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SEASONAL VARIATION OF CAUVERY RIVER DUE TO DISCHARGED INDUSTRIAL EFFLUENTS AT PALLIPALAYAM IN NAMAKKAL

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ABSTRACT
The impact of industrial effluent like dyeing, sugar, and paper discharged from the banks of Cauvery river at pallipalayam in Namakkal district. It is observed during the study that many dyeing, sugar and paper units discharged their untreated effluent into the river Cauvery in this criminately without any treatment. The river water samples and ground water samples and soil sample collected in the study area reveals that high degree of the pollution cost by untreated effluent of heavy metal analysis from the river water and ground water and soil. So that industries major culprit in damaging the river water, ground water and soil used for the agricultural purpose. The increased loading of toxic effluent day by day due to the toxic effluent of surface water, ground water and soil. The total pollution due to industrial effluent causes the great damage to the environmental pollution of river Cauvery at pallipalayam in Namakkal district.
Keywords: Raw effluents, treated effluents, total dissolved solids, dyeing industry, physico chemical analysis

INTRODUCTION

The Kaveri, also spelled Cauvery in English, is a large Indian river. The origin of the river is traditionally placed at Talakaveri, Kodagu in the Western Ghats in Karnataka, flows generally south and east through Karnataka and Tamil Nadu and across the southern Deccan plateau through the southeastern lowlands, emptying into the Bay of Bengal through two principal mouths[1-3]. The Kaveri basin is estimated to be 27,700 square miles (72,000 km2) with many tributaries. The river enters Tamil Nadu through Dharmapuri district leading to the flat plains where it meanders[4-5]. It drops into the Hogenakkal Falls just before it arrives in the town of Hogenakkal in Tamil Nadu.

The three minor tributaries, Palar, Chennar and Thoppar enter into the Kaveri on her course, above Stanley Reservoir in Mettur, where the dam has been constructed. The Mettur Dam joins the Sita and Pala mountains beyond that valley through which the Kaveri flows, up to the Grand Anicut. The dam in Mettur impounds water not only for the improvement of irrigation but also to ensure the regular and sufficient supply of water to the important Hydro-Electric generating station at Mettur.[6-8]

The river further runs through the length Erode district where river Bhavani, which running through the breadth of the district, merges with it. The confluence of the rivers Kaveri, Bhavani and Akash Ganga (imaginary) is at the exact place of Bhavani Kooduthurai or Tiriveni Sangamam, Northern a part of Erode City. In the Namakkal District nearby pallipalayam town, it runs through Kaverykarai, Aavarampalayam, Odappalli, Vanichamber and Pappampalayam.[8-10]

In this river receives untreated municipal and domestic sewages from the town, Pallipalayam are discharged regularly. Agricultural wastes also enter into this river from the nearby agricultural lands[11]. In addition, untreated industrial effluents from the industries like, paper and sugar mill effluents are discharged into this river at Vanichamber which are the major pollutant agents of this river Cauvery near the pallipalayam town, Namakkal District, Tamilnadu[12].

EXPERIMENTAL

The untreated Dyeing effluent canal from the Dyeing industry to Pallipalayam River: Geography of the Study Area

Pallipalayam is one of the Municipal towns in Namakkal district that lies between 11° 10' and 11° 20' northern latitude and between 77° 30' and 77° 40' eastern longitude. Though the river banks are plain and fertile, the terrain is rocky and uneven with an average elevation of 183 meters above MSL. The general topography of the town is flat slope along western direction towards Cauvery River, which is the major primary drain in the town running along the western boundary of the town for an approximate length of 3 km.

Need for the present study

The major industries located on the banks of river Cauvery are dyeing unit and sugar, distilleries and paper industry located at Pallipalayam. Here the industries are discharging untreated effluents in the river Cauvery and polluting the river water, ground water and soil. It affects the river continuously causing great damage to the river Cauvery. The Industrial waste water discharging in to the Cauvery River is increasing day by day. The absence of treatment plant to treat the sewage water and industrial waste water may lead to spoilage of environment. One fine morning people will not be able to get good quality of drinking water from the river and the ground water, in and around the river basin.

