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Physico-Chemical Analysis of Groundwater Samples in Karur District, Tamil Nadu, India

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A B S T R A C T

Due to industrialization and urbanization the problem of providing good quality water for drinking and irrigation has become very critical now in Karur district. Hence, in this study, emphasis has been given to water quality for drinking and irrigation in Karur district. In order to assess the groundwater quality, samples were collected from Aravakurichi and K. Paramathi block and analysis for pH, Electrical Conductivity (EC), major cations like calcium, magnesium, sodium, potassium and anions like chloride, sulphate, carbonates and bicarbonates were done in the laboratory using the standard methods given by the American Public Health Association (APHA, 2005). By using the analyzed data, the chemical indices Sodium Adsorption Ratio (SAR) were calculated. It is found that majority of the locations in both the blocks have high levels of calcium, magnesium, chloride and sulphate concentration, while all other were within the permissible limit for drinking. About 79.9% of area is having EC ranging from 0.75-2.25 dS m^{-1}, which is classified under doubtful class by USSL for irrigation. Water samples were found suitable for irrigation with respect to SAR for both the blocks.

Introduction

In addition to over exploitation and water level decline, groundwater pollution is a major concern in several regions of India. Nowadays, dumping of industrial and domestic waste pose serious threat to groundwater quality and may reduce the water availability for irrigation, domestic and industrial uses. Groundwater quality is the suitability of groundwater for a certain purpose. In the present study, it can be defined as the suitability of groundwater for human consumption and irrigation. This suitability depends mostly on the chemical composition of groundwater. As long as groundwater quality is determined by chemical composition, it can be mapped by showing the

latter in relation to permissible limits for human consumption. The correlation of groundwater chemistry with hydrologic and geologic environments also gives valuable information to understand the effect of subsurface hydro geochemical processes and to properly manage aquifer systems. Groundwater is the major source of drinking water in Karur district, Tamil Nadu, India.

Due to industrialization and urbanization the problem of providing good quality water for drinking and irrigation has become very critical now in Karur district. Hence, in this study, emphasis has been given to water quality studies, which is one of the important issues in groundwater management in Karur district. Quality variation of groundwater in an area is mainly a function of physical and chemical parameters. Geographical Information System is an effective tool for relating and integrating vast volumes of different data types obtained from different sources and compiled on different scales. Thus, in the present study, an attempt has been made to understand the spatial variation of groundwater quality and also its suitability for irrigation using Geographical Information System techniques.

Materials and Methods

Sample collection and physico-chemical analysis

The present study focused on analysis of groundwater in Aravakurichi and K. Paramathi blocks of Karur district, Tamil Nadu. The samples were collected from various locations randomly in 1 litre plastic bottles. The collected groundwater samples have been analyzed using standard methods given by American Public Health Association (APHA). The details of analytical methods followed and mapping of parameters using GIS have been enumerated in this chapter.

The tasks can basically be divided in to the following categories

Collection of water samples and physico-chemical analysis.

Determination of EC, SAR and classify the groundwater for irrigation suitability as per US Salinity Laboratory of the Department of Agriculture.

Application of GIS software in developing thematic maps.

Sampling stations

Eight samples from Aravakurichi block and ten samples from K. Paramathi block were collected for the present study and are listed in the Table 1. Study Area with sampling stations is shown in Figure 1.

Water quality parameters

The groundwater samples were analyzed for ten water quality parameters such as pH, Electrical Conductivity, Calcium, Magnesium, Sodium, Potassium, Chloride, Sulphate, Carbonate and Bicarbonate. By using the analyzed data, the chemical indices viz., Sodium Adsorption Ratio (SAR) is calculated. Water quality parameters were analysed as per standard methods given by APHA. The results were analyzed with the Bureau of Indian Standard (BIS) for potability and US Salinity Laboratory (USSL) for irrigation suitability.

