

Physicochemical Parameter Analysis of Perennial River Flow of Thamiraparani in Tirunelveli and Tuticorin Districts

Esakkimuthu T* and Dr. Marykutty Abraham

**Research Scholar, Sathyabama University, Rajiv Gandhi Salai,
Chennai - 600119, India.
(Corresponding Author)*

*Associate Professor/Scientist E, Sathyabama University,
Rajiv Gandhi Salai, Chennai – 600119, India.*

Abstract

One of the very basic requirements for mankind is water. Not only for human being, water is the most indispensable requirement needed for every living creature in the world. Although the major portion of the Earth is surrounded by water body called Ocean, the fresh water source is always attributed to rivers, lakes, ponds etc. Water quality is the most important aspect need to be looked for the purpose of human utilization. The present research work is aimed to find out the various physico-chemical parameters present in the river Thamirabarani, in southern Tamilnadu. Water samples are collected at eight stations starting from the major city, Tirunelveli till the point called Punnaikayal, the point at which the river reaches the sea (Bay of Bengal). The physico-chemical parameters such as pH, TDS, temperature, dissolved oxygen, total hardness and chloride were determined. The samples were tested on the sample sites and at the environmental lab in Government College Of Engineering (GCE), Tirunelveli.

Keywords: water samples, physico-chemical parameters, water quality, water testing

INTRODUCTION

Water is one of most precious gifts presented to the mankind by the almighty. Not only human beings almost all living organisms depend on water for different means. Industrial waste discharge, domestic waste disposal and untreated sewage when

disposed to water bodies, the various water sources getting contaminated and hence the life of aquatic organisms are put into mess. Also the above said factors make water unfit for human consumption and agriculture (Saluja DS 2019). Since many industries find water bodies as the best place for their effluent discharge, the water quality getting worse and the naturally occurring equilibrium of the ecosystem getting disturbed (Thillai Arasu P 2007). The prediction given by world water assessment program warns the human society that quality of water available to everyone will be reduced by 30% in another two decades (Kolhe Bharati G, Shinde Satish M 2014).

One of the richest fresh water sources used for human consumption and utilization is river water. Rivers play a vital role in meeting the demands of local water supplies, industries, agriculture, etc. Quality and quantity of river water are determined by different factors like amount of rainfall, temperature, and weathering of rocks in that surface area (Soranam R et al, 2016). Quality of the river water also depends on various factors such as temperature, various discharges from the industries, human activities in that area. Therefore monitoring and evaluation of different physico-chemical factors gets its importance to derive the present condition of the water body (Kolhe Bharati G, 2014 and Rajkamal R et al, 2016). The physico-chemical parameters of the water such as hardness, chloride content, temperature, turbidity, dissolved oxygen, etc impacts the growth of various aquatic lives present in the river.

Tamilnadu is a heritage and cultural icon of India. While many studies reveal that the various cultures got originated from the river banks, Tamilnadu is of no exception. There are many rivers flowing across Tamilnadu. But Thamiraparani is one among the very few perennial rivers flowing in Tamilnadu. Thamirabarani river originates from the Agasthiyar hills in Papanasam and this hill is situated 2000 meters above mean sea level (Thillai Arasu P, 2007). Thamiraparani starts from the Western Ghats situated in Papanasam and flows through various cities, villages and finally reaches the Bay of Bengal Sea near a point called Punnaikayal.

The present study concentrates on revealing the various physico-chemical properties of the river water such as pH, TDS, chlorides, temperature, hardness, dissolved oxygen. Totally eight samples were collected for this study at the selected sites of Tirunelveli and Tuticorin districts.

MATERIALS AND METHODS

Study area

Tirunelveli is situated in the southern region of state of Tamilnadu. The land of Tirunelveli is flourished by the river Thamirabarani and this paves the nourishment of irrigation sectors and hence more cultivation is being done. Tirunelveli is one of the major cities, through which the Thamirabarani river passes. This study is mainly concentrated on the different sites from Tirunelveli to Punnaikayal, the place where Thamirabarani River merges with the Bay of Bengal. This study covers a distance of around 60 kms. And also this stretch covers two districts viz Tirunelveli and Tuticorin.

