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Chemical Analysis of Kodhaiyar River in Tamilnadu, India

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ABSTRACT
A study on physico-chemical and biological characteristics of river water and its suitability for drinking and irrigation purposes was carried out in kodhaiyar river of Tamilnadu. Ecological parameters like dissolved oxygen, chemical oxygen demand, Biochemical oxygen demand and chemical parameters like total hardness, Total alkalinity, chloride, nitrate, phosphate and physical parameters like temperature, P^H, turbidity were analyzed and the results were studied to ascertain the drinking water quality. From the study, it is inferred that the river water is generally portable. Few parameters in some of the selected stations were found to be higher and preventive measures should be adopted for increasing the quality of water for domestic utilization.
Keywords: contamination, ecological parameters, pollution**,** urbanization, water quality.

I. INTRODUCTION

Water is one of the most important aspects of survival and a precious resource of the earth.The quality of the water is rapidly changing according to its source. The change in its quality will definitely disturb the harmony in nature, and would become less suitable for use[1] The safety of water would enhance stability in any community.

Though water has numerous benefits, it is forced to be negative due to the limitless contamination of the foreign materials[2],[3]. Most of the Indians depend on the surface water than the ground water, which is challenged by the discharge of pollutants, industrialization, urbanization and the use of pesticides [4]

The major river system in Kanyakumari district is the Kodhaiyar river, which originates in the Western slope of Western Ghats of Agasthia hills , and joins the Arabian sea, near Thengapattinam in the name of Tambaraparani. The quality of the water is deteriorated by the brick producers, rubber processors and the discharge of human and animal wastes [5],[6],[7].

The study is to analyze the quality of the surface water of the Kodhaiyar river at a few stations like kodhaiyar lake(S_1), Pechiparai dam(S_2), Kaliyal(S_3), Arumanai(S_4) Kuzhithurai(S_5), kapukadu(S_6), Marayapuram (S_7) Athaencodu (S_8) S.T Mankad(S_9) and Thengapatanam(S_{10}). The paper attempts to assess the physico – chemical properties of surface water like the temperature, electrical conductivity, total dissolved solids, dissolved oxygen, biological oxygen demand, total hardness, total alkalinity, sodium, potassium, chloride, nitrate, phosphate and sulphate. The analysed data are compared with the values recommended by WHO [8]

II. MATERIALS AND METHODS

Various methods were adopted for collecting and handling the samples from all the 10 stations. Different methods of collection and handling were adopted based on standard procedure[9]. Plastic cans of 5 litre capacity were used to collect the samples, which were without air bubbles. The temperature was measured at the time of sample collection itself. The study period was from June 2012 to June 2013. Standard methods were used for checking the water quality and all the reagents were AR grade and double distilled water was used for preparing the solutions [10]

III. RESULTS AND DISCUSSIONS

1. Temperature

Temperature is one of the most important factors that controls the rate of metabolic and reproductive activities of aquatic organisms. The temperature of the water existed from 28^0c to 30^oc. The climate changes had no significant effects on the water.

2. pH

An indicator of acidic or alkaline condition of water is pH. The aquatic life tends to be very sensitive towards pH.The standard pH value for any purpose is 6.5 – 8.5. The maximum value of P^H was recorded as 7.42 at (S_{10}) and the minimum value of pH was recorded as 7.03 at (S_2).In general the pH was within the limits of the standard values.

3. Electrical conductivity (EC)

The measure of water capacity to convey electric current is the electrical conductivity. It brings of the measurement of total dissolved solids in water.

The EC values ranged from 50.33 µs/cm to 933.68 µs/cm and 4236.69 µs/ cm in S_{10}.

4. Total Dissolved Solids (TDS)

TDS indicates the amount of ions present in water and analyses the quality of water. High TDS in water reduces clarity in water, decreases photosynthesis and increases the temperature of water when combined with the toxic compounds and heavy metals. The TDS values ranged from 48.74 mg /l to 1056.46 mg/l and 1156.46 mg/l in S_{10}. The values were with the limit and the S_9 and S_{10} were comparitively high.

