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THE WATER QUALITY ASSESSMENT IN AND AROUND AMUBULIAR WATERSHED OF PUDUKKOTTAI DISTRICT, SOUTHERN TAMILNADU, INDIA.

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Abstract - *Groundwater is major in satisfying domestic, drinking and agricultural needs. Besides insufficiency, the groundwater resource is degrading drastically around the world. The Ambuliyar watershed falling in parts of Tamil Nadu also faces similar problems. To interpret the quality degradation, pre-monsoon data on various physical and chemical parameters was collected for 17 wells for the year 2022 from Public Works Department. Spatial distribution maps were generated on the above geochemical parameters and categorized into five classes using GIS software. Low, medium and high values were assigned for each parameter based on WHO (2011), BIS (2014) and ISI (1983) their relative importance in with each other parameters. During the pre-monsoon period, no pollution sample occurred based on the pH, HCO_3^-, SO_4^- and Cl^-, most of the sample falls in the pollution category based on the K^- and F^- and remainingparameteters falls in the good category for drinking and irrigation purposes.*

***Key Words*: Groundwater quality, Ambuliyar watershed, GIS, Pre-Monsoon.**

1. INTRODUCTION

Water is referred to an universal solvent, since among all the importance needs of human beings and animals and university known as air, water, food, shelter, etc., water plays a very important role and it is the highest role because it is essential to sustain life since the protoplasm of many living cells contains 30% of water and any substantial reduction will cause disaster. Water is required for satisfactory performance of physiological organisms, as the circulatory fluid, as a carrier of nourishing food and for the removal of products of water. It is noted and found that two third of the human body consists of water. Water is used by man for variety of purpose such as drinking, domestic and irrigation purposes etc. When compared to all other minerals available on Earth, thegroundwater serves to be precious disturbed resources of the earth. The world total water resource is estimated. At present nearly one fifth of all the water is obtained from groundwater, nearly 80% of the consumption of water is used for agricultural purpose. Not onlyfor agriculture, when considering the all animals, fisheries, need abundant quantity of water. About 40% of ground water is used for irrigation purposes.

1.1 Study area

The present study area, Ambuliar watershed is one of the small districts of Tamil Nadu with an area of 424.3 sq.Kms. The district lies between 79º 00' to 79º15' of the eastern longitude and 10º 00' to 10º 30' of the northern latitude. The study area is bounded by the districts of Tiruchirappali in the north. Thanjavur in the north-east. Bay of Bengal in the east. The minor river of Ambullar is follow from west to east direction.

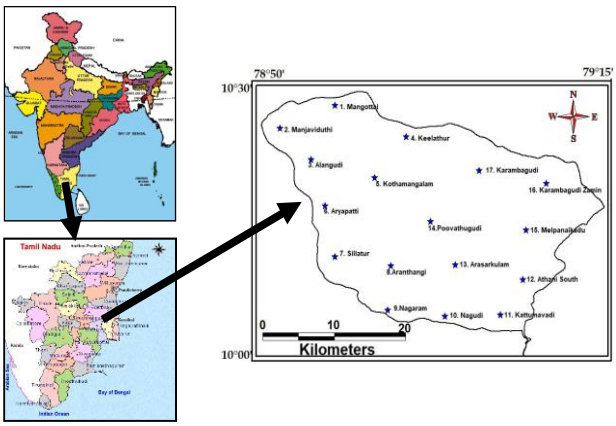


Fig -1: The study area map.

2. Methodology

The success of any scientific investigation largely depends on the nature of materials andmethods employed for the purpose. In a geochemical study involving various physic- chemical principles, a preliminary field survey prior to collection of samples is required especially with regard to the topography as well as the regional setup within the study area. This chapter deals with the method of sample collection, preservation of the samples and the principles and experimental methods are involved in this study.

2.1 Field survey

Field survey was carried out during the investigation to understand the quality of groundwater along the study area. Prior to collection of samples, toposheets and hydrographic charts were used to prepare a base map indicating the sampling stations. After scrutinizing the available literature, additional information needed for the presentstudy were collected to standardize the methodology and to fulfill the objectives. The locations of the sampling stations were fixed using Global Positioning System (GPS- Map 2000).

