INVESTIGATION OF PHYSIO-CHEMICAL PARAMETERS OF GROUND WATER IN KARUR DISTRICT

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ABSTRACT

Groundwater has been a very important source of water for various uses since ancient times. Much of the drinking water used by human and other living beings. During the recent years due to urbanization and industrialization, groundwater is increasingly laced with pollutants from industries, Municipal sewers, and agricultural fields that are treated with fertilizers and pesticides. Today, human activities are constantly adding industrial, domestic sewage, and agricultural wastes in to the groundwater resources at an alarming rate. Groundwater contamination is generally irreversible ,i.e., once it is contaminated it is difficult to restore the original water. Karur is one of the most important Industrial cities in Tamil Nadu, which is located on the bank of river Amaravathi river. Industries of diverse fields such as dying, bleaching, textiles, Steel rolling mills, cement and Paper are located in and around karur town. There is no proper management and planning for the disposal of municipal sewage and industrial efficient at Karur. The city generates organic and inorganic wastes of about 250-300 tonnes per day and the municipal corporation dumps them in the dump yard at karur. The typical sewage comprising of domestic and other wastewater are discharging directly into the river without any proper treatment. Hence, the resent study has been undertaken to investigate the physicochemical analysis of ground water on the bank of Amaravathi river at Karur.

INTRODUCTION

Water is collected from twenty station around karur district, according to the standard methods prescribed in BIS:13969-1994(Indian Standard for the sampling of groundwaterguidelines). Once polluted by industry, groundwater is very difficult o be treated.

The water quality assessment test are conducted for the following parameters,

- Total Dissolved Solids
- Electrical
  Conductivity
  Solids
- pH
- Total Hardness
- Calcium
- Magnesium
- Sodium
- Potassium
- Iron
- Manganese
- Nitrate
- Chloride
- Fluoride
- Sulphate
- Phosphate

All these parameters are tested by standard method and following their procedure. The results are then compared with the standard specification.

STUDY AREA

The study area in the karur taluk with the location of the sampling points are shown in follow
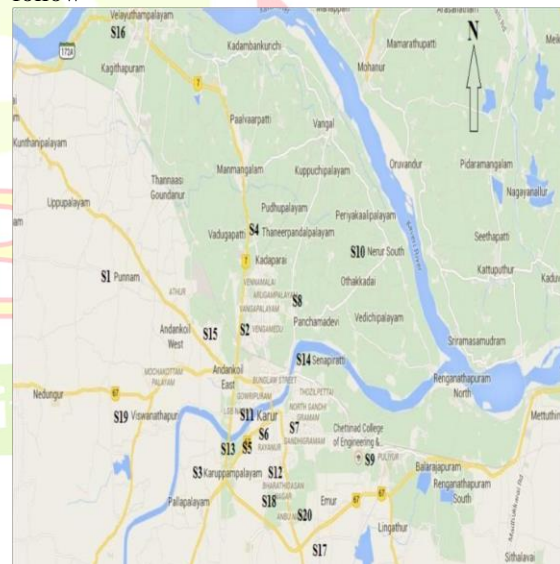
COLLECTION OF WATER SAMPLES

The water samples are collected from various locations around karur taluk using sample bottles Then the collected samples are preserved by adding chemicals.

SAMPLE ANALYSIS

Then the samples are analyzed for different parameters such as pH, chlorides, Total Hardness, Total Dissolved Solids, alkalinity, Sulphates, Fluorides, etc.The analyzing processes are carried out in the Environmental Engineering laboratory using Standard Methods.

SITE DESCRIPTION

S.No.	Station	Location
1	S1	Punnam
2	S2	Vengamadu
3	S3	Karupampalayam
4	S4	Semadai
5	S5	Chellandipalayam
6	S6	Thirumaniliyur
7	S7	Gandhigramam
8	S8	Arasucolony
9	S9	Pulliyur
10	S10	Nerur
11	S11	Karur
12	S12	Othaiyur
13	S13	Sukaliyur
14	S14	Sanapirati
15	S15	Velusamypuram
16	S16	Velayuthampalay am
17	S17	Velliyanai
18	S18	Thanthonimalai
19	S19	Visvanathapuri
20	S20	Manavadi

Table No.1   pH

The protective cover of the pH meter is removed and pH meter is turned on by the switch. Calibrate the pH meter with at least two standard buffer solution among of pH 4, 7, 9. Rise the electrode do with deionizer distilled water and carefully wipe with a tissue paper. Dip the pH meter in the sample solution and swirl the solution and wait up for one minute for study reading.