5. Dissolved oxygen (DO)

DO indicates the ability of the water to support aquatic life. The limit of DO in drinking water is 5 mg/l and should be greater than 5 mg/l for the water used for agricultural purposes(12). The maximum value of DO was recorded as 5.8 mg/l at S_1 and the minimum value of DO was recorded as 4.73 mg/l at S_{10}. In general the DO was within the limits of the standard values.

6. Biological oxygen demand (BOD)

BOD measures the amount of food for bacteria in water. It determines the strength as oxygen to stabilize the domestic and industrial wastes in water.The BOD values ranged from 3.22 mg/l to 1.93 mg/l and 1.98 mg /l in S_{10}. The values existed as per the Indian standard limit for drinking water. Although the BOD values less than 3 mg/l denotes the domestic sewage pollutions which was found in S_5, S_6, S_7, S_8 and S_9.

7. Total Hardness (TH)

The Property that prevents lather formation with soap is the total hardness. TH mainly depends on the calcium and magnesium salts. It increases the boiling point of water. The TH values varied between 13.82 mg /l and 66.32 mg/l and 124 mg/l in S_{10}

8. Total Alkalinity (TA)

The ionic concentration in the water is referred as the alkalinity. The TA has the tendency to neutralize the hydrogen ions . The phenolphthalein alkalinity value is nil, which indicates the absence of carbonate and hydroxyl ions. The bicarbonate alkalinity ranges from 9.91 mg/l to 27.71 mg /l and 29.7 mg /l in S_{10} .The values found were within the permissible limits (600 ppm). Moreover little abnormalities in the value of alkalinity are not harmful for human beings.

9. Sodium

Sodium is the dominant cation present in water, it may be due to the weathering of alkali feldspar in rocks. The value of sodium concentration ranged from 2.29 mg /l to 112.5 mg/l and 243.96 mg/l in S_{10}. Sodium is an important factor for both agricultural and domestic use of water. However, its presence is harmful for patients suffering from cardiac, renal and circulatory diseases. A recommended maximum permissible limit for sodium in public water supplies is 250 p pm (WHO).The sodium in all of the samples within the permissible limit.

10. Potassium

The value of potassium concentration were from 0.96 mg/l to 18.98 mg/l and 20.99 mg/l in S_{10}. The source of potassium in fresh water is due to the rocks and it increases in polluted water.

11. Chloride

The most dominant anion in water is chloride. It originates from the activities such as dissolution of salt deposits, use of inorganic fertilizers, land fill, animal feed etc. They are harmful, when present in irrigational water and are toxic to plants. The chloride values ranged between 16.44 mg/l and 665.33 mg/l and 768.32 mg/l in S_{10}

12. Nitrate

Nitrate value ranged from 0.33 mg/l to 0.85 mg/l and 0.76 mg/l in S_{10}. Surface water generally contains sewage and wastes rich in nitrates. The nitrate pollution would cause Eutrophication, which affects the water quality. Despite the values not increasing the permissible limits, the sites such as S_2, S_3, S_4, S_5, S_6, S_7 and S_8 shows and increasing signs, which is made evident from the nitrate values (0.96, 1.12 , 1.18, 1.43, 1.23, 1.11, 1.05). This could be due to the disposal of animal and hospital wastes.

13. Phosphate

Phosphate occurs the surface water due to the domestic sewage, detergents and the agricultural fertilizers. The values of phosphate ranged from 0.16 mg/l to 0.87 mg/l and 0.38 mg/l in S_{10}. Eutrophication is the main cause for the phosphate pollution in the environment.

