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WATER QUALITY ANALYSIS OF KUPPAM VILLAGE

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ABSTRACT

In this work, samples of water were collected from different bore wells from different areas ofkuppam village. Over the due course of time various parameters regarding the water quality were analysed to the Indian Standards..10500-2012 (Drinking water specifications) was referred in order to check the acceptabilityof water.The considered parameters are pH,solids in water,hardness,chloride,sulphate,Turbidity,iron,fluoride,etcMost of the parameters were not found to be in the desirable range for drinking andhence,appropriate measures were suggested to improve the quality of water.

Keywords – Water quality, drinking water, Turbidity, Conductivity, chloride, sulphate, iron.

1 INTRODUCTION

Water quality can be defined as the chemical,physical and biological characteristics of water,usually in respect to its suitability for a designated use, of water has many uses such as, for drinking , fisheries , agriculture and industries. Quality analysis of water is to measure the required parameters of water following standard methods to check whether they are in accordance with the bureau of Indian standards (IS10500:2012) orAccording to WHO organization,since about 80% of all the diseases in human beings are caused by water.

In the last few decades, there has been a tremendous increase in the demand for fresh water due to rapid growth of population and the accelerated pace of industrialization.Ground water is used for domestic and industrial water supply and also for irrigation purposes in all over the world.Water sampling and analysis involves the collection of water samples and measurement for chemical and biological characteristics to determine its quality.Theses results are compared against water quality standards in regulations and guidelines to determine its use and /or the treatment required to make the water suitable for its intended use

(drinking water)

These days' cities are growing in all aspects and facing human induced stress on environment. Due to the growth of population in cities it has become difficult to satisfy the people with the available water resources. Of all the wants of the people, the potable drinking water is one which needs more attention these days. Its quantity and quality and its proper distribution are very important

Following are some major hydrological issues in urban and city areas.

- Disruption of natural hydrological cycle.
- Decline in water levels and possible land subsidence.
- Determination of surface and groundwater quality.
- Increase in pollutant loads from runoff discharges and sewage outfalls.
- Industrial and commercial operations involving the handling of large quantities of chemical substances which may be accidentally released into the subsurface in significant amounts as the result of leaks and spills occurring during transport, storage and utilization activities

1.1 Water Quality

Water quality refers to the chemical, physical and biological characteristics ofwater. It is a measure of the condition of water relative to the requirements of one or more biotic species and or to any human need or purpose. It is most frequently used by reference to a set of standards against which compliance can be assessed. The most common standards used to assess water quality relate to health ofecosystems, safety of human contact anddrinking water.

Different properties were analysed & compared during the course of the project.

1.2 Importance of the study

Water quality testing is an important part of environmental monitoring. When water quality is poor, it affects not only aquatic life but the surrounding ecosystem as well.

These sections detail all of the parameters that affect the quality of water in the environment. These properties can be physical, chemical or biological factors. Physical properties of water quality include temperature and turbidity. Chemical characteristics involve parameters such as pH and dissolved oxygen. Biological indicators of water quality include algae and phytoplankton. These parameters are relevant not only to surface water studies of the ocean, lakes and rivers, but to groundwater and industrial processes as well.

Water quality monitoring can help researchers predict and learn from natural processes in the environment and determine human impacts on an ecosystem. These measurement efforts can also assist in restoration projects or ensure environmental standards are being met.

The following chapters will discuss each water quality parameter specifically. Each page defines what the parameter is, where it comes from and why it is important to measure.

1.3 Objective of the study

Assessing the quality of water resources of the study area by physico-chemical analysis of surface and groundwater samples.

Evaluation of their quality based on various hydrochemical parameters. Finding the suitability of water resources for the drinking purposes.

Suggesting the measures to bring down the parameters below the permissiable limit

1.4Scope of the study

On chemical parameters like Fluoride, Hardness etc., help to delineate the areas of safe potable groundwater.

Presence of chemical parameters and their concentrations will be known at studied area.

Water qualities, quantity will be known at studied area.

Identification of zones of ground water free from fluoride and hardness etc., can be used for irrigation and domestic purposes.

2 LITERATURE REVIEW

REVIEW OF ARTICLES

1.Sriniwas Kushtagi and PadakiSriniwas(2011)14 carried out studies on water quality index of Groundwater of Aland taluka, Gulbarga(INDIA)states that main aim of the current work is to evaluate the quality of well water for rural and urban population based on W.Q.I. results, groundwater characteristics and quality assessment .Ten villages of Aland taluka are selected and at each village water samples at three places were collected using standard procedural methods and analyzed for pH, TH, Ca, Mg, CL, TDS, Fe, F, NO3,SO4 .BIS-10500-1991 standards were adopted for calculation of water quality index.

2. K. Elangovan (2010)carried out characteristics of tube well water for district Erode (India) states that ground water quality of 60 locations in Erode district during pre- monsoon and post monsoon seasons. Ground water samples were tested for 11 physico-chemical parameters following the standard methods and procedures. World Health Organization (WHO) standards were adopted for calculation of water quality index by using the methods proposed by Horton and modified by Tiwari and Mishra.

3. Sarala C.et.al [04](2007)studied the groundwater quality parameters in the surrounding wells of Jawaharnagar, in upper Musi catchment area of Ranga Reddy district in Andhra Pradesh. The bore wells data was collected from the study area for two seasons i.e., post monsoon in December 2007and pre monsoon in June 2008. The groundwater is acidic in nature and very hard. It is done by using Arc GIS software. The study reveals that the concentrations of major constituents are well within the permissible limits of IS10500-1994, except in few cases where total hardness and fluoride concentrations are high. The fluoride conc. exceeded the permissible limit. From the analysis it was observed that the groundwater is polluted in the entire study area. During last few years, the utilization of surface and groundwater for drinking, industrial and agricultural purposes has increased manifolds but consequently it is observed that the water is polluted and affecting the human health, soil nutrients,livestock,biomass and environment in certain areas.

4. G. Achuthan Nair et al (9) (2004)carried out ground water quality status by water quality index at North –East Libya The quality of groundwater was assessed to their suitability for drinking at six places of north-east Libya viz. El-MarjAlbayda, Shahat, Susa, Ras al-Hilal and Derna, during November, 2003 to March, 2004, by determining their physicochemical parameters (17 parameters) and water quality index (15 parameters). Peoples of Libya are aware for ground water quality and purity level and present study will be use full for maintaining the desired levels.

5. Cristina Rosu, IoanaPistea, MihaelaCalugar, IldikoMartonos, A.Ozunu7(2011) , carried out work on quality of ground water by W.Q.I. method in Tureni Village, Cluj County. The rural population from Romania is dealing even today with the absence of access to a sure drinking water source. Therefore in 2002 only 65% of the Romanian population had access to drinking water, distributed in 90% from the urban environment and 33% from the rural one. This work presents a case study referring to a 3 month (AprilMay-June 2011) monitoring of weekly samples of the quality of well water (10 samples) from Tureni village, Cluj County. A portable multi parameter model WTW 720 Germany was used to measure the pH, total dissolved solids (TDS), electrical conductivity (EC), temperature, oxidation-reduction potential and salinity of the collected water samples (these tests were done on site).