2.2 Collection of groundwater samples

The water samples have been collected from 17 representative locations at Ambuliar watershed Pudukottai district, distributed over the study are during the month of February 2021 from both bore wells and dug wells. Method of collection and analysis of groundwater samples were basically the same as given by Brown et al. (1974). The samples were collected in 250 and 100 ml capacity polythene bottles. Prior to collection, both bottles were thoroughly washed with distilled water and then the 100ml bottle is rinsed with diluted HNO_3 acid, with in the laboratory before filling the bottle with the sample. In the field the polythene bottles were rinsed with the respective water samples before filling and labeled accordingly. The latitude and longitude of the respective samples were measured by using Garmin E-Trex 12 channel GPS and some other details were noted in the notepad).

4. Result and Discussion

4.1 Physical properties of groundwater

4.1.1Colour

Colour of ground water is indicated by its chemistry and the presence of impurities. Most underground waters are colorless. Hard waters are bluish, ferrous salts and hydrogen sulphide colour, the water in greenish, blue, organic compounds make it yellowish, while suspended mineral particles make it grayish.

4.1.2 Electric conductivity

Since the water is electrolyte solution there will be Electric conductivity. Electric conductivity is directly proportional to the amount of dissolve salts. The dissolved water does not conduct electric current. Sensitivities of underground water range between 610 to 2500 (µs/cm). Radioactivity of ground water is the result of the presenceof uranium, radium. The maximum, minimum and average concentration of Electrical conductivity of the study Area are 3722 (µs/cm), 70 (µs/cm) and 695 (µs/cm).

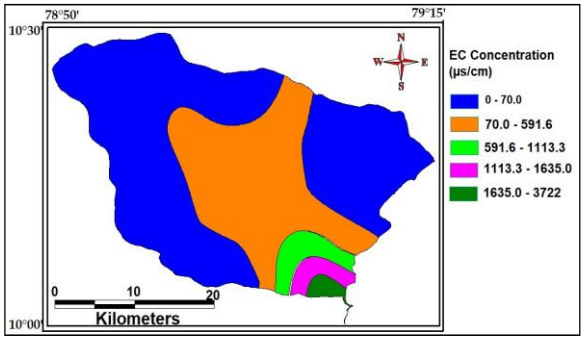


Fig – Electric conductivity of study area

4.1.3 Odour

Groundwater usually have no odour but sometimes it is detectable for example the hydrogen sulphide imparts the small of rotten eggs to the water stagnant water in some wood caused well often has an objectionable musty odour. Shallow ground water will have "marsh" odour is often related to the bacterial decay of organically matter.

4.1.3 pH

The value is a measure of hydrogen ions present in water. The pH value for ground water varies within a wide range from 1.8 to 11.0. However the most common pH values for ground water those between 5 to 8. According to world drinking water standards, pH value should be between 6.6 to 7.22. The maximum, minimum and average concentration of pH of the study Area is 8.5, 7.0 and 7.0

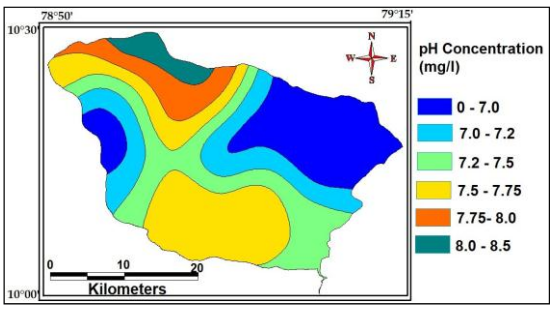


Fig - pH of the study area

4.1.4 salinity

The salinity should never exceed 1000 mg/lit. The total salinity of water from 10 mg/litto 600 mg/lit.

4.1.5 Temperature

When compare to surface water temperature the test for temperature of the ground water remain constant throughout the year. The annual variation in ground water temperature is the largest for tables near the ground surface and decreased with the depth of ground water surfaces and decreases with the depth of ground water, beingabout 1°c at depth of 10 to 20 meters. The temperature of 7°c to 11° c makes drinking water the most tasty and refreshing. Temperature of about 35° c to 37° c.

