Chemical Analysis of PazhayarRiver in Tamilnadu, India

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ABSTRACT

In Pazhayar river of Kanyakumari District, a study on physico-chemical and biological characteristics of river water and its suitability for drinking and irrigation purposes. 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, 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 under very poor condition. Preventive measures should be adopted for control the pollution in this river.

Keywords: ecological parameters, water quality, pollution, irrigation, portable

i. Introduction

The most important of all natural resources known on earth is water. The water quality is rapidly changing according to its source. A large number of factors and geological conditions influence the correlations between physico-chemical parameters of water samples (1). In urban areas, the careless disposal of industrial effluents and other wastes in rivers may contribute greatly to the poor quality of river water(2).

In kanyakumari district there are a few non-perennial rivers taking their origin from the Western Ghats and running across the gentle slopes of the mid lands (3). These rivers confluence with the waters of the Arabian sea on the west (4). The average value of the water quality index for pazhayar river was 81.59 (5).

The river Pazhayar starts in the northern slope of Western Ghats in the Mahendragiri hills and joins the Arabian sea near Manakudy, which is 12km in the south of Nagercoil. The quality of the water is deteriorated by the brick producers, rubber processors and the discharge of human and animal wastes.

The study is to analyze the quality of the surface water of the Pazhayar river at a few stations like Surulacode(S_1), Arumanallur(S_2), Chekkadi(S_3), Poothapandy(S_4) , Veeranamangalam(S_5), Ozhuginasery(S_6),Edalakudi (S_7), Suchindram (S_8) , North Thamaraikulam (S_9) and Mela manakudy(S_{10}). The paper attempts to assess the physico – chemical properties of surface water like turbidity,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 (6).

ii. Materials and methods:

Various methods were adopted for collecting and using the samples from all the 10 stations. Different methods of collection and using were adopted based on standard procedure (7). 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 (8, 9, 10).

III. Results and discussions

1.Turbidity

High turbidity in water reduces the clarity of water.It existed from 1 NTU to 8 NTU.The values were comparitively high.

2.pH

P^H is the indicator of acidic or alkaline condition of water. The aquatic life generally 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 (11). The EC values ranged from 50.33 µs/cm to3982.48 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 the clarity of 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 2.34 mg/l at S_8.

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(13). The BOD values ranged from 3.22 mg/l to 6.96 mg/l.

7.Total Hardness (TH)

Total Hardness (TH**)** is the **p**roperty that prevents lather formation with soap. TH mainly depends on the calcium and magnesium salts. It increases the boiling point of water. The TH values varied between 113.82 mg /l and760.48 mg/l and 850 mg/l in S_{10}

8.Total Alkalinity (TA)

Total Alkalinity (TA) is the ionic concentration in the water. 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

Chloride is the most dominant anion in water. 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 865.33 mg/l and 968.32 mg/l in S_{10}

12. Nitrate

Nitrate value ranged from 0.33 mg/l to 2.11mg/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, 1.23,2.11,2.05). 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**

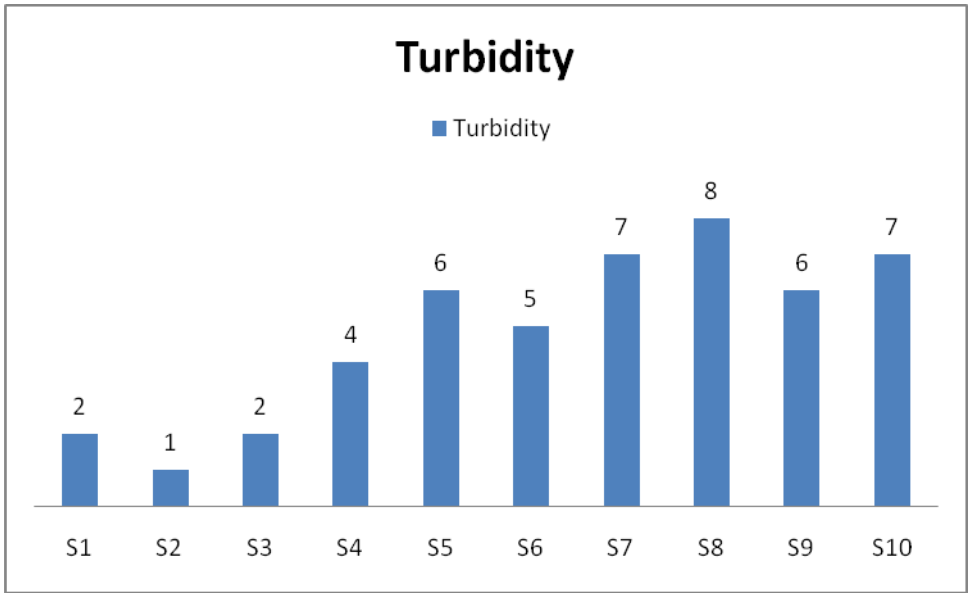
Sulphate is naturally present in water due to the addition of sulphuric acid, zinc sulphate, gypsum and other materials. The concentration of sulphate gets increased with the discharge of wastes. The precipitation of calcium ions and the sodium poisoning of plants could be caused by the sulphate ions. 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

