Physicochemical analysis of groundwater from various parts of Nagapattinam District, Tamilnadu (India)

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ABSTRACT - The present research work are assessing the quality of ground water from various parts of Nagapattinam district for determine its fitness for drinking and other uses. The water quality parameters like pH, TDS, Calcium, magnesium hardness, alkalinity & some heavy metal are analyzed by Indian standard methods, further the physicochemical parameters of Nagapattinam region groundwater sample are compared with standard limits recommended by BIS. The results showed that all the parameters of ten ground water samples are lying above the limits as per BIS standards, from the results I was confirmed that all the collected groundwater samples are containing harmful substances that cause adverse effect to human being, animals and can't use other purposes.

Key words: Physicochemical Parameters, Ground water quality, Nagapattinam, Tamilnadu.

1. INTRODUCTION

Water is one of the abundantly available substances in nature. It is an essential constituent of all animal and vegetable matter and forms about 75% of the matter of earth's crust. The human body consists about 70% of water. All body mechanisms in animals and plants depend on water as the media at the same time if the ground water had excess of hardness will cause some diseases to the human being for example kidney problem, heart disorder, nervous problem, etc., hence the ground water quality analysis is very important one.

Now a day most of the countries analyzed (checked) the groundwater quality for drinking purpose, so I was choose to analyze groundwater quality of Nagapattinam region; few literature survey are given below about water quality analysis.

Generally the calcium is essential to the human body, but the calcium in human being has excess (Hypercalcimia) it cause some disease to human being such as urinary problem, heart problem, coma and death, if serum calcium level rises to 160 mg / 100 ml. 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& kidney problems.

G. Gnanachandrasamy, et al., (2015) has reported that the calcium of groundwater samples in lower part of Nagapattinam district having excess compare than WHO & BIS limit. Maximum values of calcium ion were observed 355.4 mg/L in monsoon season.

Deepali *et al.,2012* have concluded that most of the groundwater samples of around Sidcul in Haridwar are suitable for drinking, irrigation and other purpose, but still some of the samples showed the presence of high level of physicochemical and metallic contamination due to the presence of industries in the study area.

D. Kannan *et al.,* 2014 has reported the water quality of Thiruvarur and Nagapatattinam regions groundwater samples is not suitable for drinking purpose, because in the region groundwater had excess of TDS, TA, Ca^{2+}, Fe^{3+}.

N. Mani *et al.,* has reported In Thanjavur region some of ground water samples was contaminated, because in the presence of excess of calcium hardness, magnesium hardness, TDS and total alkalinity.

T. Mohanapriya et al., has reported most of the region in Thiruvarur district has excess of hardness, alkalinity, etc., & she is concluded in this region most of the groundwater cause kidney problem to that region human being.

D. Kannan *et al.,* 2014, has reported in Thiruvarur region groundwater samples has excess of calcium, magnesium hardness. The hard water is said to cause serious health problems such as urolithosis, cardiovascular disorder, kidney problems and cancer (Meena, K.S, *et al* 2011). Additionally, WHO reports that excess intake of calcium is associate with kidney stones and that of magnesium leads to diarrhea and laxative effect due to change in bowel habit. Water quality of Thiruvarur region most of the areas groundwater is not suitable for drinking purpose, because in the presence of excess hardness (D. Kannan *et al* 2014).

From the literature survey is very helpful for analyze water quality of Nagapattinam region groundwater samples. The objective of the study is to assess the water quality parameters like Phosphate, pH , TDS, Ca^{2+}, Mg^{2+}, Fe^{2+}, etc., to compare the result with BIS desirable limit.

2. EXPERIMENTAL

2. 1. Study area

Nagapattinam is located at 10^0 .76' N and 79^0.84' E latitude. Fig – 1 showed the location of ground water samples was collected from Nagapattinam region and table – 1 are given about sampling points of Nagapattinam district.

