

Evaluation of Physical and Chemical Parameters of Water Samples Collected From Thenpennaiyar River at Kelavarapalli, Krishnagiri District, South India

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Abstract: The present of study is carried out to determine the seasonal variations of physicochemical parameter in the water samples from Thenpennaiyar River, Krishnagiri, South India, which is suitable for human consumption, the study has been carried out during to the one year period (May-2014 to April -2015). The purpose of this study is access to quality of water sources in four different seasons, such as summer (April), pre-monsoon (September), monsoon (December), post-monsoon (February). Water samples are analysed for physicochemical parameters including pH, electrical conductivity, total dissolved solids, free ammonia, turbidity, total hardness, chloride, fluoride, sulphate, phosphate, total alkalinity, Total hardness, Calcium, Magnesium, Nitrite and Nitrate. The Result showed the variations of analyses parameters in the water sample as follows : Turbidity [3.5-8.2]NTU, total dissolved solids [664-840]mg/L, electrical conductivity[948-1194] Mosh/cm, pH [7.47-8.99], total Alkalinity [200-380] mg/L, Total hardness [210-340] mg/L, Calcium [52-72] mg/L, Magnesium [19-38] mg/L, free Ammonia [21.07-58.01], Nitrite [0.24-3.62] mg/L, Nitrate [4-8]mg/L, Chloride [170-200] mg/L, Fluoride [0.20-0.41] mg/L, Sulphate [20-49] mg/L, and Phosphate [1.60-5.26] mg/L. They are determined in research laboratory in TWAD. From the result it is found to the most of the parameters in Thenpennaiyar River is within the maximum permissible limit to WHO and ICMR. The present findings have concluded that the investigation area of Thenpennaiyar River, physicochemical parameters of water samples are not polluted and do not cause any disease and health effects on living organisms. The turbidity of water is more in post-monsoon period compare to pre-monsoon period. Nitrite is highly summer period compared to the post and pre monsoon period. The total dissolved solid value is highly in post-monsoon period. Phosphate value is high in monsoon period.

Keywords: Seasonal variations, physicochemical parameters, Thenpennaiyar River, Phosphate.

1. INTRODUCTION

Water is the elixir of life and its importance can be traced back to the beginning of the earth is one of the highest planet and solar system processing water, Oxygen, and basic raw material to support life. It is one of the most vital natural resources and almost all the major human civilization is centurion the river basins. Water has no alternative in the facts the essence and sustenance of life is based on the water. It is also the wonderful universal solvent with the unique property of dissolving and carrying in suspension a wide spectrum of substances and for the same reason it is susceptible to contamination. Water is resource for agriculture, manufacturing and other human activities. In urban areas, the careless

disposal of industrial effluents and other wastes in river and lakes may contribute greatly to the poor quality of river water.

Water quality is the physical, chemical and biological characteristics based on the most common standards used to assess water quality related to the drinking water safety of human contact for the health of ecosystems. The water body such as lakes, river and oceans Topic substances and high populations of certain microorganisms can present a health hazard for non-drinking purpose such as irrigation, industrial uses and etc.... The quality of water may be described according to their physical, chemical, and microbiological characteristics. The physicochemical properties will also help in the identification of sources of pollution, for conducting further investigation to the eco-biological impacts and also for initiating necessary steps for remedial actions in case of polluted water bodies. The availability of good quality water is an indispensable feature for preventing diseases and improving quality of life. The physicochemical properties will also help in the identification of sources of pollution, for conducting further investigation on the eco-biological impacts and also for initiating necessary steps for remedial actions in case of polluted water bodies. On the other hand, in case of pristine aqua systems, such studies shall contribute towards the protection and prevention of its good water quality. The main objective of this work has to analyse various physical, chemical and parameter of the Thenpennaiyar River water, Krishnagiri, South India during the period of May 2014 to April 2015 in four different seasons (summer, pre-monsoon and monsoon, post-monsoon).

2. MATERIALS AND METHODS

2.1 Collection of water samples:

The present study was carried out the over periods of 12 months from May-2014 to April-2015 from Thenpennaiyar river at kelavarapalli, Krishna giri district, South India. It is located 65 kilometres from Krishnagiri. The samples are collected in plastic containers, they are cleaned with dilute nitric acid and rinsed several times with tap water and finally rinsed with sample water, the samples are kept storing in a refrigerator. Samples are preserved and analysed by adopting the procedures outlined by standards method for various parameters. Two litres of river water samples are collected in these containers and tested the physicochemical parameters at South India water supply and drainage board, Environmental Engineering institute, Hosur , Krishnagiri District.

2.2 Analysis of Water Samples:

Water samples are tested for various physicochemical parameters, physical parameters and turbidity is noted down. The chemical parameters pH is measured by elico, model lil20 digital pH meter, which gives direct values of pH, total dissolved solids, total hardness, fluoride, chloride, electrical conductivity, chloride, sulphate, nitrate, free ammonia (as NH_3), total alkalinity and phosphate are analysed by standard methods.

3. RESULTS AND DISCUSSIONS

Monitoring water resources will quantity water quality, density impairments and help policy makers make land use decisions that will not only preserve natural areas. The fate and transport of many anthropogenic pollutants are determined by not only hydrological cycled, but also physic chemical processes. The monitored values of physicochemical parameters of Karman River water samples are noted in the following tables (**Table1 & 2**).

3.1 pH:

Natural waters, the pH scale runs from 0 to 14. A pH value of 7 is neutral; pH less than 7 is acidic and greater than 7 represents base saturation or alkalinity. The principal component regulating ion pH in natural waters is the carbonate, which comprises CO_2 , H_2CO_3 and HCO_3 (APHA, 1995). Generally, tropical waters tend to have low pH. Lower values in pH are indicative at high acidity, which can be caused by the deposition of acid forming Substances in precipitation. A high organic content will tend to decrease the pH because of the carbonate chemistry. As microorganisms break down organic material, the by product will be CO_2 that will dissolve and equilibrate with the water forming carbonic and (H_2CO_3). Most metals will become more soluble in water as the pH decreases. The excesses of dissolved metals in solution will negatively affect the health of the aquatic organisms. pH values recorded in the river water is in agreement with the pH values reported for other fresh water system.

One of the important factors that serve as an indicator of pollution of water body pH is the scale of intensity of acidity and alkalinity of water and measures the concentration of hydrogen ions. At the period of study, the pH ranges from 7.47

to 8.99 in the Thenpennaiyar River, at Kelavarapalli, Krishnagiri, South India. (Fig-1). The minimum pH of 7.4 has recorded in the Month of April 2014 and maximum pH of 8.99 was observed in the Month of February 2015. The mean value of pH in the river recorded have 8.58, the result also shows that the alkaline pH is particularly due to bicarbonate and not due to carbonate alkalinity. The mild alkaline nature suggests that approximately 95% of CO₂ in water is present as bicarbonate. The rain water is responsible for neutralization and finally to alkaline. The fluctuation of pH in this lotic system may be due to the buffering capacity.