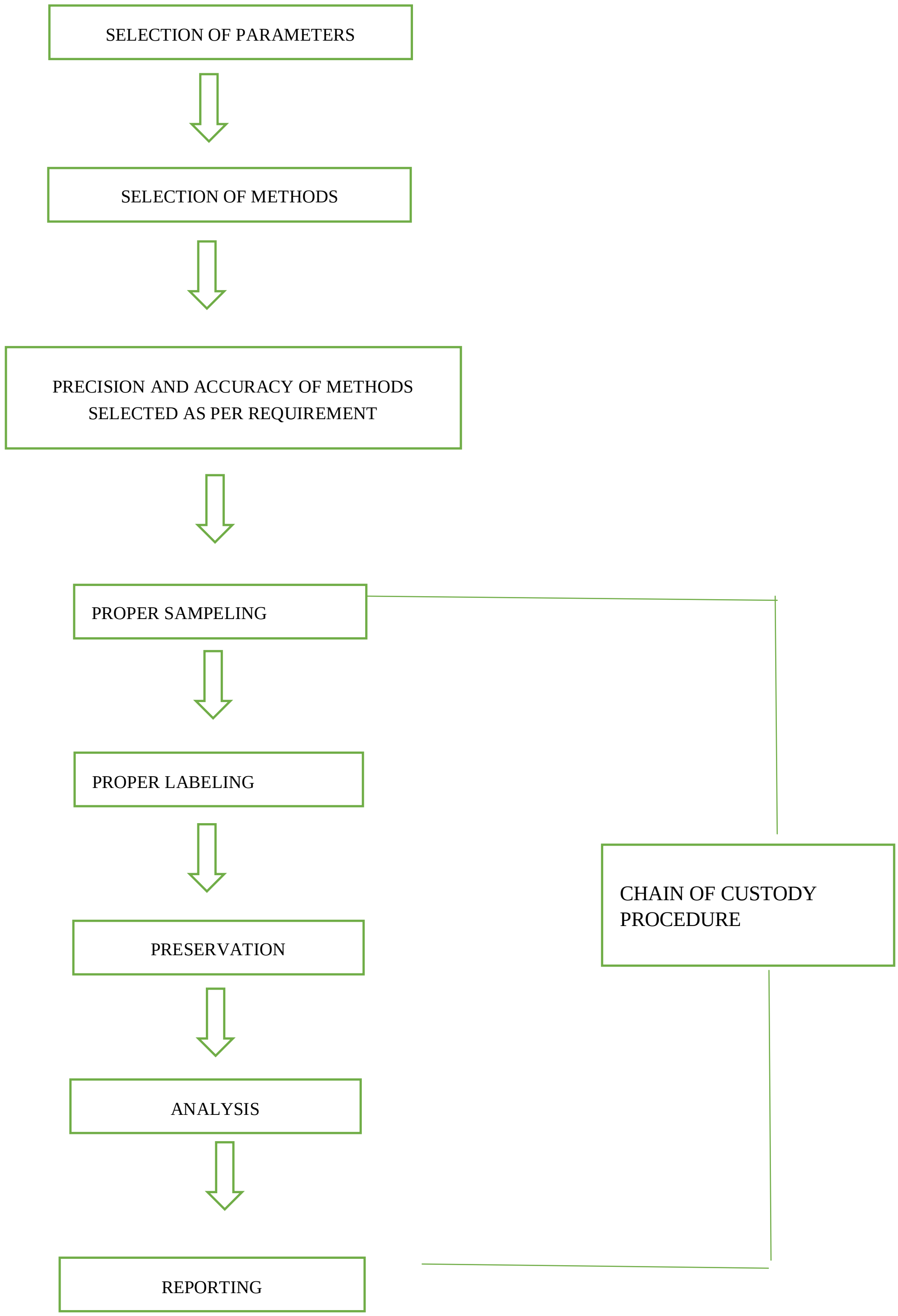
6.Shivasharanappa, Padaki Srinivas and Mallikarjun S Huggi5(2013)carried out research work on Bidar city (Karnataka) for their characteristics of ground water and Water quality index (W.Q.I.). This research work deals with revaluation of W.Q.I. for ground water for the residential and industrial area of bidar. In the city there are 35 wards, samples collected from all wards and tested for 17 parameters. The parameters are pH, total hardness, Ca (Calcium), Mg (magnesium), chloride (Cl), NO3 (Nitrate), SO4 (sulphate), T.D.S., Fe+3 (Iron), F (Fluoride), sodium (Na), potassium (K), alkalinity, manganese (Mn), D.O., total solids and Zinc (Zn). Tested results were used for suggest the models for water quality analysis. J Sirajudeen, S Arul Manikandan and V Manivel (2013) 6 Carried out the work on ground water for evaluating the W.Q.I. Samples collected an Ampikapuram area near Uyyakondan channel Tiruchirappalli district. For Evolution of water quality index following parameters are examined: pH, E.C., T.D.S., Total hardness, D.O., C.O.D., B.O.D., Cl- , NO3 and Mg .The WQI for these samples ranged between is 244 to 383.8.The analysis reveals that the groundwater of the area needs some degree of treatment before consumption, and it also needs to be protected from the perils of contamination.

7.Okha-Maliya(2000)Along this section, the 2000 TDS contour was traced in 2004 by GWRDC. It was almost parallel to the coast line and 10 to 20 km inland. The contour was traced closest to the sea between Khambaliya-Jamnagar where basalts are exposed. On the coast line the TDS goes up to 6000 ppm.Okha-Porbandar-Madhavpur (Saurashtra coast)Along this section the fresh-saline ground water interface was traced and monitored by GWRDC since 1980 by conducting VES and measurement of depth to water level and quality of water from observation wells along profiles perpendicular to the coastline. Two such profiles along Dwarka- Ladwa and Gorsar-Hantarpur (near Madhavpur) are shown in Figs. 5.22 and 5.23 respectively. The fresh-saline interface was 4 to 7 km inland in 1986-87. Along Okha-Madhavpur section the 2000 ppm iso-TDS contour in 1997 was, in general, 10-12 km inland. However, all along this section there were patches with less than 2000 ppm TDS very close to the coast line.

8.VikasTomar et.al [02](2011) collected water samples from 67 locations during pre and post-monsoon seasons of the year 2011 from Karnal district, Haryana and were subjected to analysis for chemical characteristics. The type of water that predominates in the study area was of sodium-calcium bicarbonate and magnesium bicarbonate type during pre and post-monsoon seasons of the year 2011 respectively andbased on hydro-chemical facies.Based on chemical analysis, the pre and post monsoon water samples were classified as per different standard irrigation criteria to study the chemical changes resulting due to rain and natural recharge. It indicates that Na-Ca-HCO3 type water dominates during pre monsoon and Mg-HCO3 during post monsoon seasons of the year 2011.

9. Shimaa M. Ghoraba et.al [08](2011)collected 120 ground water samples from 29 Districts of Balochistan,Pakistan. The various parameters are selected for the testing of samples. All samples were analyzed for pH, Calcium, Carbonate, Magnesium, Sodium, Potassium, Chlorides, Sulphate and Nitrate, TDS and bicarbonate. The results revealed highly variable hydrochemistry. The chloride is found to be most predominating. The groundwater in Balochistan has high concentrations of fluoride, iron and nitrate in many districts. The pH part of the Durov diagram reveals that groundwater in study area is alkaline and electrical conductivity of most of samples lies in the range of drinking water standards adapted in Pakistan. From the SAR and conductivity plot it was found that most of groundwater cannot be used on soil without restricted drainage and special requirement of Management for salinity control.Comparision of data with WHO(2011) standards for drinking water indicate that the groundwater in the most of study area are suitable for drinking purpose except some few places. The groundwater recorded a wide range in TDS.