Sample collection

Water samples were collected from eight sites starting from the city of Tirunelveli and along with the passage of Thamirabbarani river till the point where it reaches the sea (Punnaikayal). Freshly cleaned plastic bottles of one litre capacity were used to collect the water samples.

Few readings such as temperature and TDS were measured at the respective sites to get more precise results. The geographical location of above sites is given in the table 1 and the mapping location is given in Fig1. The stations at which the samples were collected are given below:

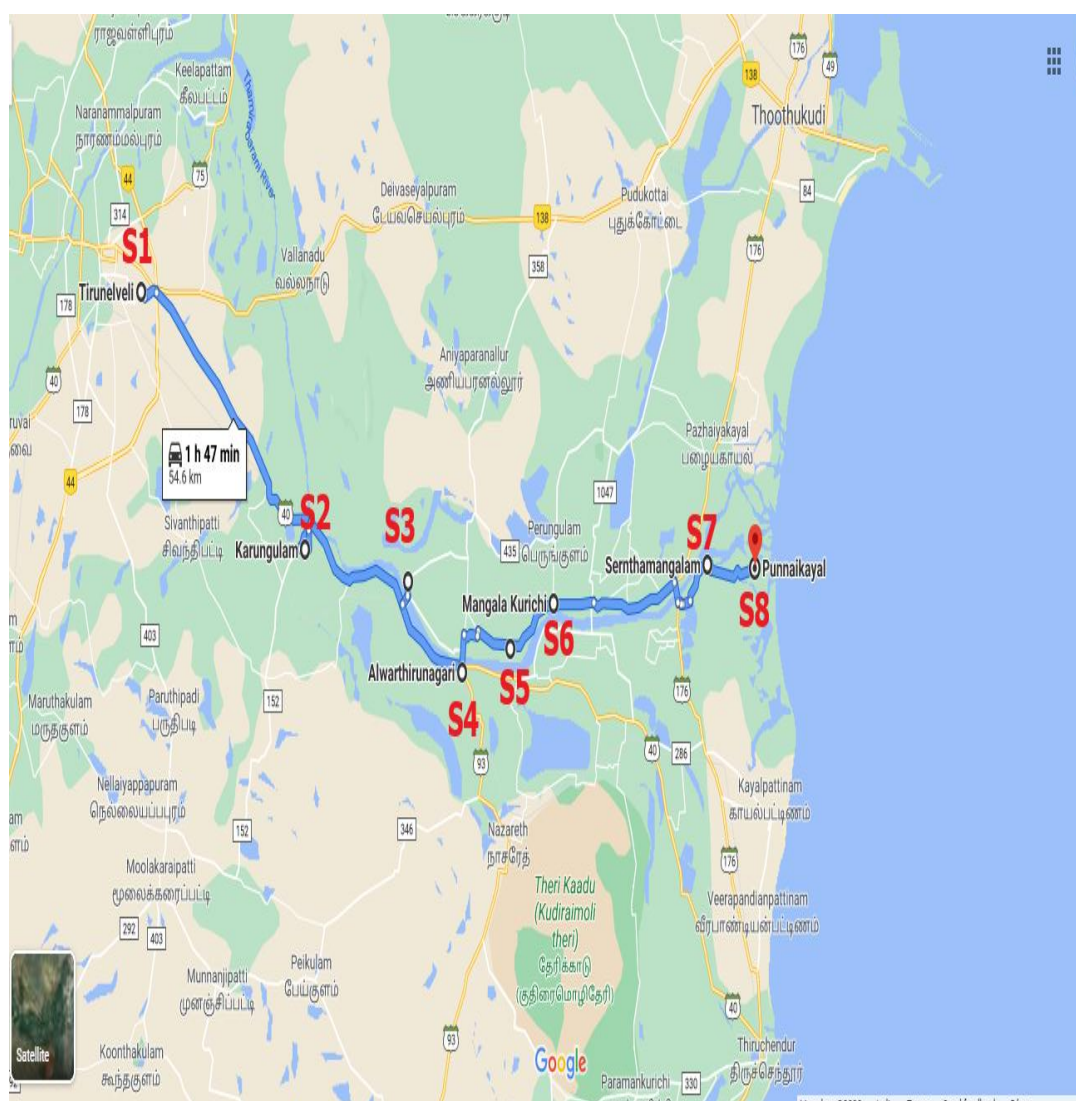


Fig 1. Mapping locations of the sampling sites

Tirunelveli(S1), Karungulam(S2), Sri vaikundam(S3), Alwarthirunagari(S4), Irattaitirupathi(S5), Mangalakurichi(S6), Senthamangalam(S7) and Punnaikayal(S8)

