

Assessment of ground water quality in various parts of Thanjavur District, Tamil Nadu (India)

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ABSTRACT

The present study is assess the quality of ground water from Thanjavur district, and check its fitness for drinking eight samples of ground water were collected from Thanjavur district. The pH was estimated by pH meter, calcium, magnesium, chloride were analyzed by titration method sulphade, iron, nitrate, nitrite, chromium were estimated by spectrometric method, total dissolved solids of the water samples was determined by gravimetrically, colour of the water samples was determined by platinum-cobalt method ,taste of the water samples can determine by taste rating method, turbidity of the water samples was determine by Nephelometric method etc., are determine for some parts of Thanjavur district water samples compared with standard limits recommended by BIS. Comparative study of groundwater for this region can be used for the quality of water is more suitable for drinking purpose.

Keywords: Physicochemical Parameters; Ground water analysis; Thanjavur; Tamil Nadu

1. INTRODUCTION

Water is an essential natural resource for sustaining life and environment that we have always thought to be available in abundance and free gift of nature however chemical composition of surface or subsurface water is one of the prime factors on which the suitability of water for domestic, industrial and agriculture purpose depends. Fresh water occurs as surface water and groundwater in this groundwater contributes only 0.6% of the total water resources on earth. It is major and preferred source of drinking water in rural and urban areas particularly in India.

In many countries around the world including India some of the regions are contaminated. Presence of more than 200 chemical constituents in groundwater has been documented including about 150 organic, 50 inorganic and radio nucleotides. Contaminants in groundwater exist for hundreds of years due to their slow movement in water aquifers.

In developing countries contamination of water supplies by organic chemicals is lesser concern, because most of the health problems are found to be associated with the presence of inorganic chemicals and pathogenic organisms in drinking water.

Physiologically calcium is needed for the body in small quantities, though water provides only a small proportion of the body's requirement of calcium. Calcium salts are nontoxic except at very high doses. In human body, Hypercalcemia causes coma and death, if serum calcium level rises to 160 mg / 100 ml. High concentration of magnesium has a laxative effect, acting like "Milk of Magnesia" and the water becomes unpalatable before toxic concentrations are reached. Excess of magnesium (above 400 mg/l) in water causes nausea and muscular weakness. Generally hardness has no adverse effect on health. However, some evidence has been attributed about its role in heart disease (Park and Park, 1980). According to the report of NRC (1977), fifty studies in nine countries have established a consistent statistical association between drinking water hardness and incidence of cardio vascular problem. High concentrations of hardness of 150 – 300 mg/l and above have been reported to cause kidney problems (Jain, 1998).

South western part of Anantapur district in Andhra Pradesh, most of the ground water samples have higher concentration of fluoride compared with WHO permissible limit (V. Sunitha, et.al.).

The chandola lake receives very high amount of pollution from the surrounding. And the water of lake is highly contaminated and if the similar condition continue for the longer period, chandola lake may soon become ecological inactive (verma pradeep, et.al.).

The groundwater samples of TDS, TA, Ca^{2+} , Fe^{3+} are high from both Thiruvarur and Nagapatattinam Region. The estimated parameters were compared with BIS drinking water quality guideline. The physicochemical analysis of water samples concluded that the water quality of these two regions most of the areas ground water is not suitable for drinking purpose (D. Kannan et.al.).

Ground water quality of Bikaner and kolayat revealed that, in some samples water quality parameters like total alkalinity, pH, hardness, TDS, sulphate, chloride, nitrate, calcium, magnesium and iron were beyond the permissible limit as per WHO standards. So the proper environment management plan may be adopted to control drinking water pollution. The ground water of this area needs some degree of treatment before drinking and it needs to be protected from contamination so as to prevent adverse health effect on human beings (Rajdeep Kaur, et.al.).

The ground water in yinchuan area has been assessed for its chemical constituents and suitability for drinking and irrigation uses. According to the findings of this study, the ground water in the study area is not entirely fit for direct drinking with respect to TDS, TH, Fe^{3+} , F^- , chloride, and sulphate. In some of these constituents exceed the permissible limits of SDWQ (Li Peiyue, et.al.). The study involved the determination of physical and chemical parameters of groundwater from Thanjavur district in Tamilnadu (India). The objective of the study is to assess the present water quality parameters like pH, Alkalinity, TDS, Al^{3+} , etc., to compare the result with the BIS Permissible limits.