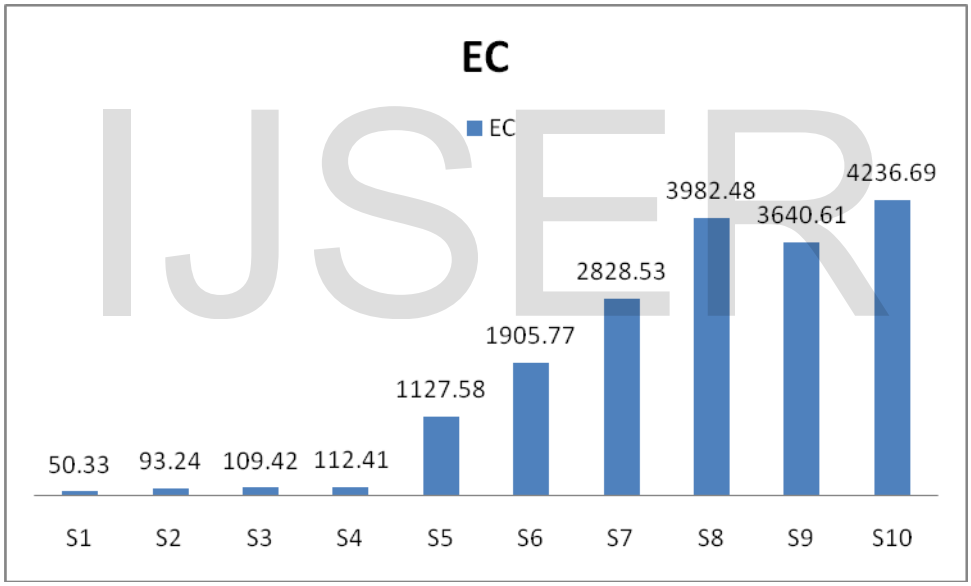
In the present study, it is significant that the concentration of chemical properties were higher in the water collected from Pazhayar river. The river water from these localities should be avoided totally for bathing, drinking and cooking purposes. Adopting proper disposal of waste water and proper underground sewage plan will give the solution to protect this river from

pollution.. It is evident that in the next few years, water quality deterioration will be high. Therefore, a close monitoring of the water quality is of great necessity inorder to create a healthy environment.

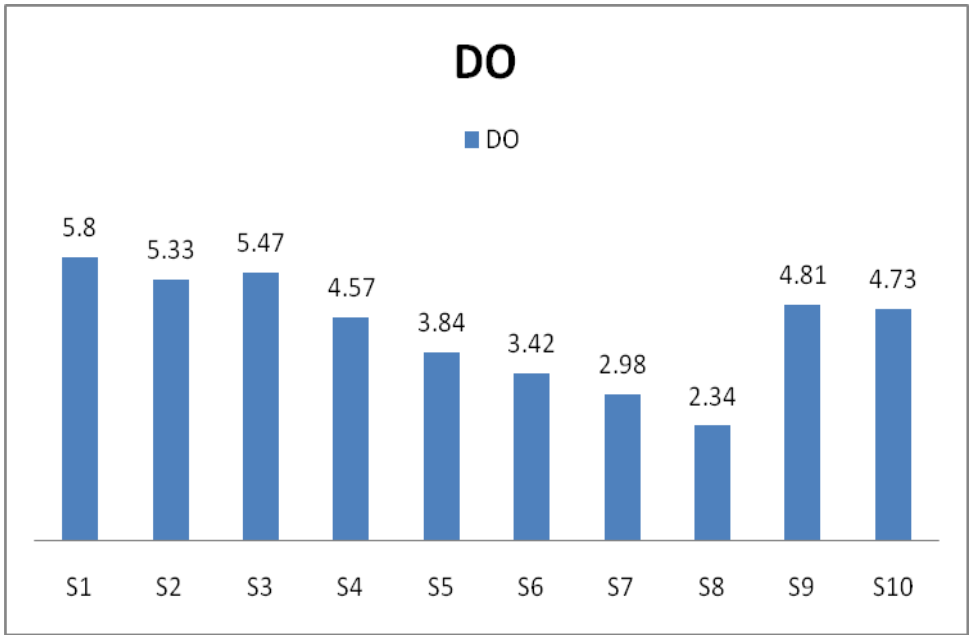
Sl. NO	Parameters	WHO	ISI	Sampling Station									
				S_1	S_2	S_3	S_4	S_5	S_6	S_7	S_8	S_9	S_{10}
1	Turbidity	5 NTU	-	2	1	2	4	6	5	7	8	6	7
2	pH	7–8.5	6.5–8.5	7.05	7.03	7.08	7.15	7.24	7.28	7.31	7.33	7.35	7.42
3	EC	1400	-	50.33	93.24	109.42	112.41	1127.58	1905.77	2828.53	3982.48	3640.61	4236.69
4	TDS	1000	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	4.57	3.84	3.42	2.98	2.34	4.81	4.73
6	BOD	-----	---	3.22	4	4.46	4.07	5	5	6	6.96	5.14	5.28
7	TH	500	300	113.82	118.33	218.66	219.83	319.66	524.58	628.51	729.59	760.48	850
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	12	----	8.96	11.76	21.87	31.87	31.92	45.94	44.36	56.54	58.98	60.99
11	Cl^-	250	250	16.44	20.69	22.31	26.2	28.39	99.26	160.34	565.33	865.33	968.32
12	NO_3^-	45-50	45	0.33	0.96	1.12	1.18	1.43	1.23	2.11	2.05	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