14. Sulphate

Sulphate is naturally present in water due to the addition of sulphuric acid, zinc sulphate, gypsum and other materials. The concentration of sulphate gets increased with the discharge of wastes. The precipitation of calcium ions and the sodium poisoning of plants could be caused by the sulphate ions. The values of sulphate concentration ranged from 3.09 mg / l to 40.12 mg/l and 58.49 mg /l in S_{10}, despite the values within permissible limits, the values were high in S_7, S_8 and S_9, which could be due to the hospital, agricultural and animal wastes.

IV. CONCLUSION

The analysis of the collected samples shows that the physico – chemical parameters of the water and within the quality standards of water. But the

SO_4^{2-}, NO_3^- and PO_4^{3-} are found to be increasing in sites such as S_5, S_6, S_7, S_8 and S_9. This could be due to the domestic, animal, industrial and hospital wastes. The site S_{10}, being an estuary, is mainly used for irrigation .The study shows that the concentration of Na,Cl^-,SO_4^{2-}, $NO_3^-$and PO_4^{3-} are increasing in S_{10}, which would affect the water quality for irrigation and would also affect the wells in the future. It is known that once pollution starts, the deterioration is evident. It is evident that in the next few years, water quality deterioration could be high. Therefore, a close monitoring of the water quality is of great necessity, to create a healthy environment.

l.NO	*Parameters*	*WHO*	*ISI*	*Sampling Stations*									
				S_1	S_2	S_3	S_4	S_5	S_6	S_7	S_8	S_9	S_{10}
1	*Temperature*	*-*	*-*	*30.0*	*29.7*	*29.9*	*29.3*	*28.9*	*28.5*	*28.2*	*28.3*	*28.1*	*28.0*
2	*pH*	*7–8.5*	*6.5–8.5*	*7.05*	*7.03*	*7.08*	*7.15*	*7.24*	*7.28*	*7.31*	*7.33*	*7.35*	*7.42*
3	*EC*	*1400*	*-*	*50.33*	*93.24*	*109.42*	*112.41*	*127.58*	*414.47*	*615.68*	*815.32*	*933.68*	*4236.69*
4	*TDS*	*1000*	*500*	*48.74*	*64.03*	*64.21*	*71.68*	*73.72*	*179.43*	*867.97*	*976.46*	*1056.46*	*1156.46*
5	*DO*	*-----*	*5.0*	*5.8*	*5.33*	*5.47*	*5.57*	*4.84*	*5.49*	*4.96*	*4.87*	*4.81*	*4.73*
6	*BOD*	*-----*	*---*	*3.22*	*2.64*	*2.46*	*3.07*	*2.29*	*1.97*	*1.95*	*1.96*	*1.93*	*1.98*
7	*TH*	*500*	*300*	*13.82*	*18.33*	*18.66*	*19.83*	*19.66*	*24.58*	*28.51*	*29.59*	*66.32*	*124*
8	*TA*	*120*	*200*	*9.91*	*12.84*	*14.41*	*16.75*	*16.33*	*20.91*	*25.6*	*26.76*	*27.71*	*29.7*
9	*Na*	*200*	*200*	*2.29*	*4.83*	*4.49*	*4.54*	*5.14*	*18.26*	*62.13*	*83.46*	*112.5*	*243.96*
10	*K*	*-----*	*----*	*0.96*	*1.76*	*1.87*	*1.87*	*1.92*	*5.94*	*14.36*	*16.54*	*18.98*	*20.99*
11	*Cl^-*	*250*	*250*	*16.44*	*20.69*	*22.31*	*26.2*	*28.39*	*99.26*	*160.34*	*565.33*	*665.33*	*768.32*
12	*NO_3^-*	*45-50*	*45*	*0.33*	*0.96*	*1.12*	*1.18*	*1.43*	*1.23*	*1.11*	*1.05*	*0.85*	*0.76*
13	*PO_4^{3-}*	*------*	*---*	*0.16*	*0.22*	*0.34*	*0.27*	*0.82*	*0.62*	*0.87*	*0.45*	*0.35*	*0.38*
14	*SO_4^{2-}*	*150*	*150*	*3.26*	*3.09*	*5.66*	*7.79*	*4.78*	*13.8*	*24.46*	*30.08*	*40.12*	*58.49*

