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Experimental Investigation of Ground Water Quality of Drinking Purpose in Salem District Reactor

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ABSTRACT: Water is an undeniable basic necessity of any living organism in this world. Naturally it become mandatory that the water we consume has to be clean, safe and should be par with standard for the drinking purpose. Groundwater forms a major source of drinking water in urban as well as in rural areas. More than 90% of the rural population uses groundwater for domestic purposes. Groundwater quality of Salem district was assessed by carrying out water quality tests for the samples collected at the random locations in the area and utilizing Geographic Information System (GIS) techniques to prepare spatial maps for various water quality parameters. In this study, fifty-one groundwater samples were collected from random locations within the Salem District during November 2021. Standard methods were adopted for carrying out the water quality tests and the parameters like Temperature, pH, calcium, magnesium, sulphates, total dissolved solids, chloride, electrical conductivity and Fluoride were determined. Fluoride contamination in groundwater is high in many places. Fluoride is a chemical element that has shown to cause significant effects on human health through drinking water. Fluoride has beneficial effects on teeth at low concentrations of 1mg/l by preventing and reducing the risk of tooth decay. Fluoride can also be quite detrimental at higher concentrations exceeding 1.5 to 2mg/l of water. High concentrations of fluoride pose a risk of dental fluorosis as well as skeletal fluorosis

I. INTRODUCTION

Water is the most precious gift of nature, the most crucial for sustaining life and is required in almost all the activities of man - for drinking and municipal use, for irrigation, to meet the growing food and fiber needs, for industries, power generation, navigation and recreation. Moreover, the rainfall is mostly confined to the monsoon season and is unevenly distributed both in space and time even during the monsoon season. As a result, the country is affected by frequent droughts. Nearly one third of the country is drought prone. In the very near future, water will be a scarce resource and therefore, needs to be harnessed in the most scientific and efficient manner. Groundwater is the major source of drinking water in both urban and rural India. The demand for water has increased over the years and this has led to water scarcity in many parts of the world.

Presence of low or high concentration of certain ions is a major issue as they make the ground water unsuitable for various purposes. Fluoride is one such ion that causes health problems in people living in more than 25 nations around the world. Fluoride concentration of at least 0.6 mg/l is required for human consumption as it will help to have stronger teeth and bones. Consumption of water with fluoride concentration above 1.5 mg/l results in acute to chronic dental fluorosis where the tooth become coloured from yellow to brown. Skeletal fluorosis which causes weakness and bending of the bones also results due to long term consumption of water containing high fluoride.