In the study area the industrial waste water is discharged in to the right bank and left bank of river Cauvery and the agriculture waste water also contaminates the surface and the ground water. The environmental damage caused by water pollution by the discharge of industrial waste water in Cauvery River has not been studied. Hence the present investigations were carried out to study the comprehensive pollution impact of industrial waste water on Cauvery River, surface water and ground water and soil.

Scope of the study

i. To access nature and extent of pollution control (is needed) in different water bodies
ii. To evaluate effectiveness of pollution control, strict vigilance necessary for water resources
iii. To evaluate water quality trend over a period of time, like monsoon, post monsoon, pre monsoon and summer.
iv. To assess assimilative capacity of a water body thereby reducing cost on pollution control.
v. To understand the environmental fact and toxic nature of different pollutants in water resources.
vi. To evaluate the fitness of water for different uses.

Objectives

The foremost objective of the present study is to develop a strategic scheme for zero effluent discharge system based on the above facts for the dye, paper and pulp effluent. The objectives of the proposed study is to evaluate,

i. To study the impact of industrial effluents on river Cauvery
ii. To study the impact of industrial effluents in river Cauvery - on groundwater
iii. To study the impact of heavy metals in river Cauvery and ground water.
iv. To study the impact of heavy metals on soil in the river bank
v. To study the micro biological analysis of river water
vi. To study the treatment of Dyeing, Paper and Sugar industry Effluent
vii. To design water pollution modeling in order to study the impact of dyeing, paper and pulp effluents on river water, well water and soil also to predict the possible distances and extent of contamination of ground water on the river bank.