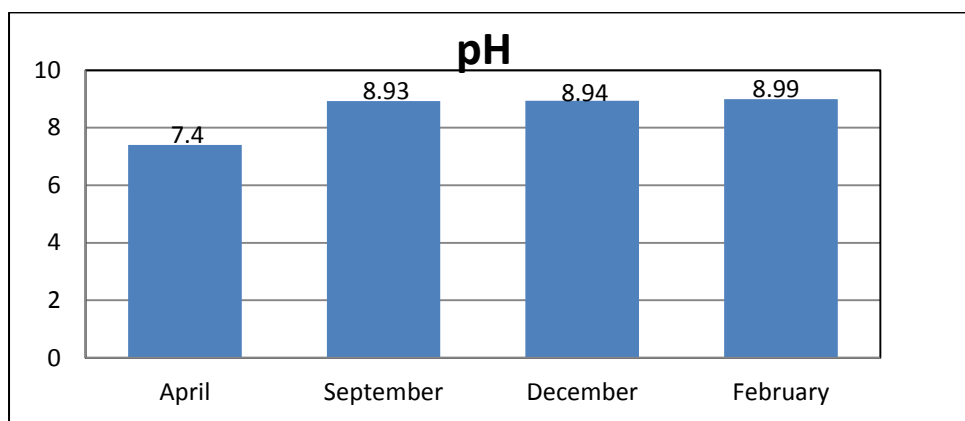


Figure.1: pH Variation of Thenpennaiyar River

TABLE.1: Physicochemical Parameters Analysis of Water Samples in Different Seasons in Thenpennaiyar River at Kelavarapalli, Krishnagiri District, South India.

S.No	Parameters	April (Summer)	September (Pre-monsoon)	December (Monsoon)	February (Post-monsoon)	Max	Min	Range	Mean	S.D
I Physical examinations										
1	Appearance	Colourless & clear	Colourless & clear	Colourless & clear	Colourless & clear	-	-	-	-	-
2	Odour	Nil	Nil	Nil	Nil	-	-	-	-	-
3	Turbidity (NTU units)	5.2	3.5	7.1	8.2	8.2	3.5	2.35	6	1.79
4	Total dissolved solids (mg/L)	736	664	834	840	840	664	88	768.5	73.10
5	Electrical Conductivity (mics/cm)	1050	948	1194	1192	1194	948	123	1096	103.48
II Chemical examinations										
6	pH	7.47	8.93	8.94	8.99	8.99	7.47	0.76	8.58	0.813
7	Total Alkalinity as CaCO ₃ (mg/L)	200	280	352	380	380	200	90	303	69.76
8	Total Hardness as CaCO ₃ (mg/L)	340	210	230	25	340	210	65	257.5	49.40
9	Calcium as Ca (mg/L)	72	52	60	64	72	52	10	62	11.2
10	Magnesium as mg (mg/L)	38	19	19	22	38	19	9.5	24.5	7.88
11	Free Ammonia as NH ₃ (mg/L)	21.07	24.76	58.01	45.28	58.01	21.07	18.47	37.28	4.70
12	Nitrite as No ₂ (mg/L)	3.62	0.48	0.24	0.45	3.62	0.24	1.69	1.19	1.40
13	Nitrate as No ₃ (mg/L)	8	6	4	4	8	4	2	5.5	1.65
14	Chloride as Cl (mg/L)	178	170	180	200	200	170	15.5	182	11.04
15	Fluoride as F (mg/L)	0.41	0.20	0.20	0.20	0.41	0.20	0.105	0.25	1.37
16	Sulphate as So ₄ (mg/L)	49	20	22	20	49	20	14.5	30.25	12.54
17	Phosphate as Po ₄ (mg/L)	1.60	2.63	5.26	2.13	5.26	1.60	1.83	3.82	1.67

TABLE.2: Correlation Coefficient between Physicochemical Parameters in Different Seasons of in Thenpennaiyar River at kelavarapalli, Krishnagiri District, South India.

	Turbidity	Total dissolved solids	Electrical Conductivity	pH	Total Alkalinity	Total Hardness	Calcium	Magnesium	Ammonia	Nitrite	Nitrate	Chloride	Fluoride	Sulphate	Phosphate
Turbidity	1														
Total dissolved solids	0.984	1													
Electrical Conductivity	0.977	0.999	1												
pH	0.376**	0.530*	0.220**	1											
Total Alkalinity	0.725	0.475**	0.704	-0.32**	1										
Total Hardness	0.017**	-0.691	0.449**	-0.757	-0.677	1									
Calcium	0.327**	-0.412**	0.218	0.211**	-0.237**	0.189**	1								
Magnesium	-0.152**	-0.678	0.779	-0.174	0.784	0.992	0.552**	1							
Ammonia	0.801	0.812	0.886	0.512**	0.734	-0.472**	-0.094	-0.612	1						
Nitrite	-0.282**	-0.293**	0.090**	-0.506**	0.947	0.961	0.505**	0.991	-0.683	1					
Nitrate	-0.665	-0.712	0.699	-0.699	-0.940	0.717	0.268**	0.822	0.921	0.889	1				
Chloride	0.890	0.808	0.763	0.193**	0.462**	0.197**	0.241**	-0.063**	0.488**	-0.204**	0.546*	1			
Fluoride	-0.053**	-0.018**	0.017**	-0.052**	-0.063**	0.064**	0.017**	-0.066**	-0.016**	0.066**	-0.058*	-0.014**	1		
Sulphate	-0.232**	-0.225**	0.620	-0.776	-0.960	0.880	0.504**	0.962	0.118**	0.972	0.835	-0.216**	0.064**	1	
Phosphate	0.218**	0.129**	0.453**	0.345**	0.303**	-0.540**	-0.219**	-0.513**	0.076**	-0.497**	-0.154*	0.137**	-0.030**	0.285*	1

All the values are significant at the 0.05 level (2-tailed)

* Shows perfect positive correlation

3.2 Turbidity:

The Turbidity of any water sample is the reduction of transparency due to the presence of particulate matter such as lay or slit, finely divided organic matter, plankton and other microscopic organisms. Its observed higher turbidity during Post monsoon period and minimum turbidity during Pre -monsoon season at Thenpennaiyar River at Kelavara palli, Krishnagiri District, South India. Found highest and lowest values of turbidity as 8.2 NTU and 3.5 NTU respectively in Thenpennaiyar River at kelavarapalli, Krishnagiri District, South India. The turbidity ranged from 3.5 to 8.2 in Thenpennaiyar River at kelavarapalli, Krishnagiri District, South India. May be due to silt and other particles matter from mountain areas In the present study, the higher turbidity was evident in the post Monsoon season due to low depth and heavy flux of sewage and lower at Pre Monsoon season (**Figure 2**).