II. NEED FOR STUDY

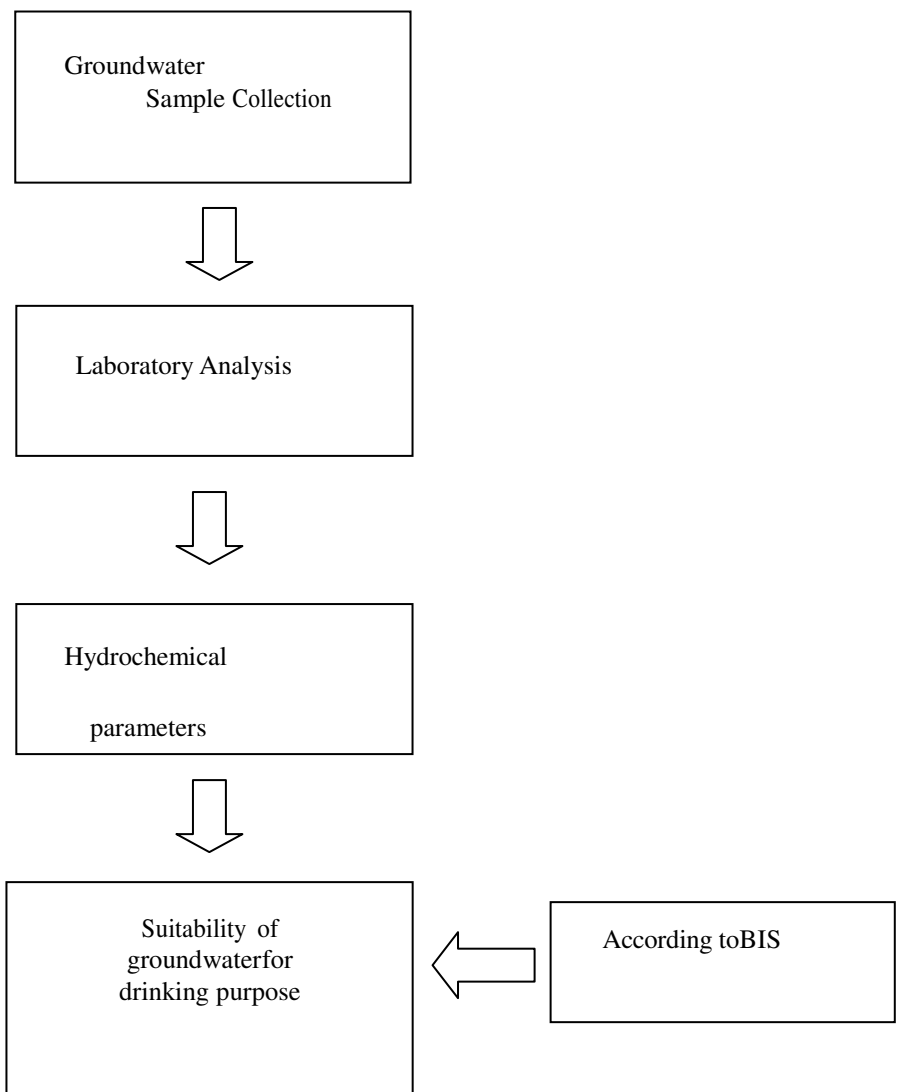
Now a days among rural population, Groundwater based systems are the only sources of drinking water supply in the area. Due to high concentration of fluoride in groundwater, both dental and skeletal fluorosis is prevalent. In addition to already affected population, still a larger fraction is potentially at risk. In order to take any meaningful action towards elimination or minimization of the problem. It is essential to have a comprehensive study to ascertain the causative factor and to delineate areas and extent of contamination. Fluoride contamination is a major hazard in different parts of India especially in Salem District, Tamil Nadu. Therefore, it is necessary to monitor the groundwater in this region.



III. APPLICATION

In groundwater studies, GIS is commonly used for site suitability analysis, estimation of groundwater vulnerability to contamination, groundwater flow modeling, solute transport and leaching, and integrating groundwater quality assessment models with spatial data to create spatial decision support systems. Groundwater quality map is important for any city to estimate the water safeness for drinking and irrigation purposes. It is also helpful as a precautionary indication of potential environmental health problems

IV. MATERIALS AND METHODS



V. METHODOLOGY FOR FLUORIDE ANALYSIS

SURVEY ANALYSIS: Survey analysis sheet was framed based on few journals as reference. The survey analysis which is collected in the study area is used to collect the details of people who are affected by Dental Fluorosis, Skeleton Mottling and also, its severity in various region of Salem district.

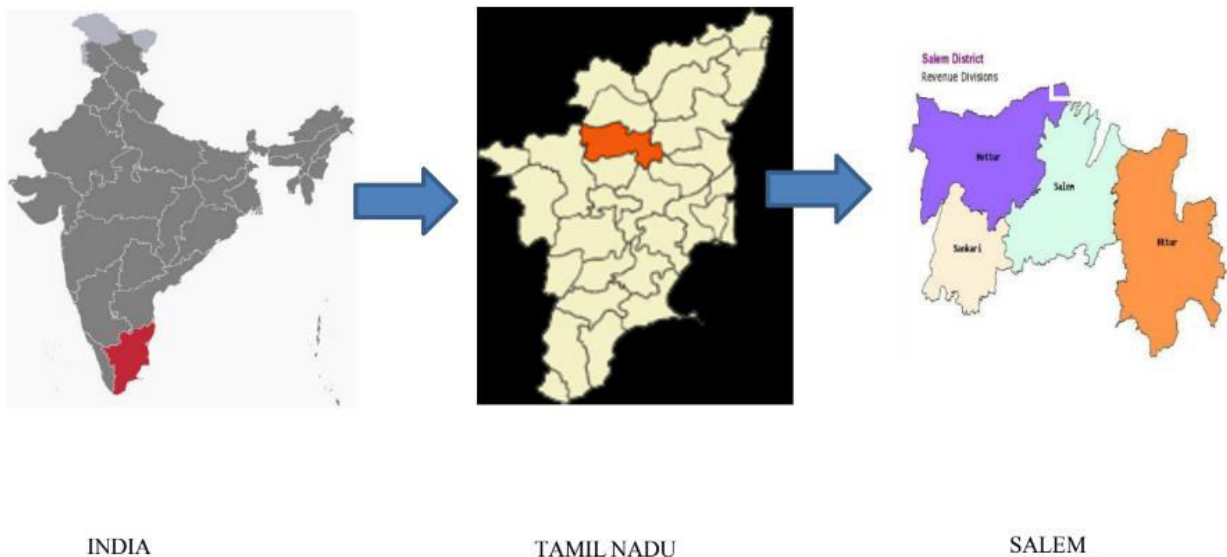
GROUNDWATER SAMPLE ANALYSIS: Water samples were collected in clean can bottles of one litre capacity. The sampling bottles were washed with distilled water and were washed again prior to each sampling with the filtrates of samples. In the case of bore wells water samples were collected after pumping the water for 10min. In the case of open wells, water samples were collected 30cm below the water level. The sample bottles are closed tightly and labeled. The samples were preserved, cooled and protected from breakage while transporting the bottles to the laboratory. Within 24 hours the sample is shifted to the lab for analysis.