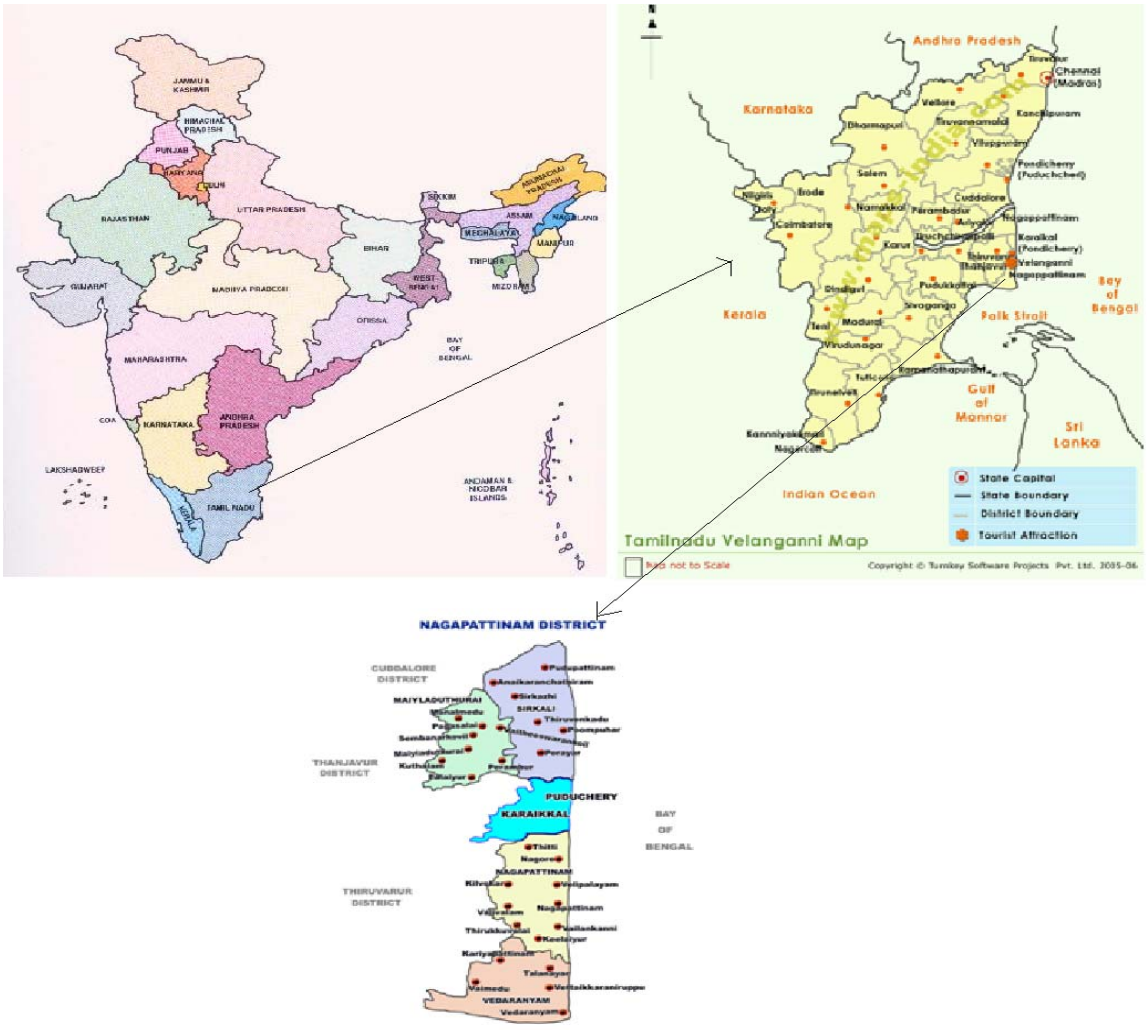

Figure-1: Study Area

Table-1: Sampling points of Nagapattinam region

Sampling Point	Sampling Point Number
Sikkal	S1
Nagapattinam	S2
Nagore	S3
Narimanam	S4
Thittacheri	S5
Thirumarugal	S6
Thirukkannapuram	S7
Enangudi	S8
Ganapathipuram	S9
Ambal	S10

