



Research Article

A Comparative Study on Chemical Analysis of Ground Water from Various Parts of Thiruvapur District, Tamilnadu (India)

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ABSTRACT

The aim of the present study was to assess the quality of groundwater from Thiruvapur district, Tamilnadu (India) and to check its fitness for drinking purpose. Ten samples of groundwater were collected from Thiruvapur region. The pH was estimated by pH meter. Calcium, magnesium, chloride were analyzed by titration method. Sulphate, iron, nitrate, nitrite, chromium were estimated by spectrophotometric method. Total dissolved solids of the water samples were determined gravimetrically. Color of the water samples was determined by platinum-cobalt method. Taste of the water samples was determined by taste rating method. Turbidity of the water samples was determined by Nephelometric method. Some parts of Thiruvapur region water samples were compared with standard limits recommended by BIS. The comparative study of groundwater for this region, most of the areas is not suitable for drinking purpose.

Keywords: Physicochemical Parameters, Ground water analysis, Thiruvapur, Tamilnadu.

1. INTRODUCTION

Groundwater has become the major source of water supply for domestic, industrials and agricultural sectors of many countries. It is estimated that one third of the world's population use groundwater for drinking purpose.

Unfortunately 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.

The groundwater samples of TDS, TA, Ca^{2+} , Fe^{3+} are high from

both Thiruvapur and Nagapattinam 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 purpose¹.

The drinking water sources of villages and urban areas of Uttar Pradesh were highly polluted by fluoride due to the presence of brick kilns².

Physicochemical analysis of groundwater samples near industrial area, Cuddalore district, Tamilnadu, India. They have analyzed TDS, DO, TA, Na^+ , Cl^- , etc., Using APHA 1998 method. A comparison with ISI 10500-91, Standard shows that the water is more suitable for drinking purpose³.

K. Mohammad Rafi *et al.*, have carried out chemical analysis of groundwater and study on its pollution impact in and around jammalamadugu area of YSR, district, Andhrapradesh, India.

They have analyzed various Physical and Chemical parameters such as pH, EC, TDS, SO_4^{2-} , NO_3^- , etc., Were determined using

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standard procedure. It is found that the ground water samples are suitable for drinking purpose in the sampling areas⁴.

Generally water is polluted on all the surface of earth. All metabolic and physiological activities and life process of aquatic organisms are generally influenced by such polluted waste and hence, it is essential to study physicochemical characteristics of groundwater⁵.

In the study involve the determination of physicochemical parameters of ground water from Thiruvavur District. The objective of the study is to assess the water quality parameters like Phosphate, pH, TDS, Ca^{2+} , Mg^{2+} , Fe^{2+} , Cr^{6+} , etc., to compare the result with BIS.

2. MATERIALS AND METHODS

2.1 Study area

Thiruvavur is located at 10.7716 N, 79. 6368 E

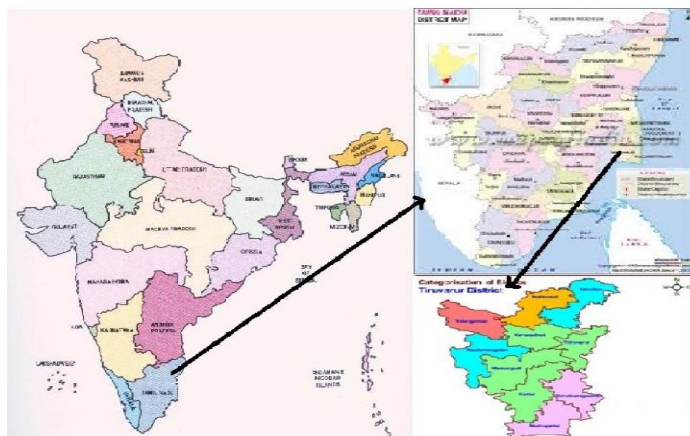


Fig. 1: Study area

Table 1: Sampling points of Thiruvavur region

Sampling Place	Sampling point No.
Manjanavadi	S1
Rayanallur	S2
Maruthur	S3
Pallivarthi	S4
Verkudi	S5
Nagangudi	S6
Kudikatu	S7
Mankootai	S8
Assheam	S9
Thattankovil	S10

Fig. 1 shows the location of the ground water sample collected. Table – 1 are given about sampling points of Thiruvavur region

2.2 Methodology

A total ten 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 July -2014. The samples in the canes were kept in the refrigerator. Table-2 is given about methods used for estimation of variation physicochemical parameters.

