

An Assessment of water quality parameters of Brahmani river water at Samal, Anugul, Odisha

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Abstract

Physico-chemical parameters of river water Brahmani, at Samal, Anugul, Odisha were determined to reveal the aptness of water for drinking purpose or domestic applications. The physico-chemical aspect such as Colour, Odour, temperature, pH, electrical conductivity (EC), turbidity, total dissolved solids (TDS), dissolved oxygen (DO), total alkalinity (TA), total hardness (TH), calcium (Ca^{2+}), magnesium (Mg^{2+}), chemical oxygen demand (COD) and chloride (Cl) values were investigated. Then, the Water Quality Index (WQI) was evaluated. Analysis of various parameters inferred that the water quality index of the river Brahmani is unfit for drinking.

Key words: Water quality index, Dissolve oxygen, Turbidity, Total dissolved solids

Introduction

River water is the key source for the irrigation and also domestic purpose. The cities, villages nearby to the river generally depends upon this precious source of water. But due to the human population expulsion, rapid industrializations, introduction of various types of chemicals in household practices and use of huge amount of fertilizers, pesticides, weedicides *etc.* in the agricultural practices polluting and damaging this natural water resources to a greater extent and threatening their existence[1-6]. Due to decrease in rain fall to a significant level and increase in the population also contributing to the water pollution. The various pollutant present in the water caused many diseases which becomes threatens to all living organisms. Thus the availability of good quality water is an indispensable feature for preventing diseases and improving quality of life [7,8]. Various physico-chemical parameters like pH, turbidity, alkalinity, total hardness, total dissolved solid, calcium, magnesium and chloride concentration have a vital role in determining the portability of drinking water. Water quality index (WQI) is an important criteria to find the

suitability of water [9-13]. WQI is a rating that summarizes various the water quality parameters to rating the quality of the water.

Keeping in view of the above facts under consideration the present study was targeted for the study of the various physico-chemical parameters of Brahmani river water at Samal, Anugul, Odisha. Samal is situated in the district of Anugul in the state of Odisha, India. It is 40-km away from Angul district headquarter and 20 km from Talchar, Samal. This place established a slot for itself in the impressive corridor of Odisha tourism [14]. The establishment of a Hydroelectric Project in Samal is increased its importance in the region. Some of the leading industries located in this area are: Thermal power station, Heavy water project, Fertilizer corporation of India, NALCO, Orichem Limited etc..

Materials and methods

Samples were collected using polythene bottles of two liter capacity with stopper. These bottles were cleaned properly before use as per procedure adopted earlier [15]. The samples were collected between 10 am to 11 am. Mercury glass thermometer and portable pH meter were used to . measured Temperature and pH of water samples respectively in the sampling side immediately after collecting the samples. Other physico-chemical parameters were analyzed in the laboratory within 4h of collection. Electrical conductivity, turbidity and TDS were measured by the help of Water and Soil analysis kit. All other parameters such as dissolved oxygen (DO), biochemical oxygen demand (BOD), chemical oxygen demand (COD), total alkalinity, hardness, chloride, total solids and total dissolved solids were estimated following the standard methods as detailed in Standard methods [15,16].

Results and discussion

The water samples were collected in the month of March from river Brahmani, at Samal in the district of Anugul, Odisha, India. Two samples were taken as sample 1 and sample 2. In Table 1, various physico-chemical parameters of the water samples obtained are presented. These parameters are described below:

Colour: Mostly colour of the water is due to presence of organic materials such as leaves, woods in various stages of their decomposition. The other factors that contribute towards the colour of the water are natural metallic ions, planktons, weeds and industrial wastes.

Odour: The odour of the water is caused by the presence of various gases emitted due to the decomposition of phytoplankton and/or zooplankton. The odour of the samples under study was found to be odourless.

Temperature: One of the important biologically significant factor is temperature of the water which has a significant role in the metabolic actions of the species. The temperature of both the sample 1 and 2 was found to be 26°C at the sampling.

pH: The strength of the acid or alkaline order of a solution is indicated in terms of pH scale. The quantitative presence of dissolve gases like CO₂, NH₃, H₂S etc contributed towards pH values of the water. The pH values of water sample 1 and 2 are 7.90 and 8.10 respectively, and were within the limit prescribed by ISI.

Electrical conductivity (EC) in micro-ohm/cm: The conductance of a solution is expressed in terms of Electrical conductivity (EC). It signifies the amount of total dissolved salts present in water¹⁴. The EC of water depends upon the presence of ions, concentration, mobility, valencies of ions as well as the temperature. EC values were found to be 125 and 121 micro-ohms/cm for sample 1 and sample 2 respectively.

Turbidity: The term turbidity in water is caused by the presence of suspended materials like clay, finely divided organic and inorganic substances, slit, soluble chromogenic materials, plankton and other microorganism that able to interfaces with the passage of light through the water or in which visual deepness is limited. Less penetration of sunlight due to turbidity have tremendous affect on the aquatic life as it slow down the photosynthesis process. The turbidity of both the sample was found to be 27 and 27 nephalometric unit.

Dissolved oxygen: Dissolved oxygen imitate the total physical and biological materials prevailing in the water. The main sources of dissolved oxygen are diffusion of oxygen from air as well as photosynthetic activity taking place in aquatic bodies [17,18]. The DO level indicate the degree of pollution in water bodies. In the present study, DO values obtained for the samples are 6.68 and 7.0

for the respective sample 1 and sample 2, which are above the permissible limit of WHO as well as ISI.

Total solid: Total solid is referred to all the solid materials present in water including the dissolved one. Total solid can be define as the residual matter that remains after the evaporation and drying of water at a particular temperature. The total solids present in the sample 1 and sample 2 is 140.5 gm/L and 138.2 gm/L respectively.