Table 1. Geographical location of the sampling sites

S.No	Sampling site	Latitude and Longitude
1	Tirunelveli	8°43'44.0"N 77°42'54.9"E
2	Karungulam	8°38'50.8"N 77°51'32.1"E
3	Sri vaikuntam	8°37'42.1"N 77°54'34.7"E
4	Alwarthirunagari	8°36'29.0"N 77°56'37.3"E
5	Irattathirupathi	8°36'29.7"N 77°58'23.8"E
6	Mangalakurichi	8°37'24.4"N 77°59'50.1"E
7	SenthaMangalam	8°39'34.0"N 78°05'53.0"E
8	Punnaikayal	8°38'17.0"N 78°06'55.0"E

Methodology

pH:

The pH is an important measure of any liquid and this reading is useful finding the acidity or alkalinity nature of the sample. A solution whose reading more than 7 is an alkaline solution whereas a count less than 7 is more acidic in nature. The pH for the collected samples was measured using pH meter. The pH meter consists of pH sensitive electrode and with a reference electrode.

Dissolved oxygen:

Dissolved oxygen is the volume of gaseous oxygen present in the water body. The amount of dissolved oxygen is determined by different factors such as temperature of the water, amount of salt present in the water, etc. In this study, Winkler method is employed to determine the dissolved oxygen content. A standard titration process was done in this Winkler method to find out the amount of dissolved oxygen in the water sample.

Steps involved:

300ml of the sample is taken in a BOD stoppered bottle. Add 2ml manganese sulphate solution and then add 2ml of alkali-iodide. In order to have a good mixture, invert the bottle down and then up. Add 2ml of Conc.sulphuric acid and make sure the solution is mixed up well. Take 203ml of the above solution into a conical flask. Titrate the sample in the conical flask with 0.025N sodium thiosulphate solution and the reading is to be noted for the colour change.

$$\text{Dissolved oxygen (mg/l)} = \text{Amount of thiosulphate} \times 0.2 \times 1000/200$$

Temperature:

Temperature was measured using water proof TDS and temperature meter. The temperature was measured at the sampling sites.

TDS:

TDS is one of the primary parameter. It is used to determine the inorganic salts and other organic matters present in the sample. TDS was measured using water proof TDS and temperature meter.

Hardness:

One of the parameter which describes the quality of the water sample taken is the total hardness. Generally hardness can be explained by the calcium and magnesium ions present in the water. The total hardness was measured using EDTA method.

Take 25ml of the sample in a 250ml Erlenmeyer flask. Add 25ml of distilled water in the above same flask. This addition of distilled water will not impact the result. But this is for getting a clear end point. Add 20 drops of the ph solution to the above said flask. Add a pinch of indicator, so that the color of the solution will turn to red. Fill the burette with the EDTA solution and make a note of the initial reading. Titrate the solution until the red color changes to blue. This reading can be used for determining the amount of calcium carbonate present in the sample and eventually this give the hardness of the sample.

Chloride:

Gaseous chlorine combines with the metal to yield a salt compound called chloride. Magnesium chloride and sodium chloride are some common forms of chloride.

Solutions needed:

Silver nitrate solution

Potassium chromate Indicator solution

Steps to be taken:

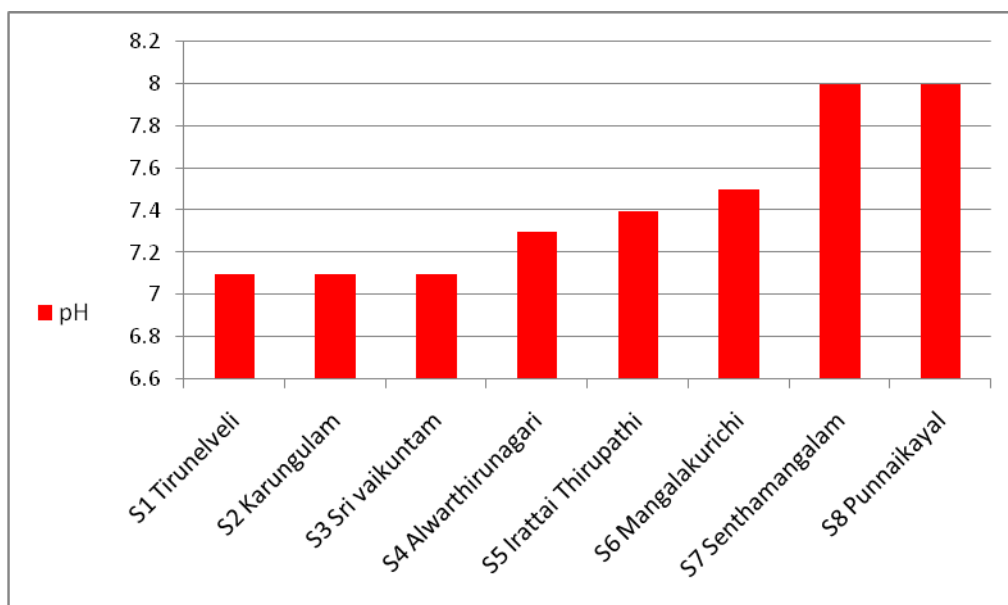
Take 20ml of the water sample in a 100ml volumetric flask. Add the remaining contents of the flask with distilled water. Now the diluted water sample is prepared. Pipette out 10ml of diluted sample in to conical flask. 50ml of distilled water is added to this. 1ml of potassium chromate indicator is added to the above solution. Titrate the above prepared sample with 0.1mol L^{-1} solution of silver nitrate and note down the reading at which the color changes.

RESULTS AND DISCUSSION

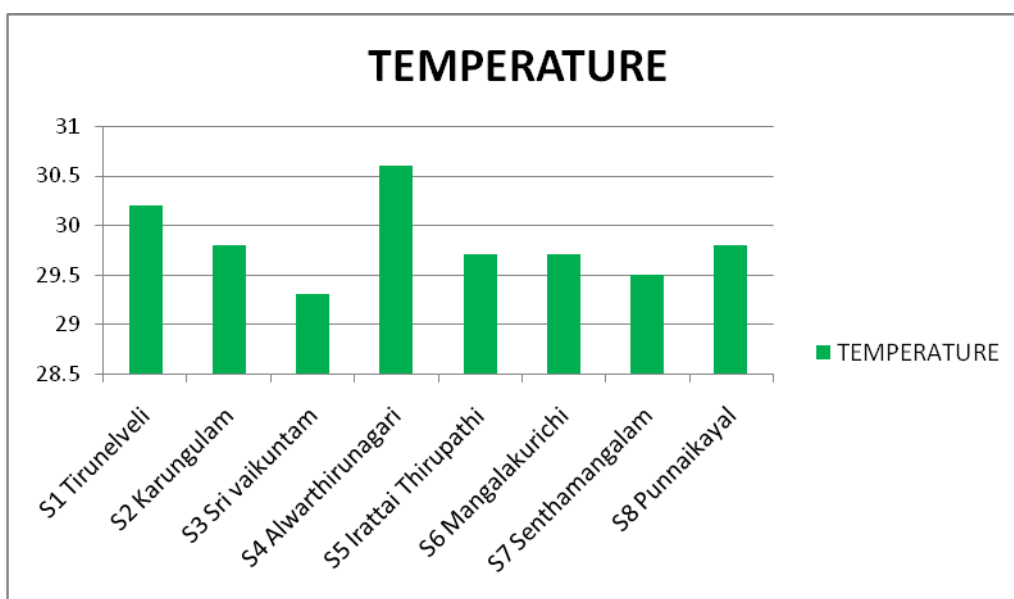
The pH meter showed a reading of 7.1 (Table 2 & Graph 1) at the stations Tirunelveli, Karungulam, Srivaikundam, and the pH slightly increases in Alwarthirunagari, Irraitirupathy, and Mangalakurichi. The pH gets its peak value (8.0) in the places

where the river flows nearer to the ocean (All values were found to be within the prescribed limits of IS10500-2012)

The temperature recorded at the samples varied between 29.3°C to 30.6°C (Table 2& Graph 2). These readings were to be in accordance with the prescribed limits of IS10500-2012.

