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Study of Underground Water Quality using Gis

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Abstract : Water is one of the most basic needs for the survival of the human race. The present generation, however has seemed to forget the importance of preserving the quality of water[2]. Due to over exploitation and polluting of surface water by human activities and industries, surface water these days have reached the extent that it cannot be used even for domestic purposes[7,9]. Hence underground water has come into use, due to the rise in population and the unavailability of surface water in all places, it is not possible to use underground water for domestic purposes without knowing the properties and minerals in it.A detailed report showing the water quality parameters and the variations along the region would help in monitoring and provide the necessary treatment for underground water for its safe use. For this work, Coimbatore district was taken as the study area and samples from 35(Thirty Five) random stations in Coimbatore district were collected from the 8 Taluks in the district and seven different water quality parameters were checked. The results were integrated using GIS. This study aims to give a clear view of the quality of underground water in an efficient manner by blending the parameters with GIS.

1.0 Introduction

The chemistry of water is very vibrant, mostly controlled by its medium of contact in view of the fact that it directly hints the quality of water for various purposes, its monitoring and evaluation gained considerable importance in the present century[3,5].

A terrific raise in the population increased the stress on surface water and the underground water, resulting in scarcity of water in most of the places[8,10]. From the ancient times the ground water is used mostly for drinking because of the filtering effect of aquifers. Though, at present one cannot drink the water directly from the source without treatment. Various chemical, physical and biological processes alter the original quality of water when it moves through the hydrological cycle; the reactions of soil, rock, organic matter, Natural processes and human activities are causes behind changes in water quality. So this study examines the quality of underground water in the Coimbatore district region from 35 random stations on the basis of the seven water quality parameters. The quality of the water samples collected are analyzed in the laboratory and the result is shown in the form of maps using GIS Application.Based on the results, ranks are allotted to the samples from which we can understand the safety level of the water sample for that particular parameter. An overall ranking is also given to the water samples from which the overall safety level of the water present in that area is known.

1.1 Study Objectives

The objectives of this study are:

- To derive a detailed report regarding the quality of underground water in Coimbatore district with respect to the various test parameters on the water samples collected.
- To efficiently integrate the data collected with GIS and provide detailed variation of underground water quality in the form of maps.

2.0 Study Area

The study area selected is Coimbatore in the state of Tamil Nadu. Coimbatore is the second upcoming smart city in India and is called as Manchester of South India. The longitude of Coimbatore lies between 76º65' E – 77º 29' E. The latitude lies between 10 º 22' N – 11 º 41' N. The total area of Coimbatore is 471 Square kilometers. The study area is shown in Figure1

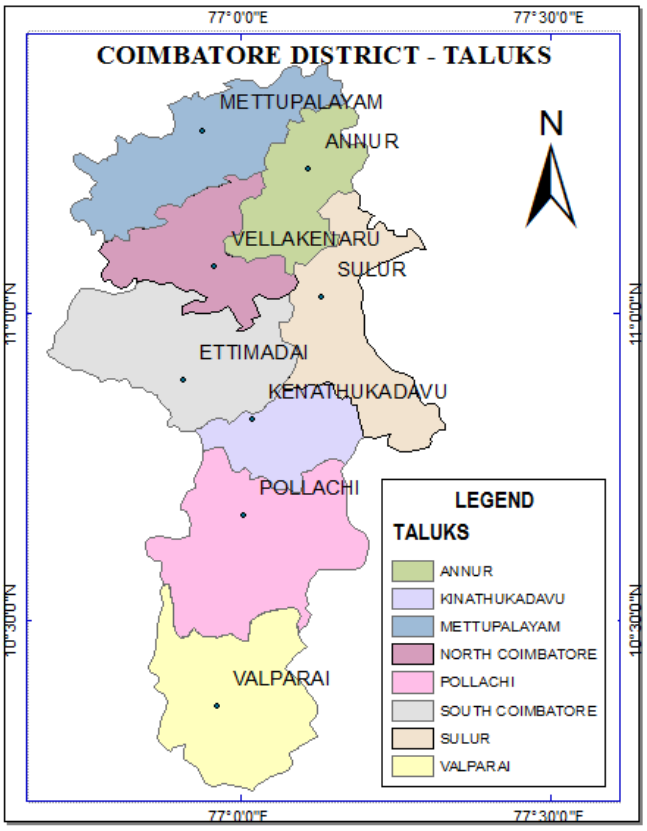

Figure 1: Study Area

3.0 Methodology

The underground water samples are randomly collected from 35 stations. All the samples were collected by grab sampling method in plastic bottles from all the sampling stations. The Taluk Boundary of the district updated in the year 2015 is also collected. The methodology layout is as shown in Figure below