3 METHODOLOGY


SELECTION OF PARAMETERS
SELECTION OF METHODS
PRECISION AND ACCURACY OF METHODS SELECTED AS PER REQUIREMENT
PROPER SAMPELING
PROPER LABELING
PRESERVATION
ANALYSIS
REPORTING
CHAIN OF CUSTODY PROCEDURE

4 SURVEYING OF GROUND WATER LEVEL

4.1 Topographical Surveying

Topographic surveying is the processes of determining the positions, both on plan and elevation, of the natural and artificial features of a locality for the purpose of delineating them by means of conventional signs upon a topographic map. By topography is meant the shape of configuration of the earth's surface. The basic purpose of the topographic maps is to indicate the three dimensional relationships for the terrain of any given area of land. Thus, on a topographic map, the relative position of points are represented both in horizontally as well as vertically. The representation of the difference in elevation is called the relief.. In addition to the relief, topographic map depicts natural feature such as streams, rivers, lakes, trees etc. as well as artificial features such as highways, railroads, canals, towns, houses, fences and property lines. The topographic maps are very essential for the planning and designing of the most engineering projects such as location of railways, highways, design of irrigation and drainage systems, the developments of water power, lay out of industrial plots and city planning. Topographic map are also very useful in directing military operations during war. The map can be used as base map for representing the quality and quantity of groundwater parameters

4.2 About the Project

In the present study the groundwater samples are collected around KUPPAM Town. The ground water samples collected are regularly used for domestic purposes. Therefore the detailed characters of these groundwater and their regarding domestic suitability are described in present work.
The study area is physically surveyed to know the geological and hydrological characters. Later, it was decided to study the characters of the groundwater. The groundwater samples are collected in the month of april 2021 in a polyethylene bottles after cleaning the bottles for two times by the water to be collected. The groundwater samples are collected from number of borewells within the town where water is regularly is used for domestic purposes. The selected borewell sites are from thick populated areas in the town.
All collected water samples are subjected for chemical analyses in the Department of Studies in Environment. The Following parameters are employed in estimating the various constituents

4.3 Collection of Samples

The samples were collected from different areas inkuppam town
4.3.1 sample (i) sommaiah street
4.3.2 sample (ii) srilanka colony
4.3.3 sample (iii) model colony
4.3.4 sample (iv)dkpalli
4.3.5 sample (v) urban colony
4.3.6 sample (vi)hp road
4.3.7 sample (vii)ntr colony
4.3.8 sample (viii)muniswamypuram
4.3.9 sample (ix)jp road
4.3.10 sample (x)Krishnadasanapalli

5 EXPERIMENTAL METHOD

- Calcium
- Magnesium
- Determination of pH
- Hardness
- Turbidity
- Chlorides content
- Total dissolved solids
- Sulphate content
- Iron content
- Fluoride content
- Nitrate content

5.1 Determination of pH

The pH is important parameter of water, which determines the suitability of water for various purposes such as drinking, bathing, cooking, washing and agriculture etc. The pH level of water having desirable limit is 6.5 to 8.5 as specified by the BIS. Pure water is said to be neutral, with a pH of 7. Water with a pH below 7.0 is considered acidic while water with pH greater than 7.0 is considered as basic or alkaline

The determination pf pH is the most frequently used test in the water chemistry.so all students must learn how to test pH pf water for various purpose in their life irrespective of their branches.

Test procedure

- Standardize the pH meter as per the directions given by the manufacturer's manual using buffer solutions of pH 4.0, 7.0 and 9.2.
- Clean the electrode using distilled water and wipe off.
- Insert the electrode in the sample. Wait for a steady reading. Note the pH. The reading will get directly from pH meter.
- Temperature of the sample is noted.

Fig :-5.3 pH meter

5.2 Total Hardness

Hard water is generally considered to be one which requires considerable amount of soap to produce foam or leather. **Hard water cause scale formation in boilers heaters and hot water pipes.** The rain water catches CO_2 from the atmosphere when the water pass through $CaCO_3$ rock in the Soil, these compounds make the water hard. Calcium and magnesium chlorides and sulphates also cause hardness.

There are two types of hardness:

- Temporary Hardness
- Permanent Hardness

Temporary hardness

this type of hardness is mostly caused by $Ca(HCO_3)$ or $Mg(HCO_3)$ or both,therefore it is also called carbonate hardness,these compound dissolve in water and form Ca_2,Mg+2 and HCO_3 ions which causes hardness

$$H_2O + CO_2 \rightarrow H_2CO_3$$

$$CaCO_3 + H_2CO_3 \rightarrow Ca(HCO_3)_2$$

Temporary hardness can be removed by Clark's method by adding limewater, $Ca(OH)_2$ to the hard water.

$$Ca(HCO_3)_2 + Ca(OH)_2 \rightarrow 2CaCO_3 + 2H_2O$$

$$Mg(HCO_3)_2 + Ca(OH)_2 \rightarrow MgCO_3 + CaCO_3 + 2H_2O$$

As the magnesium carbonate and calcium carbonate are insoluble in water and settles down.

Permanent hardness

It is also known as **non-carbonate hardness** and it is caused by $CaCl_2.MgCl_2$, $CaSo_4$ and $MgSO_4$, the ion exchange method is used for the removal of the permanent hardness sodium zeolite is added to hard water due to which calcium or magnesium zeolite is formed which is insoluble in water.

Test procedure:

- Take 50ml of water sample in conical flask.
- Take 50ml of water sample in conical flask.
- Add 1ml of buffer solution (AluminumHydroxide Ammonium Chloride) of hardness1.
- Add 3 drops of ferrochrome black tea to the flask and shake well.
- Place the flask below the burette containing EDTA (Ethylene diamine tetra-acitic acid) solution of 0.02 normality.
- Note the initial reading of the burette and open the tape of the burette to allow the solution to flow in the flask.
- Note The Final Reading when the colour of the water in the flask turn bluish.
- The total harness (temporary + permanent hardness) is found by using the following formula.

Range of hardness as per IS-10500:2012:-

- Acceptable range = 200 mg/l
- Permissible range= 600 mg/l

Fig :-5.4 Hardness of water

5.3 Turbidity

Turbidity is the cloudiness or haziness of a fluid causedby large numbers of individual particles that are generally invisible to the naked eye, similar to smokein air. The measurement of turbidity is a key test of water quality.

Test procedure:

- Remove the backing from the secchi disk icon sticker.
- Adhere sticker on the inside bottom of the large white jar (kit container) Position the sticker slightly off center.
- Fill the jar to the turbidity fill line located on the outside kit label.
- Hold the Turbidity Chart on the top edge of the jar. Looking down into the jar, compare the appearance of the secchi disk icon in the jar to the chart. Record the result as Turbidity in NTU

Range of turbidity as per IS 10500-2012:

- Acceptable range = 1 NTU
- Permissible range= 5 NTU

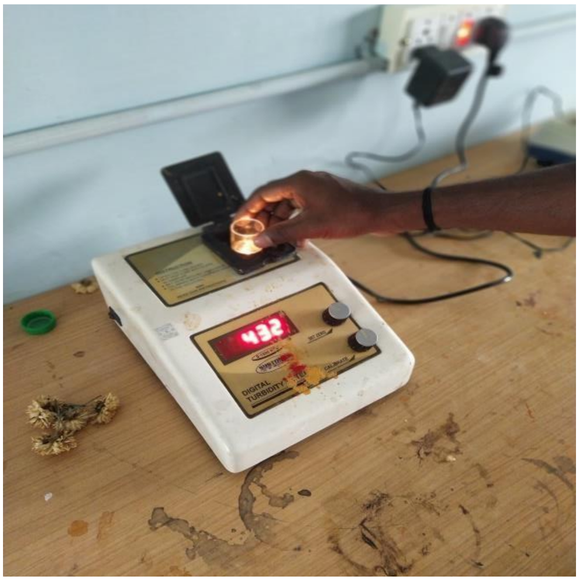


Fig :-5.5 Turbidity of water

5.4 Chlorides

Chloride is one of the most important parameter in assessing the water quality and higher concentration of chloride indicates higher degree of organic pollution . According to BIS and ICMR the permissible limit of chloride in drinking water is 250 mg/l. High concentration of chloride was observed may be due to natural processes such as the passage of water through natural salt formations in the earth or it may be an indication of pollution from industrial or domestic use.In drinking water, high chloride content may lead to laxative effects

Test procedure

- Take 50ML of sample (V ml) and dilute to 100ML
- If the sample is highly coloured, add 3ml of aluminum hydroxide and shake well, allow settling, filtering, washing and collecting filtrate.
- Bring the sample pH to 7-8 by adding acid or alkali
- Add 1ml indicator (Potassium chromate)
- Titrate the solution against standard silver nitrate solution until a reddish brown precipitate is obtained.
- Note down the volume (V1 ml)
- Take 100 mL distilled water in another flask and repeat the procedure from step 3 to 5 and note down the volume of AgNO3 as V2 ml.

Range of chlorides as per IS 10500-2012:

Acceptable range = 250 mg/l
Permissible range= 1000 mg/l

Fig :- 5.6 chlorides in water

5.5 Total dissolved solids

Highconcentrations of total dissolved solids can causewater to taste bad, forcing consumers to use other water sources. Highly mineralized water also deteriorates plumbing and appliances. Waters containing more than 500 milligrams per litre (mg/l) of dissolved solids should not be used if other less mineralized supplies are available. This does not mean that any water in excess of 500 mg/l is unusable. People may eventually adjust to drinking water containing high total dissolved solids.

Fig :- 5.7 Total dissolved solids in water

5.6 Sulphate content

Three reasons for limiting the concentration of sulphates in drinking water are:

Sulphates can cause laxative effects with high intake, especially in combination with magnesium or sodium.

- Water containing large amounts of sulphate tends to form hard scales in boilers and heat exchangers
- Sulphates can impact taste. The laxative effect is commonly noted by people not used to water high in sulphates. These effects vary from one person to another and appear to fade with time. For these reasons, the recommended limit is 250-500 mg/l.

Fig:-5.8sulphate content in water

5.7 Iron content

The primary source of iron is the water bearing strata. Iron is typically dissolved in water and when brought to the surface, can form “rust” which may settle out. Another source of iron is iron-reducing bacteria, which depend upon iron to live. These bacteria add iron to the water by attacking the piping of the system. Removing naturally-occurring iron in the water may require special water treatment equipment. Iron-reducing bacteria may be controlled or eliminated by adequate chlorination. The most common water complaints are those of red water, laundry spotting, metallic tastes, and staining of plumbing fixtures. These are usually due to the presence of iron above 0.3 mg/l. Iron and manganese have similar adverse effects and frequently occur together in natural waters. Concentrations of manganese greater than 0.05 mg/l. may cause brown/black stains and deposits.

Fig:-5.9 iron content in water

5.8 Fluoride content

Addition of fluoride to toothpaste and to drinking water has done much to reduce the occurrenceofdental caries (cavities). Although addition of fluoride is certainly effective,toomuchfluoridecanbeharmful;therefore,itisimportanttohaveaconvenient methodformonitoringfluoridelevels. A simple and widely used method uses a fluoride ion6selectiveelectrode.

Reagents

a) Standard fluoride solutio

b) Zirconium alizarin acid

To compute the fluoride content in a given sample, take 0.1 ml,0.2 ml…..10 ml of std fluoride solution in a clean tubes and add distilled water up to 50 ml mark accurately in all nessler tubes. This gives std fluoride concentration 0, 0.2, 0.4….2 mg/l.

Test Procedure

Take 50 ml of given water sample in a clean nesslertube .

Add 1 ml of acid zirconium alizarin solution in a given sample as well as in all other given solutions and mix properly.

Allow the nessler tube for chain reaction for about 45-60 min compare the colour developed in sample with std and select appropriate solution .

Note down the fluoride concentration.

Permissible value: 1.5 mg/lit

5.9 Nitrate content

High nitrate concentrations can occur in wells located in or near feedlots, barnyards, sewage disposal systems or areas of high fertilizer application, and often indicate the presence of other forms of groundwater contamination. High nitrate water should never be used in infant feeding. In infants, nitrate can destroy the oxygen-carrying capacity of the blood, causing a condition known as methemoglobinemia. This results in an oxygen starvation condition and the infant appears blue. Serious poisonings, sometimes fatal, have occurred in infants less than six months old after drinking water containing nitrate as nitrogen at concentrations greater than 10 mg/l.

Test Procedure

1. You must make 4 standard solutions with the following concentrations: 10µM, 20µM, 40µM, and 60µM. Using the formula, M1V1 = M2V2, calculate the volume of stock solution that you will need to make 100mL of each standard.
   - Using the pipets provided, add the appropriate volume of stock solution to a 100mL volumetric flask for each standard. Bring to volume with Milli-Q water.
   - Using the beakers provided, arrange and label enough beakers for each of your standards, a blank (Milli-Q water) and three replicates of each of the water samples at your station.
   - Make the dilute NH4-EDTA solution (Reagent C) in the 500mL volumetric flask. You will need to make a number of batches of this reagent over the course of the experiment.
   - Make the Cd-reduction column at your station.

a. First, put a plug of glass wool in the base of the column.

b. Add the Cd-Cu granules to the column. Use your squirt bottles and spatulas to coax the granules into the column. Be sure to keep water above the Cd-Cu granules at all times so that the column doesn't dry out. Drain excess water into a waste beaker whenever needed.

c. Make 200mL of a "wash" solution – 150mL Reagent C + 40mL Milli-Q water + 10mL stock NO3 - . Add to the column. Drain until the water level is approximately 1 cm above the granules. d. Wash the column a second time but with 200mL dilute NH4-EDTA solution (Reagent C).

Fig :- 5.11 Testing for nitrate content

6 RESULTS AND DISCUSSION

This chapter deals with the results that we obtained from the water analysis experiments of samples from 10 different areas of kuppam town.

The physical parameters like colour, odourand taste of waters are acceptable.