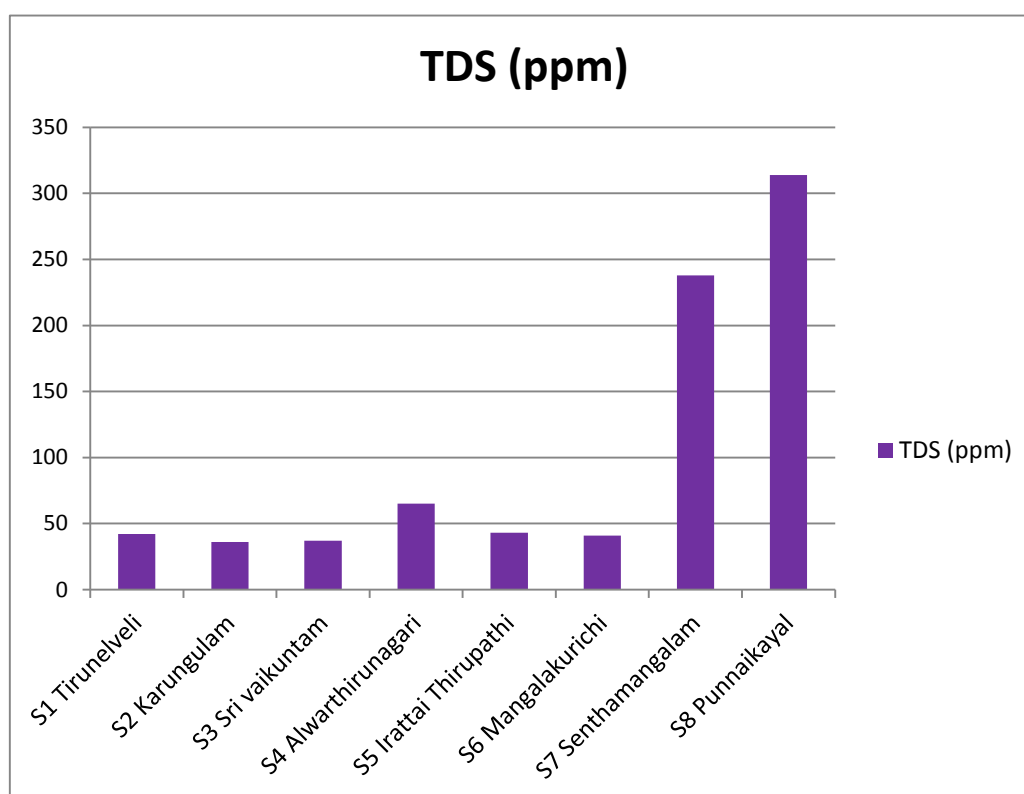


Graph 1. pH variation of the Sampling sites at river Thamirabarani



Graph 2. Temperature variation of the Sampling sites at river Thamirabarani

The TDS measured was lowest at the stations S2(Karungulum) 36ppm and Srivaikuntam 37ppm and the populated towns such as Tirunelveli measured 42ppm and Alwarthirunagari measured 65ppm. The stations S6(SenthaMangalam) and S7(Punnaikayal) recorded highest TDS contents such as 239ppm and 314ppm (Table 2& Graph 3). This is evident as the river passes near the coastal area the amount of solids and suspended materials are relatively higher than the other sampling stations (All values were found to be within the prescribed limits of IS10500-2012).