2. EXPERIMENTAL

2. 1. Study area

Thanjavur is located at 11° 38' 0" N and 75° 45' 0" E. Fig. 1 shows the location of the ground water samples collected. Table – 1 are given about sampling points of Thanjavur district.

2. 2. Methodology

Total eight ground water samples were collected from bore wells of study area (Fig. 1), using pre cleaned sterilized poly - propylene plastic bottle with cap. The sampling has been carried out in the month of JUN-2014. The samples in the canes were kept in the refrigerator. Table 2 is given about methods used for estimation of variation physicochemical parameters.

3. RESULTS AND DISCUSSION

The water samples were collected from various parts of Thanjavur district, and were analyzed for their physicochemical characteristics. The temperature, odour and taste of the samples were noted at the collection point immediately.

The other physical parameters such as turbidity, odour, connectivity and total dissolved solids were determined by standard procedures. The pH of the water samples was measured using pH meter. The chemical parameters like alkalinity, calcium hardness, magnesium hardness and chloride were estimated titrimetric method, iron, nitrate, nitrite, sulphate and phosphate were estimated by spectrometric method. The results were compared with BIS-drinking water quality guideline. The estimated physicochemical parameters are reported in the Table number 3 and 4.

3. 1. Colour

Colour of water may be due to the presence of fine particles in suspension (or) due to certain mineral matter in solution. The entire collected sample had colorless, (Table 3).

3. 2. Temperature

The temperature of the water is important for its effect on the chemical and biological reactions of the organisms in water. Temperature is an essential factor in the determination of other parameters like conductivity pH, etc., the temperature of the samples ranged from (29.4 °C to 32.3 °C), (Table 3).

3. 3. Odour and Taste

Organic and inorganic chemicals originating from domestic wastes and by decomposition of vegetables matter contributes taste and odour to the water. The entire collected sample had odour less and taste less, (Table 3).

3. 4. Turbidity

Turbidity in natural water is caused by clay, organic matter, phytoplankton etc., and the turbidity of ground water sample from Thanjavur region range from (0.2 NTU to 0.8 NTU), (Table 3).

3. 5. Electrical Conductivity

Electrical conductivity is the capacity of water to convey current and this may be due to the presence of soluble salts and ionic species which act as conducting medium. Conductivity of the samples ranged between (0.33 mS/cm to 1.33 mS/cm), (Table 3), (Fig 2).

3. 6. Total Dissolved Solids

Many dissolved substance are undesirable in water. Dissolved minerals, gases and organic constituents may produce aesthetically displeasing colour, taste and odour. The total dissolved solids of Thanjavur region ground water range between 149 mg/l to 616 mg/l.

The TDS of ground water sample number S1 is high in the Thanjavur region, (Table 3), (Fig. 3). If the TDS of drinking water is more than 2000 mg/l, would result to affect gastro intestinal irritation for human beings.

3. 7. Hydrogen ion concentration (pH)

pH is the measure of capacity (or) alkalinity natural water is alkaline due to the presence of carbonates. The desirable pH range for drinking water is 6.5 to 8.5. The water samples had pH ranging from 7.65 to 8.15. The entire collected sample had lying with in BIS permissible limit, showing that all the samples were almost neutral and harmless, (Table 4), (Fig. 4).

3. 8. Alkalinity

Alkalinity in water is due to the presence of carbonates, bicarbonates and hydroxides. Bicarbonates are the major contributes since they are included from the basic materials in the soil. Alkalinity is also a measure of water to absorb H^+ ions. Total alkalinity of the samples was found to range from 66.20 mg/l to 234.94 mg/l.

Total alkalinity of ground water sample number S1 and S7 is high in Thanjavur region, (Table 4), (Fig. 5).

3. 9. Chloride

Discharge of domestic sewage is the main source of chloride in water. The chloride content estimated in the samples ranged between 27.99 mg/l - 110.96 mg/l, (Table 4), (Fig. 8).

3. 10. Sulphate

Sulphate occurs naturally in all kinds of water. Drainage wastes are the main source of high sulphate concentration. Excess sodium and magnesium sulphate may cause cathartic action. The samples had sulphate levels ranging between 1.04 mg/l to 5.93 mg/l. The entire collected samples had lying within BIS limit, (Table 4), (Fig. 11).