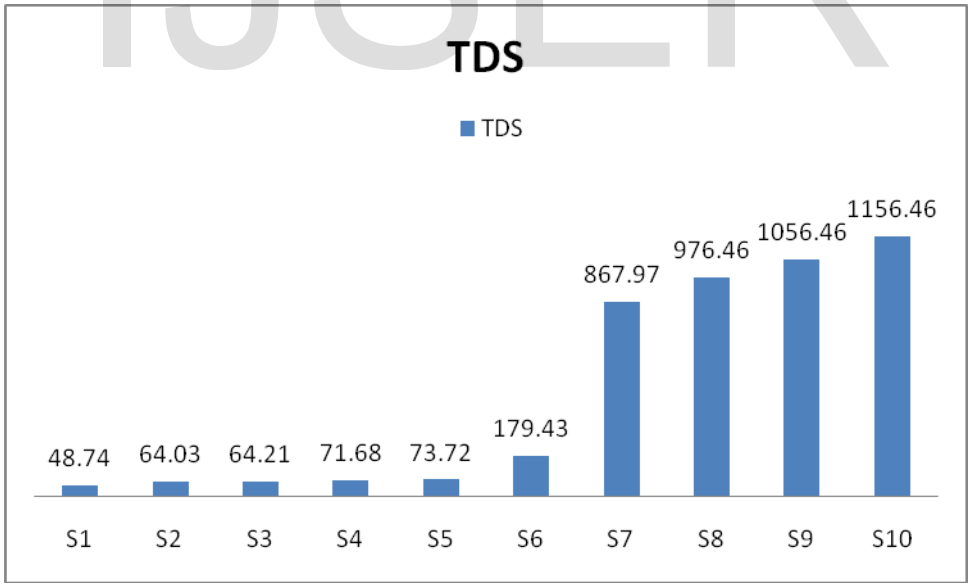
. **Graph: I Showing variations in turbidity values in ten stations**



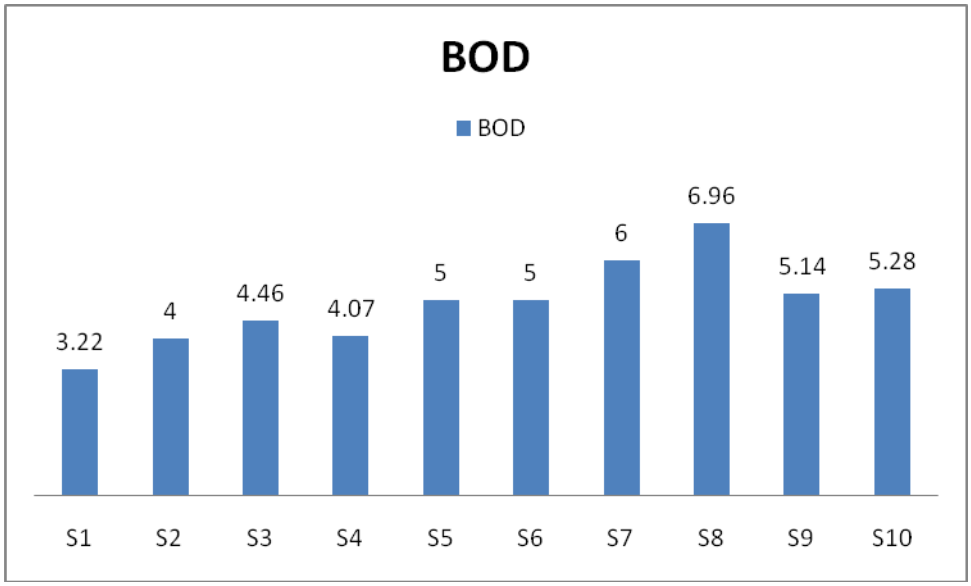
Graph: II Showing variations in electrical conductivity values in ten stations