VI. STUDY OF AREA DESCRIPTION

Salem is a district in western part of Tamil Nadu in India. It is the first district created in Tamil Nadu after the independence of India by splitting it from then Salem district on 02 October, 1965. The other major towns in the district are Attur, Yercaud, Gangavalli, Pethanayakkampalayam, Valapady and Sankagiri Edappadi, Mettur, Omalur, Kadaymappiti, Thalivasal.

Salem District is one of the major producers of mango in the state, fine quality granite is found in the district. It is also one of the main sericulture belts in the state. Around 30 percent of the district's area is under forest cover. Kaveri enters Tamil Nadu through this district.

Salem is located in the northwestern climate zone of Tamil Nadu, India. It lies between 11°47' and 12°33' N and 77°28' and 76°45' E. Occupies an area of 4,497.77 km² (1,736.60 sq. mi) (i.e. 3.46% of Tamil Nadu). It is bounded on the north by Krishnagiri District, on the east by Tiruvannamalai District and Kallakurichi district, on the south by Dharmapuri District, and on the west by Karnataka's Chamarajanagar District. The whole district is surrounded by hills and forests, and the terrain consists mostly of rolling plain.



- Mettur has The Annual potential evapotranspiration rate in this region is 1727mm, compared to annual pre-

capitation of 825 mm.

- It is a dry and semiarid production system. The study region has been facing a maximum temperature of about 37 °C in the months of April– May.
- The socio-economic condition of the region is very poor due to poor rainfall and frequent monsoon failure, thus leading to drought in many parts of the region.

It was found that groundwater in the area was largely suitable for drinking purposes but some few boreholes in the northwestern and southeastern parts had high fluoride and boron concentrations. The sodium percentage (11–99%, mean of 70%), magnesium ratios (2.05–57, mean of 29) and sodium adsorption ratio (0.15–38, mean of 4.72) were high in some of the communities in the southeastern part of the area. This study suggested that water in this part of the area is not entirely suitable for irrigation purposes.

The presence of fluoride is more than the permissible limit (above 1.5 mg L⁻¹) in the study region. A positive correlation between fluoride concentration and pH indicated that alkaline conditions improved the solubility of fluoride. Groundwater in aquifers in general is slightly alkaline in nature (Central Ground water Board Report, 2019