CHLORIDES

Take 25ml of sample in a conical flask add 2 to 3 drops of potassium chromate indicator to get light yellow, colour titrate the sample against silver nitrate solution until the colour changes from yellow to brick red the same procedure is repeated until constant values are obtained.

TOTAL HARDNESS

Take 20ml of the given hard water sample is pipetted out into a clean conical flask.5ml of ammonia buffer solution and 2 drops of Eriochrome Black-T indicator are added. The solution turns wine red in colour. This solution is titrated against EDTA solution taken in the burette. The changes of wine red colour into steel blue colour is the end point. The titration is repeated to get concordant values.

DISSOLVED SOLIDS

Wash and wipe the dish and dry it in a hot air oven for dryness. Measure the initial weight of dishes by in electrical balance. Take 20ml of filter sample in china dish and evaporate in a water bath at $103°C$ to $105°C$ cool the container to dryness in a desiccators and weight the dishes again. Note the increase the weight of dissolved solids in the sample is calculated.

ALKALINITY

Alkalinity can be measured by titrating the sample with a strong acid until all the buffering capacity of the aforementioned ions above the pH of bicarbonate or carbonate is consumed. This point is functionally set to pH 4.5. At this point, all the bases of interest have been protonated to the zero level species, hence they no longer cause alkalinity.

SULPHATE

The sulphate ion is a polyatomic anion with the empirical formula So_2 and a molecular mass of 96.06 Daltons it consists of a central sulfur atom surrounded by four equivalent oxygen atoms in a tetrahedral arrangement, Sulphates occur as microscopic particles resulting from fossil fuel and biomass combustion. They increase the acidity of the atmosphere and form acid rain.

CALCIUM

Take 50 ml sample or an aliquot diluted to 50 ml such that the calcium content is no more than 10 mg. Samples which contain alkalinity greater than 300 mg/L should be neutralized with acid, boiled for 1 min and cooled before titration. Add 2 ml NaOH solution or a volume sufficient to produce a pH of 12 to 13. Start Titration immediately after addition of the alkali. Add 0.1 to 0.2 g indicator mixture. Titrate with EDTA solution, with continuous mixing, till the colour changes from pink to purple. Check end point by adding 1 to 2 drops excess titrate to make certain that no further colour change occurs.

ELECTRICAL CONDUCTIVITY

Rinse conductivity cell with at least three portions of 0.01M KCl solution. Measure resistance of a fourth portion and note temperature. In case the

instrument indicates conductivity directly, and has internal temperature compensation, after rinsing as above, adjust temperature compensation dial to 0.0191/ °C and with the probe in standard KCl solution. The level of sample aliquot must be above the vent holes in the cell and no air bubbles must be allowed inside the cell. Adjust the temperature of sample to about 25°C (outside a temperature range of 20 - 30°C, error increases as the sample temperature increasingly deviates from the reporting temperature of 25°C). Read sample conductivity and note temperature to nearest 0.1°C. Thoroughly rinse the cell in distilled water after measurement, keep it in distilled water when not in use. The value of temperature correction $[0.0191 \times (t-25)+1]$ can be read.

FLUORIDE

Prepare a series of working standards by diluting 5.0, 10.0 and 20.0 ml of standard solution to 100 ml, corresponding to 0.5, 1.0 and 2 mg F- /L, respectively. Take between 10 to 25 ml standards and sample in 100 ml beakers. Bring the samples and the standards to the room temperature and add an equal volume of buffer to each beaker. The total volume should be sufficient to immerse the electrode and permit the use of the stirrer. Follow manufacturer's instructions to set up and calibrate the ion meter using standards in the prescribed range. Standards already diluted with the buffer may have been supplied with the meter. Avoid stirring before immersing electrodes so as not to entrap air bubbles. If a direct reading instrument is not used, plot on a semilogarithmic graph paper potential measurement of fluoride standards on arithmetic scale vs. fluoride concentration on logarithmic scale.

Important: Wash and blot dry electrodes and stirring bar when used for different solutions and samples. Samples and standards should be maintained at nearly the same temperature throughout calibration and testing procedure.