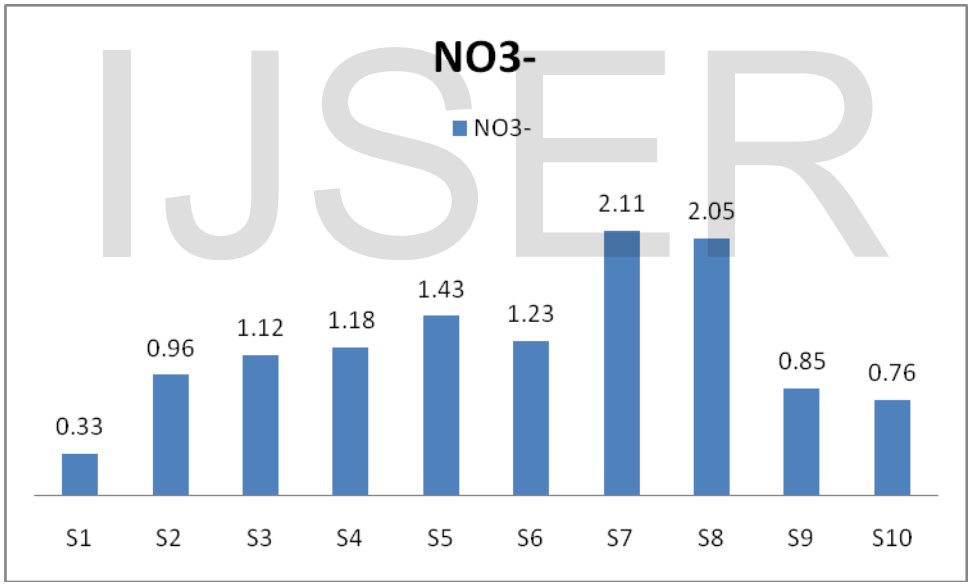
Graph: III Showing variations in dissolved oxygen values in ten stations



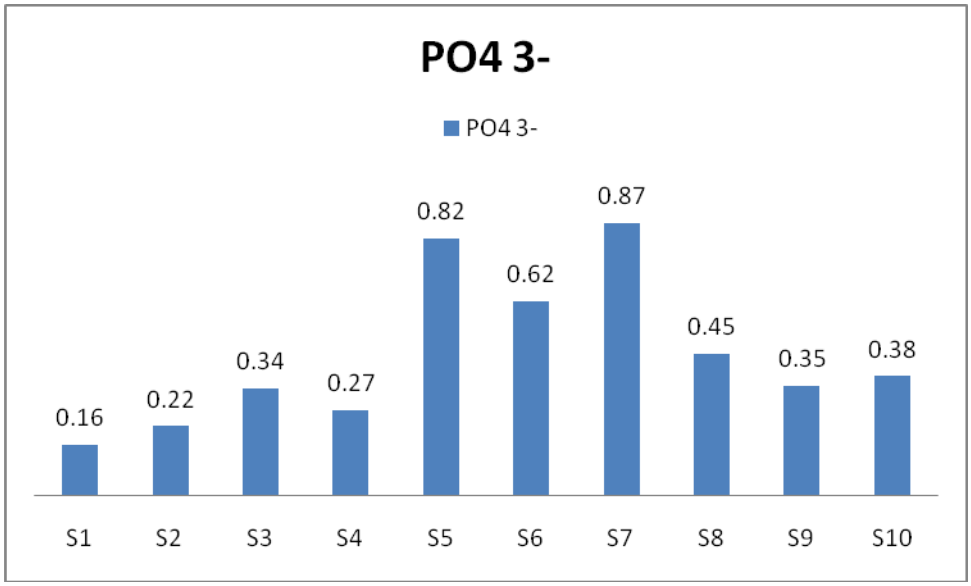
Graph: IV Showing variations values in TDS ten stations



Graph: V Showing variations in BOD values in ten stations



Graph : VI Showing variations in NO3- values in ten stations



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

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