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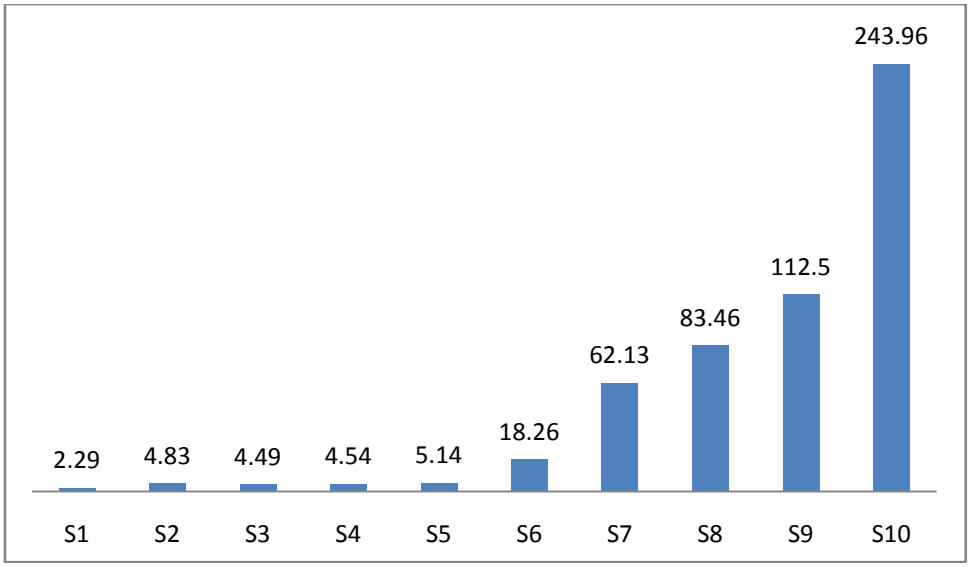
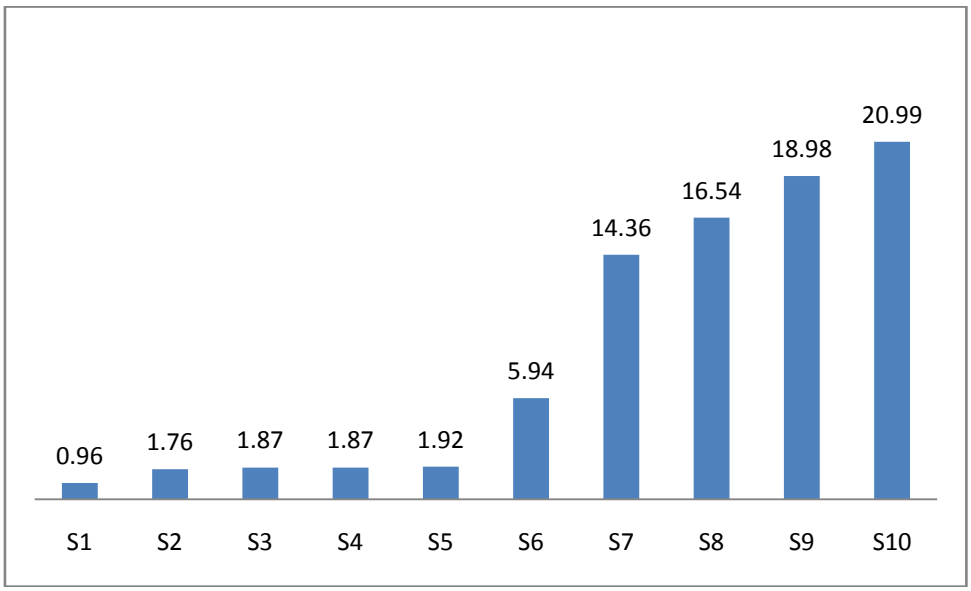
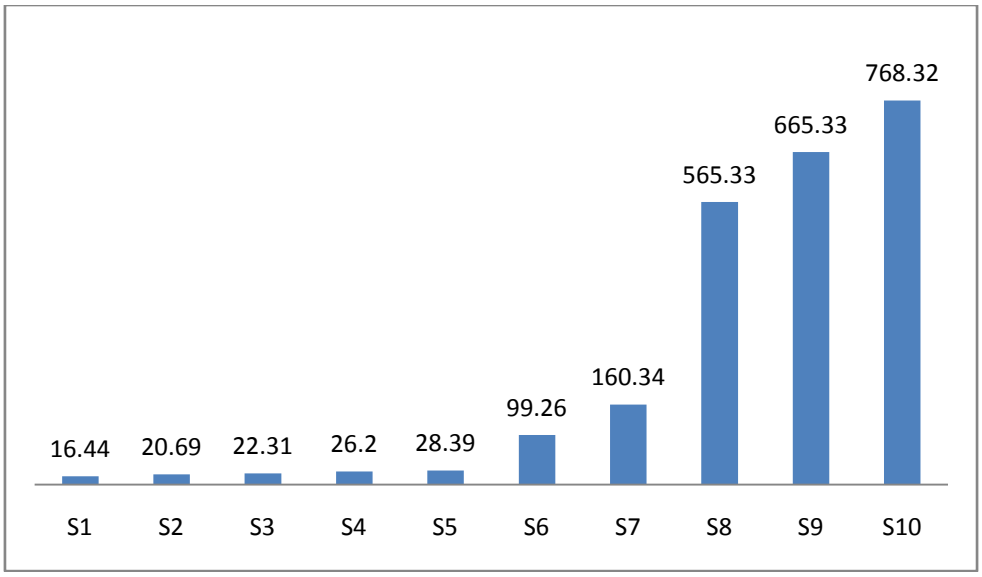