2.2. Methodology

Water samples were collected in previously sterilized poly propylene plastic bottles with cap. The sampling has been carried out in month of NOV-2017. The samples in the canes (Bottle) were kept in the refrigerator. The physicochemical parameters were determined using IS analytical method. Table-2 is given about methods used for estimation of variation physicochemical parameters.

Table – 2: Methods used for estimation of variation physicochemical parameters.

Parameters	Methods	References
Apperance	Platinum - Cobalt method	IS : 3025 (Part 4)
pH	pH – Metric	IS : 3025 (Part II)
Turbidity	Nephelometric method	IS : 3025 (Part 10)
Electrical Conductivity	Conduct metric	IS 3025 : 1964
Total Dissolved Solid	Gravimetric method	IS : 3025 (Part 16)
Total Alkalinity	Titrimetric method	IS : 3025 (Part 23)
Chloride	Argento metric method	IS : 3025 (Part 32)
Sulphate	Turbidity method	IS : 3025 (Part 24)
Calcium	EDTA Titrimetric method	IS : 3025 (Part 40)
Magnesium	EDTA Titrimetric method	IS : 3025 (Part 46)
Nitrate	Chromotropic acid method	IS : 3025 (Part 34)
Iron	1, 10, Phenanthroline method	IS : 3025 (Part 53)
Fluoride	Zirconium alizarin method	IS 3025 : 1964

3. RESULTS AND DISCUSSION

The water samples were collected from various parts of Nagappattinam region, and were analyzed for their physicochemical characteristics. The results were compared with BIS drinking water quality guideline. The estimated physicochemical parameters are reported in the table- 3 and table- 4.

3.1. Appearance:

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 colour less nature (Table- 3).

Table-3: Physical parameters of groundwater collected from Nagapattinam region

Parameters	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	**BIS Desirable limit**
Appearance	Clear	Clear	Clear	Clear	Clear	Clear	Clear	Clear	Clear	Clear	-
Conductivity	2086	1202	5101	1666	1768	1231	1202	1246	1159	1449	-
TDS	1440	830	3520	1150	1220	850	830	860	800	1000	500 mg/l
Turbidity	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	0.2 NTU

3.2. 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. The present study most of the samples site have higher EC values .The data are given in table- 3.

3.3. Total Dissolved Solids:

Total dissolved solids indicate the salinity behavior of groundwater. Generally water containing more than 500 mg/l of TDS is not considered desirable for drinking water supplies.The TDS of groundwater varied from 800 mg/l to 3520 mg/l. Nagappattinam region collected groundwater samples have exceed the BIS desirable limit. The TDS values are given in table -3, fig- 2