Physico- chemical analysis

Samples are analyzed in the laboratory by using standard methods of analysis (APHA, 1998). High purity (A.R. Grade) chemicals and double distilled water is used for preparing standard solutions for analysis. Various physical parameters like pH and EC are determined on the spot with the help of

digital portable pH meter and Conductivity meter. The chloride ions are determined by titrating the water samples against a standard solution of $AgNO_3$ using potassium chromate as an indicator. Calcium (Ca^{2+}), Magnesium (Mg^{2+}), Carbonate (CO_3^{2-}) and Bicarbonate (HCO^{3-}) are also determined by volumetric titration methods. While Sodium (Na^{+}) and Potassium are determined by Flame photometry as recommended by APHA. Sulphates (SO_4^{-}) are estimated by Turbidity method using spectrophotometer (Kristina Furn (2003), Sivakumar *et al.,* (2010), Krishnaraj *et al.,* (2013).

Global Positioning System (GPS) data collection

Latitude and Longitude data for all selected stations in the study area have been recorded with Global Positioning System (GPS).

Irrigation water suitability as per USSL classification

Due to urbanization and industrialization, the groundwater is being polluted in several major cities of the country. The groundwater resources are often over exploited to meet the increasing demand by the people. Sometimes groundwater contains various minerals and salts in solution at elevated concentrations posing danger to the human conception or utility. The open well or tube well waters are expected to contain more dissolved salts of the sodium, calcium and magnesium and their use in irrigation results in the increase of the salinity of the soil and thereby the loss of fertility. Further, the presence of accumulated amounts of high concentration of carbonate and bi-carbonates of alkali or alkaline earth metals, turns to be responsible for the dispersion of soil particles that ultimately reduces porosity of the soil and thereby the loss of fertility. In the present study, the collected water samples were classified on suitability of water for irrigation as per the criteria suggested by the US Salinity Laboratory of the Department of Agriculture. The classification of water as per USSL is presented in Table 2 to 4. The spatial distribution maps for EC and SAR are generated on the basis of different categories of groundwater samples, using ArcGIS 10.1 software depicting the places of Saline and Alkali waters in the blocks.

Parameters selected and their calculation

Parameters selected for the present study are EC and SAR. From the analysed data, Sodium Absorption ratio (SAR) is calculated by the following equations. $^{+}\sqrt{++ +++ / 2}$

(All values of cations and anions are in me L^{-1})

Significance of selected parameters for Irrigation

Electrical Conductivity (EC)

The most influencing water quality guideline on crop productivity is the salinity hazard as measured by electrical conductivity (EC). The primary effect of high EC water on crop productivity is the inability of the plant to compete with ions in the soil solution for water. The higher the EC, the less water is available to plants, even though the soil may appear wet, because plants can only transpire **"**pure**"** water, usable plant water in the soil solution decreases dramatically as EC increases. Classification of groundwater based on salinity hazard is presented in Table 2.

Sodium Adsorption Ratio (SAR)

Excessive amount of salt in general and sodium in particular affect the soil permeability, soil structure and create toxic condition for plants. Sodium in irrigation

water is generally taken up by the clay soil in return of calcium and magnesium due to ion exchange. It leads to the development of alkali soil, which has unfavourable structure and resists aeration. To quantify this effect an empirical parameter termed as SAR is used.

The sodium hazard classes based on USSL classification is given in Table 3. Based on SAR values, water can be classified as excellent (10), good (10-18), doubtful (18-26), and unsuitable (>26).

Application of GIS in developing thematic maps Creation of data base

The physico-chemical parameters such as pH, chloride, calcium, magnesium, sodium, potassium, sulphate, EC and SAR of groundwater were analyzed using standard procedures and a database was prepared on excel. The database was then inserted into ArcGIS 10.1 software for creating spatial distribution map.

Generation of maps

Raster interpolation technique, Inverse distance weighted (IDW) of spatial analyst module were used to generate the thematic map. Sampling locations in excel were imported into the base map as point layer and the thematic maps were generated using IDW, the output was then reclassified and mapped according to the permissible limits.