The below table gives the parameter values in ppm or mg/litre

Sample no	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Temp.	23	20	24	23	24	25	21	25	25	23
Ca	38	18	26	16	34	20	18	20	08	10
Mg	06	32	14	55	106	08	24	12	00	00

Cl	82.4	62.54	187.43	66.52	62.55	52.62	145.6	94.32	70.48	167.78
CO3	30	20	25	40	45	20	40	15	25	30
HCO3	155	175	145	290	240	195	280	145	160	180
TH	220	302	232	401	331	248	203	304	198	168
TDS	1500	700	600	1800	1600	700	600	1200	1400	1400
pH	7.19	7.28	7.35	8.63	8.92	7.34	7.43	7.50	8.09	7.42
Flouride	1.4	1.2	1.4	1.4	1.2	1.2	1.2	1.4	1.2	1.2
Turbidity	0	0	0	0	0	0	0	0	0	0
SO4	21.5	43.1	36.4	10.9	8.5	6.4	14.5	13	42.2	26.6
Fe	0	0.01	0.01	0	0.005	0	0.015	0.018	0	0.02
NO3	46.3	54.2	49.8	59.1	32	64	20.4	30.5	35.7	41.3

Table -1 The below table shows the average values of the parameters of 10 samples

Parameters	**Average values**
Temp.	25
Ca	20
Mg	24.6
Cl	99.235
CO3	26.3
HCO3	182.5
TH	260.7
TDS	1150
pH	7.715
Flouride	1.28
Turbidity	0
SO4	22.31
Fe	0.0078
NO3	43.33

6.1 Behaviours Of Each Constituent

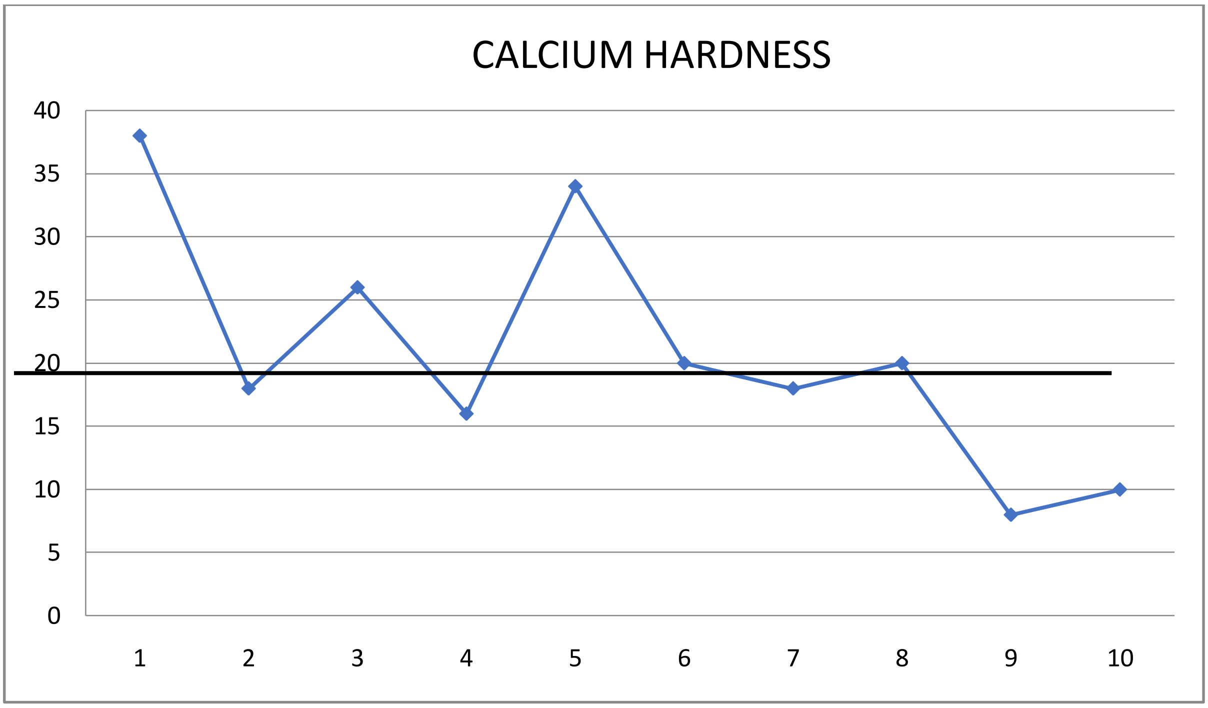
The behaviour of each constituent are studied based on plotting sample numbers vs ppm contents. The details of 10 constituents are explained in following paragraphs.

X-axis indicates the samples

Y-axis indicates the parameters contents in ppm or mg/l

6.1.1 Calcium

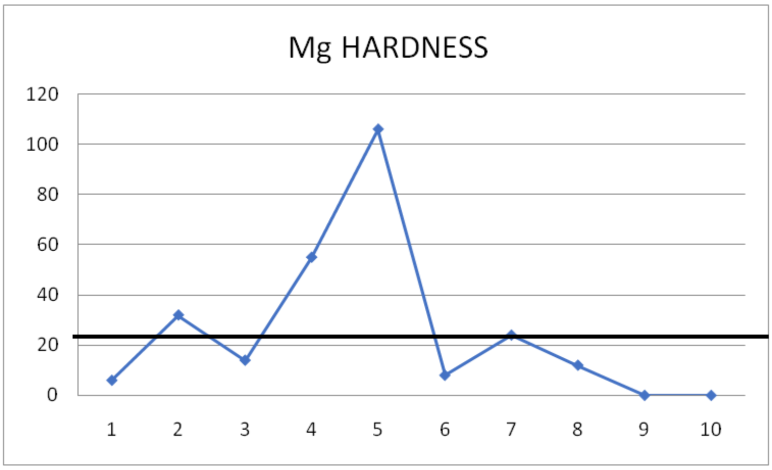
The figure below shows variation of Ca in the groundwater sample under study. The dark horizontal line indicates average content of Ca.Threesamples are above average line and five samples are below average line. This indicates the majority of the sample have lower content of Ca.



Graph - 6.1.1

6.1.2 MAGNESIUM

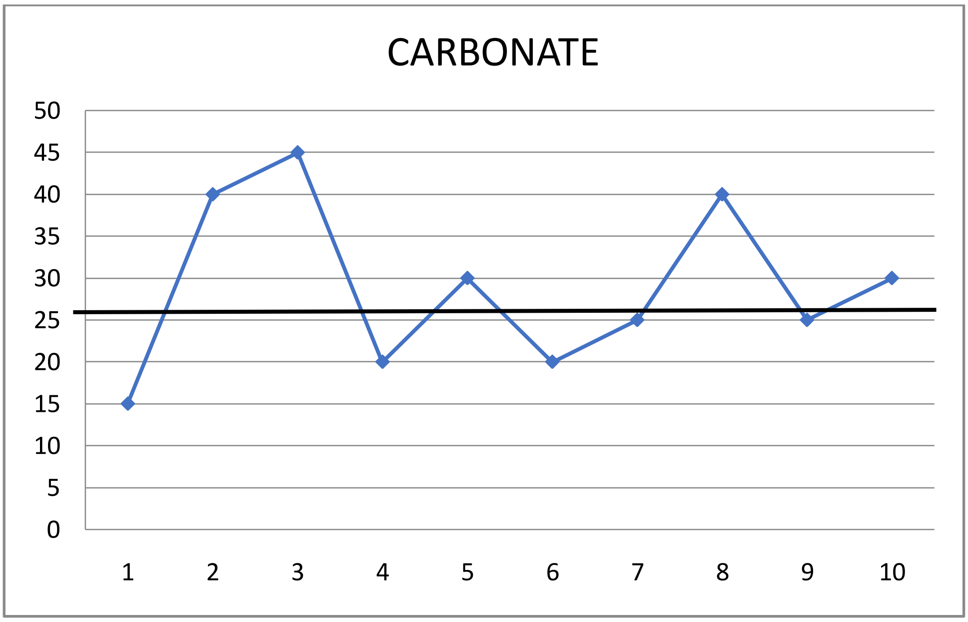
The figure below shows variation of Mg in the groundwater sample under study. The dark horizontal line indicates average content of Mg. Threesamples are above average line and sevensamples are below. This indicates the majority of the samples have high content of Mg.