3. 11. Nitrate

This is the highest oxidized form of Nitrogen. Biological oxidation of nitrogenous substance from sewage is the main source of nitrate. The samples had nitrate levels range from 2.74 mg/l to 11.53 mg/l. The entire water samples had nitrate content lying within the BIS limit, (Table 4), (Fig 9).

3. 12. Nitrite

Nitrite in water is due to incomplete oxidation of organic matter containing nitrogen. Nitrites should never be present in drinking water. Nitrite of the samples was found to range from 0.0008 mg/l to 0.0035 mg/l.

The nitrite content of ground water was found to be within the BIS describe limit. High concentration of nitrites may cause blue-baby syndrome in children, (Table 4), (Fig. 10).

3. 13. Phosphate

Generally phosphate occurs in natural water as inorganic (or) organic phosphates. Domestic sewage, agricultural effluents and detergents are the main source of phosphate in water. Excess phosphate may lead to growth of unwanted algae and eutrophication. The sample had phosphate content ranging from 0.72 to 1.72 mg/l, (Table 4), (Fig. 12).

3. 14. Calcium

The calcium hardness was recorded in 21.64 mg/l to 56.91 mg/l. for ground water of Thanjavur region. The entire collected samples had calcium content lying within BIS limit, (Table 4), (Fig 6).

3. 15. Magnesium

The magnesium hardness was recorded in 9.23 mg/l to 79.23 mg/l. The magnesium content of sample numbers S1 and S7 from Thanjavur region is above the desirable limit, (Table 4), (Fig. 7).

3. 16. Iron

Iron usually exists in ferrous and ferric forms. Generally, the ferric form is predominant in natural water. Excess iron causes stripping of clothes. The samples had iron levels ranging between 0.052 mg/l to 0.217 mg/l, (Table 4), (Fig 14). The samples number S1, S3, S6 and S8 from Thanjavur district is above the BIS permissible limit.

3. 17. Chromium

All the water samples had chromium content lying well below the detectable limits of BIS, (Table 4).

3. 18. Manganese

All the water samples had manganese content lying well below the detectable limits of BIS, (Table 4).

3. 19. Aluminium

The entire collected samples had aluminium content lying within BIS desirable limit, (Table 4), (Fig. 13).

Table 1. Sampling points of Thanjavur region.

Sampling Place	Sampling point No
Budalur	S1
Mariamman kovil	S2
Nallavanni kudikadu	S3
Malayarnatham	S4
East korugappattu	S5