Table-2: Methods used for estimation of various physicochemical parameters

Parameters	Methods
Temperature	Thermometer
pH	PH Metric
Colour	Platinum - Cobalt method
Taste	Taste rating method
Odour	Olfactory method
Turbidity	Nephelometric method
Total Alkalinity	Indicator method
Chloride	Argento metric method
Sulphate	Turbidity method
Calcium	EDTA Titrimetric method
Magnesium	EDTA Titrimetric method
Manganese	Spectrometric method
Nitrate	Chromotropic acid method
Nitrite	Spectrometric method
Iron	Spectrometric method
Phosphate	Spectrometric method

3. RESULTS AND DISCUSSION

The water samples were collected from various parts of Thiruvavur 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, 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 29.3 °C to 32.6 °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 agreeable odour and taste, (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 Thiruvarur region range from 0.3 to 1.2, (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 0.72 to 1.56 m S/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 Thiruvarur region ground water range between 290mg/l to 714mg/l.

The TDS of ground water sample number S3, S5, S6, S7, and S8 is high in the Thiruvarur region, (Table-3), (Fig-3). If the TDS of drinking Water is more than 2000 mg/l it 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 7.24 to 7.69. All the samples 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 contributors 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 76.01 mg/l to 305.27 mg/l, (Table-4), (Fig-5).

3.9 Chlorides

Discharge of domestic sewage is the main source of chloride in water. The chloride content estimated in the samples ranged between 44.98 mg/l – 181.94 mg/l, (Table-4), (Fig-6).

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 0.29 mg/l to 1.41 mg/l. All the samples lying within BIS limit, (Table-4), (Fig-7).

3.11 Nitrate

This is the highest oxidized form of Nitrogen. Biological oxidation of nitrogenous substance from sewage is the main source of nitrate. All the samples were found to have nitrate concentration ranging from 0.62mg/l to 1.79mg/l. All the water samples had nitrate content lying within the BIS limit, (Table-4), (Fig-8).

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 0.0008mg/l to 0.054 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-9)

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 to 1.5 mg/l, (Table-4), (Fig-10).

3.14 Calcium

The calcium hardness was recorded in 30.45 mg/l to 80.55 mg/l. for ground water of Thiruvarur region. The sample number S8 were exceeding the BIS limit, (Table-4), (Fig-11)

3.15 Magnesium

The magnesium hardness was recorded in 16.04 mg/l to 51.04 mg/l. The magnesium content of sample numbers S3, S6, S7 and S8 from Thiruvarur region is above the desirable limit, (Table-4), (Fig- 12).

3.16 Iron

Irons usually exist 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 0.02 mg/l to 0.39 mg/l, (Table-4). For most of the samples iron levels were below detectable limit but the sample number S8 from Thiruvarur region 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).

Table 3: Physical parameters of ground water collected from Thiruvarur region

Parameters	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	BIS Desirable limit
Temperature (°C)	29.6	29.3	31.2	32.3	31.7	32.4	29.8	30.2	31.3	32.6	-
Colour	1HU	1HU	1HU	1HU	1HU	1HU	1HU	1HU	1HU	1HU	2HU
Taste	Taste less	Taste less	Taste less	Taste less	Taste less	Taste less	Taste less	Taste less	Taste less	Taste less	Agreeable
Odour	Odour less	Odour less	Odour less	Odour less	Odour less	Odour less	Odour less	Odour less	Odour less	Odour less	Agreeable
Turbidity	0.4	0.4	0.8	0.3	0.7	1.2	0.7	1.0	0.3	0.4	2NTU
EC	0.72	0.87	1.22	0.65	1.13	1.56	1.21	1.43	0.62	0.68	-
TDS	331	399	580	300	531	714	554	665	290	308	500 mg/l

TDS = Total Dissolved Solids, EC = Electrical Conductivity

Table 4: Chemical parameters of ground water collected from Thiruvarur region.

Parameters	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	BIS Desirable limit
pH	7.39	7.3	7.26	7.24	7.24	7.3	7.48	7.44	7.69	7.36	6.5-8.5
Total Alkalinity	131.18	186.35	247.65	93.17	207.19	297.91	305.27	288.1	155.7	76.01	200 mg/l
Chloride	94.97	112.96	118.46	44.98	115.96	181.94	62.48	150	44.98	102.96	200 mg/l
Sulphate	1.29	1.25	1.41	1.25	0.041	1.12	0.87	0.37	0.29	0.79	200 mg/l
Nitrate	1.78	1.24	1.02	1.78	0.91	0.09	1.79	1.35	0.72	0.6	45 mg/l
Nitrite	0.0015	0.0017	0.0026	0.0017	0.0022	0.0028	0.0013	0.054	0.005	0.0008	0.02 mg/l
Phosphate	BDL	1.25	1.32	1.38	1.22	1.3	1.24	1.5	1.33	1.4	-
Calcium	30.45	47.29	56.5	31.26	47.69	65.72	43.28	80.55	30.45	34.06	75 mg/l
Magnesium	17.74	29.16	43.26	17.98	28.19	51.04	45.2	50.06	25.76	16.04	30 mg/l
Iron	BDL	0.02	BDL	BDL	BDL	BDL	BDL	0.39	BDL	BDL	0.1 mg/l
Chromium	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	-
Manganese	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	-

