EVALUATION OF PHYSICO- CHEMICAL PARAMETERS OF VAIGAI RIVER WATER IN MADURAI, TAMILNADU.

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ABSTRACT:

Water plays a vital role for all the existence of life on earth. The rapid growth of urban areas has affected the water quality due to over exploitation and improper waste disposal practices. In the present study various water samples were collected from different places in Vaigai River at Madurai, Tamilnadu, India during October 2016 to March, 2017. The physicochemical parameters such as temperature, colour, turbidity, total dissolved solids, total alkalinity, electrical conductivity, total hardness, calcium, magnesium, sodium, potassium, chloride, sulphate, nitrate, fluoride, dissolved oxygen, COD., etc. were determined using standard procedures. The sampling sites were selected on the basis of their distance, such as Sholavandan (S1), Thiruvedakam (S2), Thenur (S3), Kochadai (S4), Arappalayam (S5), Goripalayam (S6) and Teppakulam ((S7). The pH value 7.0 is considered as best and ideal. The pH is range from 7.38 to 7.87 which was the permissible limit. Total dissolved solidsand Electrical conductivity was found moderate in S1 to S6 site and S7 were recorded maximum. The total hardness and alkalinity also recorded maximum in S7 site than that remains. The Calcium, Mg, and Fe were recorded maximum in S7 site rest of others were permissible limit. Free NH3 was found maximum in S5 (1.2mg/L), S6 (1.5mg/L) and S7 (2.5mg/L) site. Nitrite was observed high in S3 (1.5mg/L). Phosphate was found objectable limit in S3 (1.2mg/L) and S7 (2.0mg/L). Finally, the result was concluding that the surface running water was contaminated at few sampling sites namely S5 (Arappalayam), S6 (Goripalayam) and S7 (Teppakulam) due to the anthropogenic activity and it is alarmingly above the permissible limits. But the sampling sites S1, S2, S3 and S4 are recommended for use to drinking and other purpose.The results were compared with the standard permissible limits prescribed by BIS and WHO.

KEYWORDS: Physicochemical, Water Quality, BOD.

1. Introduction

Water is the fundamental element and it is linked up with the origin, evolution and undoubtedly the destiny of life. Next to oxygen, water essential substance for all living organism on earth and only a tiny proportion of the global freshwater is present in rivers.[1] Unfortunately rivers are perhaps the worst polluted freshwater ecosystem in earth. Most rivers in India are polluted and their water unfit for human use. Many rivers and water bodies are becoming saturated with organic compounds from industrial effluents, posing a major threat to both human health and aquatic life.[2] The problem of water quality deterioration is mainly due to human activities such as discharge of industrial and sewage wastes and agricultural runoff which cause ecological damage and pose serious health hazards (Bhattacharya *et al.,* 2012) [3] .In the last few decades there had been an increasingly greater emphasis on the deterioration of the water quality of Indian rivers unmindfully used for the disposal of domestic and industrial wastes for beyond their assimilative capacities and have been rendered grossly polluted.[2-3] The quality of river water is influenced by various natural factors such as rainfall, temperature and weathering of rocks and anthropogenic activities which alter the hydrochemistry of river water (Indrani Gupta *et al.,* 2011)[6.]

Pollution from domestic sewage, waste water discharge from industries and agricultural runoff etc., find their way into rivers, which can lead to large scale deterioration of water quality. The consequence of this

is increased river pollution, loss of aquatic life and uptake of polluted water by plants and animals, which eventually gets into human body resulting in health related problems.[4] The situation is compounded by the fact that the common man in most of the countries does not have access to portable water and in many instances; raw river water is used as source of drinking water. Untreated sewage discharge not only damage for aquatic life but also hazardous to human health used for drinking purpose in the downstream areas.[5] In the wake of increasing urbanization and industrialization, the pollution potential of Vaigai River is gaining momentum day by day. The present study is an attempt to make an assessment of the change in the water quality of Vaigai River in Madurai