IRON

Take 50 ml of mixed sample into a 125 ml conical flask. If this volume is expected to contain more than 200 μg iron use a smaller portion and dilute to 50 ml. Add 2 ml conctric HCl 1 ml NH₄OH. Hcl solution, a few glass beads and heat to boiling till the volume is reduced to 15-20 ml, cool, and transfer to a 50 ml volumetric flask. Add 10 ml buffer solution and 4 ml phenanthroline solution, dilute to the mark with water. Mix and allow 10-15 min. for colour development. Filter sample through a 0.45 μ m membrane filter into a vacuum flask containing 1 ml conc. Hcl /100 ml sample. Analyze

NITRATE

Transfer 10 ml of 1.0 mg NO₃ - N/L standard to a 50 ml beaker, add 10 ml buffer and stir with magnetic stirrer. Stop stirring after mixing and immerse electrodes. Start stirring again. Take mill volt reading when stable (after about 1 min). Repeat with 10 and 50 mg NO₃-N/L standards. Plot on a semi logarithmic graph paper potential measurement of the standards in mV, on arithmetic scale, vs. NO₃ - N concentration on logarithmic scale. The calibration curve should be a straight line with a slope of +57 ±3/ decade at 25ºC. Recalibrate the probes and the instruments several times every day using the 10 mg NO₃ -N/L standard. Transfer 10 ml sample to a 50 ml beaker, add 10 ml buffer and stir with magnetic stirrer. Stop stirring after mixing and immerse electrodes. Start stirring again. Take volt reading when stable (after about 1 min). In case of direct reading ion meters, follow manufacturer's instructions to set up and calibrate the ion meter using standards in the prescribed range. Standards already diluted with the buffer may have been supplied with the meter.

Important: Wash and blot dry electrodes and stirring bar when used for different solutions and samples. Samples and standards should be maintained at nearly the same temperature throughout calibration and testing procedure

POTASSIUM

Follow instructions of flame photometer manufacturer for selecting proper photocell, wavelength, slit width adjustments, fuel gas and air pressure, steps for warm up, correcting for interference and flame background, rinsing of burner, sample ignition and emission intensity measurements. Prepare a blank and potassium calibration standards, in any of the applicable ranges, 0-100, 0-10, or mg K/L. Measure emission at 766.5 nm and prepare calibration curve. Determine potassium concentration of the sample, or diluted sample, from the curve.

as above and express as total dissolved iron.

SODIUM

Follow instructions of flame photometer manufacturer for selecting proper photocell, wavelength, slit width adjustments, fuel gas and air pressure, steps for warm up, correcting for interference and flame background, rinsing of burner, sample ignition and emission intensity measurements. Prepare a blank and sodium calibration standards, in any of the applicable ranges, 0- 100,0-10, or 0-1 mg Na/L. Set instrument zero with standard containing no sodium. Measure emission at 589nm and prepare calibration curve.

Determine sodium concentration of the sample, or diluted sample, from the curve.

RESULT AND DISCUSSION
PH VS SAMPLE
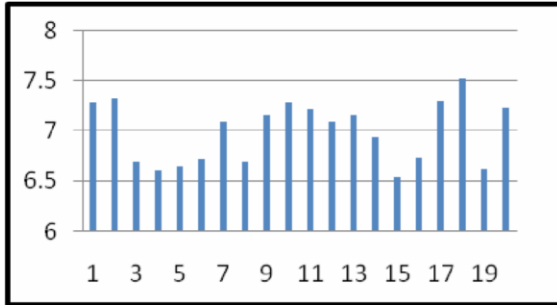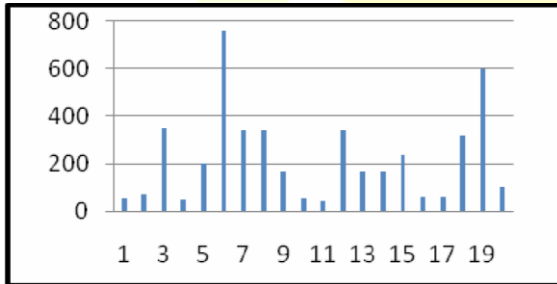

Figure No.1

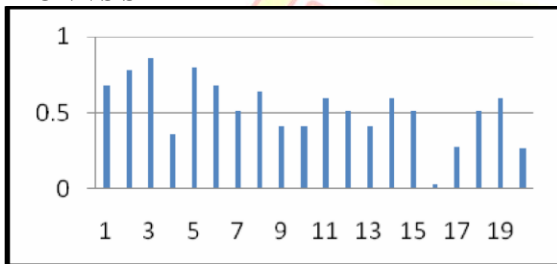### CHLORIDE VS SAMPLE

Figure No.2

IRON VS SAMPLE

Figure No.3

NITRATE VS SAMPLE
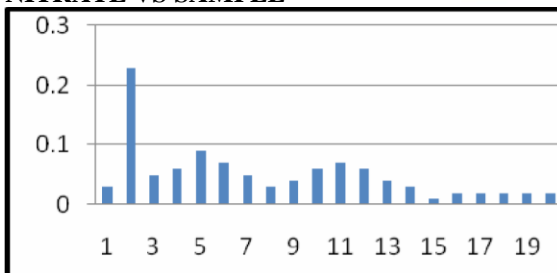
Figure No.4
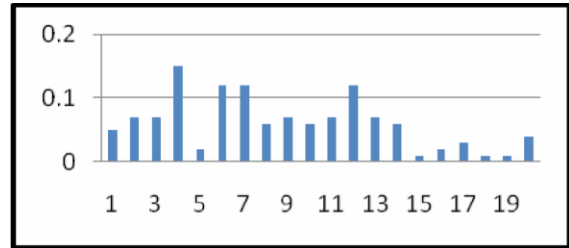
PHOSPATE VS SAMPLE