4.2 Chemical properties of groundwater

4.2.1 Total Dissolved solids

Total Dissolved Solids is a measure of the combined content of all inorganic and organicsubstances present ina liquid in molecular, ionized or micro-granular (colloidal sol) suspended form. The maximum, minimum and average concentration of Total Dissolved Solids of the study Area are 2216 Mg/L, 0.5Mg/L and 328 Mg/L

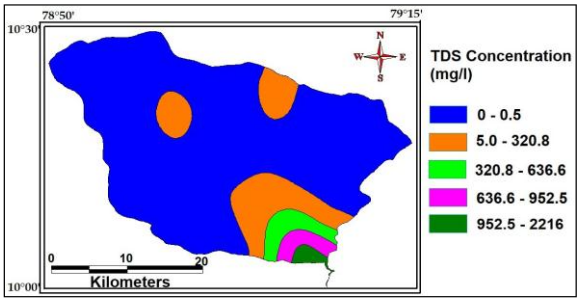


Fig – Total dissolved solids

4.2.2 Calcium

Calcium dissolves out of almost all rocks and is, consequently, detected in many waters.Waters associated with granite or siliceous sand will usually contain less than 10 mg ofcalcium per litre. Many waters from limestone areas may contain 30-100 mg l-1 and those associated with gypsiferous shale may contain several hundred milligrams per litre. The maximum, minimum and average concentration of Calcium of the study Area are 100 Mg/L, 7.9Mg/L and 42 Mg/L

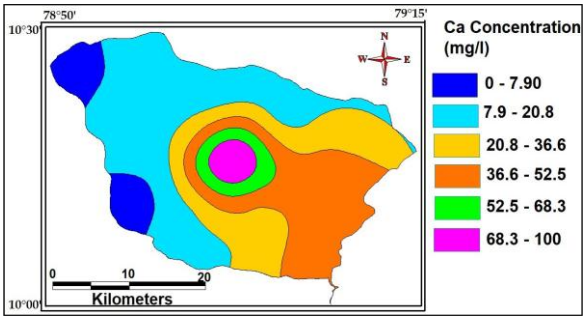


Fig – Calcium of study area

4.2.3 Magnesium

Magnesium is a relatively abundant element in the earth's crust and hence a common constituent of natural water. Waters associated with granite or siliceous sand may contain less than 5 mg of magnesium per litre. Water in contact with dolomite or magnesium-rich limestone may contain 10-50 mg l-1 and several hundred milligrams per litre may be present in water that has been in contact with deposits containing sulphates and chlorides of magnesium. The maximum, minimum and average concentration of Magnesium of the study Area are 900 Mg/L, 14.9 Mg/L and 200Mg/L

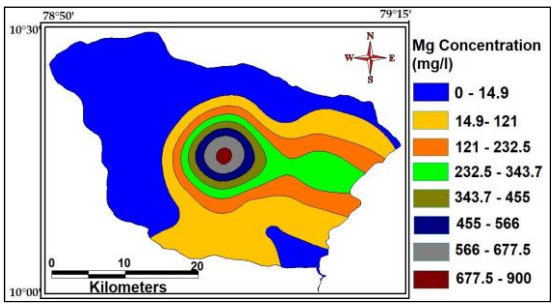


Fig – Magnesium of the study area.

4.2.4 Sodium

Sodium ions are abundant in ground water especially in those contains in deep aquifer system of all the cationsthese are the most abundant one. The maximum, minimum and average concentration of Sodium of the study Area are 470 Mg/L, 0.9 Mg/L and 76 Mg/L .

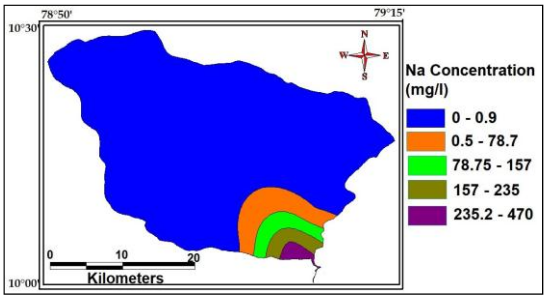


Fig – sodium of the study area

4.2.5 Potassium

Potassium ions are very abundantly found .it is much more than sodium ions. it is produced by weathering of igneous rocks as well as by the dissolution of potash salt deposits. The maximum, minimum and average concentration of Potassium of the studyArea are 1427 Mg/L, 1.2 Mg/L and 0.5Mg/L

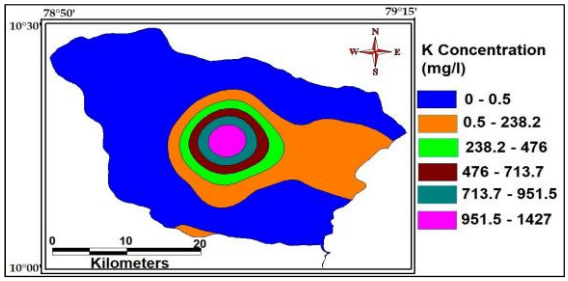


Fig- Potassium of study area

4.2.6 Chloride

Chloride anions are usually present in natural waters.A salty taste in water depends on the ions with which the chlorides are associated. Withsodium ions the taste is detectable at about 250 mg l-1 Cl, but with calcium or magnesium the taste may be undetectable at 1,000 mg l. The maximum, minimum and average concentration of Chloride of the study Area are 870 Mg/L, 0.9Mg

