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Study on the Quality of Water in the Bhavani River

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With a view to create awareness among the public about the quality of water in the Bhavani River, which is one of the important rivers of Tamilnadu, this study has been undertaken. The samples of water have been collected at various points along the course of the Bhavani river from the Nilgiris to Bhavani Kuduthurai. The samples of water were collected using standard procedural methods. The physiochemical analysis and biological examinations were extensively carried out on each sample using known standard methods. The results of these analyses point out the fact that the Bhavani river water is being highly polluted by letting out industrial effluents, industrial waste water, agricultural run off and sewage into the stream. The presence of inorganic ions such as hexavalent chromium, sulphate ions, etc., and biological waste has contributed to the pollution of the river water. As a result water borne diseases have become common in this area and the raw water cannot be used as such for industrial purposes. The Bhavani river water should be treated properly and disinfected before being supplied for industrial purposes and human consumption.

Key Words: Quality, Bhavani river, Water.

INTRODUCTION

Water, the essential element for all living beings, is invariably polluted in all countries. India is no exception to this phenomenon[1-3]. Rivers are the life lines of a country. When they are affected, the consequences are detrimental to humanity at large. In this context to create environmental awareness among the students and public, the study of the pollution of the Bhavani river which originates in the Nilgiris and flows through Coimbatore and Erode districts has been undertaken.

In recent times the environmental activists of this area, especially Gobichettipalayam, Bhavani and Erode, have often demonstrated against the excessive pollution of the Bhavani river. The Tamilnadu Pollution Control Board has taken some measures to contain pollution of the river water. In this background it has become an important social awareness activity to examine the quality of the Bhavani river water.

EXPERIMENTAL

Samples were collected at ten different sampling points of the river from Mettupalayam to Bhavani, Kuduthurai. The samples were collected as per the standard procedural method for the chemical analysis of various constituents. The river water samples were collected in sterilized neutral glass bottles of 250 mL capacity and closed with a sterilized glass stopper and properly sealed for biological investigations.

The samples were collected as composite samples. At every point four samples were collected and then the samples were mixed together and composite samples were obtained. The samples were collected down the stream nearly 4 km away to allow thorough mixing. The samples were given the serial numbers as follows (Table-1).

TABLE-1
SAMPLING POINTS

S.No.	Place of Sampling	Sample Numbers
1.	Mettupalayam	1
2.	Chittankuttai	2
3.	Bhavani Sagar reservoir	3
4.	Sathyamangalam	4
5.	Kdivery	5
6.	Punjai Puliampatty	6
7.	Pudukarai Pudur	7
8.	Athani	8
9.	Appakudal	9
10.	Bhavani	10

All reagents were of analytical grade and solutions were made of distilled water. Various water quality parameters such as pH, alkalinity, hardness, BOD, COD etc., were determined using standard analytical methods[4–6]. The instruments used were calibrated before use for observing readings. The repeated measurements were made to ensure precision and accuracy of results.

RESULTS AND DISCUSSION

The physico-chemical tests and biological examinations were conducted employing standard scientific methods so as to minimize the determinate errors. Following are some of the observations revealed from the study of the various water quality parameters. (Table-2).

The pH values of the samples varied between 7.66 and 8.58. The World Health Organization (WHO)[7] and Indian Council of Medical Research (ICMR)[8] prescribed the limiting value of pH as between 6 and 8.5 for a sample of water to be used for industrial, agricultural and domestic purposes.

The total or phenolphthalein acidity exhibited a wide range variation. Acidity is of little concern from sanitary or public health viewpoint. Acid waters are of concern to industries because of their corrosive characteristics and the expense involved in removing or containing the corrosion producing substances.

The alkaline values of the water of the river showed an increasing trend. At Bhavani Kuduthurai where the Bhavani river flows into the Cauvery river, the alkalinity of water is very high. The recommended threshold and limiting concentration of alkalinity is 60 mg/L for laundering purposes. The analysis indicated that the alkalinity value exceeds this limiting value at all places. As a result, when this raw water is used for washing purposes it may lead to the wastage of detergents.

TABLE-2
WATER QUALITY PARAMETERS OF BHAVANI RIVER

Sample No.	pH	Phenolphthalein acidity (Total acidity) (mg/L)	Total alkalinity (mg/L)	Hardness of water (mg/L)	Ca^{2+} ions (mg/L)	Mg^{2+} ions (mg/L)	Sulphite ions (mg/L)	Sulphate ions (mg/L)	Concentration of F^- ion (mg/L)	Total solids (mg/L)	DO (mg/L)	COD (mg/L)	Ammonical nitrogen (mg/L)	Cr(VI) (mg/L)	Total count (per mL)
1.	8.33	4.2	74.5	24.05	12.83	11.20	0.36	684.0	0.442	78.0	12.00	64.0	0.000	0.12	1200
2.	7.88	3.0	47.5	16.03	10.83	5.21	0.45	705.6	0.221	146.0	10.20	42.4	0.932	0.12	1360
3.	7.66	5.0	53.0	17.64	10.42	7.21	0.52	609.6	0.884	57.0	9.44	66.2	0.155	0.12	1600
4.	7.92	11.2	83.5	26.85	16.43	10.42	0.46	631.1	1.326	156.0	7.52	8.9	0.311	0.12	1680
5.	8.30	15.6	122.5	40.48	21.24	19.24	0.50	652.7	1.326	192.0	6.56	124.0	0.155	0.12	1040
6.	8.36	17.2	140.5	47.69	26.45	21.24	0.37	684.0	0.884	251.0	8.32	35.5	0.078	0.12	1280
7.	8.39	11.0	158.5	56.11	30.06	26.05	0.36	680.0	0.884	316.0	9.52	27.8	0.078	0.12	960
8.	8.41	14.8	168.5	55.31	26.85	28.45	0.30	697.8	0.884	321.0	8.64	44.5	0.078	0.12	880
9.	8.43	15.2	178.0	62.12	34.87	27.25	0.42	660.5	1.105	335.5	7.28	37.4	0.078	0.12	1120
10.	8.58	8.8	257.0	88.98	45.29	43.69	0.38	740.9	1.326	435.0	11.8	18.8	0.078	0.12	1280