3.3 Electrical Conductivity:

Conductivity in natural waters is the normalized measure of the waters ability to conduct electric current. This is mostly influenced by dissolved salts such as sodium chloride and potassium chloride. The conductivity ranged from 948 mhos to 1194 mhos during Pre-monsoon and monsoon seasons. High conductivity during monsoon might be attributed to saline intrusion from Thenpennaiyar River at kelavarapalli, Krishnagiri District, South India and slight reduction in the station during Pre monsoon might be due to fresh water input from rain. There was a positive correlation between conductivity and TDS of the water samples (**Figure 3**).

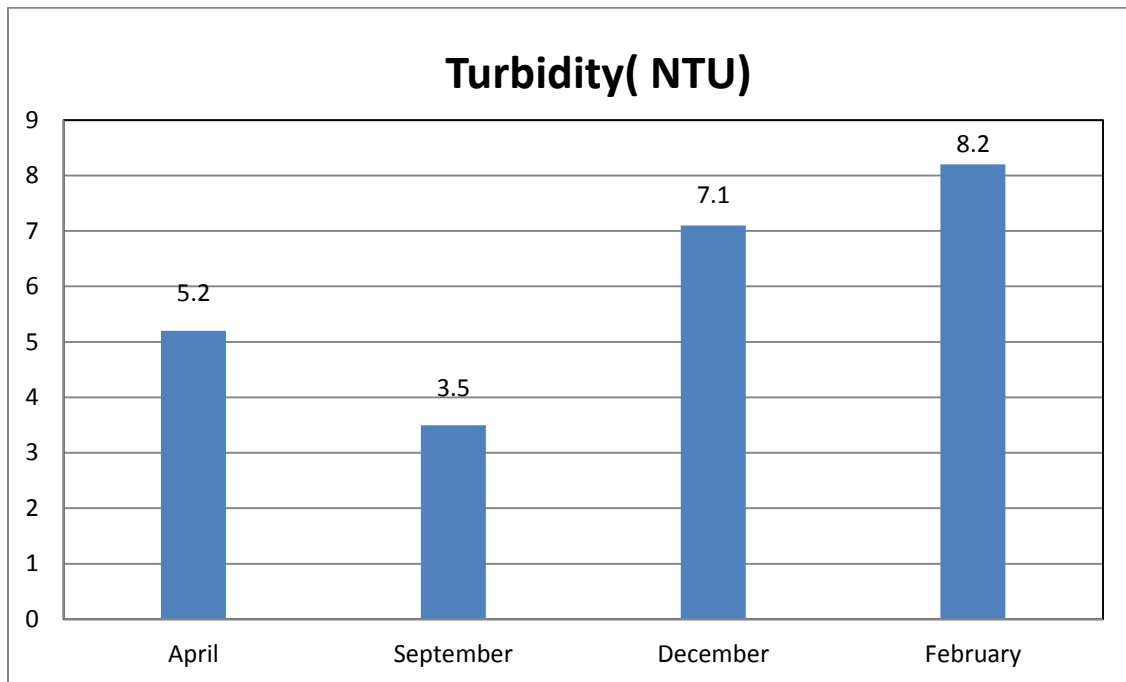


Figure.2: Turbidity Variation of Thenpennaiyar River

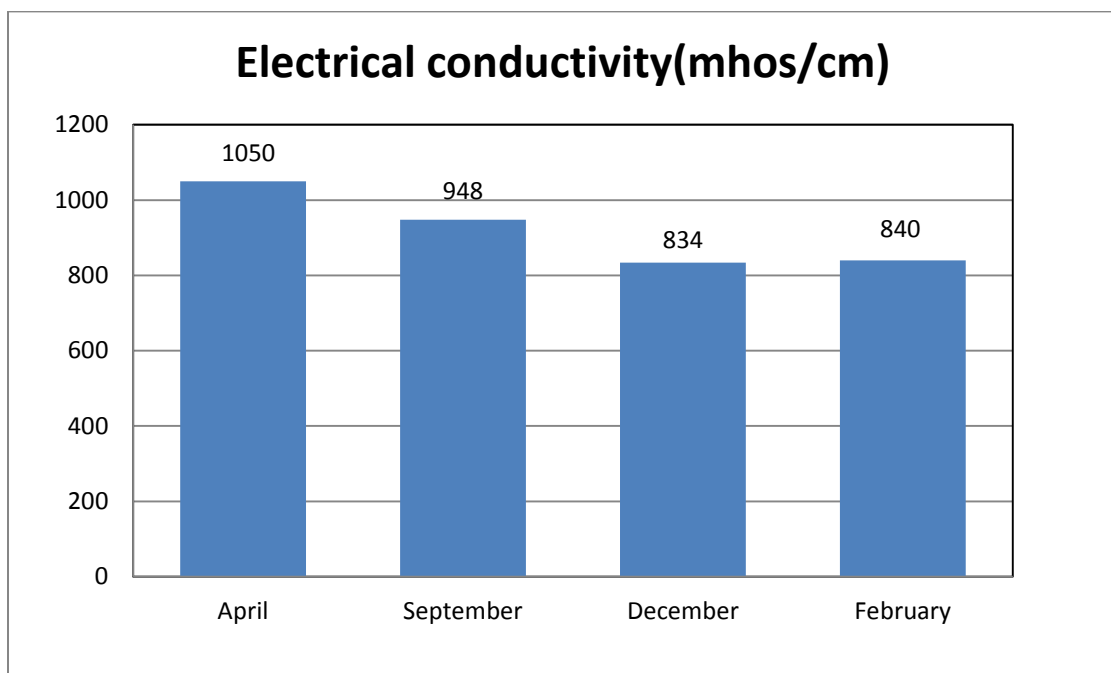


Figure.3: Electrical Conductivity Variation of Thenpennaiyar River

3.4 Total Dissolved Solids:

The Total Dissolved Solids values in the Thenpennaiyar River at Kelavarapalli, Krishnagiri District, and South India. The value TDS 840 mg/l exceeded the maximum permissible limits of WHO (600mg/l) in the Month of February 2015. In this study the primary sources for elevated TDS level in river water are agricultural runoff, particulate matter of cement and other raw material used in construction of river front, leaching of soil contamination and non point source of water pollution i.e. discharge from industrial and sewage treatment plants particularly during dry season with low water level and relatively low values during wet season might due to dilution effect. Thenpennaiyar River at Kelavarapalli, Krishnagiri District, South India show a lower TDS value in the month of September 2014 (Figure-4)

