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Physico – Chemical Analysis of the Water Samples of the River Cauvery In Dharmapuri and Tiruchirappalli Districts

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Abstract

Water pollution is a serious problem in India as almost 70 percent of surface water resources and a growing percentage of groundwater reserves are contaminated by biological, toxic, organic, and inorganic pollutants. Due to industrial development and growing population the river met the challenges of pollution. In this context, the quality of surface water at Hogenakkal in Dharmapuri and Mokkombu in Tiruchirappalli has been studied. Water samples were collected in the river bank of River Cauvery near Hogenakkal in Dharmapuri District and near Mukkombu in Tiruchirappalli District and were analyzed. All the parameters are found to be in minimum level. The results showed that even though there are many possibilities for contamination the water samples in the study area are not highly polluted and the water is fit for drinking and irrigation purposes.

Key words: Inorganic pollutants, Organic pollutants, Primary standards, Secondary standards.

1. Introduction

Water pollution occurs when waste materials are released, degrading the quality of the water for other users. Water pollution includes all of the waste materials that cannot be naturally broken down by water. In other words, anything that is added to the water, above and beyond its capacity to break it down, is called pollution. In certain circumstances, pollution can be caused by nature itself when water flows through soils with high acidities. But more often human actions are responsible for the pollutants that enter the water[1-4].

Water pollution is a serious problem in India as almost 70 percent of surface water resources and a growing percentage of groundwater reserves are contaminated by biological, toxic, organic, and inorganic pollutants. In many cases, these sources have been rendered unsafe for human consumption as well as for other activities, such as irrigation and industrial needs etc. This shows that degraded water quality can contribute to water scarcity as it limits its availability for both human use and for the ecosystem[5-7].

In 1995, the Central Pollution Control Board (CPCB) identified severely polluted stretches on 18 major rivers in India. Not surprisingly, a majority of these stretches were found in and around large urban areas. Agricultural activities also contribute in

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terms of overall impact on water quality. Geo-genic contaminants, including salinity, iron, fluoride, and arsenic have affected groundwater in over 200 districts spread across 19 states.

2. Details of the study area

Water samples were collected in the river bank of River Cauvery near **Hogenakkal in Dharmapuri** District and near **Mukkombu in Tiruchirappalli** District. In most places the ground water is available at a depth of 2-3 m in the study areas[8,9].

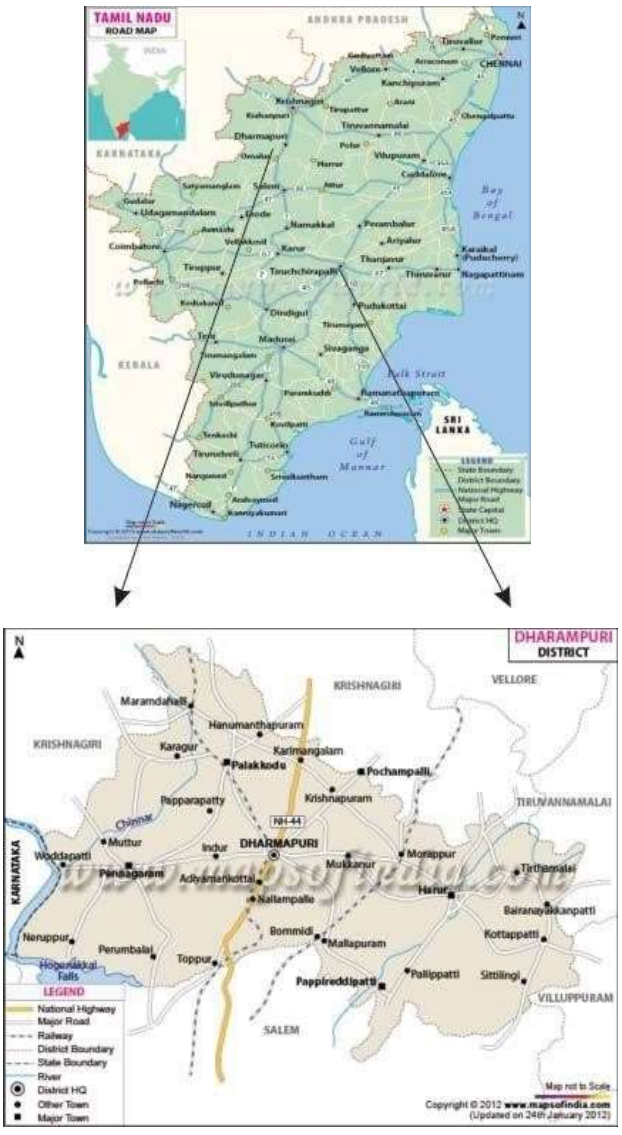

Figure.1 Dharmapuri District

Figure.2 Tiruchirappalli District

3. Experimental Work

Water samples were collected in the river bank of River Cauvery near Hogenakkal in Dharmapuri District and near Mukkombu in Tiruchirappalli District. Both the samples were analyzed for the tests given in the experimental section[10].