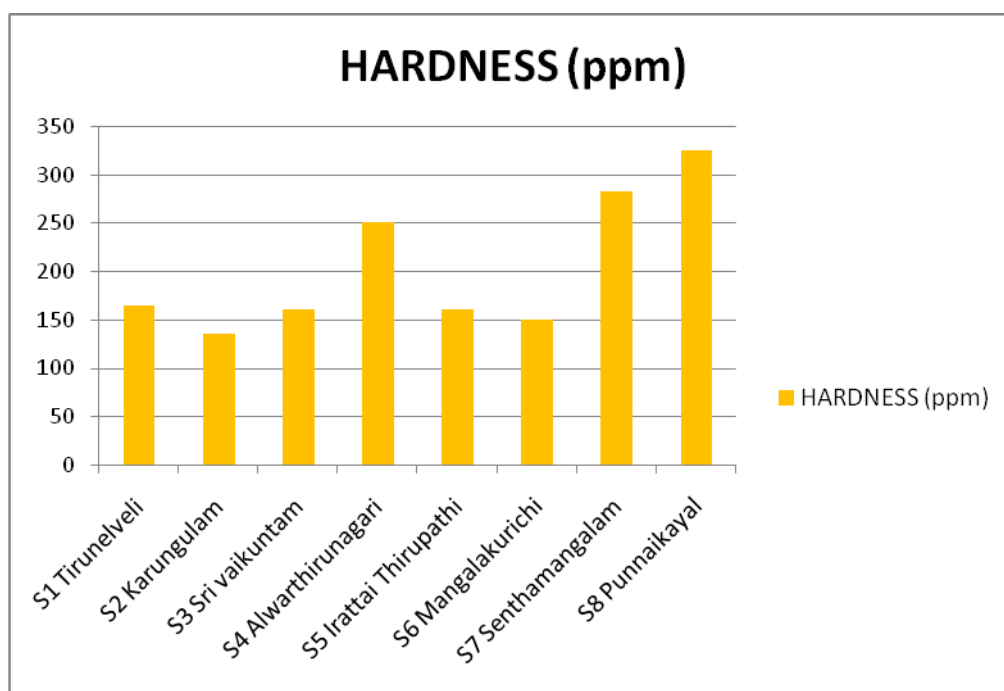


Graph 3. TDS variation of the Sampling sites at river Thamirabarani

The hardness of the sampling station S2 Karungulum is the lowest of all i.e 135ppm and the other stations such as S1 Tirunelveli, S3 Sri vaikundam, S5 Irattaitirupathi and S6 Mangalakurichi have the hardness contents from 150 to 165ppm. These values were found to be within the prescribed limits of IS10500-2012). On the other hand, The sample S4-Alwarthirunagari has more hardness level of 250ppm. The stations S6(SenthaMangalam) and S7(Punnaikayal) have its peak hardness content of 282 and 316ppm respectively (Table 2& Graph 4). These were found to be higher than the limits (200mg/l) prescribed by IS10500-2012.

Table 2. Physico chemical parameter findings of the Sampling sites at river Thamirabarani

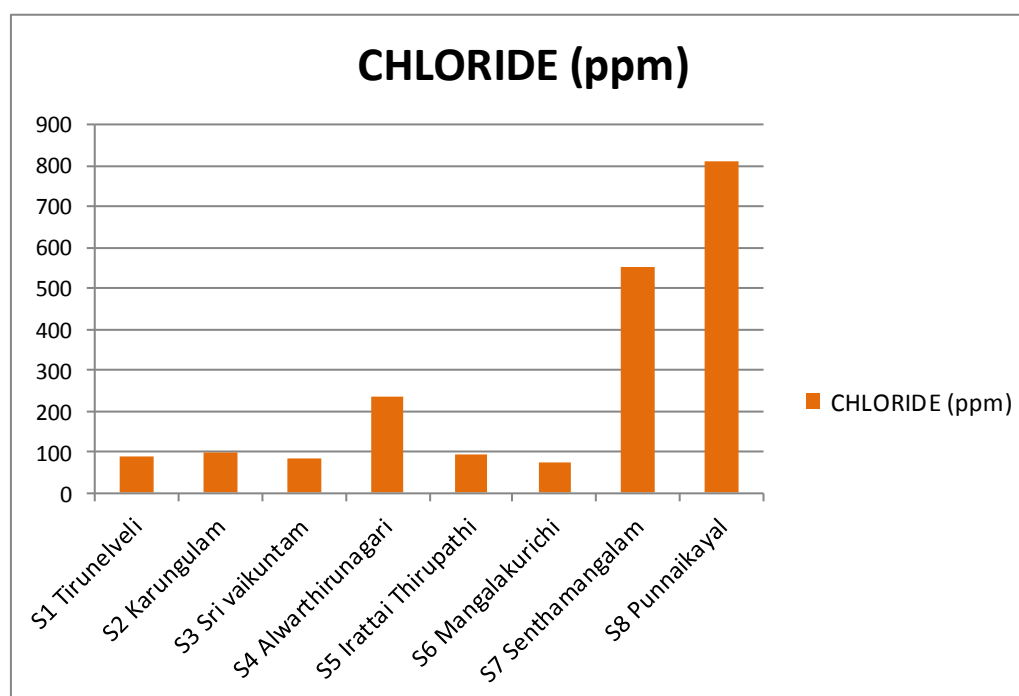
Parameter	S1 Tirunelveli	S2 Karungulam	S3 Srivaikuntam	S4 Alwar thirunagari	S5 Irattai Thirupathi	S6 Mangala kurichi	S7 Santha Mangalam	S8 Punnaikayal
Temperature	30.2	29.8	29.3	30.6	29.7	29.7	29.5	29.8
pH	7.1	7.1	7.1	7.3	7.4	7.5	8	8
TDS (ppm)	42	36	37	65	43	41	239	314
Hardness (ppm)	164	135	160	250	160	150	283	325
Chloride (ppm)	89	99	84.99	237.4	92.46	74.96	554.98	809.83
Dissolved oxygen	6.1	6.5	6.4	5.4	6.2	6.4	3.5	3.1