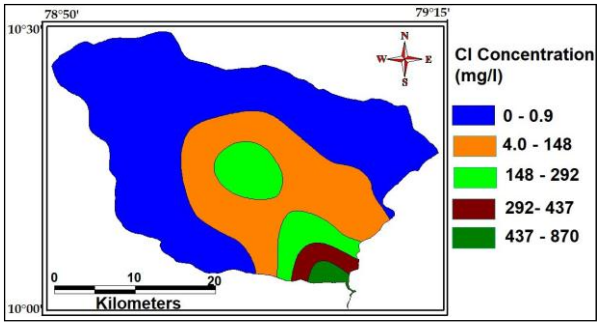


Fig- chloride of the study area.

4.2.7 Fluoride

The maximum, minimum and average concentration of the studyArea are 9.3 Mg/L, 1.0 Mg/L and 184Mg/L.

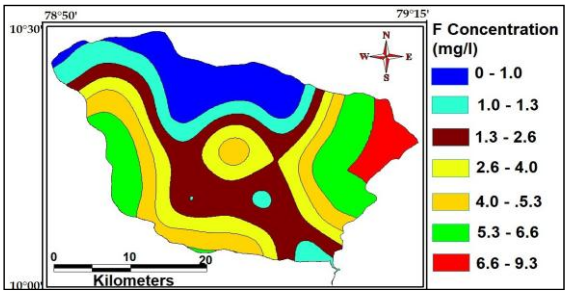
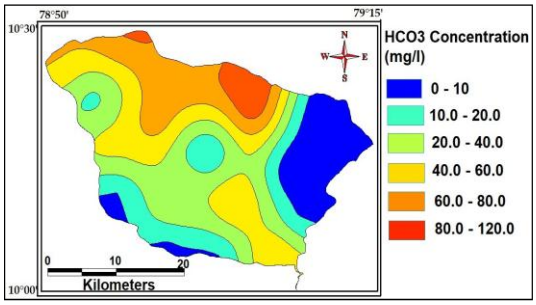


Fig- Fluoride of study area.

4.4.8 Bi-carboante

The maximum, minimum and average concentration of Bi-Carbonate of the study Areaare 120 Mg/L, 10Mg/L and 56Mg/L.



4.4.9 Sulphate

Sulphate is commonly found in air, soil and water. Since it is soluble (easily dissolved) in water, Sulphate is found at high concentration in many acquifers and in the surface water. The maximum, minimum and average concentration of Sulphate of the study Area are 202 Mg/L, 0.92 Mg/L and 34.6g/L

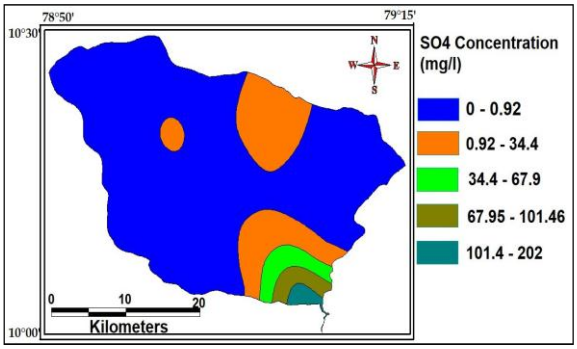


Fig – sulphate of study area.

2.2.9 Nitrate

Nitrate the most highly oxidized form of nitrogen compounds, is commonly present in surface and ground waters, because it is the end product of the aerobic decomposition of organic nitrogenous matter. Significant sources of nitrate are chemical fertilizers from cultivated land and drainage from livestock feedlots, as well as domestic and some industrial waters. The maximum, minimum and average concentration of Nitrate of thestudy Area are 75 Mg/L, 0.5 Mg/L and 23Mg/L.

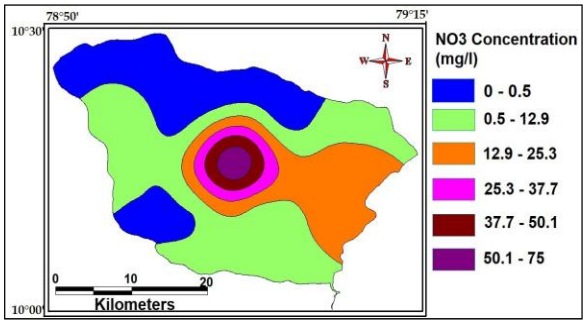


Fig- nitrate of study area

4.3 Quality of standards for domestic water supply

Following standards for quality of drinking water supply are laid down. These are primarily based either on U.S. Public health service standard or recommendation of indian standard organization and are being followed in our country without mach variations.