Results and Discussions

Assessment of groundwater quality

Physiochemical analysis

This chapter elaborates the physiochemical characteristics in the selected locations, suitability for irrigation etc. Water samples collected during the year 2015 have been analyzed for ten water quality parameters.

pH

The range of pH is from 6.98 to 8.10 in K. Paramathi block and 7.37 to 7.97 in Aravakurichi block.

The average pH is 7.65 and 7.75 in K. Paramathi block and Aravakurichi block respectively. Most of the stations in the study area show neutral range of pH values.

EC

EC value ranges from 0.71 dS m^{-1} to 3.01 dS m^{-1} in K. Paramathi block and 0.65 dS m^{-1} to 4.42 dS m^{-1} in Aravakurichi block. The average EC is 1.59 dS m^{-1} and 2.13 dS m^{-1} for K. Paramathi block and Aravakurichi block respectively.

Calcium

Calcium in the K. Paramathi sampling stations ranges from 51.30 to 307.80 mg L^{-1} and 102.60 to 432.84 mg L^{-1} in Aravakurichi.

Magnesium

Magnesium in the sampling stations in K. Paramathi ranges from 52.01 mg L^{-1} to 463.98 mg L^{-1} and in Aravakurichi the minimum concentration of 42.19 mg L^{-1} is found in Eurumarpatti village and maximum of 315.65 mg L^{-1} in Pallapatti village.

Sodium

Sodium concentration in K. Paramathi block ranges from 28 mg L^{-1} to 150 mg L^{-1}. Eurumarpatti village of Aravakurichi block has less sodium concentration of 65.69 mg L^{-1} and maximum concentration is (165.0 mg L^{-1}) at Pallapatti village.

Carbonates

In K. Paramathi, carbonate concentration ranged from zero to 192.02 mg L^{-1}. Most of the locations in Aravakurichi block have zero carbonate concentration and maximum concentration is 96.01 mg L^{-1} in Santhapadi (b).

Chloride

The chloride value is minimum (56.72 mg L^{-1}) in Kodanthur village and maximum (709.06 mg L^{-1}) in Vairamadai of K. Paramathi block. While in Aravakurichi block the minimum concentration of 85.08 mg L^{-1} is recorded at Eurumapatti village and maximum concentration of 893.41 mg L^{-1} is recorded at Pungambadi east. Chloride concentration in most of the sample were found more than the desirable level (250 mg L^{-1}) stipulated by BIS for potability, yet these values are well below the maximum permissible limit (1000 mg L^{-1}).

Bicarbonates

In K. Paramathi block bicarbonate concentration ranged from 73.21 mg L^{-1} to 268.47 mg L^{-1}. Aravakurichi block have bicarbonate concentration ranging from 73.21 mg L^{-1} to 244.06 mg L^{-1}.

Potassium

Minimum potassium concentration (3.05 mg L^{-1}) is found in surface water source in Rajapuram village of K. Paramathi block and maximum is 71.71 mg L^{-1} in Chinnadarapuram.

Sulphate

Sulphate concentration in K. Paramathi block ranges from 142.99 mg L^{-1} to 778.97 mg L^{-1} and in Aravakurichi block minimum concentration of 26.99 mg L^{-1} is recorded in Pallapatti village and maximum at Pungambai east (645.49 mg L^{-1}). The range of pH for all the stations is within the permissible limit of 6.5 to 8.5. It is found that majority of the locations in both the blocks have high levels of calcium, magnesium, chloride and sulphate concentration. The list of sample locations exceeding permissible values for potability with reference to pH, Calcium, Magnesium, Chloride and Sulphates are given in Table 4.

Irrigation suitability

The important factors that influence the irrigation water quality are salt and sodium concentrations as represented by Electrical Conductivity (EC) and Sodium Adsorption Ratio (SAR). Excessive amount of salt in general and sodium in particular affect the soil permeability, soil structure and create toxic (Table 5).