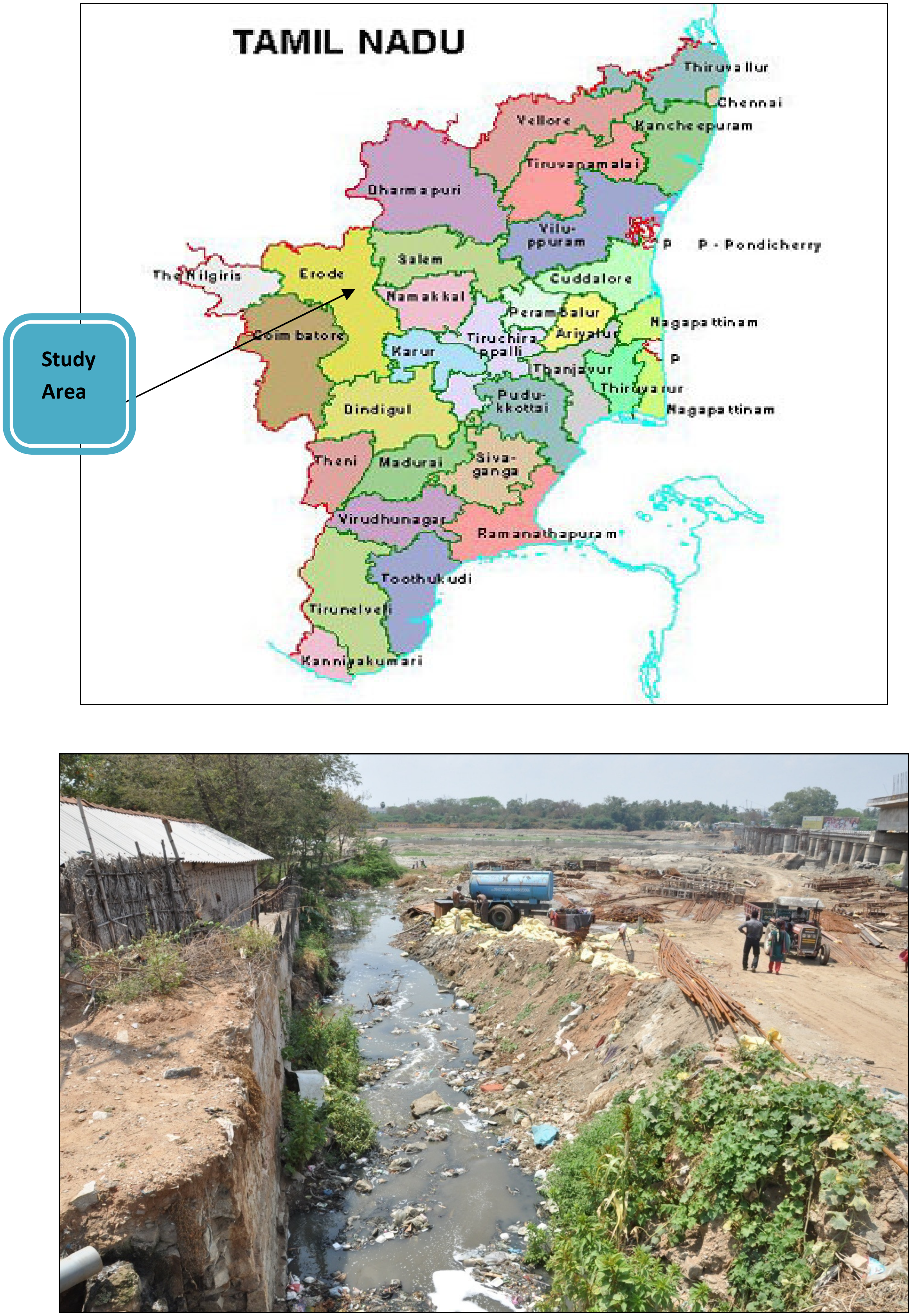

Fig.-1: Study Area

RESULTS AND DISCUSSION

In order to study the impact of industrial effluents discharged in the river and to assess the extent and magnitude of surface water pollution along the down stream of the river, the results obtained from the physical and chemical analysis are presented and discussed below: Physical parameters analysis of river water is presented in season-wise and station-wise as per the following description of season:

Season-wise Classification

Table-1

Season	Months
Pre-monsoon	December, January, February
Monsoon	June, July, August
Post-monsoon	September, October, November
Summer	March, April, May

Total Dissolved Solids

Total Dissolved solids denote mainly the various kinds of minerals present in the water. Total dissolved solids are composed mainly of carbonates, bicarbonates, sulphates and nitrates of the calcium, magnesium, sodium, potassium, Iron and manganese. In the polluted, water the concentration of other substances increases depending upon the type of pollution. They give particular taste to the water at higher concentration and reduce its potability. Conductivity meter is used to measure the dissolved solids in water.

Table-2: Total Dissolved Solids for Year 2011-12

Source of Variation	Sum of Squares	DF	Mean Square	F-Value	Significance of F
Season	59348117	3	19782342.242	5.016*	0.006
Distance	53192556	10	5319274.555	1.349	0.251
Interaction Season Vs. Distance	112540342	13	8656997.867	2.195*	0.037
Residual	118316996	30	3943899.876		
Total	230857369	43	5368789.966		

* Significant at 5 per cent level.

The above ANOVA results (Table-2) for the year 2011-12 clearly indicates that the season only has a significant role in explaining the variation in Total Dissolved Solids, whereas in case of distance there is no significant variation. It is found that there is an interaction between season and distance in causing Total Dissolved Solids during the study period.