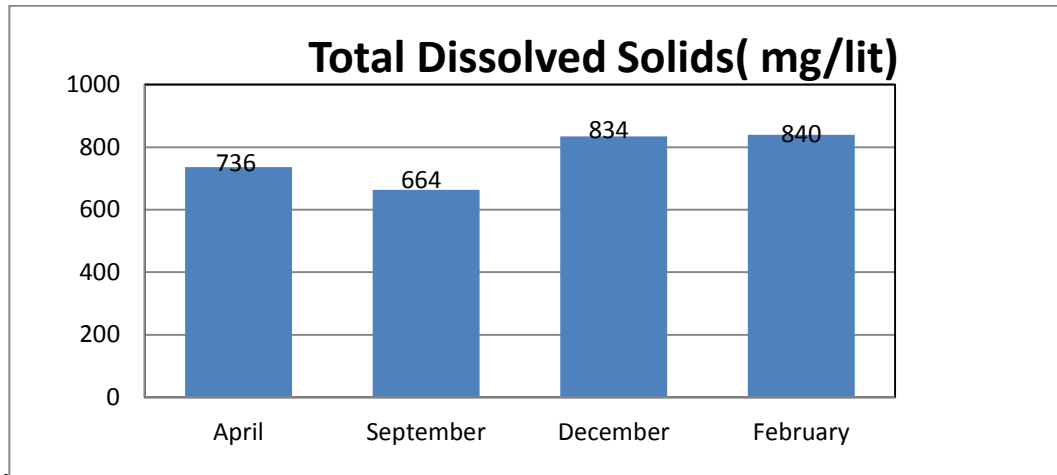


Figure.4: Total Dissolved Solids Variation of Thennennaiyar River

3.5 Nitrite:

Generally, nitrites are formed in water due to bacterial action oxidation of ammonia and are readily oxidized to nitrates. Though they are seldom present in significant concentration in surface or other natural water the nitrites in water are indicative of organic pollution. Biological decomposition of all nitrogenous organic matter such as sewage and animal wastes contribute nitrite values in water. Their presence indicates that the nitrogenous organic matter is undergoing oxidation or nitrification and that the process is not complete. The nitrate concentration on the present study ranged from as low as 0.24 mg/liter in Month of December 2014 and high range as 3.62 mg/liter in the Month of April 2014 respectively during monsoon and summer season. The presence of little higher value in water is indication of pollution in the Thennennaiyar River at Kelavarapalli, Krishnagiri District, and South India has observed nitrite in effluents from Mathura refinery that are and ultimately poured in to river (Figure-5).

3.6 Nitrate:

Nitrate pollution will cause Eutrophication of a stream where algae and aquatic plant growth will consume the oxygen and increase the TSS of water Eutrophication is usually the result of nitrate and phosphate contamination and is a significant reduction of water quality. Nitrate can exist naturally in ground water but can exist naturally in ground water but can increase dramatically on irrigated lands. The nitrate concentration on the present study ranged from as low as 4 mg/liter in Month of December 2014 and high range as 8 mg/liter in respectively during monsoon and summer season. The value on stations like Thennennaiyar River at kelavarapalli, Krishnagiri District, South India show could be attributed to anthropogenic sources, viz run off waters, discharge of effluents from retting activity containing nitrogen species and their subsequent oxidation by microbiological activity under aerobic conditions. Nitrate and phosphate are essential for the growth of blue green algae (Figure-6).

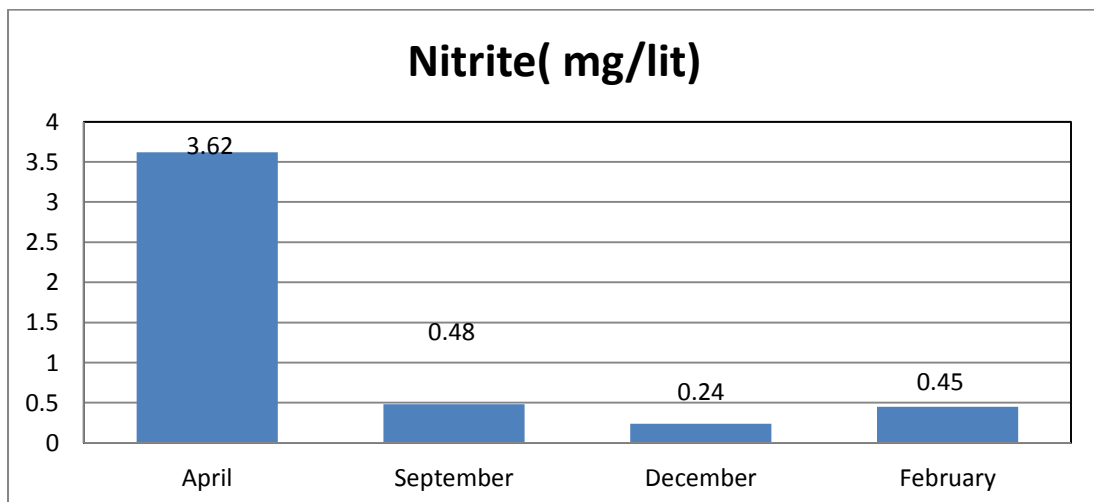


Figure.5: Nitrite Variation of Thennennaiyar River

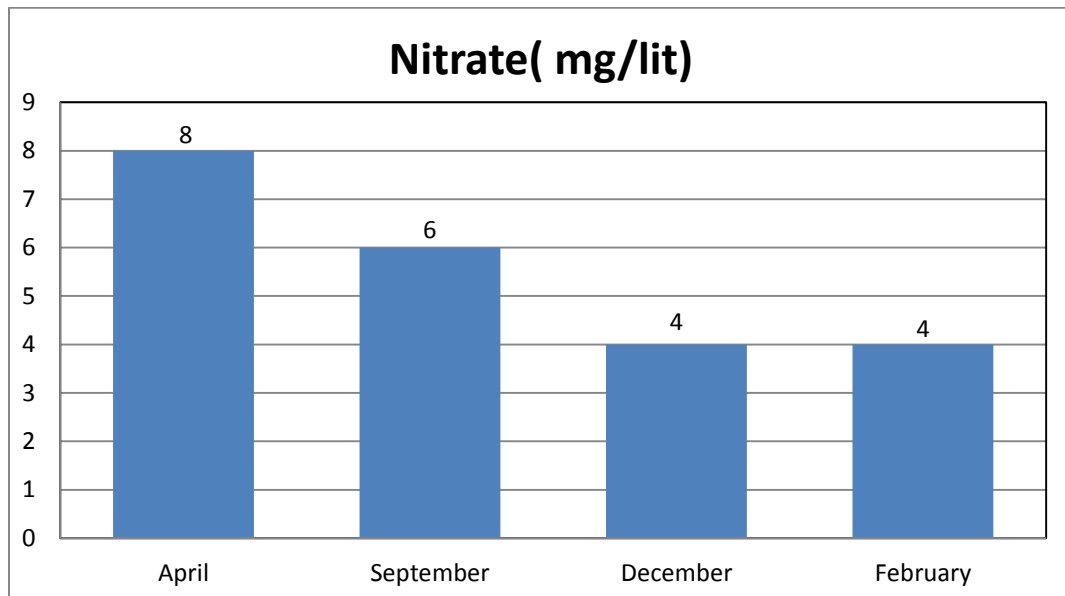


Figure.6: Nitrate Variation of Thenpennaiyar River

3.7 Sulphate:

High concentration of SO_4^{2-} could cause a cathartic action on human beings and can also cause respiratory problems. In this study, the average sulphate concentration of the river was 20 to 22 mg/liter (Figure 7) during pre monsoon and 20 to 40 mg/liter during monsoon. The increase in concentration and run off waters from agricultural lands might have also contributed to overall sulphate content in the river water.