Total dissolve solids: In water, the main ingredient of dissolved solids are salts of bicarbonates, sulphates, carbonates, chlorides, nitrates, phosphates of metal ions like sodium, magnesium, potassium, calcium, manganese and iron to name a few. The source of these salts are rocks, mines and soil. The metabolism and physiology of aquatic life get effected due the presence of high amount total solid as well as total dissolve solid. In the water samples of present study, the total dissolved solids was found as 80 mg/L and 78 mg/L in sample 1 and sample 2 respectively, which are within permissible range as recommended by ISI organization.

Total suspended solid: The residue that is left over by a filter paper is termed as Total suspended solid. This is also another indicator of the extent of water pollution as higher the amount of amount of suspended solid, higher will be the water pollution. The main source of this type of solid is sewage and industrial effluents. The total suspended solid for the sample 1 and sample 2 are 59.2 and 60.2 mg/L respectively, which is much more below the value suggested by ISI.

Chemical oxygen demand: Chemical oxygen demand (COD) is a quick study of the water sample in order to determine the amount of oxygen needed for the oxidation of all the constituents present in water. COD is a reliable parameter for judging the extent of pollution in water. In general COD of water varies with the amount of organic matter present in the water. The COD values are 9 and 13 mg/L recorded in sample 1 and sample 2 respectively.

Carbon dioxide- The concentration of CO₂ present in water is a very vital factor as it causes acidity and corrosion. The amount of carbon dioxide in sample 7.1 is mg/l and sample 7.2 is mg/l.

Chloride: The pollution of water caused by the sewage is indicated by the amount of Chloride present in the water. The chloride concentration was found for sample 1 and sample 2 as 13.90

mg/L and 13.90 mg/L respectively. These values are below the permissible limit as recommended by ISI and WHO.

Alkalinity: Alkalinity of water is its ability to neutralize a strong acid and is caused by the presence of carbonate, bicarbonate and hydroxide of calcium, sodium and potassium. The alkalinity of both the water samples was recorded as 59.84, and is under the values prescribed by the WHO and ISI.

Permanent Hardness: Permanent hardness of water is caused by the presence of nitrate, sulphate and chloride of calcium and magnesium, which can't be removed by simple boiling. On interaction with soap, these salts produce an insoluble and sticky residue commonly known as soap curd.

Blocking of pipes lines are caused by the permanent hardness. Permanent hardness of both the water sample was found to be 18.56 mg/l.

Temporary Hardness: In water presence of bicarbonates and carbonates of calcium and magnesium causes temporary hardness and it is possible to remove by boiling of water or treating with lime. Temporary Hardness of water sample 1 was found to be 1.43 mg/l and that of sample 2 was 4.83 mg/l.

Calcium and Magnesium in mg/l: Calcium and magnesium contributed towards the hardness of water. Concentration of Calcium and magnesium of sample 1 are 15.5 mg/L and 4.5 mg/L whereas the sample 2 contains 18.2 mg/L of calcium and 5.2 mg/L of magnesium. The calcium and magnesium contents of both the samples are lower than the permissible limit as per ISI.

Table 1. Observed physico-chemical parameters of Brahmani river water at Samal, Anugul, Odisha

Sl. No.	Parameters	Sample 1	Sample 2	Average	ISI
1.	Colour	Colourless	Colourless	Colourless	Colourless
2.	Odour	Odourless	Odourless	Odourless	Odourless
3.	Temperature	26	26	26	-
4.	pH	7.90	8.10	8.0	6.5-8.5
5.	Electrical conductivity	125.0	121.0	123.0	300
6.	Turbidity	27.0	27.0	27.0	10
7.	Dissolved oxygen	7.0	7.4	7.2	5
8.	Total solid	140.5	138.2	139.35	-
9.	Total Dissolved Solid	81.0	78.0	-	500
10.	Total Suspended Solid	59.2	60.2	59.85	500
11.	Chloride	13.90	13.90	13.90	250
12.	CO ₂	0.0	0.0	0.0	-
13.	Alkalinity	59.84	59.84	59.84	-
14.	Permanent Hardness	18.56	18.56	18.56	-
15.	Temporary Hardness	1.43	4.83	3.13	-
16.	Calcium	15.5	18.2	16.2	75
17.	Magnesium	4.5	5.2	4.85	30

Water quality index: Suitability of water for drinking purpose and domestic use can be determined from water quality index (WQI) [19]. This index is a numerical values depends upon the values of various physico-chemical parameters, reveals the overall water quality of a particular water body or source of water sample. WQI values are categories into five groups (a) 0-25: very bad quality of water (b) 26-50: Bad quality of water (c) 51-70: medium quality of water, (d) 71-90: Good quality of water, (e) 91-100: Excellent quality of water [20,21]. Thus greater the values of WQI, better is the quality of water. Ten physico-chemical parameters e.g. pH, Turbidity, D.O., T.S.S., T.D.S., Ca²⁺, Mg²⁺, TH, Chloride, and Electrical conductivity. The water quality index of the present water sample is 13.92, implies the very bad quality of the water and not suited for the consumption.

APPLICATIONS

This study is helpful to know the condition of the Brahmani river water at Samal, Anugul, odisha.

CONCLUSION

In this study it was intended to determine the quality of water samples particularly the physicochemical properties of water in order to in certain its WQI. The various values of the

physico chemical parameters are compared with the prescribed standard values. The water of the sampling site is slightly alkaline in nature. From the present study and outcomes, it is suggested the pre treatment of the water is required before the human consumption. The chloride, TDS, TSS concentration is below the prescribed standard value.

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