4.4 Quality of standards for irrigation purpose

4.4.1 sodium absorption ratio(SAR)

The value of SAR of the study area varies from 0.01 to 08.98 with an average of 1.85. The below table indicates 94.12% of groundwater samples in the study area belong to no problem categories, 5.88% of samples fall under increasing problemcategories are shown in the fig

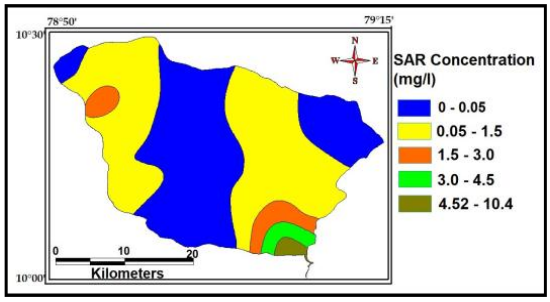


Fig- SAR of study area

Table – classification of SAR(HERMAN BOUWER,1978)

SAR ranges	Classification	No of samples	% of samples
<6	No problem	16	94.12
6-9	Increasing problem	01	05.88
>9	Severe problem	------	-------

4.4.2 Sodium percentage

The value of sodium percentage of the study area varies from 9.63 to 64.4 with an average of 38. The sodium percentage values are shown in fig. The sodium percentage in the groundwater samples were plotted against the EC values and presented over a Wilcox plot for deciphering the groundwater suitability for irrigation. It reveals that 11.8% of groundwater samples fall under excellent categories for irrigation, 64.7% of the samples falls under good categories for irrigation and rests of the samples are mostly permissible for irrigation.

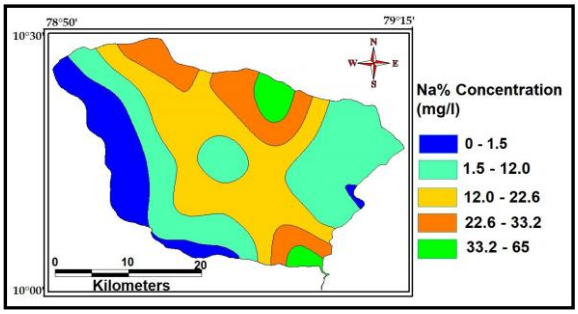


Fig- Na% of study area

Table- Classification Na % (WILCOX 1955)

range	Classification	No of samples	% of samples
<20	Excellent	02	11.8
21-40	Good	11	64.7
41-60	Permissible	04	23.5
61-80	Doubtful	-----	- ---
>80	Unsuitable	------	-----

5. CONCLUSION

The Physical and Chemical properties of underground water will vary with time, due to factors like climate, geologic, hydrologic, ecologic and biogenetic factors. It also vary due to artificial factors such as irrigation, reservoir etc., to ascertain the above phenomenon, in our project we

analyze the underground water of bore wells situated in Ambuliar sub watershed. The results obtained in this test shows slight variation in physical and chemical properties when compared to Indian Standards and WHO standards. The variation is mainly due to the low intensities of rainfall. Rainfall is the dominating factor in considering physical and chemical properties of water. Precipitation reactions are employed in the softening of hard water i.e. precipitation tends to decrease the hardness. Since, it has the property of leaching. Precipitation dilutes the existing ground water thereby reducing concentration of mineral constituents. Salinity of the underground water depends on the intensity of rainfall. So the low intensity of rainfall prevailed in the in one reason for the variation of physical and chemical properties. These studies concluded that the physical and chemical properties of underground water are not constant and vary with time to time and alsoyear by year due to factor mentioned above. And also we compared the present result with the previous result obtained during the last year. From our project, we concludethat the physical and chemical properties of ground water are not constant and vary with time to time. The samples are Aryapatti, Sillatur, Nagaram, Nagudi, Athani south, Poovadhugudi, Melpanaikadu, Karambagudi Zamin and Kattumavadi are unfit for drinking purpose because they have higher TDS, Fluoride, Sodium and Pottasium are most vulnerable constituent higher than the IS and WHO 2011 permissible limits.

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