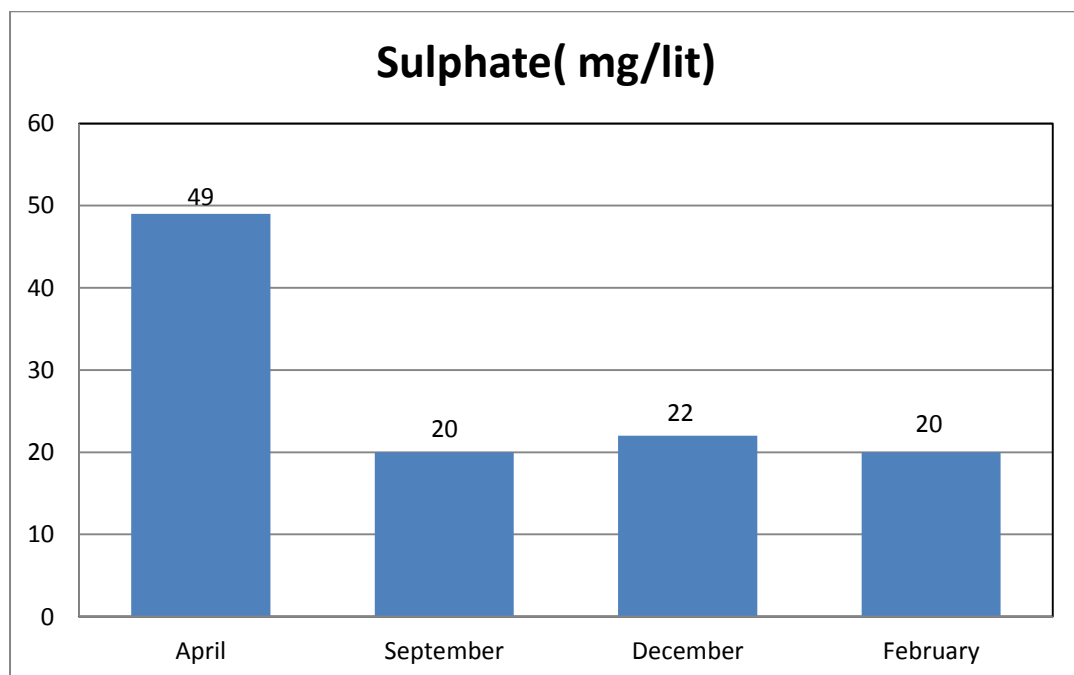


Figure.7: Sulphate Variation of Thenpennaiyar River

3.8 Phosphate

The main environmental impact associated with phosphate pollution is Eutrophication. Inorganic phosphate in surface water fluctuated 1.60 mg/liter in during summer pre -monsoon, 2.63 mg/liter in during Pre monsoon seasons, 5.26 mg/l in during Monsoon and 2.13 mg/l in post Monsoon respectively. These have indicated that the phosphate bearing contaminants such as detergents get accumulated at Thenpennaiyar River South India, during both the season. The wide spatial fluctuation in nitrate, phosphate and sulphate values observed in the present study reveals the localized mode of contamination in the river. This is particularly so for orthophosphate since it is attached to settling particles (Figure 8).

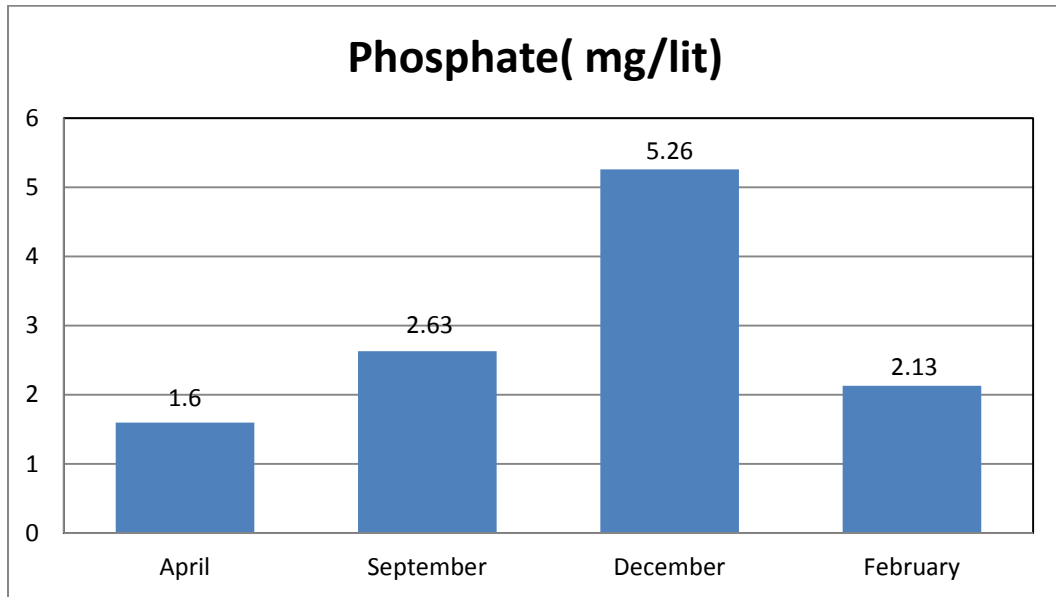


Figure.8: Phosphate Variation of Thenpennaiyar River

3.9 Chlorides:

Chlorides are presents in all portable Water, Usually, present in the sewage as Metallic Salt. The Presence of Chlorides in natural water can be attributed to salt Deposits, discharge, irrigation drainage contamination from refuge leachates and sea water intrusion in coastal areas. During the study (May 2014 to April 2015) the chlorides values were ranged 170 to 200 mg/l. Minimum alue of Chlorides was recorded 170mg/l in the month of September 2014,while Maximum value was recorded , 200mg/l in the month of February 2015(Figure 9).

The High values of chloride might be due to low water levels during Summer Season.