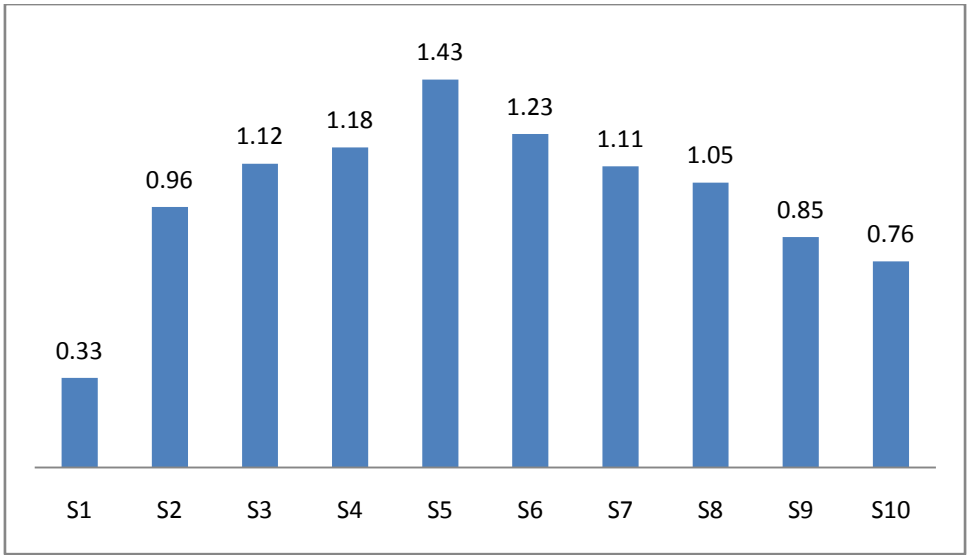
Graph: I Showing variations in Na values in ten stations