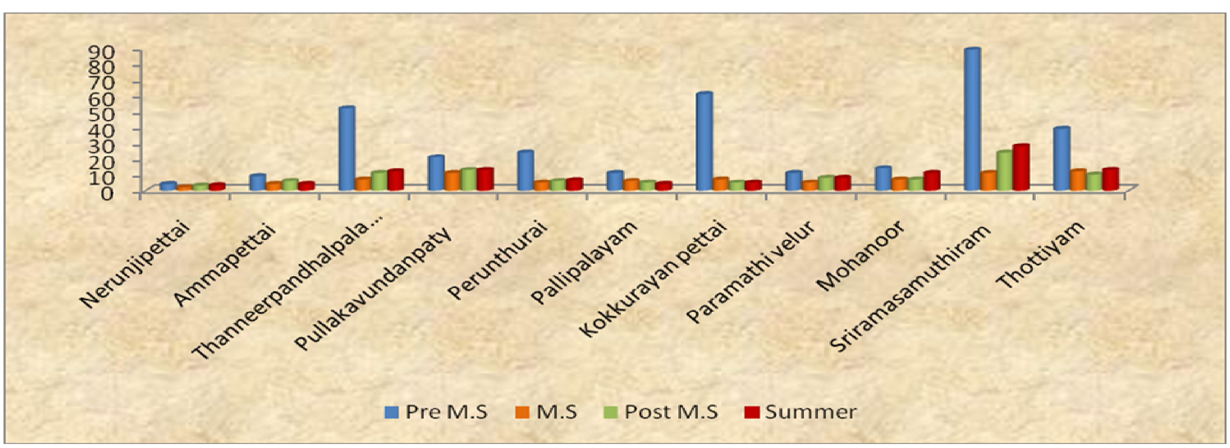

Fig.-1: TDS Analysis of River Water 2011-12

Table-3: Total Dissolved Solids for Year 2012-13

Source of Variation	Sum of Squares	DF	Mean Square	F-Value	Significance of F
Season	64104982	3	21368237.182	4.621*	0.009
Distance	114164887	10	11416488.741	2.469*	0.027
Interaction Season Vs. Distance	178269869	13	13713066.843	2.966*	0.007
Residual	138712817	30	4623760.565		
Total	316982686	43	7371690.370		

* Significant at 5 per cent level.

The computed results for the year 2012-13 (Table-3) clearly indicates that the season as well as the distance has significant role in explaining the variation in Total Dissolved Solids. Moreover, there is also interaction between season and distance in causing Total Dissolved Solids variation during the study period.

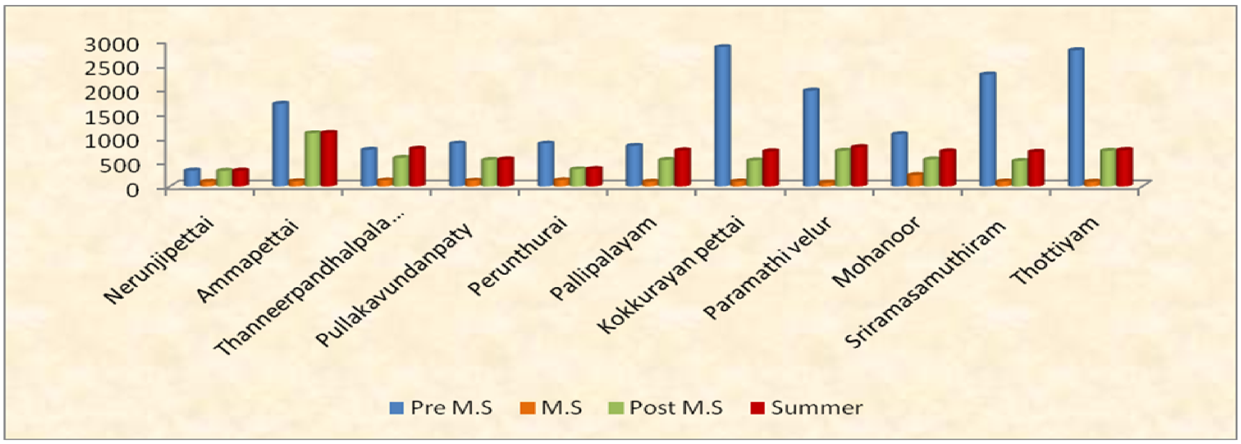

Fig.-2: TDS Analysis of River Water 2012-13

Total Hardness

Hardness is the property of water, which prevents the lather formation with soap due to the presence of Ca and Mg. However, other cations such as strontium, iron and magnesium also contribute to the hardness. The anions responsible for hardness are mainly bicarbonate, carbonate, sulphate, chloride, nitrate etc. The hard water is also not suitable for domestic use, but it prevents the corrosion in the pipes and also reduces the entry of heavy metals from pipes to the water. In order to examine the variation of total hardness in the river water, ANOVA is carried out and the results are given below for two different periods of study namely 2011-12 (Table-4) and 2012-13(Table-5).

Table-4: Total Hardness for Year 2011-12

Source of Variation	Sum of Squares	DF	Mean Square	F-Value	Significance of F
Season	4693162	2	1564392.424	5.168*	0.005
Distance	5702181	10	570219.014	1.884	0.088
Interaction Season Vs. Distance	10395362	13	799643.647	2.642*	0.014
Residual	9081276	30	302709.874		
Total	19476652	43	452945.666		

* Significant at 5 per cent level.

The above ANOVA results for the year 2011-12 clearly indicates that the season only has a significant role in explaining the variation in total hardness, whereas in case of distance there is no significant variation. It is found that there is an interaction between season and distance in causing total hardness during the study period.