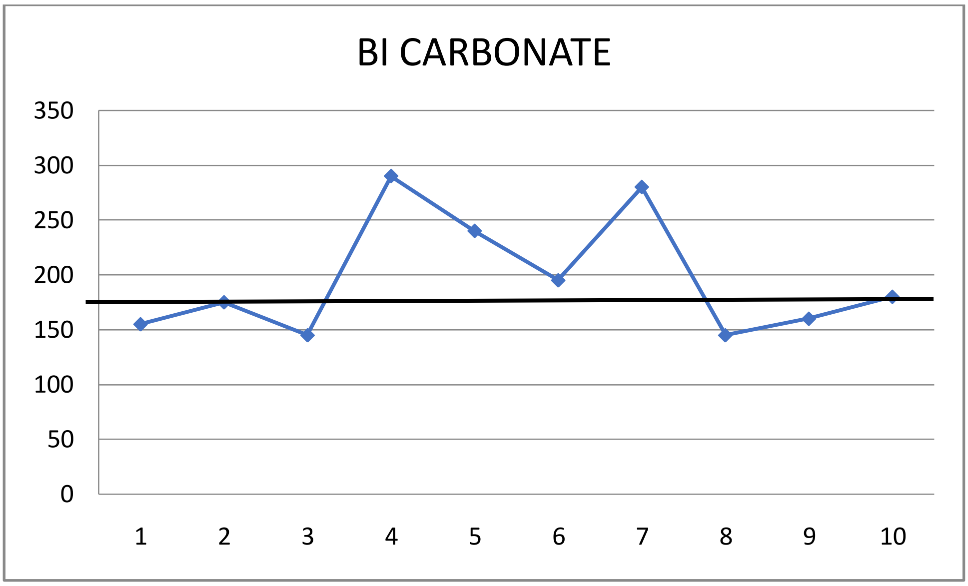
Graph -6.1.2

6.1.3 CARBONATES and BICARBONATES

The figure below shows variation of HCO_3 in the groundwater sample under study. The dark horizontal line indicates average content of HCO_3. Foursamples are above average line and six samples are below average line. Thus indicates majority of the sample have low HCO_3 content



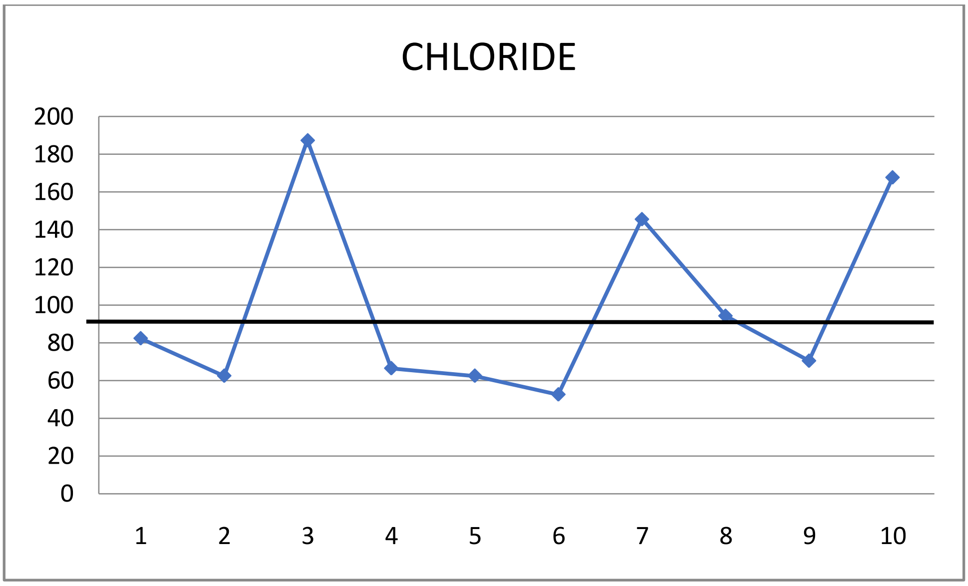
Graph-6.1.3



Graph-6.1.3.1

6.1.4 CHLORIDE

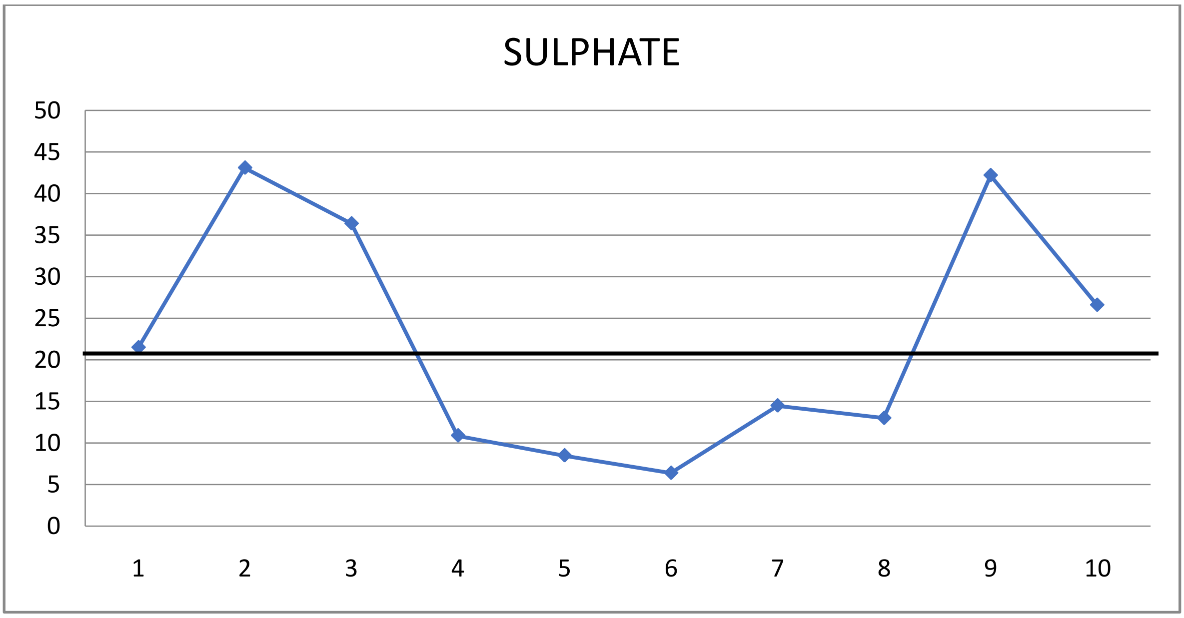
The figure below shows variation of Cl in the groundwater sample under study. The dark horizontal line indicates average content of Cl. Threesamples are above and sevensamples are below average line. Thus indicates majority samples have low content of chloride.