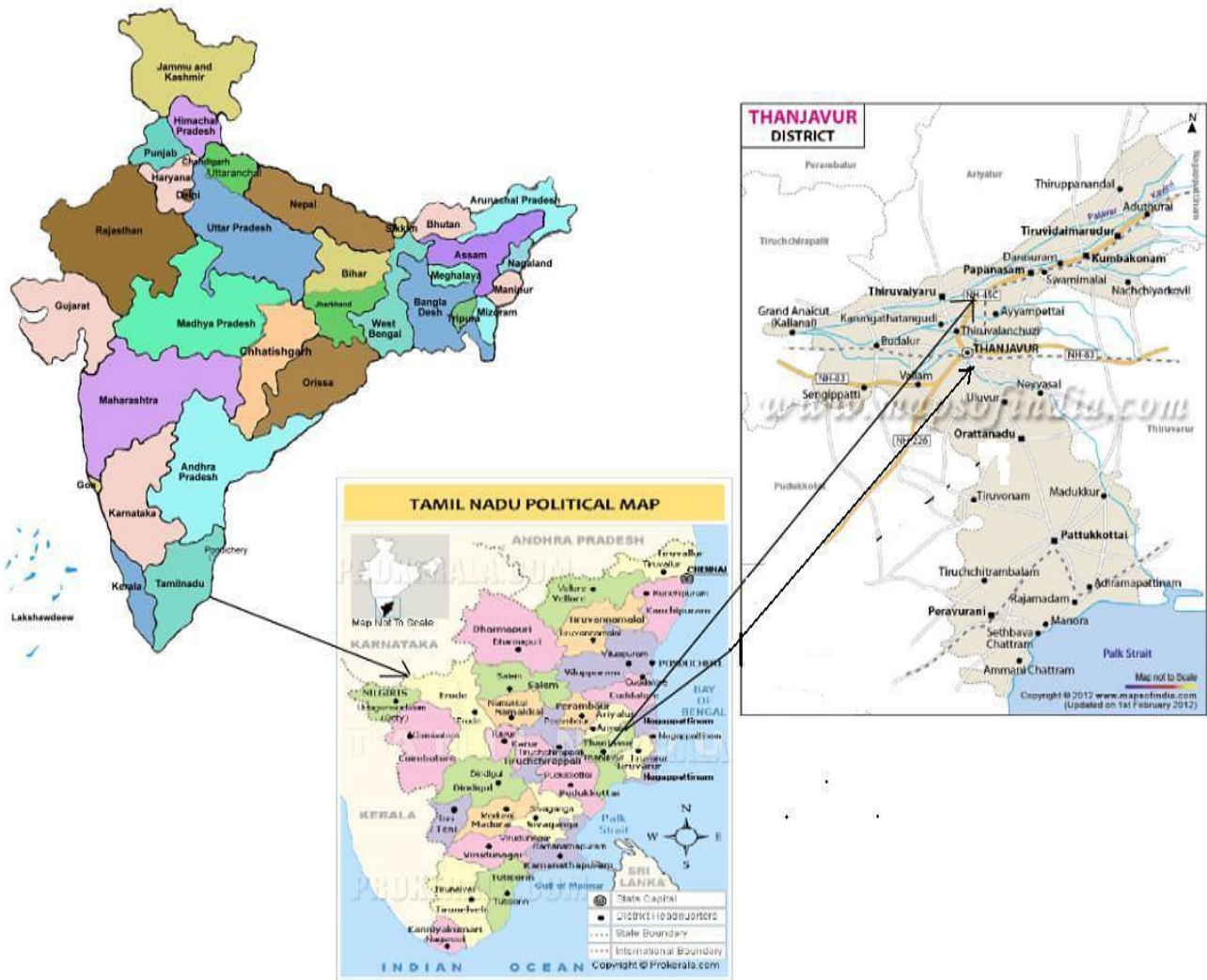


Fig. 1. Study Area.

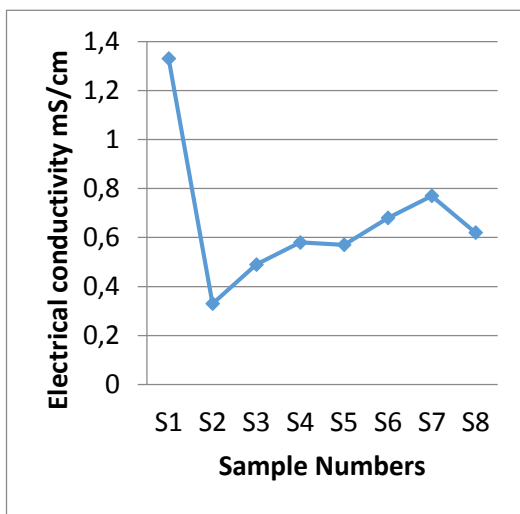


Fig. 2. E C variation of the Study area.

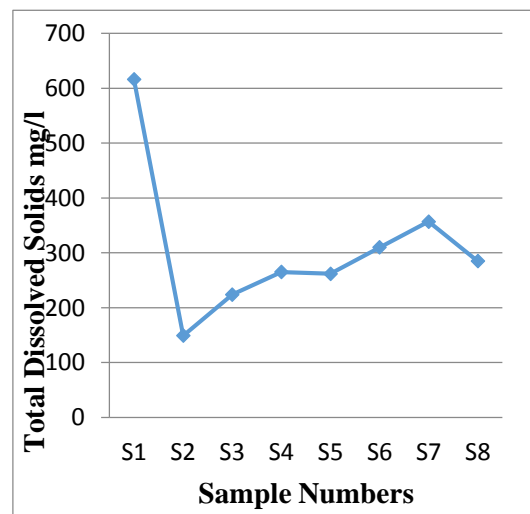


Fig. 3. TDS variation of the Study area.