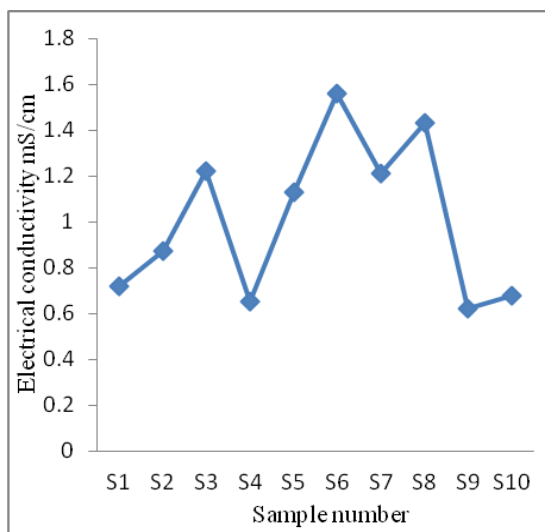


Fig. 2: Electrical conductivity Variation of the Study area

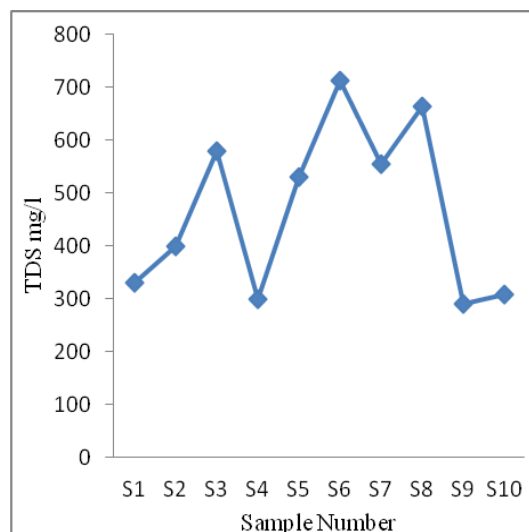


Fig. 3: Total Dissolved Solids Variation of the Study area

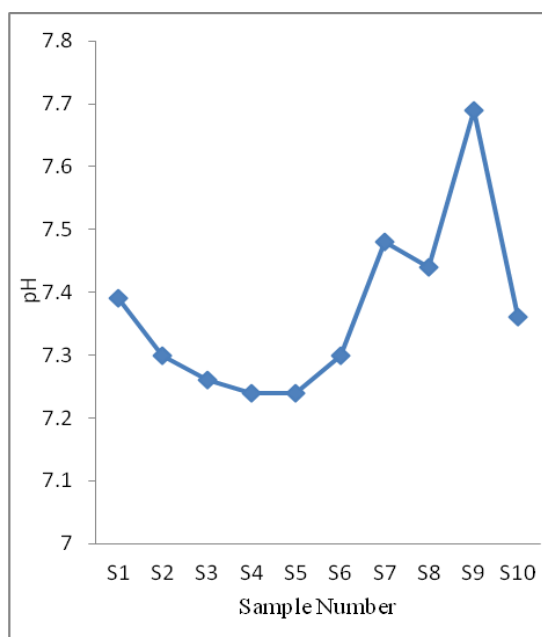


Fig. 4: pH Variation of the Study area.