Graph-6.1.4

6.1.5 SULPHATE

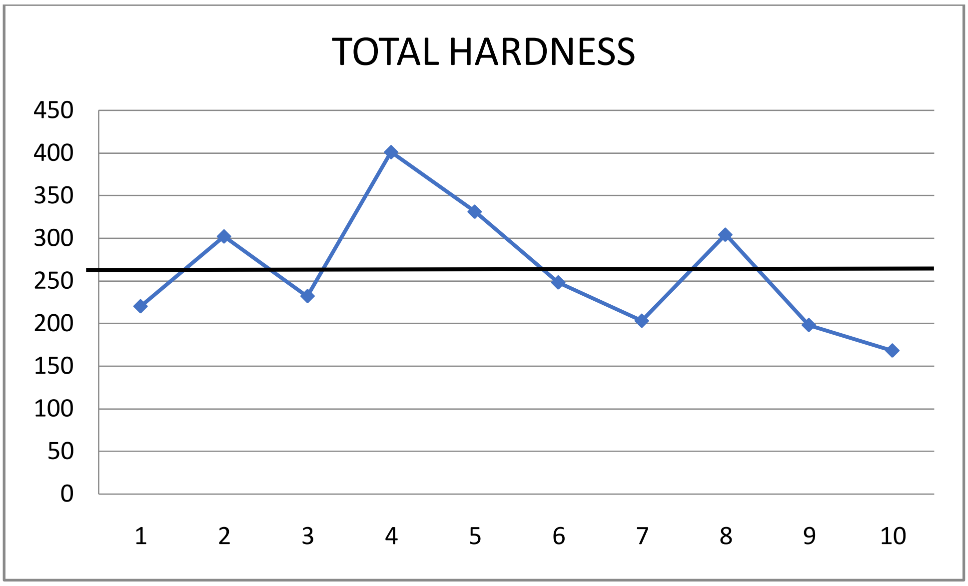
The figure below shows variation of SO_4 in the groundwater sample under study. The dark horizontal line indicates average SO_4 content. Foursamples are above and sixsamples are below average line. Thus indicates majority of samples have low content of SO_4.



Graph-6.1.5

6.1.6 HARDNESS

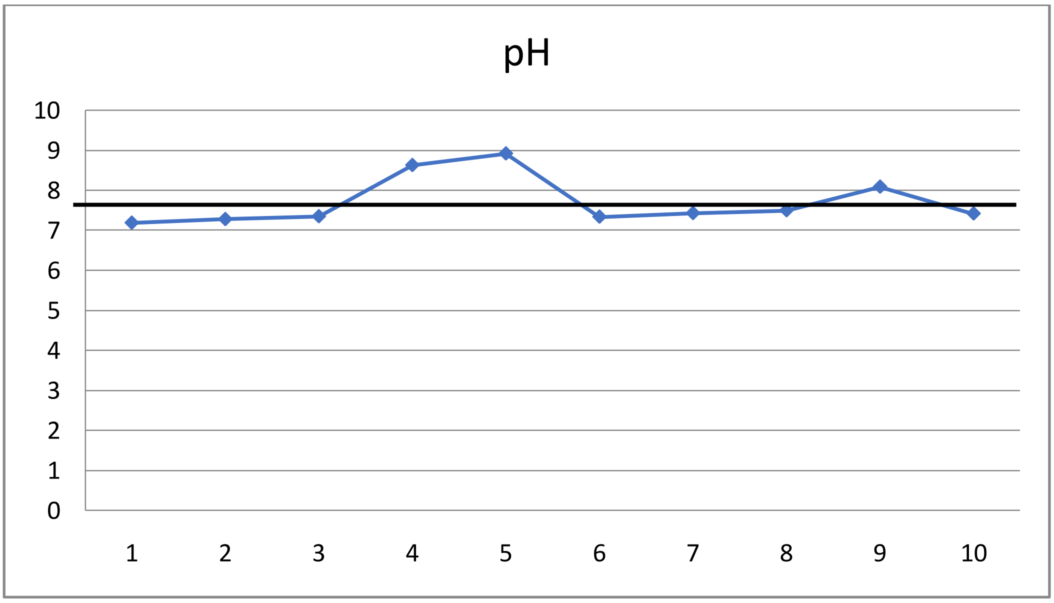
The figure below shows variation of total hardness in the groundwater sample under study. The dark horizontal line indicates average content of total hardness. Foursamples are above and sixsamples are below average line. Thus indicates majority samples have low hardness.



Graph-6.1.6

6.1.7 HYDROGEN ION CONCENTRATION(pH)

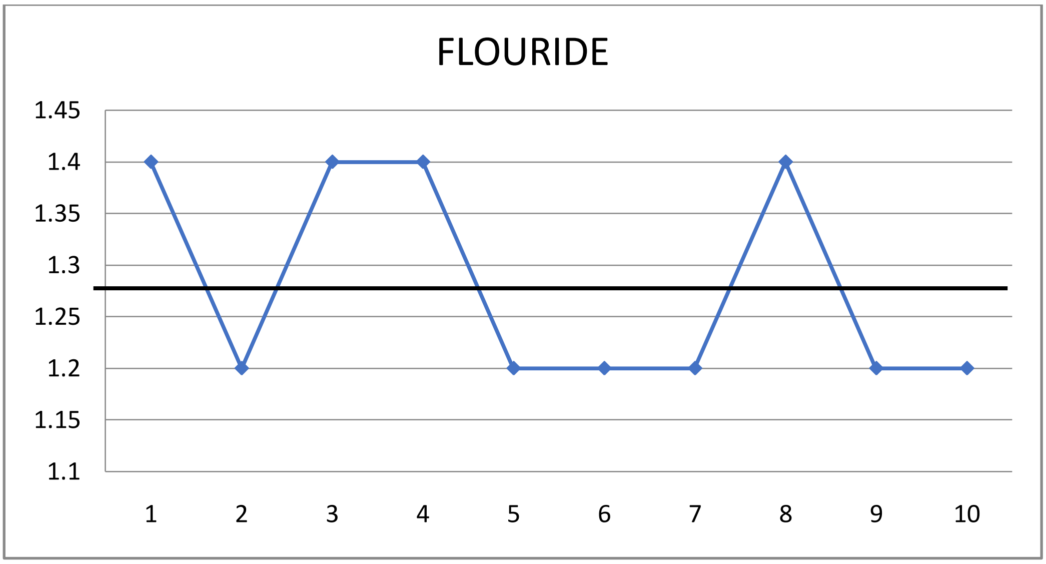
The figure below shows variation of pH in the groundwater sample under study. The dark horizontal line indicates average content of pH.Three points are above and three points are below average line. Thus indicates majority samples have high hydrogen ion concentration



Graph-6.1.7

6.1.8 FLOURIDE

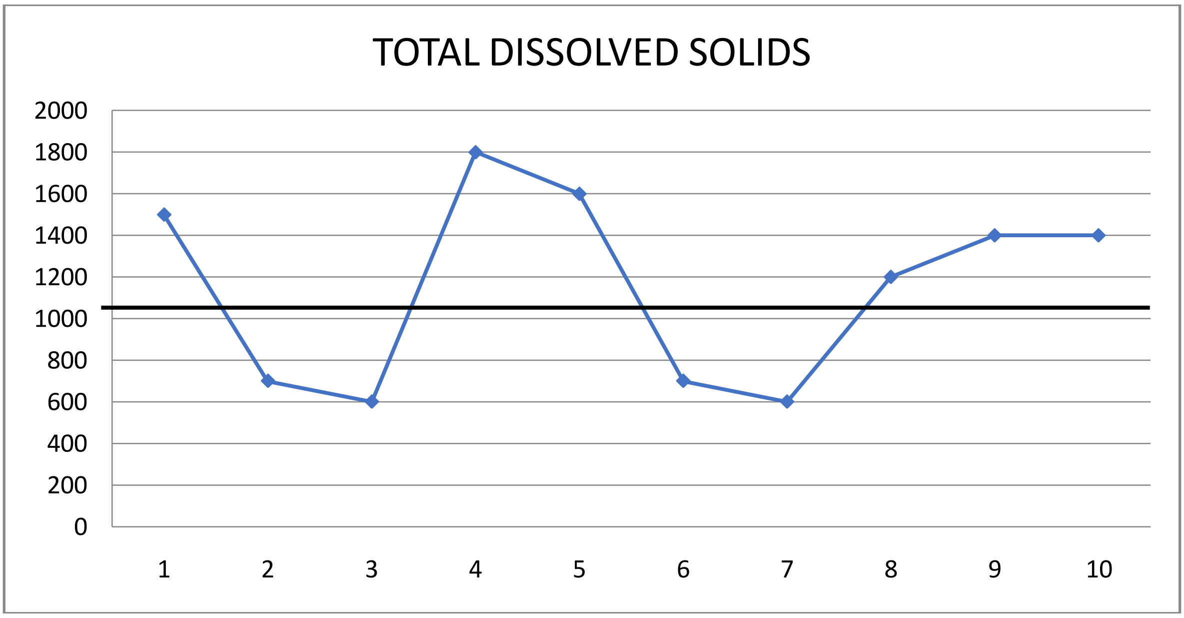
The figure below shows variation of flouride in the groundwater sample under study. The dark horizontal line indicates average content of flouride. Four samples are above and sixsamples are below average line. Thus indicates majority samples have low fluoride