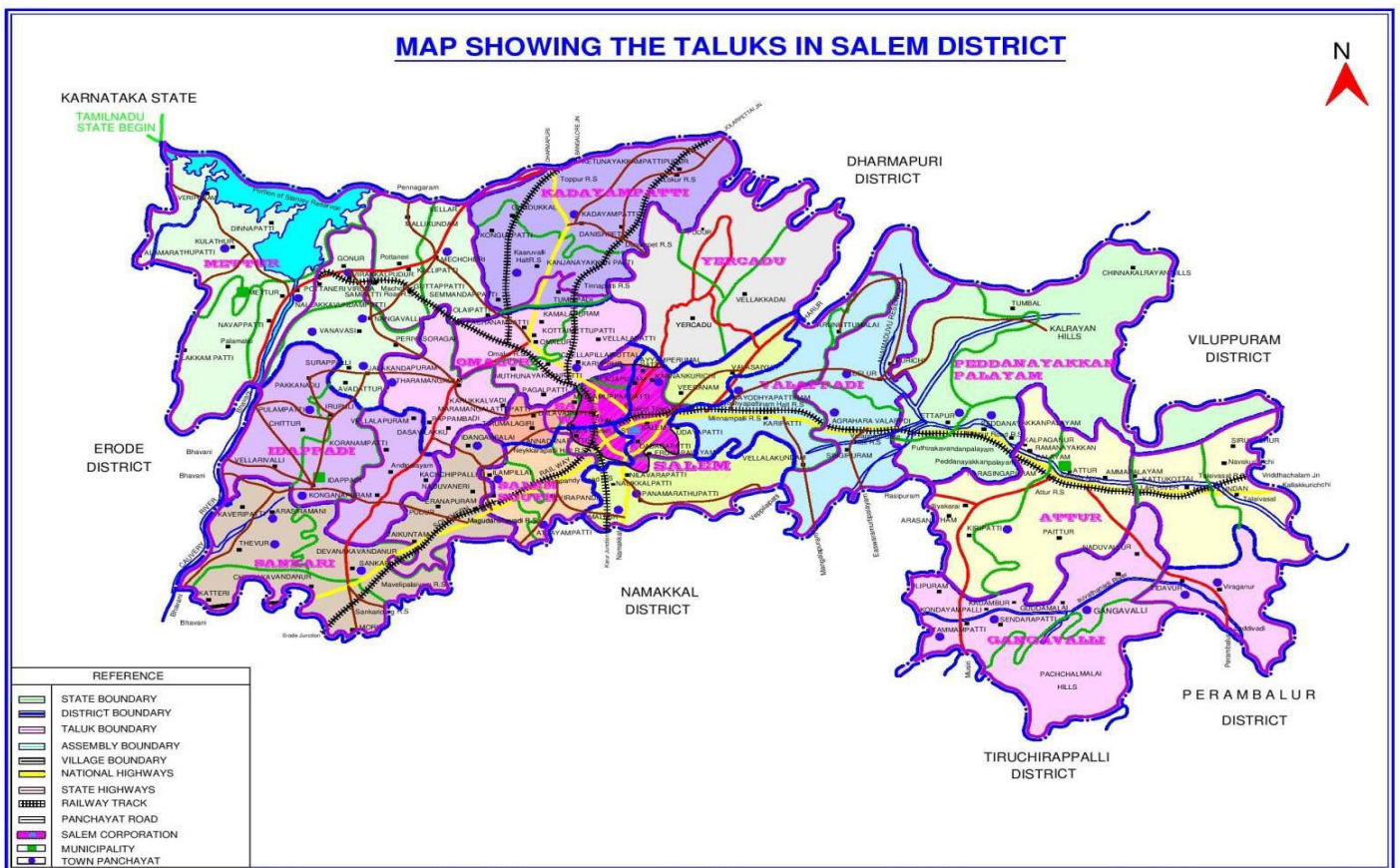
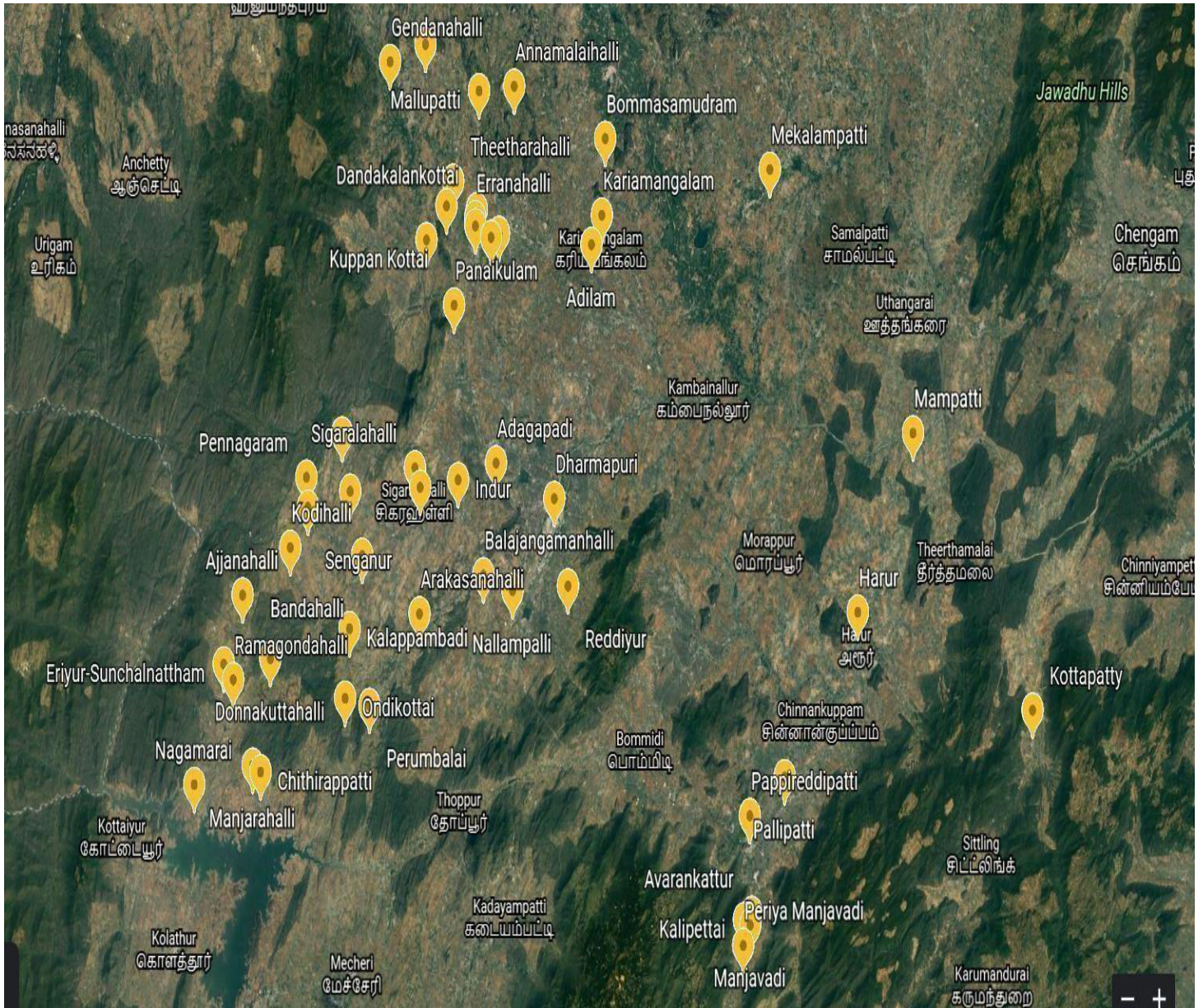