Table-4: Total Hardness for Year 2012-13

Source of Variation	Sum of Squares	DF	Mean Square	F-Value	Significance of F
Season	4295414	3	1431812	4.140*	0.015
Distance	5310723	10	531074.5	1.706	0.136
Interaction Season Vs. Distance	9606116	13	738936.4	2.315*	0.034
Residual	9337223	30	311221		
Total	18943434	43	440542		

* Significant at 5 per cent level.

The computed ANOVA results for the year 2012-13 clearly indicates that the season only has a significant role in explaining the variation in total hardness, whereas in case of distance there is no significant variation. It is also found that there is an interaction between season and distance in causing total hardness during the study period because the F-value is 2.315 which is significant at 5 per cent level.

Sodium

In order to examine the variation of sodium in the river water, Analysis of Variance (ANOVA) is carried out and the results are given below for two different period of study namely 2011-12 (Table-5) and 2012-13(Table-6).

Table-5: Sodium for Year 2011-12

Source of Variation	Sum of Squares	DF	Mean Square	F-Value	Significance of F
Season	436332.412	3	145444.142	7.292*	0.001
Distance	599749.009	10	59974.901	3.007*	0.009
Interaction Season Vs. Distance	1036081.478	13	79698.572	3.996*	0.001
Residual	598338.783	30	19944.625		
Total	1634420.199	43	38009.772		

* Significant at 5 per cent level.

The computed results of Analysis of Variance for the year 2011-12, clearly indicates that the season as well as the distance has significant role in explaining the variation in sodium of chemical parameters analysis conducted for river water. It is also found that there is an interaction between season and distance in causing sodium variation in the chemical parameters analysis conducted for river water in the study area during the study period.

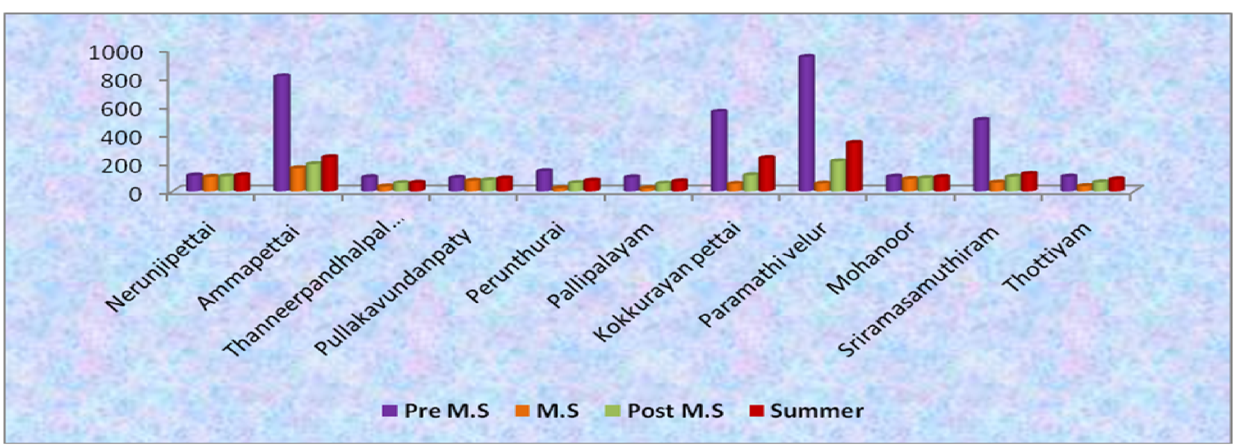

Fig.-3: Sodium of River Water 2011-12

Table-6: Sodium for Year 2012-13

Source of Variation	Sum of Squares	DF	Mean Square	F-Value	Significance of F
Season	552494.412	3	184164.80	7.575*	0.001
Distance	433728.032	10	43372.80	1.982	0.082
Interaction Season Vs. Distance	986222.234	13	75863.26	3.381*	0.004
Residual	656399.600	30	21879.99		
Total	1642622.000	43	38200.51		

* Significant at 5 per cent level.

The computed ANOVA results for the year 2012-13 clearly indicates that the season only has a significant role in explaining the variation in sodium, whereas in case of distance there is no significant variation. It is also found that there is an interaction between season and distance in causing sodium during the study period because the F-value is 3.381 which is significant at 5 per cent level.

