are compared with those standard values, which are recommended by Indian Council of Medical Research (ICMR) and World Health Organization (WHO). The water at this point is found moderately hard. Other parameters also have shown a deviation from standard value but they are well within permissible limit.

KEY WORDS : Ground water, Physico-chemical, Water quality and Human activity.

INTRODUCTION

Cuttack is a small town. The main source of water at Cuttack is river flowing through Cuttack towards low area. The river is popularity known as Mahanadi. At Cuttack, there is high potential of water pollution. Fishermen use the insecticides for killing the fishes at large scale at this point, causing water pollution. The polluted water is used by public and facing severe health problems. This point has become an illegal trade centre for fishing. The fishermen use poisonous chemical for fish killing, the whole area is covered with bad smell, causing headache, nausea to people. There is high susceptibility of water pollution and continuous monitoring of water quality is necessary in the interest of people of Cuttack town. Thus both Cuttack town along with all surrounding villages are at great risk of contaminated water. Any time it may be proved hazardous to consume such polluted water. Various human activities also causing pollution to river water. Flowing of human and animal wastage directly into the river further deteriorating the water quality. Thus there is high potential for environment pollution at Cuttack, because of these human activities.

No initiation has been taken so far to assess the current status of water quality at this point. A systematic study is attempted to investigate the water quality of this area. In view of above, the Physico-Chemical parameters of water have been determined. These are colour, odour, taste, pH, electrical conductance, total dissolved solids (TDS), dissolved oxygen (DO), chemical oxygen demand (COD), bio-chemical oxygen demand (BOD), calcium and magnesium hardness. Some anions like chloride, nitrate, sulphate are also determined.

MATERIALS AND METHODS

Samples were collected on monthly bases, covering whole year, starting from Feb. 2014 to Jan. 2015. Samples were collected in plastic bottles as per standard procedure. Suitable preservative are used (Mathur 1976) [2]. Analysis was done as per method given by AWWA, APHA (1985) [3] and other standard methods (Grassoff 1976, Strikland and Parsons 1972) [4, 5]. Trivedy and Goel (1984) [6]. Temperature, pH value and D.O. were immediately analyzed (NEERI 1986) [7]. Temperature was measured by 0.1°C precision thermometer. The pH values were determined in situ. by pH meter. Period of investigation are divided into three part premonsoon (February to May), monsoon (June to September) and postmonsoon (October to January) sampling area of Mahanadi Bridge, COD, BOD, DO, total hardness chlorides, sulphate, nitrate, phosphate, calcium and magnesium hardness were analyzed by standard methods. APHA 1989 [8], Manivaskam 1986 [9] A.R. grade chemicals were used. The results are tabulated in table 1.

RESULTS AND DISCUSSION

Temperature of water samples collected each month showing variation. It may be due to the different timing of collection. The seasonal effect also plays an important role for water temperature. The min. temp. 20.6°C and max. temp. 25.6°C were reported during premonsoon. The highest temp. 26.0°C and lowest temp. 16°C has been observed in the month of May and January respectively. The maximum pH value of 7.90 and minimum pH value of 7.19 were recorded in month of May and March respectively. The pH values were found well with in permissible limit prescribed by WHO 1985, i.e., 7 to 8.5 [10], ISI 91, i.e., 6.5 to 8.5 [11], USPH (De 1999, i.e., 6 to 8.5). The pH values were showing slightly alkaline trend, which may be due to activities performed like washing of cloths by using soaps and detergents. Electrical conductance varied in different samples ranging from 380 μ mho per cm. to 300 μ mho per cm. These values are higher than standard limits electrical conductance is a function of ion concentration; this can be used for quick checking of dissolved substances in water. Langenegger 1990 [12] has described the importance of electrical conductance. It is a measure of salinity which effect the taste of water. Edet (1993) described how taste makes water as potable [13]. Dissolved oxygen value are found ranging from 8.6 to 5.4 mg/l. Lower value of D.O. is reported in the premonsoon. It may be due to the decomposition of organic matter and limited flow of water. This fact is previously supported by Gonzalves and Joshi 1946 [14]. Badge and Verma 1985 [15], during monsoon and post monsoon the level of D.O. was quite satisfactory perhaps it is due to aeration caused by rainwater. This finding is also supported by previous workers [16], Hannan *et al.*, 1978, Hannan 1979, Mahadevan and Krishna Swami 1983 [17]. Chemical Oxygen Demand (COD) values are shown in table 1. These values are varied from min. 7.7 mg/lo to max. 18.9 mg/lo during post monsoon and premonsoon respectively. The COD level, in general is high than recommended by WHO, De, 1999 [18]. The high value of COD indicate the possibility of pollution due to chemically oxidisable organic matter. In present case the COD level is not so high even then continuous monitoring is necessary so that the direct disposal of organic matter into river should be strictly prohibited. The biological oxygen demand are found maximum during premonsoon the maximum BOD level of 11.35 mg/l and minimum BOD level of 3.35 mg/l are found during the month of February and November respectively. During post monsoon the BOD level are found generally low *i.e.*, from 3.25 mg/l to 4.50 mg/l. This may be due to removal of oxygen

demanding organic waste by rainy water. These values are higher than values recommended by ICMR 1975 [19] and ISI 1995, *i.e.*, 3 mg/l. The high values of BOD during premonsoon are expected due to deposition of dead organic matter in the river. The high BOD level is also may be due to mixing of effluent discharge into river.