**Graph 4.** Hardness variation of the Sampling sites at river Thamirabarani

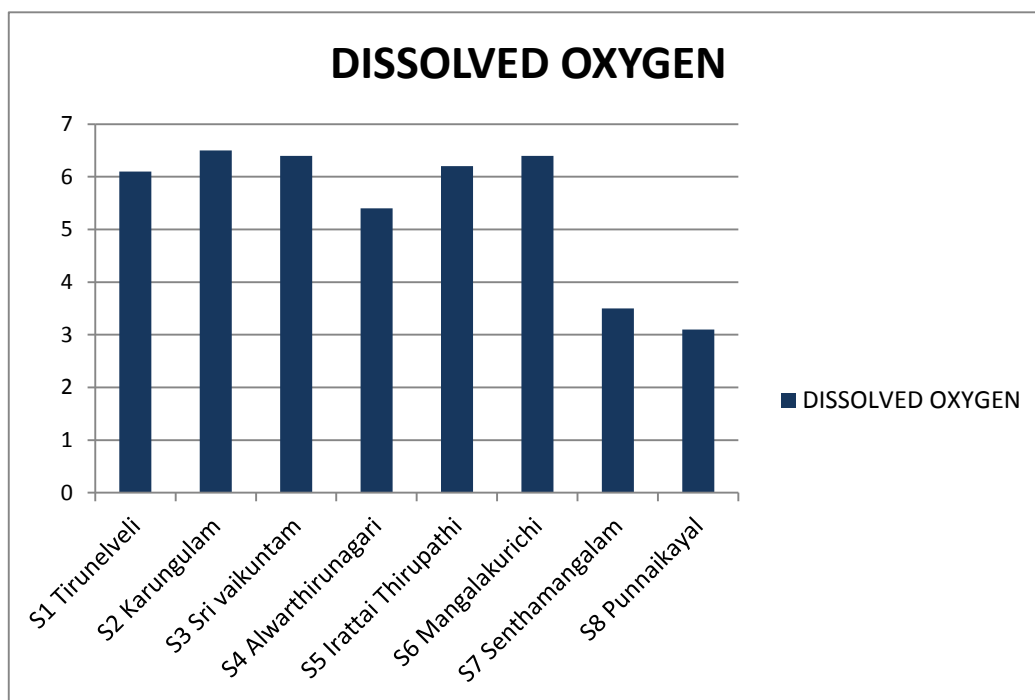
Chloride content was lowest at the site S6 Mangalakurichi and the other sites S1,S2,S3,S4 and S5 have nominal chloride content ranging from 89ppm to 99ppm. These values were found to be within the prescribed limits of IS10500-2012). On the other hand, the sites S7Senthamangalam and S8Punnaikayal recorded the highest chloride contents of 554ppm and 809ppm respectively (Table 2 & Graph 5). These were found to be higher than the limits (250mg/l) prescribed by IS10500-2012.

Dissolved oxygen is lowest at the sites nearer to sea S7 Senthamangalam and S8 Punnaikayal and all the other sites witnessed a range from 5.4 to 6.5ppm (Table 2& Graph 6).

From the above studies, the water sample collected from the site S4Alwarthirunagari recorded higher values of chloride, TDS, hardness because of the higher pollution levels at that area. The river water at this site is contaminated by municipal and domestic sewage disposal. Effective treatments should be done before disposing the waste into the river. The sites S7 and S8 recorded their peak value for chloride, TDS, hardness and low dissolved oxygen content. This is evident that since these sites are very close to the sea these recorded the higher values.