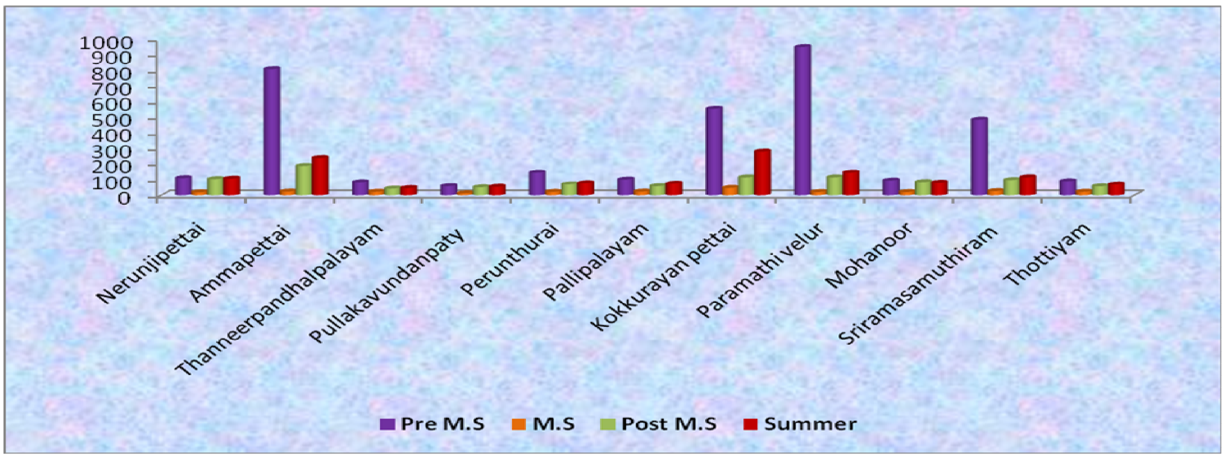

Fig.-4: Sodium of River Water 2012-13

Iron

All kinds of water including ground water have appreciable quantities of iron. Iron occurs in two valence Fe^{2+} and Fe^{3+} In ground water most of the iron remains in ferrous state due to general oxygen. In alkaline conditions in ground water, the iron is mostly ferrous bicarbonate. When the ground water with high concentration of iron is tapped, it quickly oxidizes to ferric hydroxide. If appreciable quantities of ferrous bicarbonates are present in ground water and they come in contact with oxygen at surface the hydroxides are formed, CO_2 is released and hence it increases the pH, facilitating the oxidation processes. This gives a rusty appearance to the water. Although iron has got little concern as health hazard but it still considered as a nuisance in excessive quantities.

In order to find out the variation of iron in the river water, Analysis of Variance (ANOVA) is carried out and the results are given below for two different period of study namely 2011-12 and 2012-13.

Table-7: Iron for Year 2011-12

Source of Variation	Sum of Squares	DF	Mean Square	F-Value	Significance of F
Season	8.227	3	2.742	6.006*	0.002
Distance	21.386	10	2.135	4.684*	0.000
Interaction Season Vs. Distance	29.612	13	2.273	4.989*	0.000
Residual	13.700	30	0.455		
Total	43.312	43	1.004		

* Significant at 5 per cent level.

It is found that the above computed results of Analysis of Variance for the year 2011-12 clearly illustrates that the season as well as the distance has significant role in explaining the variation in iron of chemical parameters analysis conducted for river water in the study area. It is also found that there is an interaction between season and distance in causing iron variation in the chemical parameters analysis conducted for river water during the study period.