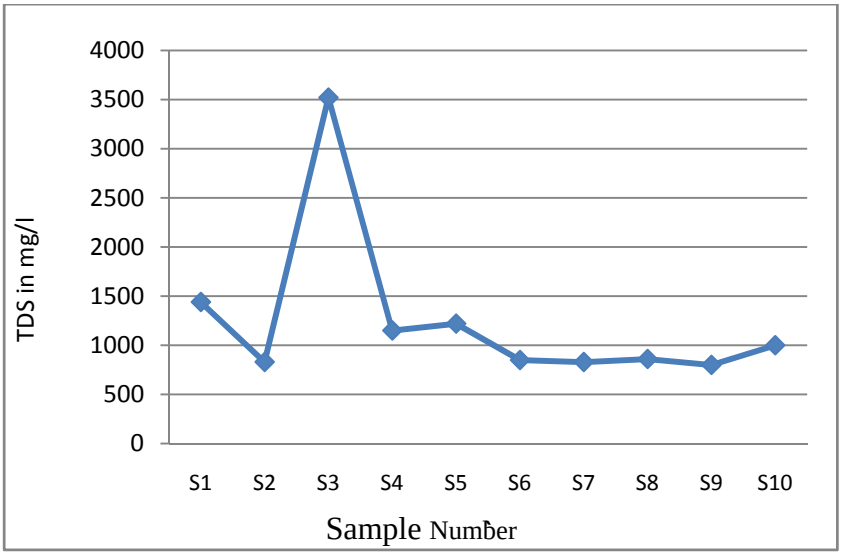

Fig- 2: TDS variation of the Study area.

3.4. Turbitity:

Turbitity in natural water is caused by clay, organic matter, phytoplankton etc., The entire collected groundwater samples haven't any turbidity.

3.5. Hydrogen ion concentration (pH):

Generally pH of water is influenced by buffering capacity of water. The water samples had pH ranged from 7.32 to 7.95. All the samples lying with in BIS permissible limit, showing that all the samples were almost neutral and harmless, (Table- 4).

Table-4: Chemical parameters of groundwater collected from Nagapattinam region

Parameters	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	**BIS Desirable limit**
pH	7.86	7.32	7.54	7.38	7.64	7.78	7.81	7.35	7.95	7.32	6.5 – 8.5
TH	408	292	692	400	348	228	180	184	260	296	400 mg/l
TA	348	200	352	228	336	292	304	332	204	256	200 mg/l
Cl^-	442	121	2041	272	283	119	150	155	110	218	200 mg/l
SO_4^{2-}	36	34	96	30	38	32	36	35	34	37	200 mg/l
Fe^{3+}	0.22	0.33	0.33	0.22	0.22	0.22	0.33	0.22	0.33	0.22	0.1 mg/l
Ca^{2+}	32	32	171	65	51	51	40	22	48	30	75 mg/l
Mg^{2+}	79	51	64	57	24	24	19	31	34	53	30 mg/l
NO_3^-	11	14	17	11	19	16	21	14	14	18	45 mg/l
F^-	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	1 mg/l

3.6. Total Hardness:

The hardness of water is due to associate some inorganic ions with carbonate. Total hardness of groundwater samples present from 180 mg/l to 692 mg/l (see- fig: 3).

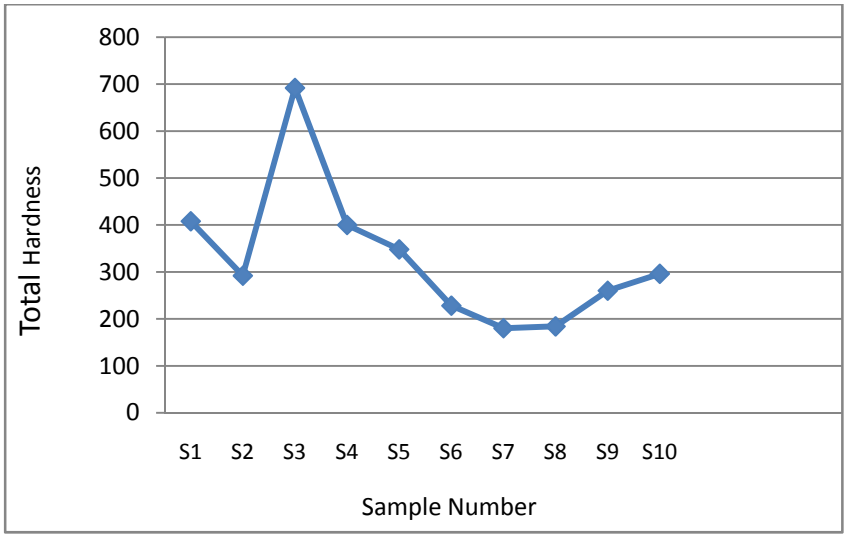

Fig- 3: Total Hardness variation of the Study area.