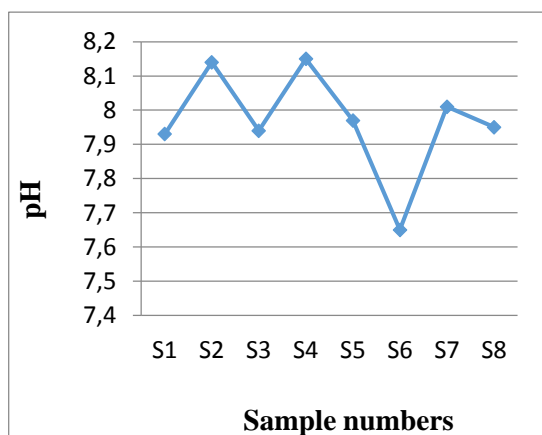


Fig. 4. pH variation of the Study area.

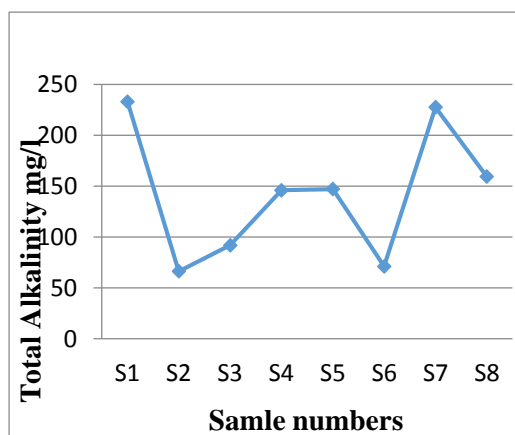


Fig. 5. Total Alkalinity variation of the Study area.

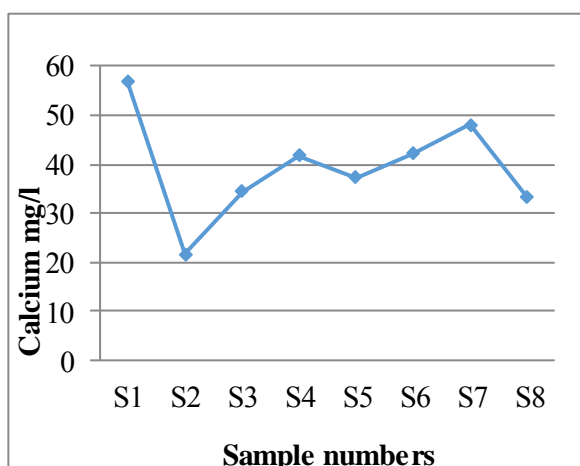


Fig. 6. Calcium variation of the Study area.

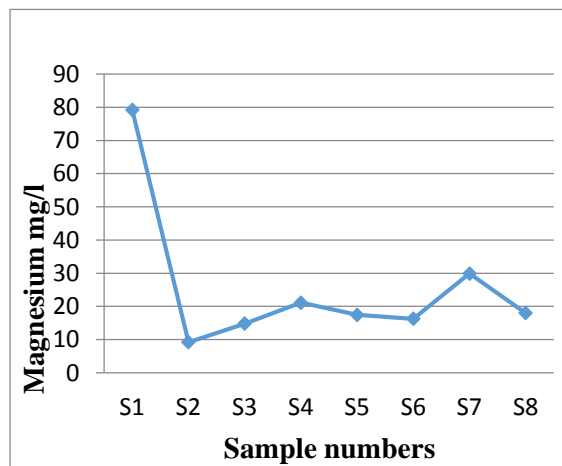


Fig. 7. Magnesium variation of the Study area.

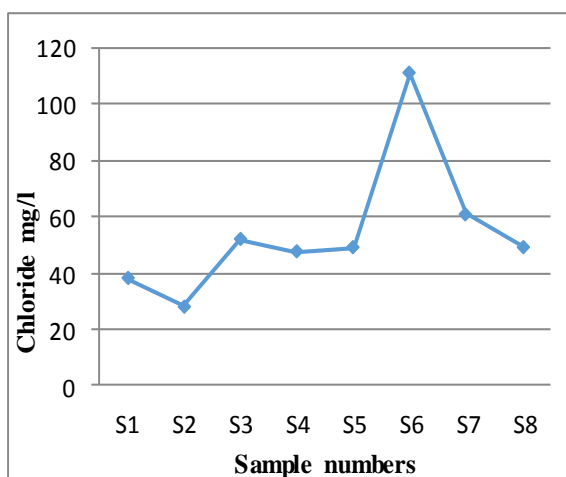


Fig. 8. Chloride variation of the Study area.