The totals hardness value lies between 16 and 88 mg/L. Hence the raw water cannot be used for boiler feed and also for laundering purposes. The amounts of calcium and magnesium vary between 10 to 45 ppm and 5 to 43 ppm respectively. The maximum limiting value of calcium in potable water is 75–2000 mg/L. The water used for industrial purposes should be free from calcium since it will cause the formation of scales in boilers.

The amount of sulphate ion is estimated to be very high at all the points. Its value varies between 600–740s mg/L. The maximum tolerance limit for sulphate ion is 400 mg/L for waters used in industries. It may cause scaling problems. It is therefore concluded that this water is undesirable for industrial purposes.

The concentration of chloride ion showed variation between 7 and 33 mg/L. The prescribed maximum tolerance limit for chloride in drinking water is 600 mg/L. In all the places throughout the course of the river the amount of chloride ion is within the limiting values.

The investigation of dissolved oxygen (DO) revealed that the value lies between 6.56 to 12 ppm. The tolerance limit for inland surface waters used as raw water and bathing ghats is 3 mg/L. At all places the water has higher DO value than the limiting value prescribed. The DO content satisfies the public water supply needs.

The chemical analysis for sulphite ion in the samples presented a value between 0.296 and 0.504 mg/L. The sulphite ion is a reducing agent. Its presence indicates the amount of sulphur content in the river water.

The amount of ammonia nitrogen varies between 0.0777 and 0.9324 mg/L in the samples analysed. It shows that there is a variation in the amount of nitrogenous matter in the river water.

The estimation of fluoride ion content shows a variant value between 0.221 and 1.326 mg/L. The World Health Organization (WHO) sets the threshold value for fluoride ion content in domestic water as 1 to 1.5 mg/L, which would prevent dental caries.

The determination of total solids indicates a wide range of variations. For drinking water the tolerance limit for total solids is between 500 mg/L to 150 mg/L. But for industrial purposes the tolerance limit prescribed in the progress report of the Committee on Water Quality Tolerance for Industrial Use is only 50 mg/L. In all the samples analysed the total solids is found to be greater than 50 mg/L.

COD test estimates the amount of a waste in terms of the total quantity of oxygen required for the oxidation of organic substances. The COD values measured vary between 18.8 to 124 mg/L. Conclusively it is proved that the river water is highly polluted.

Chromium salts are extensively used in leather and textile processing industries. Chromium enters water bodies through the discharge of industrial waste into the river stream. The toxicology study of chromium confirms that it accumulates in lungs. Chromium, which is bound to β-globulins, is found distributed in the lungs, heart, brain, liver, testis and spleen. Hexavalent chromium [Cr(VI)] is more toxic than trivalent chromium. The tolerance limit for total chromium is fixed as 0.05 mg/L or 50 ppb. The sample of water taken from the

Bhavani river, containing 0.12 mg/L of Cr(VI) is unfit for drinking purposes.

The total bacterial count was estimated to be greater than 300 per mL. According to U.S. Public Health Service, WHO and ICMR recommendations, the coliform count in any sample of 100 mL should be zero. For untreated water the value should not exceed 20. All the test samples show higher values in the total count test. It is imperative that proper disinfection methods must be adopted before the water is allowed to the public water supply systems.

The study revealed that the river is slowly but definitely polluted. The main cause for this river pollution is due to the discharge of industrial effluents, agriculture runoff and sewage into its stream. Of these contributing factors, the disposal of industrial waste water into the river leads to an increase in the pollution load. A large quantity of liquid sewage is also added to the river system without adopting any one of the treatment methods, causing an increase in the physical, chemical as well as biological pollutants. As a consequence, water borne diseases are commonly prevalent in the villages and towns situated on the banks of the Bhavani river. The river water has been found to possess high amounts of sulphates, nitrogeneous matter, suspended solids and oxidisable substances. Besides these pollutants, the river water contains a large quantity of hexavalent chromium [Cr(VI)] which is highly detrimental to public health.

In order that the Bhavani river water becomes palatable, potable, suitable for industrial and civic purposes, it should be seen that the industrial effuents and sewage are properly treated and disinfected using proper scientific methods. These steps should be taken at the individual, industrial and district administration level so that purified Bhavani river water becomes fit for all purposes of industrial and human consumption. This being a social commitment concerned with everyone's health and wealth cannot be ignored for a long time.

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