3.7. Alkalinity:

The Alkalinity is due to the presence of carbonates, bicarbonates and hydroxides in water. The present study the alkalinity ranged from 200 mg/l to 352 mg/l. The alkalinity of entire collected groundwater samples lies above the BIS desirable limit (see: table- 4, fig - 4). The excess alkalinity of groundwater is affect the abdomen part of human being.

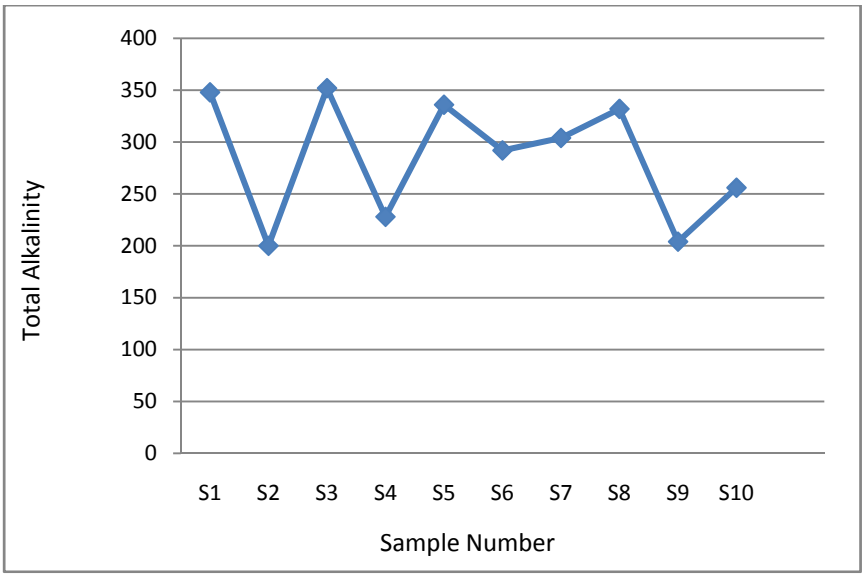

Fig- 4: Total Alkalinity variation of the Study area.

3.8. Chloride:

The graph shows that the range of chloride ion concentration is 110 mg/l to 2041mg/l. Few parts of collected groundwater samples have high concentration of chloride ion. The data variation are given in table - 4 and fig – 5

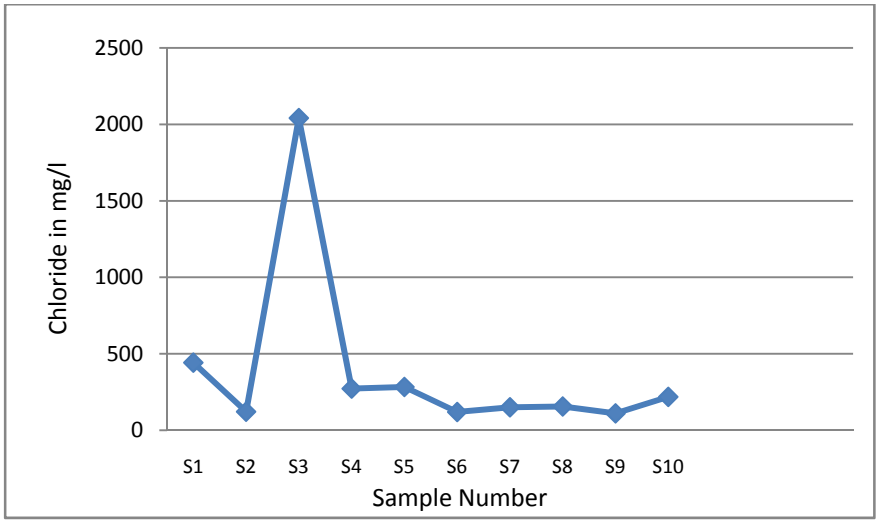

Fig- 5: Chloride variation of the Study area.