2. Study area

The Vaigai river originates in the Periyar Plateau of the Western Ghats range, and flows northeast through the Kambam Valley, which lies between the Palni Hills to the north and Varushanad Hills to the South. TheVattaparai Falls are located on this river. As it rounds the eastern corner of the Varushanad Hills, the river turns southeast, running through the region of Pandya Nadu. Madurai, the target city in the Pandya Nadu region and its ancient Capital, lies on the Vaigai. The river empties into the Palk Strait in Ramanathapuram District. The Vaigai is 258 kilometers (160mi) long, with a drainage basin 7,031 square kilometers (2,715 sq mi) large. It falls within the co-ordinates of Latitude 7o21'00'' N and Longitude 79o00'00''E. Vaigai Dam is built across the Vaigai River near Andipatty, in the Theni district of Tamil Nadu, Southern India. The Vaigai river rarely floods; its chief tributaries are the Suruliar, Theniar, VarahaNadi and Mangalar (Britannica, 2009).

3. Materials and Methods

Water samples were collected from October 2016 to March 2017. Water samples were collected in sterilized clean high density polythene bottles. Acidifying the water samples after every collection and take to the samples at laboratory within a day. The samples were analyzed (Physical and chemical Parameters) by (BIS, 1983 and APHA, 1998) [3, 1] method.The following parameters were analyzed such as Color, Odour, Turbidity, TDS, Electrical conductivity, pH, Total Alkalinity, Total Hardness, Ca, Mg, Fe, Manganese, Free NH3, NO2, NO3, Cl, F, SO4 and PO4.

4. Results and Discussion

In this present study, analysis of surface river water quality in seven locations was carried out to determine the physical and chemical characteristics of water. The Water Samples are collected from Vaigai River bed area flowing on the West and East of Madurai city respectively and receiving domestic, industrial and agricultural pollutants from their catchments areas, using clean polythene bottles and taken to the laboratory and preserved by using HNO3. pH is determined by using pH meter; Dissolved Solid is determined by using TDS meter. The other parameters are measured by using different standard methods. (APHA, 1985) [11]. Total alkalinity was determined by visual titration method using methyl orange and phenolphthalein as indicator. Total hardness and calcium were measured by EDTA titrimetric method using EBT indicator respectively. Chloride is determined by Argentometric method using potassium chromate indicator. The results indicate that the quality of water varies from location to location. The pH value of a water source is a measure of its acidity or alkalinity. For most reaction as well as for human beings, pH value 7.0 is considered as best and ideal. The pH is range from 7.38 to 7.87 which was the permissible limit. The high conductivity in some of the samples is likely due to the prolonged and extensive agricultural practices such as irrigation coupled with the inherent geological conditions acquiring high concentrations of the dissolved minerals. Total dissolved solids and Electrical conductivity were found moderate in S1 to S6 site and S7 were recorded maximum. Water hardness has no known adverse effects; however, it causes more consumption of detergents at the time of cleaning and some evidence indicates its role in heart disease (Scroeder, 1966) [10]. Excess hardness is undesirable mostly for economic and aesthetic reasons (Ragunath, 1987) [8]. The total hardness and alkalinity also recorded maximum in S7 site than that remains. The Calcium, Mg, and Fe were recorded maximum in S7 site rest of others were permissible limit. Free NH3 was found maximum in S5 (1.2mg/L), S6 (1.5mg/L) and S7 (2.5mg/L) site. The high concentration of nitrate in drinking water is toxic and causes blue baby disease/methaemoglobinaemia in children and gastric