3.1 Turbidity

Turbidity of the samples was determined by Nephelometric method using Turbidity meter.

3.2 pH

The pH of the water samples was determined by direct reading measurement by using the pH meter.

3.3 Total Dissolved Solids (TDS)

Total dissolved solids were measured by gravimetric after filtration method.

3.4 Estimation of Total Hardness

The total hardness of the samples was estimated by Complexometric titration method.

3.5 Estimation of Calcium and Magnesium (Hardness)

Calcium and Magnesium calculated from total hardness.

$$\left.\begin{array}{l}\text{Calcium Hardness as} \\ CaCO_3\,(mg/l)\end{array}\right\} = \frac{\text{Volume of EDTA required for the sample}}{\text{Volume of sample taken}}$$

Magnesium hardness = Total hardness - Calcium hardness

From the results the amount of Calcium and Magnesium were calculated.

3.6 Alkalinity

Alkalinity was measured by titrating method.

3.7 Electrical Conductivity

The electrical conductivity of the water samples was determined by conductivity cell method.

3.8 Bicarbonate (HCO_3)

Bicarbonate was calculated from pH and alkalinity.

3.9 Sodium (Na) and Potassium (K)

Sodium and Potassium were measured by flame emission photometric Method.

3.10 Nitrate (NO_3)

Nitrate in the samples were estimated by Brucine method.

3.11. Sulphate (SO_4)

Sulphate was measured by Nephelometry method.

3.12. Chloride (Cl)

Chloride was measured by Argentometric titration method.

3.13. Fluoride (F)

Fluoride was measured by Spectrophotometric method.

3.14 Chemical Oxygen Demand (COD)

The water samples were determined by open reflux method.

$$COD = \frac{(A-B) \times M \times 8}{\text{Volume of the sample}} \times 1000$$

Where

A - Volume of FAS used for blank
B - Volume of FAS used for sample
M - Molarity of FAS
8 - Atomic weight of oxygen

4. Results and Discussion

4.1 Electrical Conductivity

The electrical conductivity has a direct relation with the total solids. The conductivity values for Hogenakkal were found to be greater than those of Mukkombu. In present observations the electrical conductivity for Mukkombu range is 720. Comparative variation is shown in the table 4.1. High electrical conductivity indicates a larger quantity of dissolved mineral salts. The water of Hogenakkal is not saline but interestingly it got even higher conductivity value is 800. We can assume that it happened due to the presence of a large amount of total dissolved solids as a result of severe pollution.

4.2 Total Dissolved Solids (TDS)

TDS analysis has great implications in the control of biological and physical waste water treatment processes. A large amount of total solids makes the river water more turbid and increases its electrical conductivity. The maximum value recorded for Hogenakkal was 456 mg/L and for Mukkombu the range is 417. Comparative variation is shown in the Table 4.1.

4.3 Colour and Odour

The two location surface water samples were colourless and odourless.

4.4 Turbidity

Turbidity as insoluble particulates impedes the passage of light through water by scattering and absorbing the rays. Turbidity measurement is important from the aesthetic point of view. Turbidity in water has a significant effect on the microbiological quality of drinking water due to the presence of bacteria and virus. The drinking water standards of Central Public Health and Environmental Engineering Organization have also been incorporated in the Table for easy quality check. On comparing the two location samples the Turbidity is nil. The turbidity in natural waters is caused by suspended matter like clay, slit, organic, matter, phytoplankton and other microorganisms.

4.5 pH

pH is a major water quality parameter. It hase been we observed no significant variation in two study areas. In Mukkombu the pH range is 7.6 and for Hogenakkal, it is 7.8. Comparative variation is shown in Table 4.2. Perhaps pollutants in Mukkobu have less influence on pH.

4.6 Temperature

Compared the Hogenakkal and Mukkombu values are same (33.5 °C). The higher temperature has shows the presence of insoluble pollutants. The locations have insoluble pollutants.