3.9. Sulphate:

Drainage wastes are the main source of high sulphate concentration. The entire collected groundwater samples sulphate concentration lies below the BIS desirable limit. Nagappattinam region groundwater sample sulphate concentration ranged between 30 mg/l to 96 mg/l (see – table: 4 and fig-6)

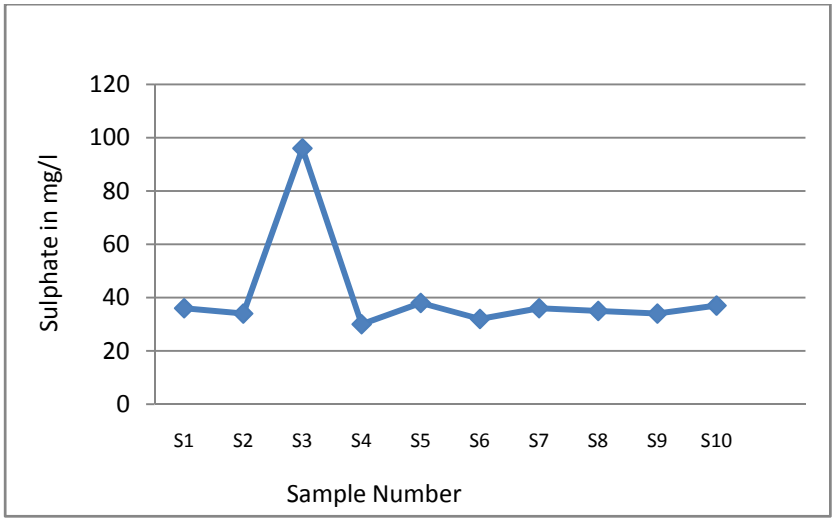

Fig- 6: Sulphate variation of the Study area.

3.10. Calcium:

Calcium of water sample was found in the range from 22 mg/l to 171 mg/l (see : table-4 & fig-7). In Nagappattinam region groundwater sample number S3 have high concentration of calcium hardness compared with BIS limit.

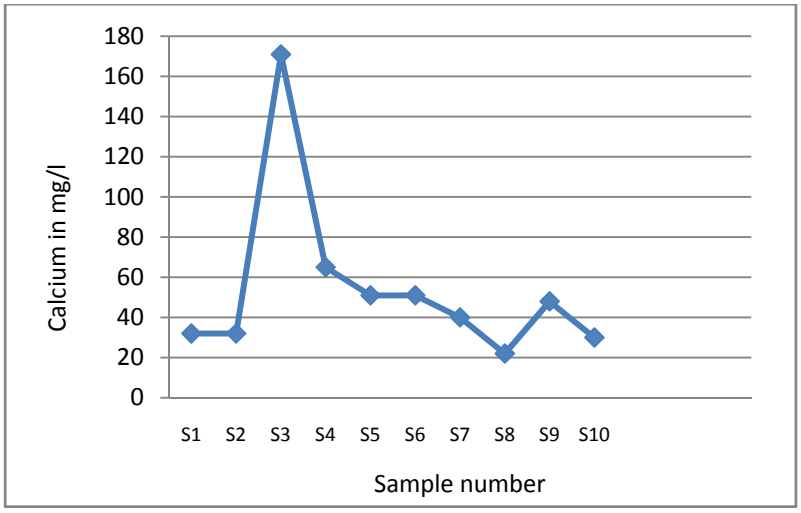

Fig- 7: Calcium variation of the Study area.

3.11. Magnesium:

The magnesium hardness was recorded in 19 mg/l to 79 mg/l (see : table-4 & fig-8). The collected groundwater sample number S1, S2. S3, S4, S5 & S10 have excess magnesium hardness.