carcinomas (Comly, 1945 and Gilly *et al.*, 1984) [4, 5]. Most of the locations the source of nitrate in groundwater occurs by direct anthropogenic pollution (septic tanks etc). In urban areas urbanization is leaching of fertilizers in agricultural area is the source for the high concentration of nitrate in all locations. The result indicates that nitrate concentrations exceed the standards and are not fit for drinking purposes. Nitrite was observed high in S3 (1.5mg/L). The fluoride ion content should be within 0.5 to 1.0 ppm as suggested by WHO (1984) [14]. In present study Fluoride contents were found permissible limit in all sampling sites.Phosphate was found objectable limit in S3 (1.2mg/L) and S7 (2.0mg/L).In the present study water was very hard and crossed the permissible limits. It is well known that hardness is not caused by a single substance but by a variety of dissolved polyvalent metallic ions, predominantly calcium and magnesium cation, although other cation likes barium, iron,manganese, strontium and zinc also contribute. The high concentration of total hardness in water samples may be due to dissolution of polyvalent metallic ions from sedimentary rocks, seepage and run off from soil. As we know calcium and magnesium, are the two principal ions. The concentration of total hardness in drinking water sources ranged between 75 and 1110 mg/L (Nawlakhe; 1995) [7], the obtained value of many of the parameters of some area exceeds permissible limit and some area does not exceeds limit of WHO (1984) [14] standards. It should be observed that several parameters are with or not within the permissible limit of the International Standards. Water quality standards vary significantly due to different environmental conditions, and ecosystem. The variation observed were probably due to various factors such as trace metal contents, environmental pollutions due to organic pollutant, domestic usage etc., Finally, the result was concluding that the surface running water was contaminated at few sampling sites namely S5 (Arappalayam), S6 (Goripalayam) and S7 (Teppakulam) by the anthropogenic activity. But the sampling sites S1, S2, S3 and S4 are recommended for use to drinking and other purpose.

Table: Showing results of physico-chemical results of Vaigai River sampling sites
(Average value of Oct 2016 to March 2017)

Parameters	S1	S2	S3	S4	S5	S6	S7
TDS	535	553	639	698	792	952	2008
EC	757	775	898	952	998	1360	2868
PH	7.44	7.49	7.43	7.54	7.38	7.52	7.87
T.A	200	220	260	280	280	300	800
T.H	240	260	340	340	350	360	920
Ca	60	65	85	60	75	90	230
Mg	23	25	33	23	29	35	88
Mn	0	0	0	0	0	0	0
Free NH_3	0.4	0.8	1.0	1.0	1.2	1.5	2.5
NO_2	1.0	1.0	1.5	0.4	0.8	0.2	0.2
F	0.8	0.8	1.2	1.0	0.8	0.8	1.0
SO_2	10	21	10	12	14	31	55
PO_4	1.0	0.8	1.2	0.6	1.0	1.0	2.0
Fe	0	0	0	0	0	0	0

Plate 1: Show that study area of Vaigai River sampling sites.