Graph 5. Chloride variation of the Sampling sites at river Thamirabarani



Graph 6. Dissolved oxygen variation of the Sampling sites at river Thamirabarani

ACKNOWLEDGMENT

Authors sincerely thank Professor.S.Sidhardhan, Head of Dept, Civil Engineering for allowing utilizing Lab facilities provided at the Environmental Lab in Government College of Engineering (GCE), Tirunelveli.

REFERENCES

- [1] Annalakshmi G and Amsath 2012. A An Assessment Of Water Quality Of River Cauvery And Its Tributaries Arasalar With Reference To Physico-Chemical Parameters At Tanjore Dt, Tamilnadu, India, International Journal Of Applied Biology And Pharmaceutical Technology, Volume: 3: Issue-1.
- [2] Arasu, T.P., Hema, S., and Neelakantan, M.A. 2007. Physico-chemical analysis of Thamirabarani river water in South India, Indian Journal of Science and Technology, Vol.1 No.2.
- [3] Badr et al., 2013. Water Quality Assessment in the Nile River, Damietta Branch, Egypt, CATRINA 8 (1): 41-50.
- [4] Bharati, K.G., Satish, S.M. 2014. Study of Some Physico-Chemical Parameters of Godavari River Water at Ramkund, Nashik With Reference to Correlation Study, PARIPEX - INDIAN JOURNAL OF RESEARCH, Volume : 3 | Issue : 5.

- [5] Debels, P. et al, 2005. Evaluation Of Water Quality In The Chillan River (Central Chile) Using Physicochemical Parameters And A Modified Water Quality Index, *Environmental Monitoring and Assessment* 110: 301–322.
- [6] Dubey, M. and Ujjania, N.C. 2013. Water Quality And Pollution Status Of Tapi River, Gujarat, India, *International Journal of Pure and Applied Zoology*, Vol. 1, Issue 3, pp: 261-266.
- [7] Kumar, S.D., Srikantaswamy, S. and Jagadish, K. 2014. An Overview On Assessment of Cauvery River Water Quality, –*International Journal for Innovative Research in Science & Technology*| Volume 1 | Issue 7 | December.
- [8] Muyen et al., 2016. Assessment of water quality index: a case study in Old Brahmaputra river of Mymensingh District in Bangladesh, *Progressive Agriculture*, 27 (3): 355-361.
- [9] Pentewar, M.S. 2018. Physico-chemical aspects of Godavari river at Nanded district MS, India, *Int. J. of Life Sciences*, Special issue, A10; January, 174-176.
- [10] Piplode, S. and Barde, V.S. 2015. Physico-chemical Evaluation of Narmada River Water at Khalghat MP, India, *Research Journal of Chemical Sciences*, Vol. 5(5), 24-26.
- [11] Rajkamal, R. et al., 2016. Assessment of water quality standards in the villages of Kanchipuram district, Tamil Nadu, India, *Int J Community Med Public Health*. Nov;3(11):3179-3183.
- [12] Saluja, D.S. 2019. Physico-Chemical Study of Tapti River Water at Multai, District - Betul (M.P.), *International Journal of Science and Research (IJSR)*, Volume 8 Issue 11, November, 195-197.
- [13] Soranam, R., Senthilmanickam, J. and Sabaridasan, A. 2016. A Study on Physico-Chemical Properties of Water Samples from Cauvery River of Pallipalayam Town, Namakkal District of Tamil Nadu, India, *Int. J. Adv. Sci. Eng.* Vol. 2 No.4 202-208 202.
- [14] Subramanian, G.R., Subramanian, V. and Sukumar, S. 2011. Pre and Post-Monsoon variation in PhysicoChemical characteristics in Groundwater quality of parts of Tirunelveli District, Tamil Nadu, India, *International Journal of Geomatics and Geosciences* Volume 2 Issue 1.
- [15] Sureshkumar, M. et al, 2016. Analysis Of Physico-Chemical Characteristics Of Groundwater In Kanchipuram Municipality, Tamil Nadu, India, *RASĀYAN J. Chem*, Vol. 9 | No. 3 |454 - 459 | July – September.