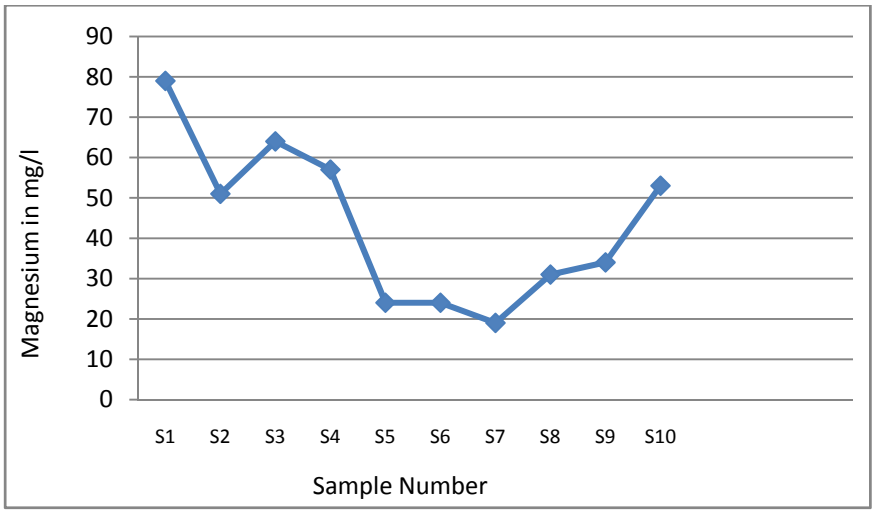

Fig- 8: Magnesium variation of the Study area.

3.12. Nitrate:

This is the highest oxidized form of Nitrogen. Biological oxidation of nitrogenous substance from sewage is the main source of nitrate. The samples nitrate concentration present from 11 mg/l – 21 mg/l (see : table-4 & fig-9). The entire collected groundwater samples nitrate concentration lies within BIS desirable limit.

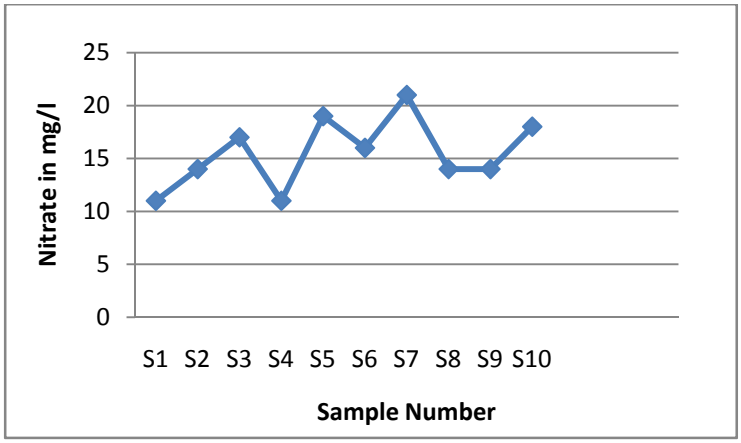

Fig- 9: Nitrate variation of the Study area.

3.14. Fluoride:

Industrial waste is the main source of fluoride ion. The entire collected groundwater samples fluoride ion lies within BIS desirable limit.

3.15. Iron:

Irons usually exist in ferrous and ferric forms. Generally, the ferric form is predominant in natural water. The collected groundwater samples had iron level ranging between 0.22 mg/l to 0.33 mg/l (see : table- 4). Most of the Nagappattinam region groundwater samples have excess level of ion concentration. The excess of iron causing stripping of cloths.

4. Conclusion

The present investigation showed that all the ten groundwater samples are physically and chemically not suitable for drinking purpose, because in the region ground water had excess of TDS, chloride, iron and magnesium hardness.The results showed that all the parameters of ten ground water samples are lying above the limits as per BIS standards. The results confirmed that all the collected groundwater samples are containing harmful substances that cause adverse effect to human being.This study given a knowledge and awareness created among the Nagapattinam region people.

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