Fig: Salem Map

6.1 SAMPLING LOCATION



Location Map of sampling points



Details of Salem District Taluk and No of Panchayath

S.No	Thaluk Name	No Of Village
1	Salem	59
2	Salem West	40
3	Salem South	49
4	Yercaud	67
5	Gangavalli	40
6	Attur	59
7	Pethanaickenpalayam	47
8	Valapady	64
9	Sankari	52
10	Edapadi	25
11	Mettur	48
12	Omalur	62
13	Kadayampatti	28

VII. CONCLUSION

In this study the hydrochemical parameters like Temperature, pH, Electrical conductivity, Total dissolved solids, Calcium , Magnesium , Chloride , Sulphate , Fluoride were determined in 51 sampling locations of the Dharmapuri district . The following conclusions were drawn .Based on pH and temperature, all the samples are within the limit according to BIS standards.Based on Electrical conductivity, 34% of samples exceeded the permissible limit. From the results determined with respect to total dissolved solids, 35% of the samples fall under fresh water type and 65% of sample under brackish water.Based on calcium concentration, all the samples are within permissible limit for drinking.On the basis of Magnesium, 55% of the samples exceeded the permissible limit for drinking. Based on Chloride concentration,4% falls under brackish ,71% falls under brackish salt, 22 % falls under salty, 4% falls under hyper saline.Based on Sulphate concentration, 2% of samples exceed the permissible limit for drinking.



Based on Fluoride concentration, 61% of samples exceed the permissible limit for drinking. Especially places like Attur, Ammapettai, Thalaivasal, Valapady, Pethanaikkampalayam and Omalur are under high risk .

Based on the survey analysis conducted, 87% of the citizens were affected by dental fluorosis and 48% of the citizens were affected by skeletal fluorosis along with dental issues. It was observed that the most affected were in the age group of 50 and above. The most affected places were salem, salem west, slem west, yercaud, gangavalli, attur, pethanaikkampalayam, valapady, sankari, edappadi, omalur, kadayampatti.

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