Sendamangalam Santhapadi showed high salinity with respect to EC. Only Kodanthur and Eurumarpatti are under medium salinity. As per irrigation classification by USSL most of the locations are classified under doubtful class and four location samples are unsuitable for irrigation. Kodanthur and Eurumarpatti villages of K. Paramathi and Aravakuichi block respectively area classified as good. The classification of groundwater as per USSL for irrigation is presented in Table 6.

Sodium Adsorption Ratio (SAR) and its significance

Excessive amount of salt in general and sodium in particular affect the soil permeability, soil structure and create toxic condition for plants. The classification of groundwater with respect to SAR as per USSL irrigation suitability is presented in Table 7. All the eighteen stations, in both the blocks are categorised under S1 class that indicates excellent irrigation quality with respect to SAR.

Thematic maps of physico-chemical parameters

Thematic maps for potability

Thematic maps of pH, calcium, chloride, magnesium, sodium, potassium and sulphate were prepared using Inverse Distance Weighted (IDW) tool in ArcGIS 10.1 software. These maps were classified based on the permissible limit for potability and mapped. The percentage distribution for each of the parameters is also calculated.

pH

All the locations are having normal pH range of 6.5-8.5. For mapping purpose pH was reclassified into three classes viz., 7.3 to 7.6, 7.6 to 7.7 and 7.7 Figure 2 shows the spatial distribution of pH for the study area.

Calcium

Calcium is reclassified into three classes <75 mg L^{-1}, 75-200 mg L^{-1} and >200 mg L^{-1} and mapped as shown in Figure 3. About 61% of the area was found to have a concentration range of 75-200 mg L^{-1}, which covers almost Aravakurichi block. Only 5.3% of the area is within the desirable value of 75 mg L^{-1}. The rest of the area (38%) is having concentration >200 mg L^{-1}.

Chloride

Most of the area (78%) had chloride in the range of 250-600 mg L^{-1} followed by <250 mg L^{-1} of 13.5%, 8.24% of area is having concentration of >600 mg L-1.Figure 4 shows the spatial distribution of chloride.

Magnesium

The concentration of magnesium was found to be more than the permissible limits (30 mg L^{-1}) in all the locations. About 6.36% of area is having magnesium concentration in the range 45-100 mg L^{-1}. 93% of the area is having very high concentration more than maximum permissible value of 100 mg L^{-1}.

Figure 5 shows the spatial distribution of magnesium.

Sodium

Sodium concentration in study areas shows variations from 28 mg L^{-1} to 165 mg L^{-1}. It is reclassified into three classes namely <50 mg L^{-1}, 50-100 mg L^{-1} and >100 mg L^{-1} (Figure 6).

All locations were within the permissible limits (200 mg L^{-1}).

Potassium

Potassium is classified into three classes viz., <20 mg L^{-1}, 20-40 mg L^{-1} and >40 mg L^{-1} as shown in Figure 7. About 56.33% of the area is having concentration < 20 mg L^{-1}, 29.72% of area under 20-40 mg L^{-1} and >40 mg L^{-1} concentration is covered by 13.94% of the area.

Sulphates

The concentration of sulphate was found to be more than the permissible limits (200 mg L^{-1}) in all the locations except Pallapatti, Nagamballi and Kodanthur. Sulphate is classified into four classes namely <200 mg L^{-1}, 200-400 mg L^{-1}, 400-600 mg L^{-1} and >600 mg L^{-1} (Figure 8).

About 70% of the area is having concentration 200-400 mg L^{-1} and 24.9% with 400-600 mg L^{-1}. Two locations Pungambadi (E) and Vairamadai in Aravakurichi and K. Paramathi block respectively is having very high concentration of sulphate (>600 mg L^{-1}).