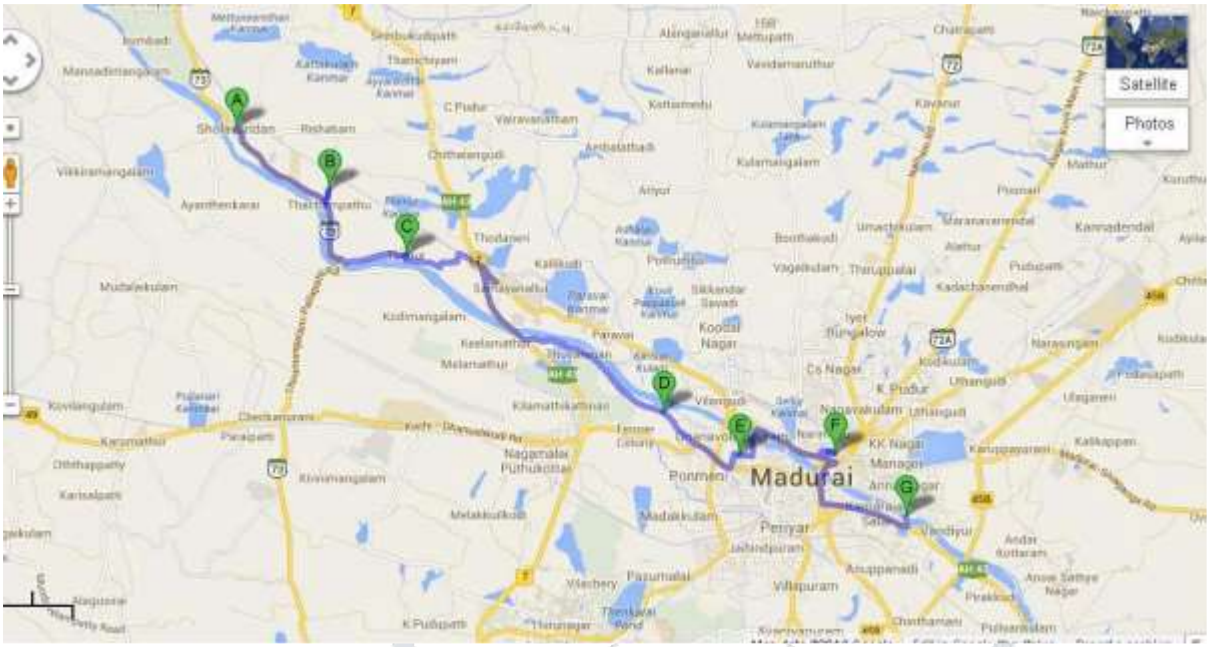


Fig 2: The pH values of different sampling sites of the Vaigai River

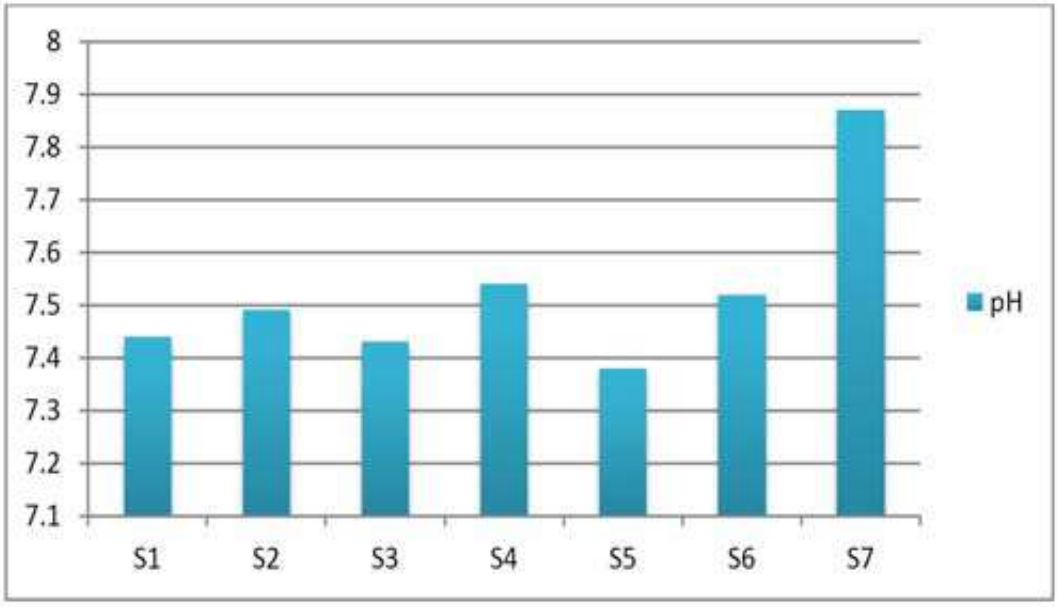


Fig 3: Total hardness and Total Alkalinity ranges of different sampling sites of the Vaigai River