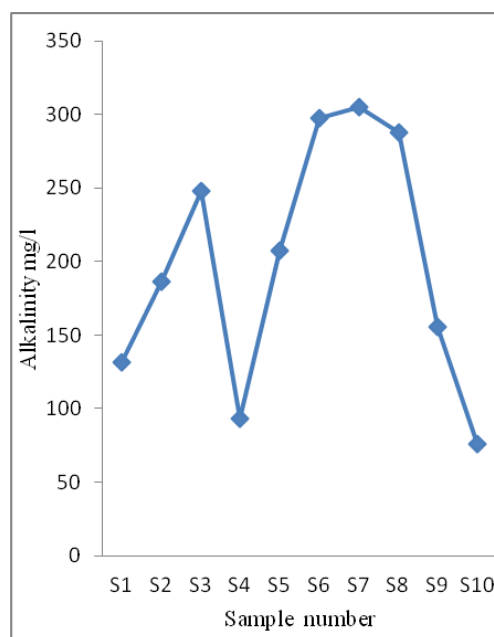


Fig. 5: Total Alkalinity Variation of the Study area

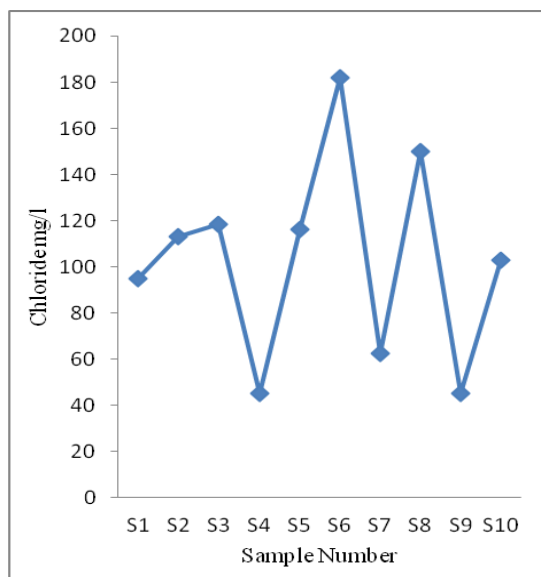


Fig. 6: Chloride Variation of the Study area

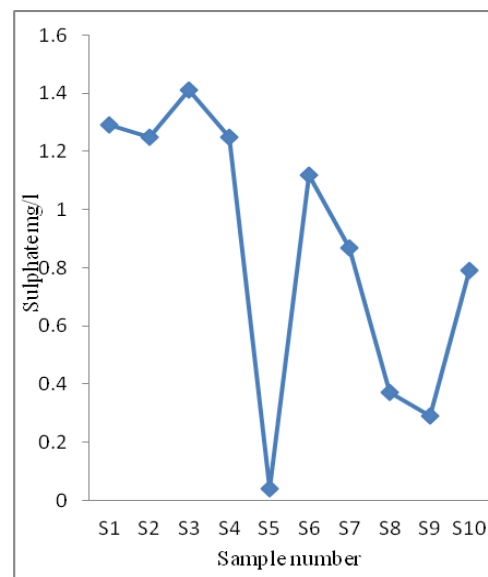


Fig. 7: Sulphate Variation of the Study area

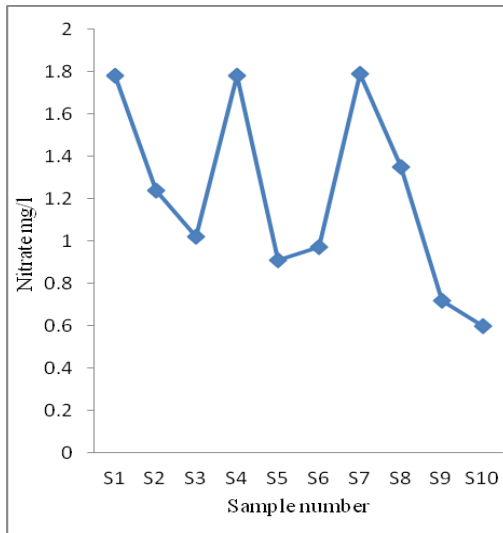


Fig. 8: Nitrate Variation of the Study area.