Figure No.5

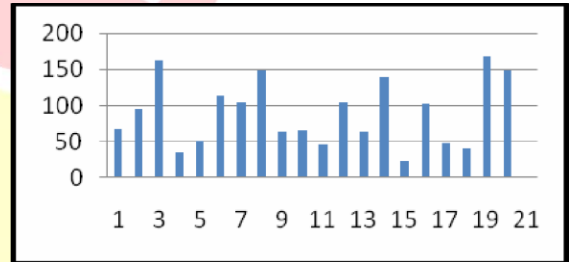### SULPHATE VS SAMPLE

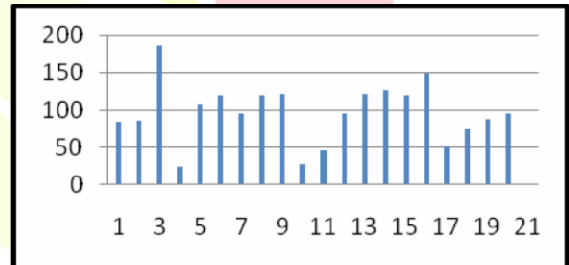**Figure No.6**

POTTASIUM VS SAMPLE

Figure No.7

TOTAL HARDNESS VS SAMPLE
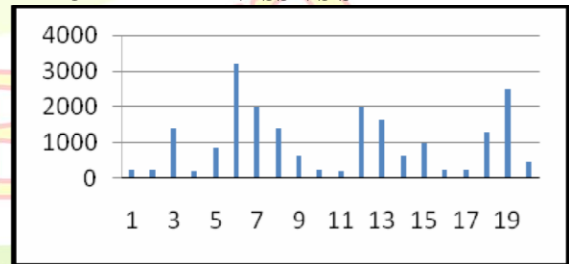
Figure No.8
Acceptable & Permissible limit

Physicochemical parameters	Acceptable limit	Permissible limit
Total dissolved solids mg/L	500	2000
Electrical conductivity micro mho/cm	-	-

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P_H	6.5-8.5	6.5-8.5
Total Hardness as $CaCo_3$ mg/L	200	600
Calcium as Ca mg/L	75	200
Magnesium as Mg mg/L	30	100
Sodium as Na mg/L	-	-
Potassium as K mg/L	-	-
Iron as Fe mg/L	0.3	0.3
Manganese mg/L	0.1	0.3
Nitrite as NO_2 mg/L	-	-
Chloride as CI mg/L	250	1000
Fluoride as F mg/L	1.0	1.5
Sulphate as SO_4 mg/L	200	400
Phosphate as PO_4 mg/L	-	-

Table No.2

CONCLUSION

Potable Water	Not Potable Water
S1	S3
S2	S5
S4	S6
S10	S7
S11	S8
S13	S9
S14	S12
S15	S18
S16	S19
S17	
S20	

Table No.3

The groundwater samples were taken at the Karur taluk. Twenty water samples are collected around 20km at karur. The water samples were subjected to physico- chemical analysis. The results of Karupampalayam, chellandipalayam, Thirumanalaiyur,Ghandigramam, Arasucolony,Pulliyur,Othaiyur,Thanthoni malai, and Visvanathapuri are show that most of the physico-chemical parameters like TDS, TH, Ca, Mg, CI, Fe, F. are well above the permissible limit. The results show that most of the groundwater sampling stations near the dyeing area are much polluted. Some of the groundwater stations far away from the dyeing area are used for drinking and irrigation purpose. The ground and river water samples are much polluted in the urban area than rural area. This may be due to the heavy pollution load, domestic sewage, and other waste by thickly populated inhabitants. The above results confirm that the groundwater quality is affected. But if the same condition continues in future, the groundwater source will completely be polluted and become unfit of drinking and other purposes. It is high time to preserve and protect this valuable ground source. Hence, dumping of waste ,dyeing waste water should treated properly to avoided and they should not be let into the river. The mentioned pollution control measures should be taken properly to protect the ground water sources.

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