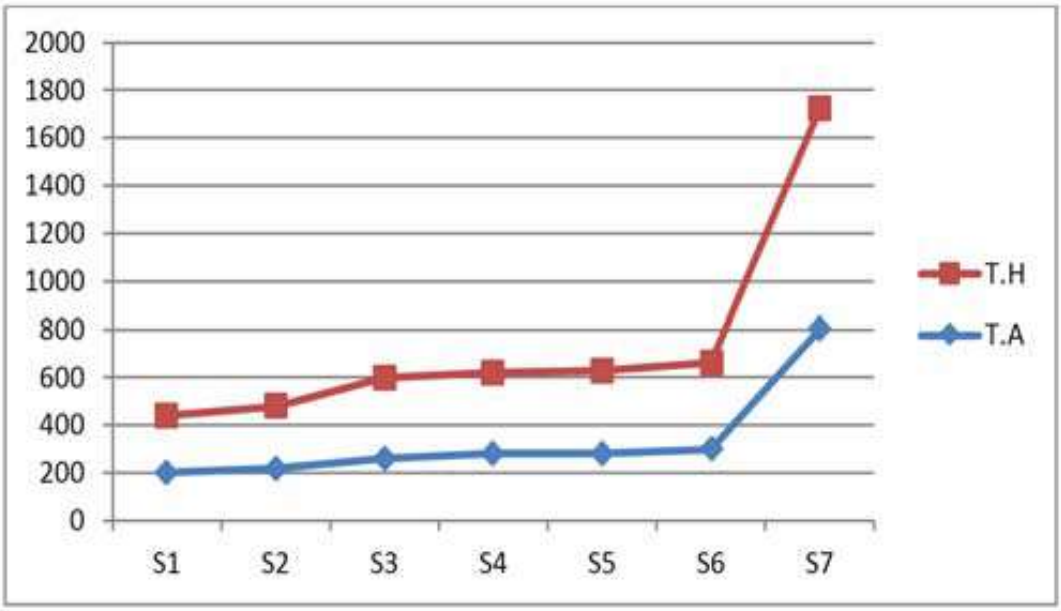


Fig 4: Mg and Ca concentrations of different sampling sites of the Vaigai River

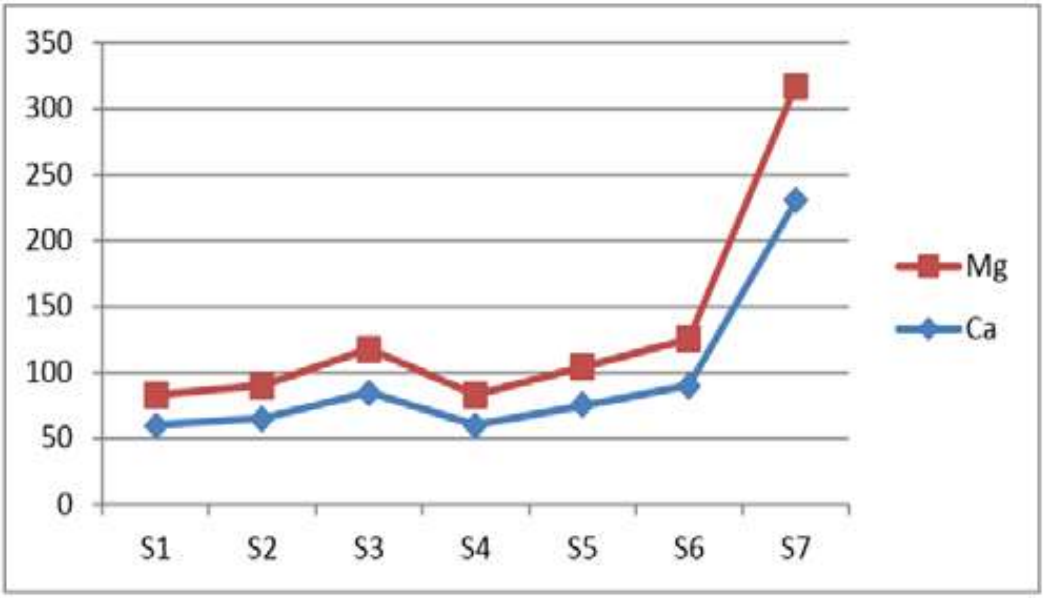


Fig 5: Phosphate, Fluoride, Nitrogen dioxide and Free ammonia concentrations at different sampling sites of the Vaigai River.