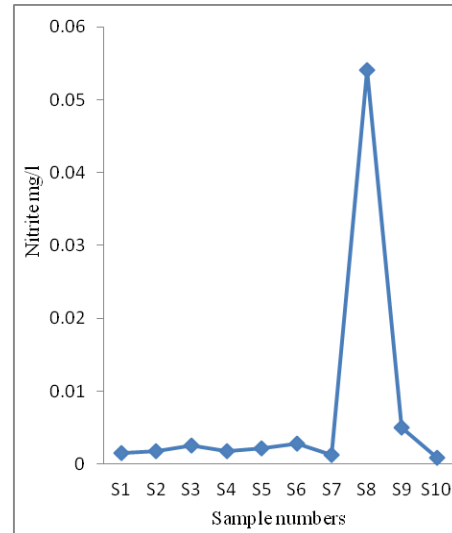


Fig. 9: Nitrite Variation of the Study area

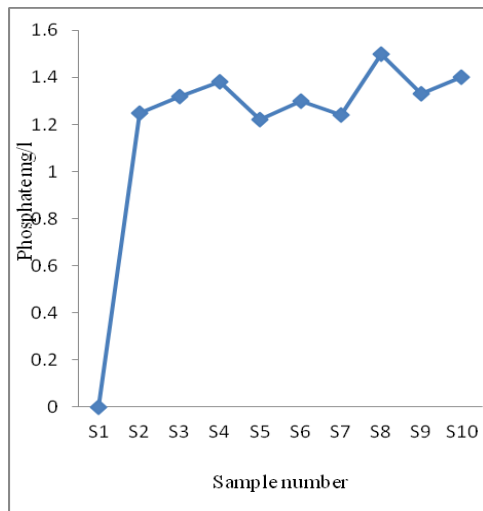


Fig. 10: Phosphate Variation of the Study area.

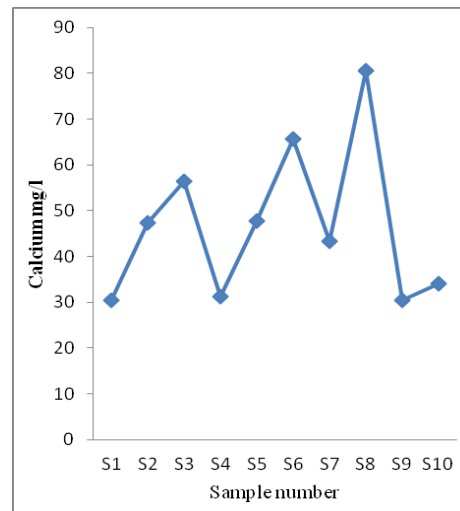


Fig. 11: Calcium Variation of the Study area.

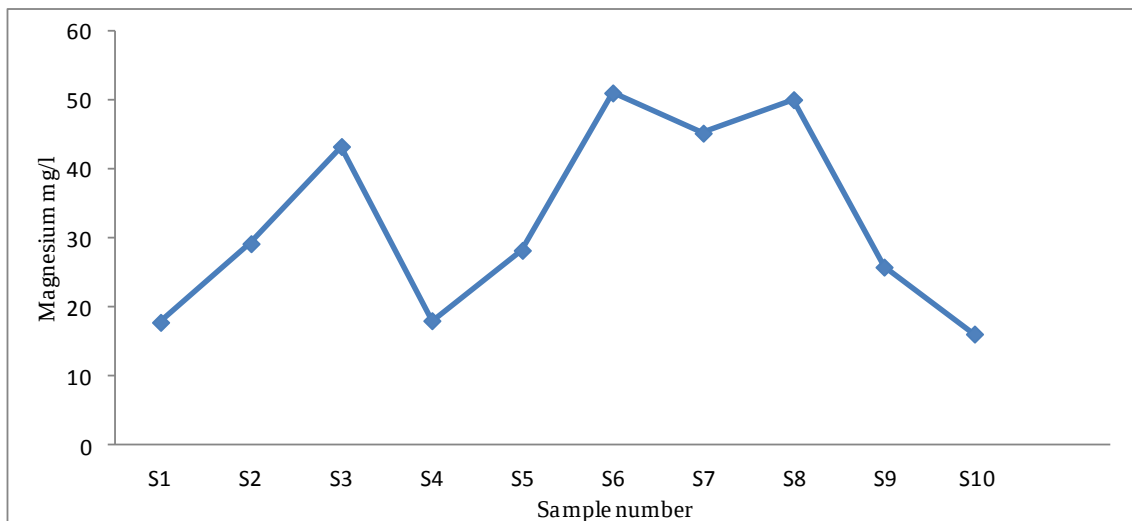


Fig. 12: Magnesium Variation of the Study area

4. CONCLUSION

Water sample were collected from bore well of Thiruvavur region. The samples were analyzed for physical parameters such as temperature, colour, odour, taste, turbidity, electrical conductivity and total dissolved solids. The various chemical parameters like pH, total alkalinity, chloride, sulphate, calcium, magnesium, manganese, nitrate, irons, nitrite, phosphate, chromium and manganese content were also analyzed. Standard analytical procedures like spectrophotometry, volumetry were used for analysis. In most of the groundwater samples of TDS, TA, Ca^{2+} , Mg^{2+} and Fe^{3+} are high from Thiruvavur regions. The estimated parameters were compared with BIS drinking water quality guideline. The physicochemical analysis of water samples concluded that the water quality of Thiruvavur region most of the areas groundwater is not suitable for drinking purpose. The human beings of Thiruvavur region are suffering with various diseases like gastro intestinal irritations and skin irritation. This study given a knowledge and awareness created among the people.

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