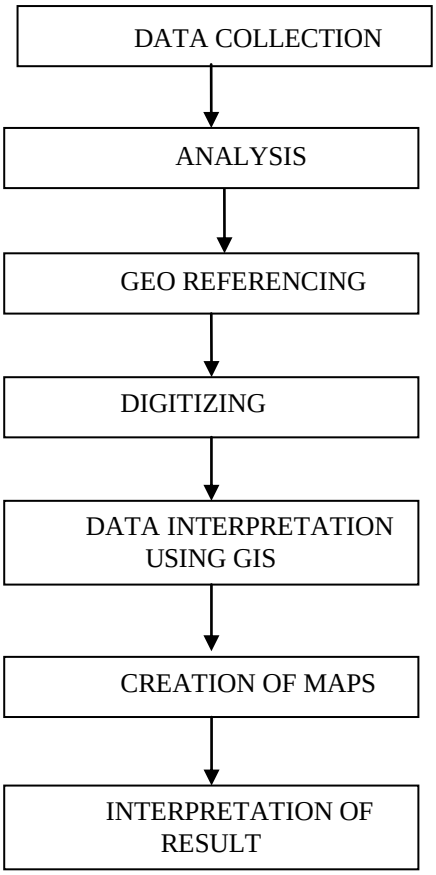

Figure 2: Methodology Layout

3.1 Analysis Using GIS

The collected samples have been analysed for their properties on different parameters such as pH, Acidity, Alkalinity, Hardness, Chlorides, Total Dissolved Solids and Dissolved Oxygen. These parameters are shown in maps which are created with the help of GIS Application. The results of each station is for a particular parameter is shown separately in each map. Based on the values the areas are denoted as safe, moderate and unsafe. It is also noted that the environment surrounding the stations also affects the properties of underground water. This study has demonstrated the utility of GIS combined with analytical data to assess and mapping of groundwater quality.From the above observation, it may concluded that almost all the parameters like pH, Acidity, Alkalinity, Hardness, Chlorides, TDS and Dissolved Oxygen are in the permissible range for most of the samples. However, the samples from Chettipalayam, Veerapandi and Somanur are not in the permissible range.