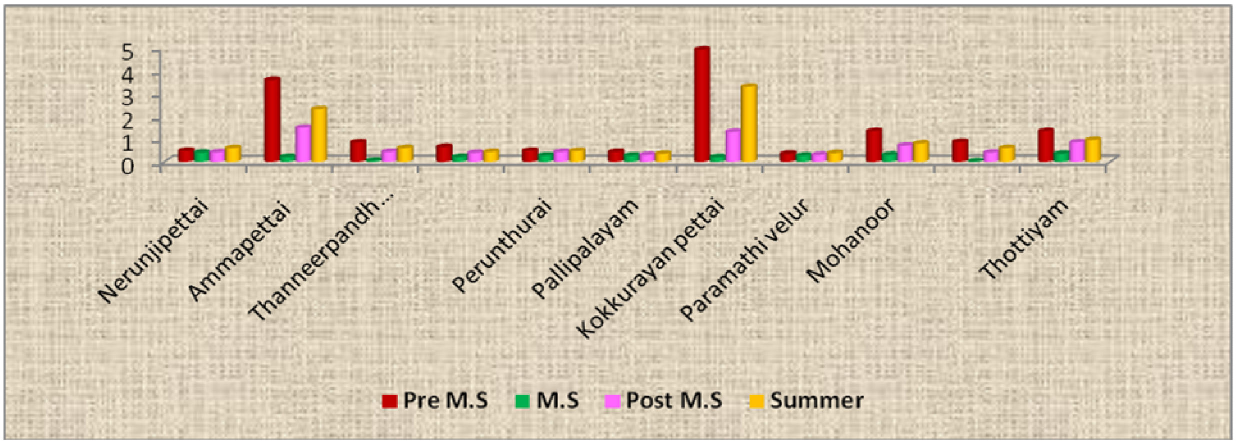

Fig.-5: Iron of River Water 2011-12

Table-8: Iron for Year 2012-13

Source of Variation	Sum of Squares	DF	Mean Square	F-Value	Significance of F
Season	7.342	3	2.44	5.516*	0.004
Distance	32.991	10	3.32	8.260*	0.000
Interaction Season Vs. Distance	40.335	13	3.10	7.574*	0.000
Residual	11.987	30	0.45		
Total	52.323	43	1.21		

* Significant at 5 per cent level.

The computed results of ANOVA for the year 2012-13 clearly indicates that the season as well as the distance has significant role in explaining the variation in iron of chemical parameters analysis conducted for river water. It is also found that there is an interaction between season and distance in causing iron variation in the chemical parameters analysis conducted for river water in the study area during the period under study.

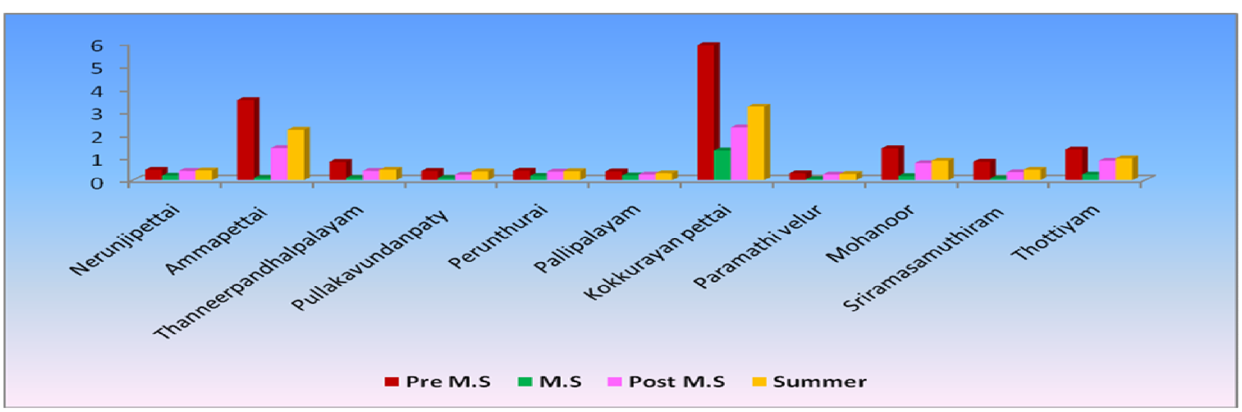

Fig.-6: Iron of River Water 2012-13

CONCLUSION

The Various chemical industries like dyeing industry, sugar and distilleries are discharging untreated effluents in the river without any treatment. They contain toxic chemicals and heavy metals like copper, zinc, iron, lead and manganese. The heavy metals contaminate the river water along with other hazardous chemicals. These chemicals have impaired the quality of water very much. The effluents are discharged continuously getting accumulated in the river making the water unsuitable for drinking as a result of which the ground water gets highly polluted.

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