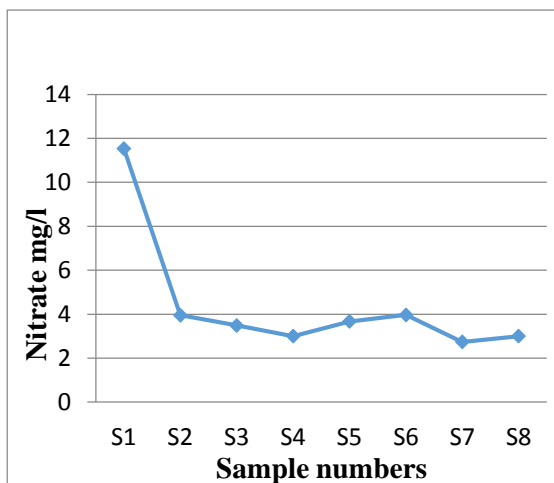


Fig. 9. Nitrate variation of the Study area.

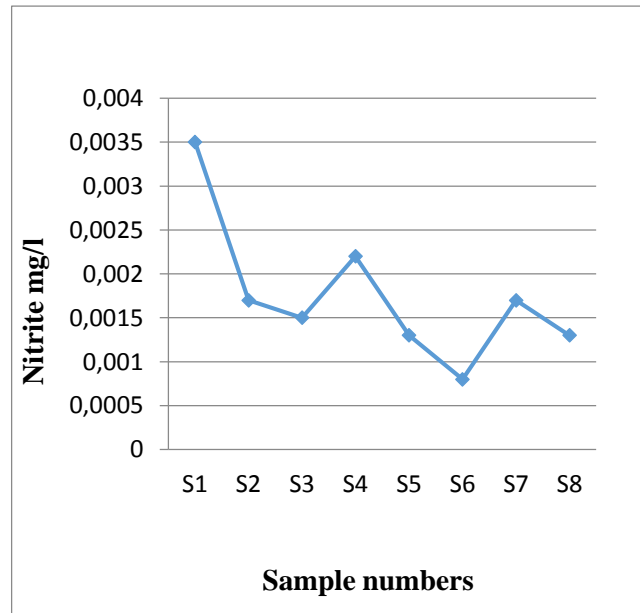


Fig. 10. Nitrite variation of the Study area.

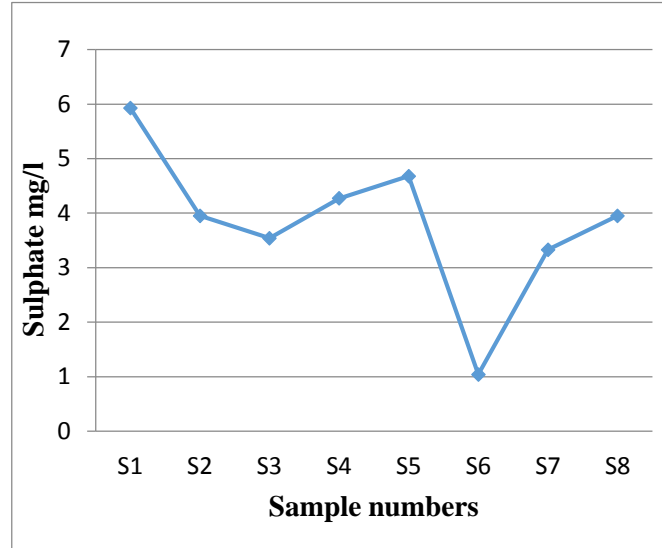


Fig. 11. Sulphate variation of the Study area.