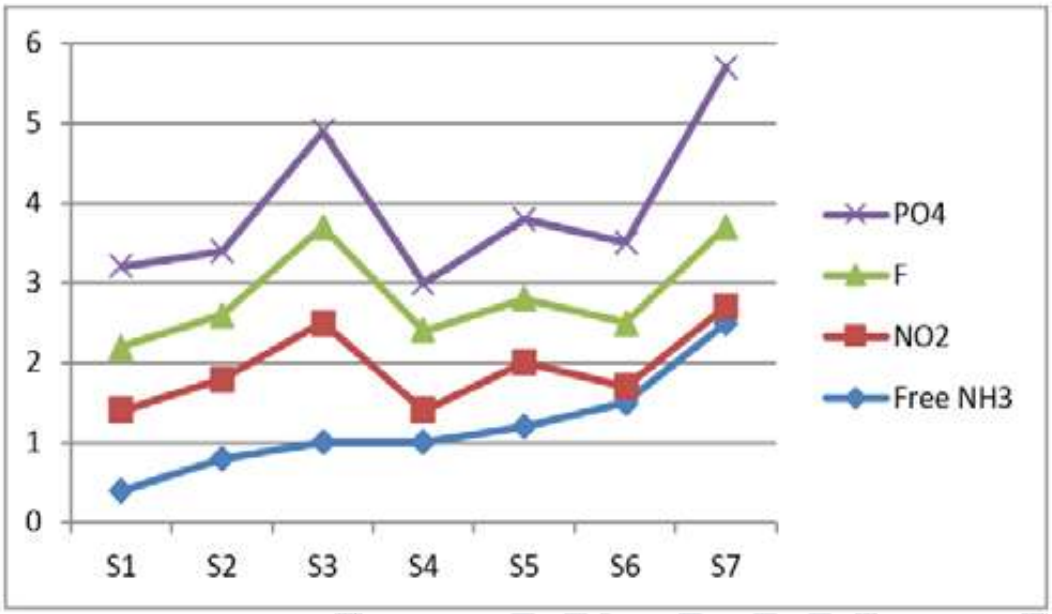
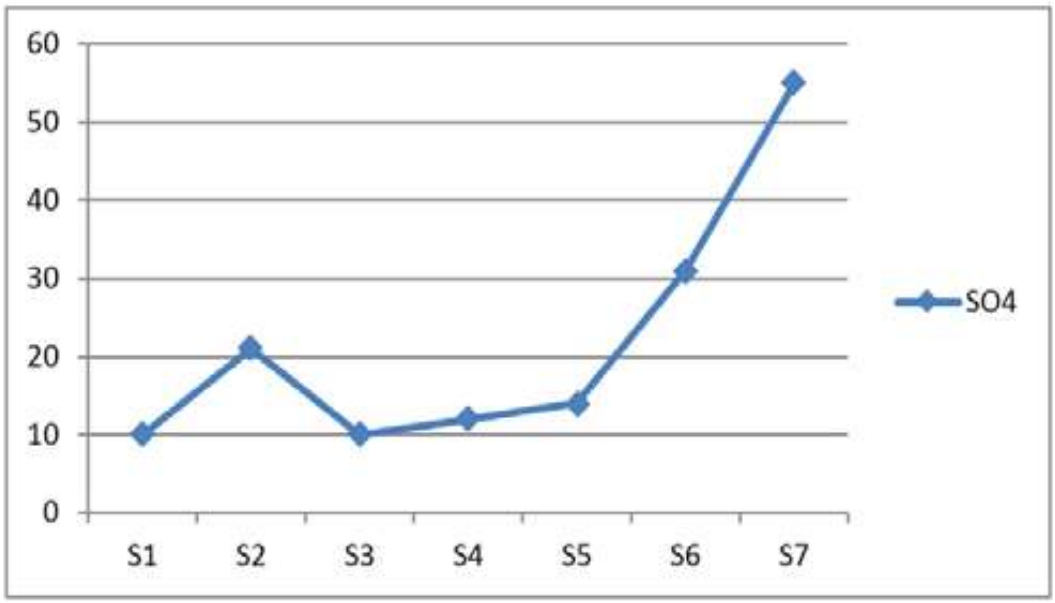


Fig 6: Sulphate concentration at different sampling sites of the Vaigai River



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