4.7 Total Hardness (TH)

The principal cations that impart hardness are Ca^{2+} and Mg^{2+}. The anions responsible for hardness are mainly bicarbonates, carbonates, SO_4^{2-},Cl^-,NO_3^-,SiO_3^{2-}. Table 4.2 shows the concentration of Ca^{2+} and Mg^{2+} range is 26 and 33 mg/L in Hogenakkal, in Mukkombu it range is 24 and 22 mg/L. Table 4.2 show the value of total hardness in Hogenakkal water sample to range is 200mg/L, hardness in Mukkombu water sample range is 150 mg/L. Total hardness was observed in acceptable range, because over the standard limits (>1300 mg/L) of hardness, water is unsuitable for irrigation as it will render the soil very alkaline[11-13].

Table 4.1 Physical quality of water samples Hogenakkal and Mukkombu

S. No	Physical Parameters	Standard A CPHEEO	Experimental Value	
			Hogenakkal	Mukkombu
1	Color	---	Colourless	Colourless
2	Odour	---	Odourless	Odourless
3	Turbidiry	2.5	Nil	Nil
4	Total dissolved solids	500	456	417
5	Electrical Conductivity	---	800	720

CPHEEO - Central Public Health Engineering Environmental Organization

4.8 Sulphate

In present study the observed value of sulphate is 53 mg/L for the river Hogenakkal. For Mukkombu, the minimum value is 48 mg/L. Comparative variation is shown in the table 4.2. Sulphate was observed in acceptable range, because over the standard limits (>400 mg/L). Sulphate is an important constituent of hardness with Ca and Mg. Excess amount of sulphate in water has carthartic effect on human health.

4.9 Sodium

If sodium content of irrigation water is high compared to the calcium and magnesium content, the sodium will be absorbed by the soil and will replace the calcium and magnesium. As the exchangeable sodium increases in the soil, the soil becomes more alkaline and adverse physical and chemical conditions develop that limit or prevent plant growth. Sodium content of Hogenakkal and Mukkombu water under study ranges are 89 and 95 mg/L, respectively and are shown in Table 4.2. Sodium content of Hogenakkal and Mukkombu water under study is high. Excess of sodium also leads to rise in pH to unfavorable levels.

4.10 Fluoride

Fluoride is important in human nutrition for the normal development of bones. In general it should not exceed 1.5 mg/L. In present study the observed value 0.32 mg/L for the river Hogenakkal. For Mukkombu, sample value is 0.33 mg/L. both sample water values are minimum in level.

4.11 Chloride

Chloride imparts a salty taste to water. In the study area, chloride, content is found to be in beyond the permissible limit of drinking water (250 mg/L). In present study the observed value 103 mg/L for the river Hogenakkal. For Mukkombu, the minimum value is 92 mg/L. Comparative variation is shown in the Table 4.2. It is found that chloride ion concentration is higher in Hogenakkal water. But concentration of chloride ion was observed in acceptable range[14,15]. Therefore, it is concluded that chloride ion concentration of both water will not induce adverse effect if used for irrigation purpose.

4.12 Chemical Oxygen Demand (COD)

Chemical Oxygen Demand (COD) is important parameter for the assessment of water quality. This is a measure of both the biologically oxidisable and biologically inert organic matter present in the both sample. It is important and quality measured parameter for steam and industrial the waste water analysis and water treatment plant. The observed value of COD is 8 and 11mg/L in Hogenakkal and Mukkombu. All water samples were found to have COD within the limits of WHO (250 mg/L) level.

Table 4.2 Chemical quality of water samples from Hogenakkal and Mukkombu

S. No	Chemical Parameters	Standard A CPHEEO	Experimental Value	
			Hogenakkal	Mukkombu
1	pH	6.5 – 8.5	7.8	7.6
2	Calcium	75 – 200	26	24

3	Magnesium	50 -150	33	22
4	Sodium	---	89	95
5	Pottasium	---	4	4
6	Biocarbonate	200 – 600	256	232
7	Carbonate	---	0	0
8	Sulphate	200 – 400	53	48
9	Chloride	250 – 1000	103	92
10	Nitrate	50	20	16
11	Fluoride	1 – 1.5	0.32	0.33
12	Total Hardness as $CaCO_3$	300 – 600	200	150
13	Alkalinity as $CaCo_3$	200 – 600	210	190
14	Temperature	---	33.5	33.5
15	Suspended Solids	---	1	1
16	COD	250	8	11

CPHEEO - Central Public Health Engineering Environmental Organization

5. Conclusions

Water quality has become a major global concern due to ever increasing human developmental activities that over exploit and pollute water resources on surface and below ground level. The level of water pollution in the area can be determined by the status of water quality around that area. Based on the results and interpretation of the same, the following conclusions are drawn. All the parameter values are found to be minimum level. The results showed that even though there are many possibilities for contamination the water samples in the study area are not highly polluted and the water is fit for drinking and irrigation.

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