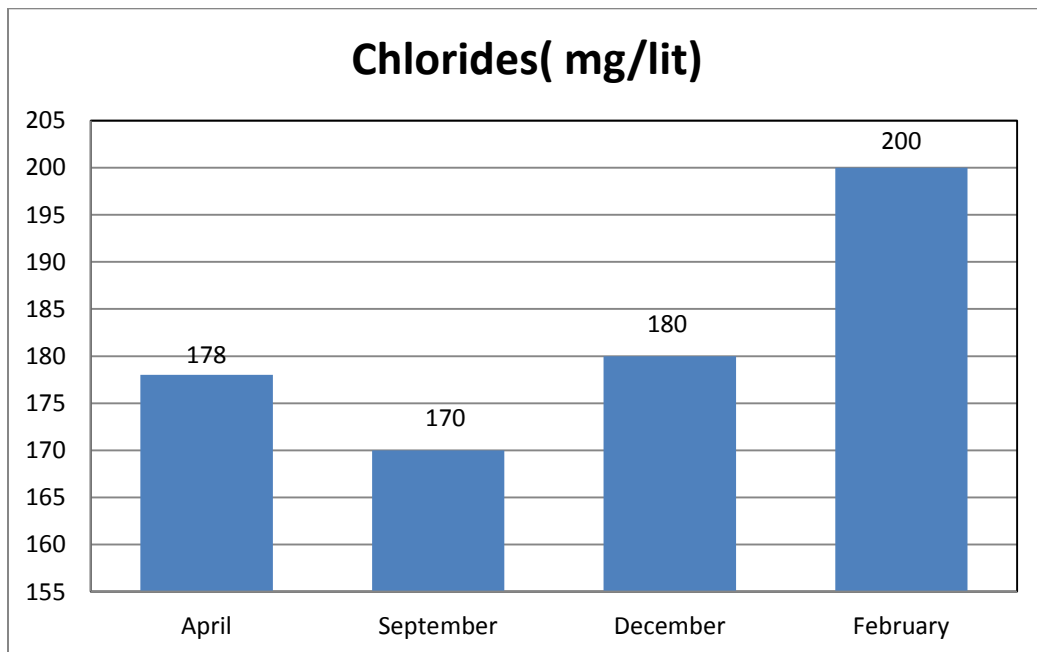


Figure.9: Chlorides Variation of Thenpennaiyar River

3.10 Calcium and Magnesium

Calcium is also an important micronutrient in the aquatic environment and its concentration may vary according to the influx of the material present in aquatic media. The high concentration of calcium might be contributed to the geological formation. The Concentration of Calcium was found to be higher (72 mg/l) in Summer Season and lower (19 mg/l) in Pre Monsoon Season (Figure 10).

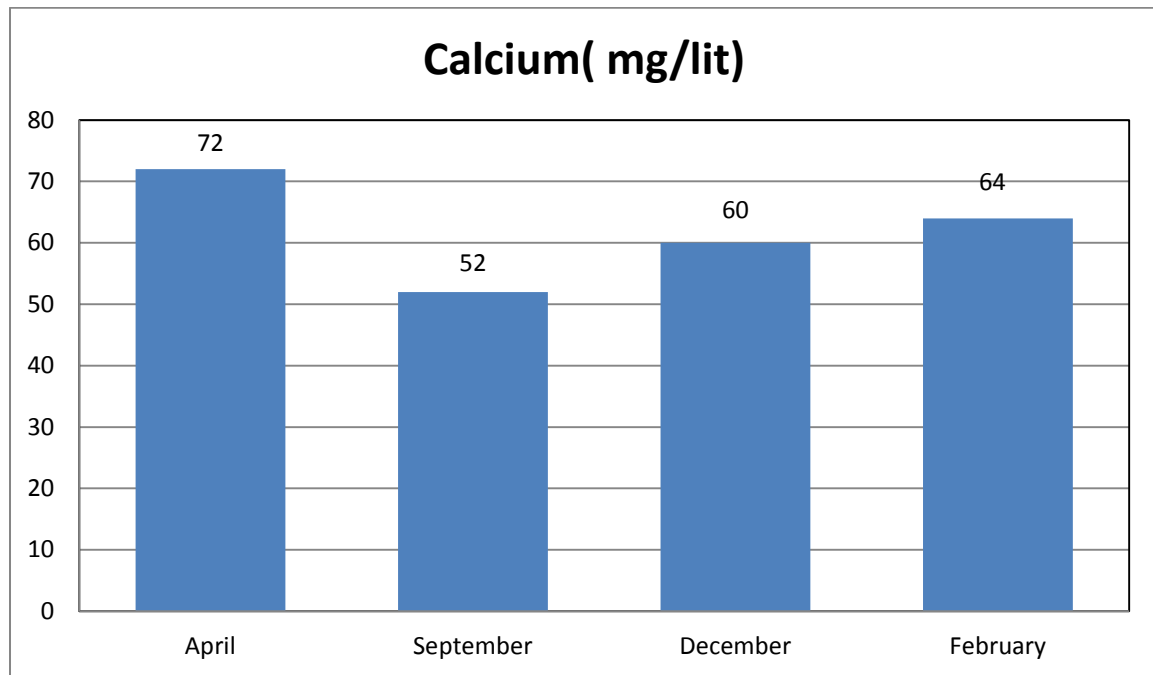


Figure.10: Calcium Variation of Thenpennaiyar River

Magnesium is a necessary constituent of chlorophyll without which no ecosystem could operate. The concentration of magnesium are varied from 19 mg/l to 38 mg/l (Figure 11) at Thenpennaiyar River at Kelavarapalli, Krishnagiri District, South India The Maximum concentration 38 mg/l is noticed during Summer and minimum values 19 mg/l noticed during Pre-monsoon.

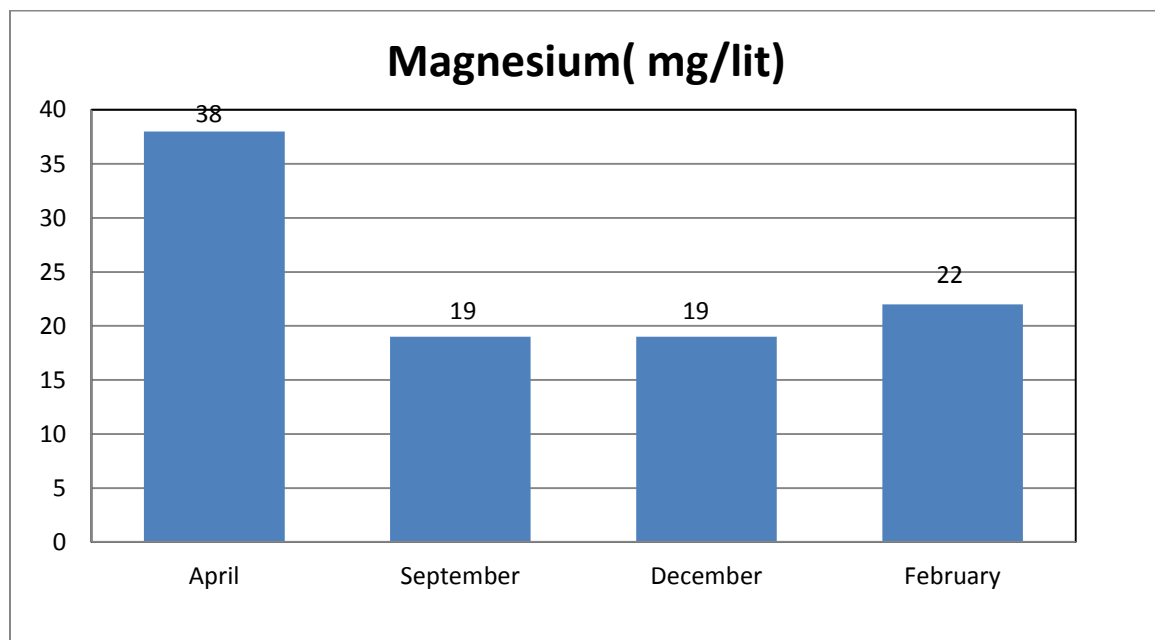


Figure.11: Magnesium Variation of Thenpennaiyar River

3.11 Alkalinity

In the study area, total alkalinity value range from 200 mg/liter to 380 mg/liters (Figure-12) .The Maximum concentration 380 mg/l is notice during to post-monsoon and minimum values 200 mg/l notice during to the summer. Total alkalinity observed in to the present study is well within the prescribed standards of drinking water (> 120mg/liter) alkalinity is imparted to the more presence to CO₂ suggesting the decay of organic matter is the prominent activity elevating alkalinity in natural water. It is also important that alkalinity resulting from naturally occurring ions like CO₃ and HCO₃ are not considered as a health hazard for drinking purposed.