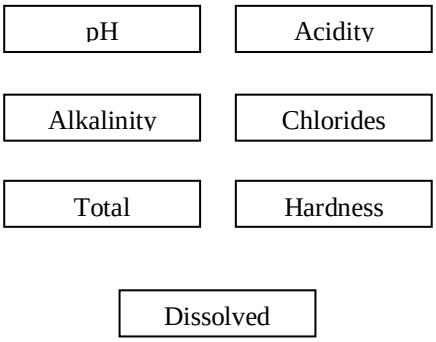

Figure 3: Stages of Analyses

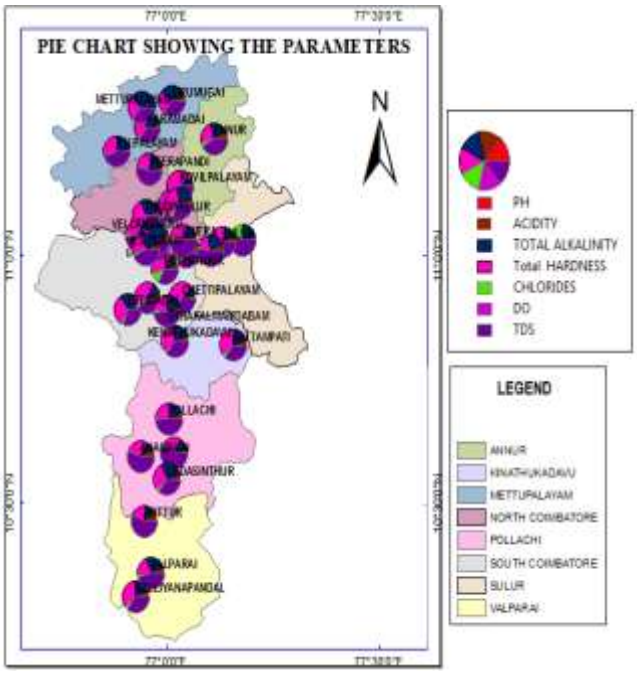

Figure 4:MapShowing the Parameters

It is to be noted that the above stations have a different environment compared to the other stations i.e., these stations are surrounded by industries and mills other than natural environment. As we are dealing with underground water, it is to be noted that even land pollution through improper garbage disposal and other means through the land loses its fertility and quality also affects the quality of underground water and increases the TDS level. From this we get to know that the surroundings, environment and even the land plays an important role in the quality of underground water.The overall parameters of all the 35 stations are shown in one map and the overall rank for the taluk based on the station's overall rank is as shown in mapping

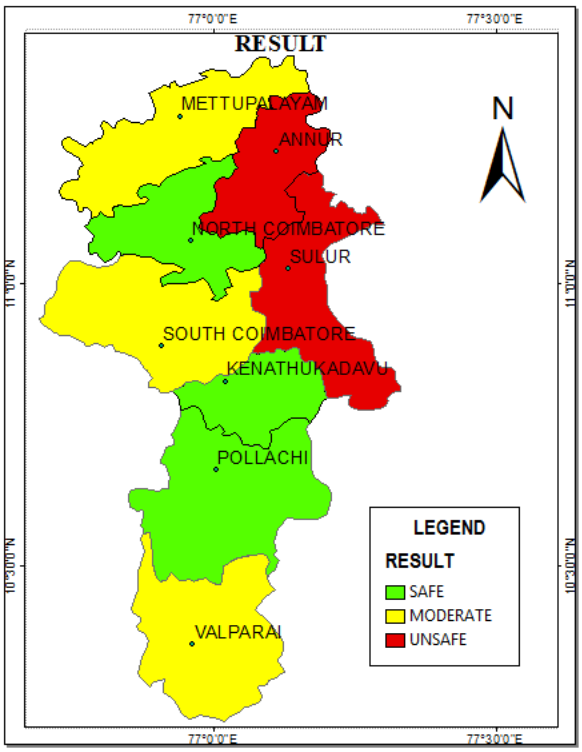

Figure 5: Risky area

4.0 Conclusion

Water is the prime requirement for the existence of life groundwater is a precious resource of finite extent. Over the years, increasing population, urbanization and expansion in agriculture has head in the scientific exploitation of ground water creating a water stress condition. Thus paving the way for the use of underground water. The Coimbatore district is under threat due to the critical issues of environmental pollution and water scarcity problems. The groundwater and underground water quality in Coimbatore District has been reduced due to pollution. Hence monitoring the underground water quality is indispensable. The study was carried out from a randomly selected 35 stations in the Coimbatore district. GIS technologies can provide appropriate platform for convergent analysis of large volume of multi-disciplinary data and decision making for underground water studies can be effectively done. The GIS bare zoning of underground water quality map may be used as a guideline for predicting the underground water quality to new areas. The present study provides a guideline for solving water quality problem in Coimbatore District. This study has demonstrated the utility of GIS combined with analytical data to assess and mapping of underground water quality. The spatial distribution map of pH, Total Dissolved Solids, Total Alkalinity, Total Hardness, Chloride, Acidity and Dissolved Oxygen shows that, these parameters were within the permissible limit throughout the study area for most of the stations. Thus spatial distribution maps of various quality parameters are used to demarcate the locational distribution of water quality in a comprehensive manner.

5.0 References

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10. Thilagavathi (1998) studied land use influence of ground water level. Using remote Sensing, GIS created a database and developed a digital model with MODFLOW software package to model the optimum utilization of land and water to increase the yield without damaging the environment.

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