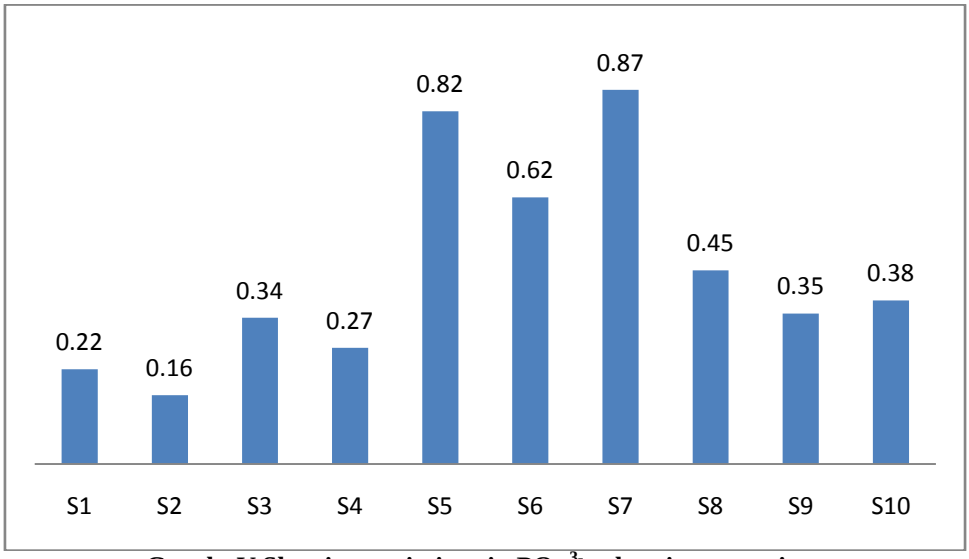
Graph: II Showing variations in K values in ten stations



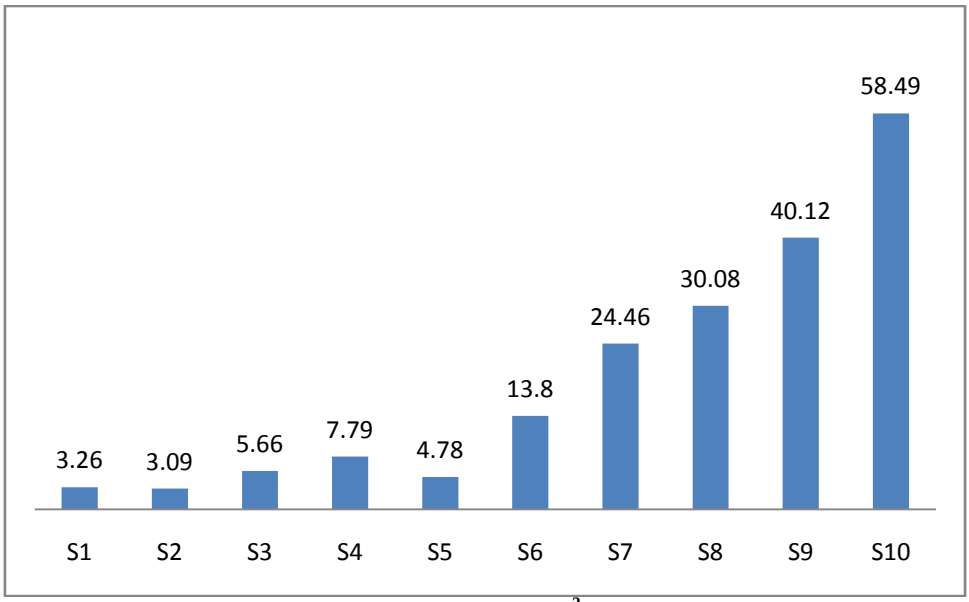
Graph: III Showing variations in Cl ⁻ values in ten stations



Graph: IV Showing variations in NO_3^- values in ten stations



Graph: V Showing variations in PO_4^{3-} values in ten stations



Graph: VI Showing variations in SO_4^{2-} values in ten stations

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