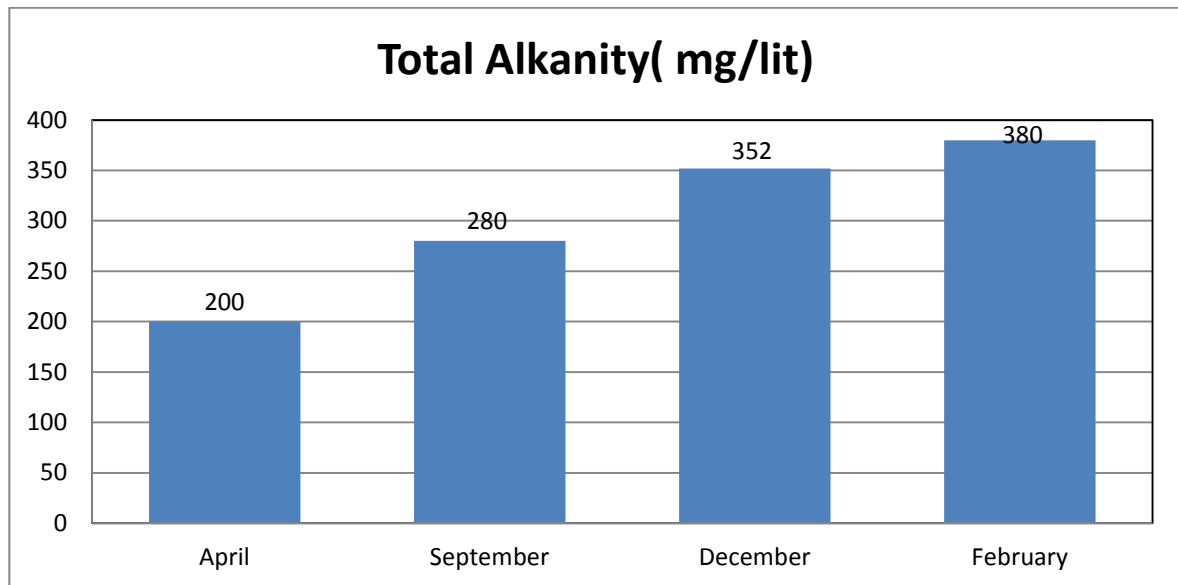


Figure.12: Total Variation of Thenpennaiyar River

3.12 Total Hardness:

Water hardness commonly defined as the sum of polyvalent cations dissolved in Water. The Most common cations Calcium, Magnesium, iron and Magnese may be contribute. During the Study (May 2014 to April 2015) the Total Hardness values were ranged 210 to 340 mg/l(**Figure-13**). Minimum Value to the total hardness was recorded 210 mg/l in the month of September 2015, while Maximum valuable recorded, 340 mg/l in the month of April 2015.

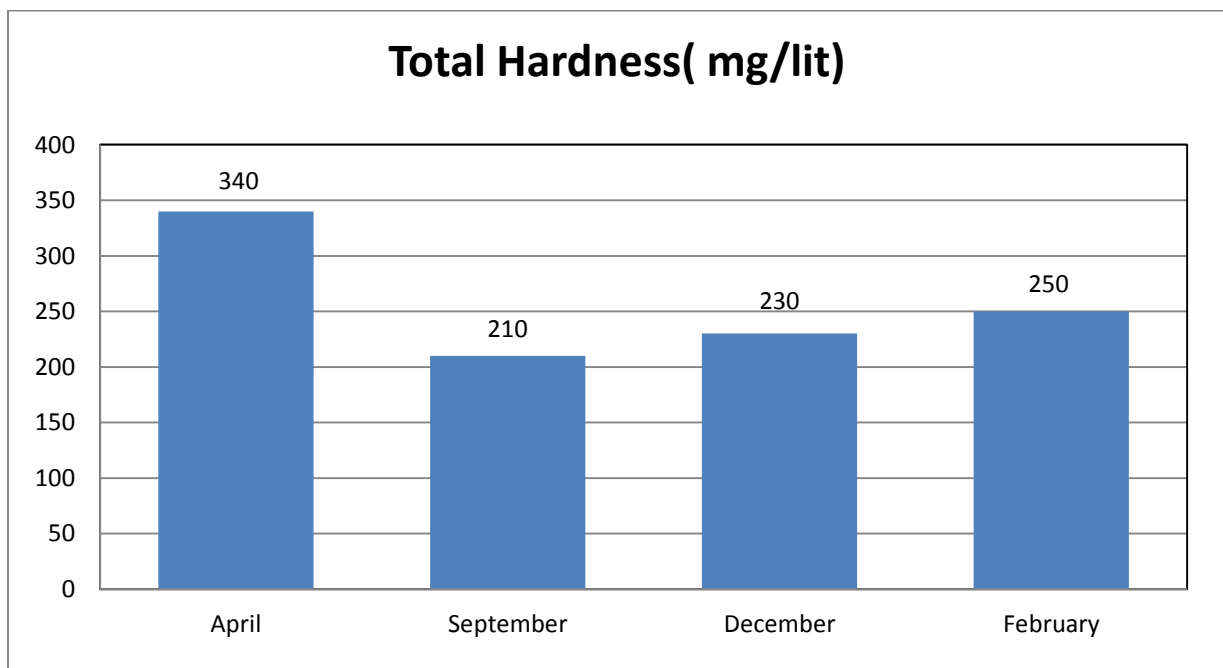


Figure.13: Total Hardness Variation of Thenpennaiyar River

3.13 Free Ammonia

The availability of Iron depends on the redox potential, temperature and pH. With regard to free ammonia is present naturally in surface water and waste water. It is produced largely by domination of organic nitrogen containing compounds and hydrolysis of urea. Free ammonia concentration was found between 21.07 mg/l to 58.01 mg/l (**Figure-14**) during summer and monsoon season. Ammonia in the form ammonium salts is one of the most important nitrogenous plant and nutrients the concentration of which is known to determine the fertility of the pond. In general Ammonia values were found to decrease with increasing depth to seasonal variation is more pronounced than that of the spatial variations.