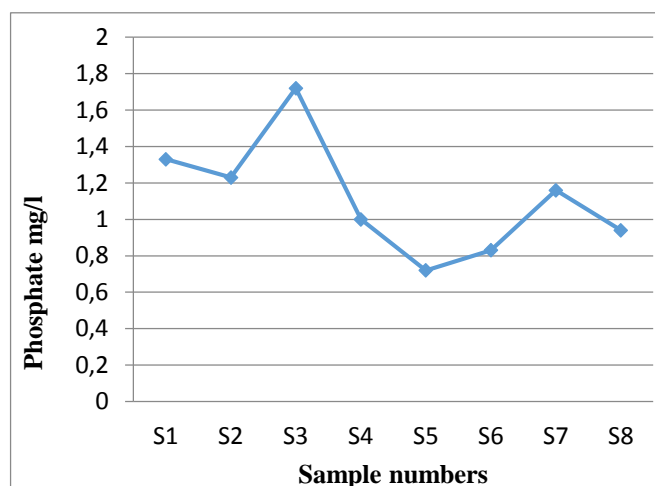


Fig. 12. Phosphate variation of the Study area.

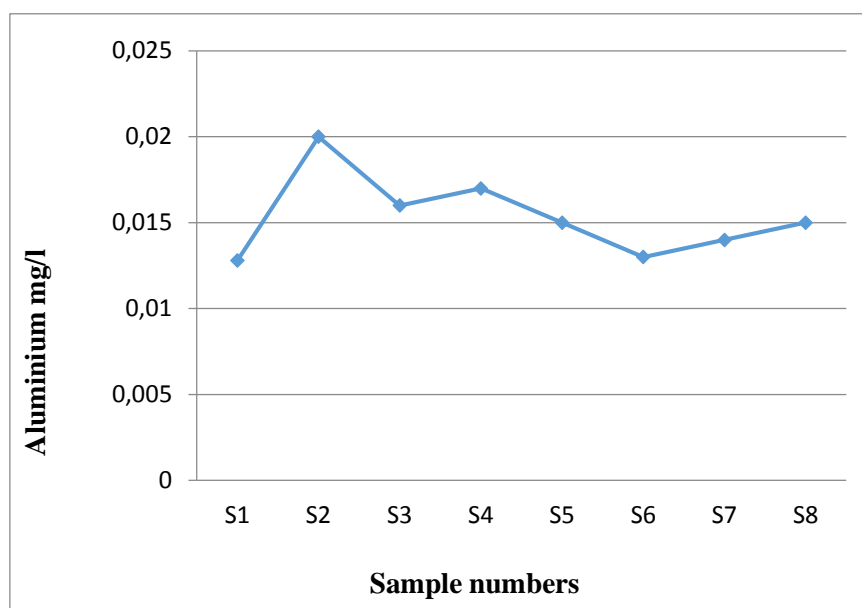


Fig. 13. Aluminium variation of the Study area.

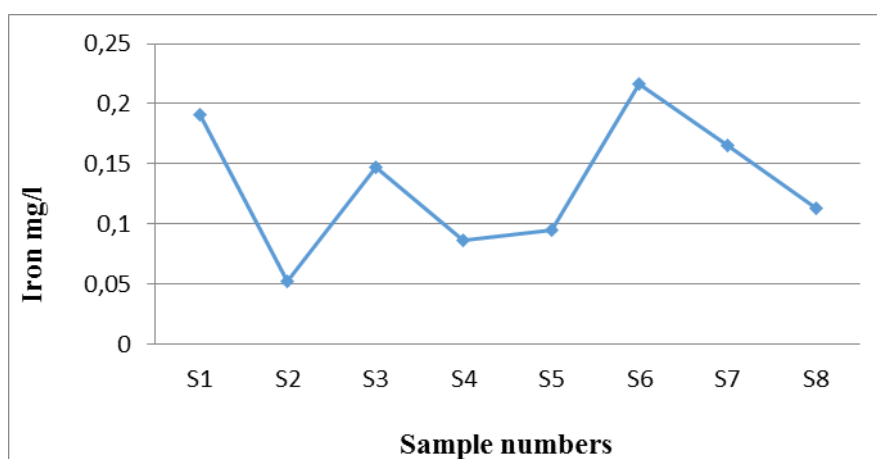


Fig. 14. Iron variation of the Study area.

4. CONCLUSION

The physicochemical analysis of water samples concluded that the water quality of Thanjavur region is acceptable for drinking as well as for other purpose, but the ground water sample number S1 is not suitable for drinking purpose, because in the presence of excess total dissolved solids, total alkalinity, Fe^{3+} and magnesium ion concentration. So rain water harvesting is one of the solutions to minimize the inorganic chemical concentration in ground water. This study given a knowledge and awareness created among the people.

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