Graph-6.1.8

6.1.9 TOTAL DISSOLVED SOLIDS

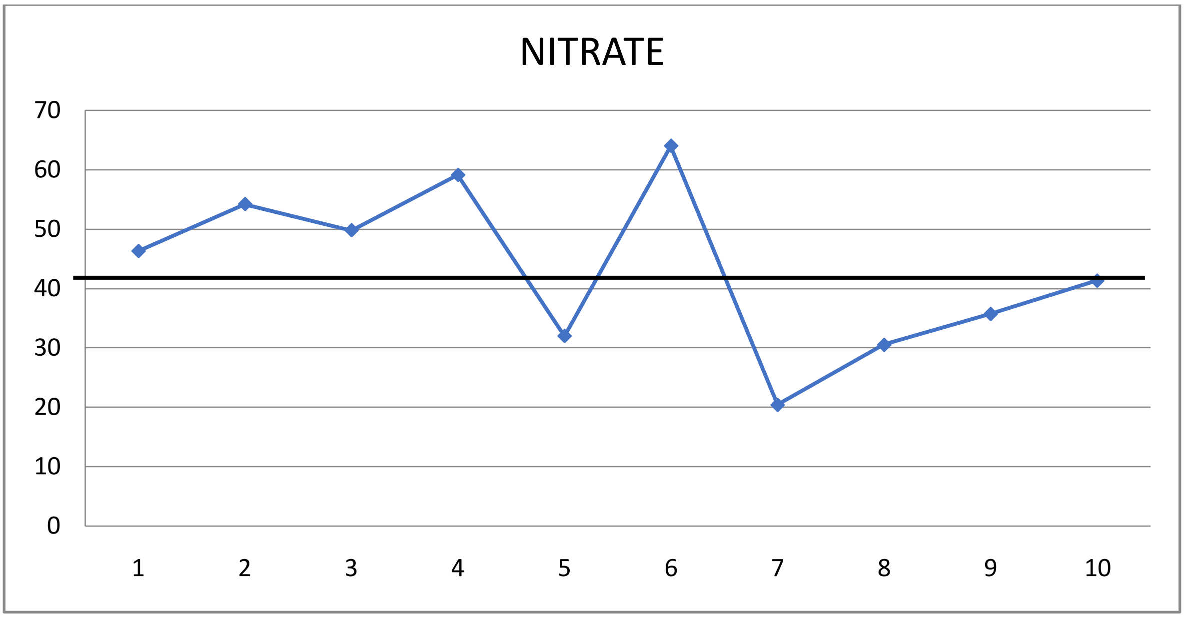
The figure below shows variation of Total dissolved solidsin the groundwater sample under study. The dark horizontal line indicates average content of Total dissolved solids . six samples are above and four samples are below average line. Thus indicates majority samples have high total dissolved solids.



Graph-6.1.9

6.1.10 NITRATE

The figure below shows variation of Nitrate in the groundwater sample under study. The dark horizontal line indicates average content of nitrate. Five samples are above and fivesamples are below average line.



Graph-6.1.10

Standard Table comparing study area values and IS 10500:2012 code

Sl No	**Parameter**	**IS10500:2012**		**Study Area**	
		Acceptable limit	Permissible limit	Minimum	Maximum
1)	pH	6.5-8.5	No relaxation	7.19	8.93
2)	T.D.S	500	2000	600	1800
3)	Total Hardness	200	600	168	401
4)	Ca	75	200	10	38
5)	Mg	30	100	00	106
6)	Cl	250	1000	52.62	167.78
7)	SO_4	200	400	8.5	43.1
8)	Fe	0.3	No relaxation	0	0.01
9)	F	NA	NA	1	1.4
10)	Colour	-	-		
11)	Taste & Odour				
12)	Turbidity	1	5	0	0
13)	Nitrate	45	No relaxation		
14)	CO_3			15	45
15)	HCO_3			145	290

Table :- 3

For the above table pH,totalhardness,fluoride,and nitrate parameters seems to be excess concentration when comparing to acceptable limit of IS-10500:2012.these chemical concentration may leads to

1. **pH**

   Additionally,an overall excess of alkalinity in the body may cause gastrointestinal issues and skin irritationtoo much alkalinity may also agitate the body's normal pH leading to metabolic alkalosis a condition that may produce the following symptoms

   1) Nausea
   2) Vomiting

2. **fluoride**
   - Ingestion of excess fluoride,most common in drinking water,can cause fluorosis which affects the teeth and bones,moderate amounts leads to denteleffects,but long term ingestion of large amounts can lead to potentially severe skeletal problems

3. **Nitrate**
   - Nitrate enters the human body through the use of ground water for drinking and causes a number of health disorder,namely,methemoglobinemia,gastric,cancer,goitre,birth malformations,hypertension,etc.,when present in high concentration in drinking water

4. **Total hardness**
   - Hard water is mainly an aesthetic concern because of theunplesent taste that a high concentration of calcium and other ions give to water.
   - Drinking water 200-800µs/cm

CONCLUSION

- The domestic sewage flows in the natural open drainage in most of the areas of kuppam and such flows on the roads are very common during rainy season.which might be reasons for the higher concentration of the chemical in the tested borewell waters.
- The physical parameters like colour ,taste,ouder,turbudity are well with in the permissible limit.
- The ground water seems to be alkaline in maximum of study area this may be due to bicarbonates or dissolutions of carbonate minerals
- Few samples showed higher concentration of total hardness
- The physical parameters like colour,odour,turbidity are well below the harmful limit
- Ca,TDS,mg,cl,so^4, Fe, well below permissiable limit and make the water safe to drink
- Fluoride,nitrate,concentration are greater than permissible units which may leads to serious health issues as mentioned.
- The excess fluoride content may be due to seepage from municipal waste and effluents
- So the concerned area population have to think of filtering and reverse osmosis of drinking water before usage or can choose alternate water source.
- The nitrate concentration in sample 2 ,4 and 6 is more due to excess usage of fertilizers from the agricultural lands.

SCOPE FORFUTURE STUDY

- we can do the same process for other parameters which not listed above in chapter-6.
- These process can be done for other water sources also like tap water etc.,
- The water tests can be improved by using modern testing kits like Adruino, IOT.
- The test can be done in other areas which we have not mentioned.

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