3.14 Fluoride:

The fluoride is most exclusive bone-seeking element owing to its activity for organic, calcium, phosphate. The fluoride concentration showed more (0.41) in summer season and less in (0.2) to the pre- monsoon, Monsoon, and post monsoon (Figure-15). Low concentration of fluoride below 0.5 mg/l causes dental carries and higher concentration beyond 1.5 mg/l causes dental and skeletal fluorides. Surface water generally contains less than 0.5 mg/l fluorides However, when it is present in a greater concentration, it's become pollutant.

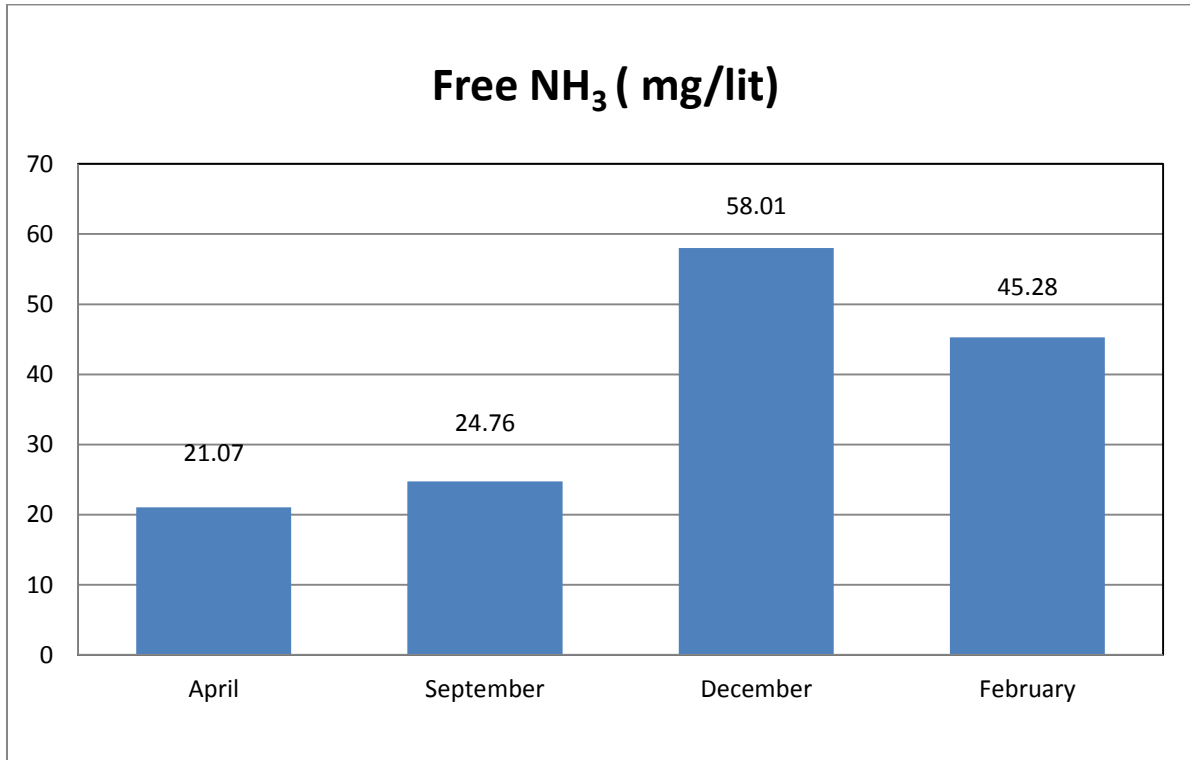


Figure.14: Free NH₃ Variation of Thenpennaiyar River

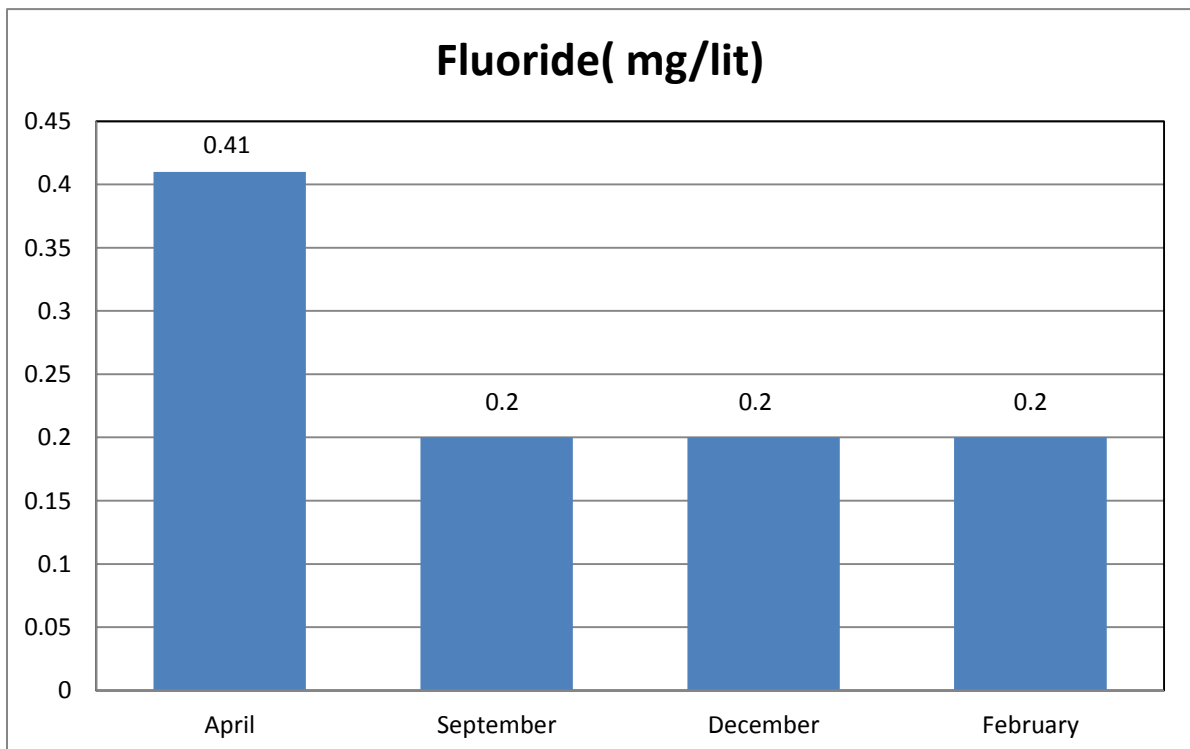


Figure.15: Fluoride Variation of Thenpennaiyar River

4. CONCLUSION

Pollution monitoring aquatic ecosystem is a strategic event having multifaceted applications in socio-economic, health and environmental sectors. It includes the collection, preservation and analysis of water samples to identify their qualitative and quantitative characteristics. The commonly adopted monitoring processes are physicochemical monitoring. So, thus concluded the investigated area of Then pennaiyar River, Krishna giri was not yet polluted and may not causes any health impact problems on living organisms. The turbidity of water is more in post-monsoon period compared to pre-monsoon period. Nitrite is high summer period compared to post and pre monsoon period. The total dissolved solids value was high in post-monsoon period. Phosphate value is high in monsoon period.

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