Table 1 : Results of water analysis at Cuttack Town (Mahanadi River), Odisha

| S. N. | Parameters | Seasons | | | | | | | | | | | |
|-------|----------------|-------------|-----------|-----------|-----------|----------------|----------------|----------|----------|--------------|-----------|-----------|-----------|
| | | Pre monsoon | | | | Monsoon | | | | Post monsoon | | | |
| | | Feb. | Mar. | Apr. | May | Jun. | July | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. |
| 1. | Colour | Colorless | Colorless | Colorless | Colorless | Greenish Muddy | Greenish Muddy | Muddy | Muddy | Colorless | Colorless | Colorless | Colorless |
| 2. | Odour | Nil | Nil | Nil | Nil | Fishy | Disagreeable | Fishy | Fishy | Nil | Nil | Nil | Nil |
| 3. | Taste | Normal | Normal | Normal | Normal | Metallic | Metallic | Metallic | Metallic | Normal | Normal | Normal | Normal |
| 4. | Temperature °C | 20.6 | 21.3 | 24.9 | 25.6 | 26.90 | 25.8 | 25.8 | 25.6 | 18.2 | 18.1 | 16.5 | 16.0 |
| 5. | pH | 7.52 | 7.19 | 7.25 | 7.90 | 7.30 | 7.55 | 7.80 | 7.80 | 7.65 | 7.64 | 7.35 | 7.80 |
| 6. | E.C. | 355 | 359 | 356 | 358 | 380 | 380 | 385 | 389 | 355 | 300 | 319 | 329 |
| 7. | D.O. | 5.9 | 6.2 | 5.8 | 5.8 | 6.4 | 6.3 | 6.9 | 7.1 | 7.3 | 8.3 | 8.3 | 8.6 |
| 8. | C.O.D. | 18.3 | 18.6 | 18.9 | 18.6 | 16.9 | 15.6 | 16.0 | 8.2 | 8.5 | 7.9 | 8.7 | 8.7 |
| 9. | B.O.D. | 11.35 | 11.30 | 11.29 | 9.60 | 8.35 | 8.65 | 8.75 | 8.75 | 3.50 | 3.35 | 3.25 | 4.50 |
| 10. | T.D.S. | 275 | 269 | 250 | 305 | 395 | 365 | 375 | 395 | 376 | 356 | 365 | 375 |
| 11. | Total hardness | 165 | 175 | 189 | 189 | 210 | 185 | 195 | 199 | 206 | 225 | 220 | 225 |
| 12. | Chloride | 34.3 | 35.5 | 35.8 | 24.8 | 23.5 | 24.8 | 25.6 | 24.5 | 26.9 | 26.9 | 26.8 | 27.2 |
| 13. | Sulphate | 65.3 | 65.6 | 66.3 | 76.3 | 75.9 | 73.6 | 73.4 | 74.5 | 74.9 | 77.4 | 76.9 | 75.5 |
| 14. | Nitrate | 4.35 | 4.5 | 4.00 | 6.10 | 6.19 | 6.03 | 5.98 | 5.90 | 5.85 | 5.20 | 5.20 | 5.75 |
| 15. | Phosphate | 2.66 | 2.26 | 2.70 | 2.70 | 2.68 | 2.96 | 2.85 | 2.85 | 2.69 | 2.66 | 2.89 | 2.86 |
| 16. | Ca Hardness | 130.95 | 130.95 | 131.20 | 128.20 | 115.26 | 113.95 | 127.90 | 126.50 | 121.00 | 131.05 | 130.40 | 131.50 |
| 17. | Mg Hardness | 135.60 | 135.85 | 130.75 | 124.00 | 125.00 | 125.00 | 136.00 | 136.00 | 135.00 | 132.00 | 125.00 | 130.00 |

Except pH, E.C. (μ mho/cm) total hardness, Ca hardness, Mg hardness (as ppm CaCO_3 equivalent), all other units are in ppm.

Total hardness is found ranging from 165 to 225 mg/l which are well with in permissible limit. Bureau of Indian Standard New Delhi has commended the limit of total hardness in drinking water ranging from 200 mg/l to 600 mg/l. Hardness of water is mainly due to presence of carbonate of Ca and Mg. It is expressed in terms of an equivalent amount of calcium carbonate. The water of this area is moderate hard. The presence of chloride, sulphate, nitrates and found well within permissible limits. Chlorides are present in range from 23.5 to 35.5 mg/l, therefore these ions create no problem. There is no specific permissible limit for phosphate. The natural water contains phosphate less than 0.1 mg/l. Therefore, seeing the data of phosphates indicates higher level and this may be due to geochemical nature of the underlying rocks.

CONCLUSION

The physico-chemical properties of river water at Mahanadi Bridge were analysed. The result indicate that the water is moderately hard having slightly alkaline nature. Due to washing and bathing, this point of river shows froth collection with fishy bed smell which restrict the use as potable water without proper pretreatment. Till now the situation is not very serious even then, the continuous monitoring of water quality at this point is necessary. The activities like garbage throwing and effluent flowing into the river must be stopped immediately.

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