Table.1 Selected sampling stations in Aravakurichi and K. Paramathi block

Sr. No	Block	Village		Well type	Latitude	Longitude	
1	K.Paramathi	Puthukkanalli		Bore well	10.95	77.96	
2	K.Paramathi	Thennilai		Bore well	10.93	77.83	
3	K.Paramathi	Vairamadai		Bore well	10.94	77.78	
4	K.Paramathi	Kodanthur		Bore well	10.93	77.79	
5	K.Paramathi	Poondipalayam		Bore well	11.00	77.79	
6	K.Paramathi	Kuppam		Bore well	11.01	77.92	
7	K.Paramathi	Chinnadharapuram (a)		Surface water	10.85	77.84	
8	K.Paramathi	Chinnadharapuram (b)		Bore well	10.85	77.85	
9	K.Paramathi	Rajapuram (a)		Bore well	10.81	77.88	
10	K.Paramathi	Rajapuram (b)		Open well	10.81	77.88	
11	Aravakurichi	Nagamballi		Bore well	10.81	77.92	
12	Aravakurichi	Kodaiyur		Bore well	10.88	77.98	
13	Aravakurichi	Pungambadi (E)		Bore well	10.76	77.96	
14	Aravakurichi	Pallapatti		Bore well	10.72	77.90	
15	Aravakurichi	Eurumarpatti		Bore well	10.71	77.96	
16	Aravakurichi	Sendamangalam		Open well	10.68	77.85	
17	Aravakurichi	Santhapadi (a)		Bore well	10.75	77.83	
18	Aravakurichi	Santhapadi (b)		Open well	10.78	77.82	

Table.2 Salinity hazard classes based on USSL classification

Salinity hazard class	EC (micromhos cm^{-1})	Remark
C1	100-250	Low
C2	250-750	Medium
C3	750-2250	High
C4	>2250	Very high

Table.3 Sodium hazard classes based on USSL classification

Sodium Hazard class	SAR	Remark
S1	<10	Low
S2	10-18	Medium
S3	18-26	High
S4	>26	Very high

Table.4 List of the stations exceeding permissible values for potability as per BIS

Parameter	Permissible limit	Remark	Areas exceeding permissible values for potability
		Beyond this range the water	
pH	6.5 to 8.5	Will affect the mucous membrane and / or water supply system	Nil
		Encrustation in water supply	Eurumarpatti, Santhapadi, Puthukkanalli, Thennilai, Chinnadarapuram, Kodaiyur, Sendamangalam,
Calcium as Ca	75 mg L^{-1}	structure and adverse effects on domestic use	Pallapatti, Rajapuram, Poondipalayam, Santhapadi, Kuppam, Vairamadai, Nagamballi, Pungambadi(E)
Magnesium as Mg	30 mg L^{-1}	-	All locations
Chloride as Cl	250 mg L^{-1}	Beyond this limit tats, corrosion and palatability are effected	Chinnadarapuram, Kuppam, Rajapuram, Santhapadi, Sendamangalam,Chinnadharapuram Rajapuram, Vairamadai, Pallapatti, Nagamballi, Pungambadi(E)
Sulphate as SO_4	200 mg L^{-1}	Beyond this causes gastro intentional irritation when magnesium or sodium are present	Eurumarpatti, Rajapuram, Sendamangalam Puthukkanalli, Thennilai, Santhapadi, Chinnadharapuram, Kodaiyur, Poondipalayam, Rajapuram, Santhapadi, Kuppam, Pungambadi(E), Vairamadai
(Source: Maruthi, 2013)			

Table.5 Salient features of groundwater samples for irrigation suitability for K. Paramathi and Aravakurichi block

Sr. No	Village	pH	SAR	EC
				dS m^{-1}
	K. Paramathi block			
1	Puthukkanalli	7.72	3.24	1.36
2	Thennilai	7.49	3.29	1.13
3	Vairamadai	7.55	1.09	3.01
4	Kodanthur	7.30	0.72	0.71
5	Poondipalayam	7.80	1.41	1.15
6	Kuppam	8.10	2.63	1.56
7	Chinnadharapuram (a)	7.73	1.85	2.06
8	Chinnadharapuram (b)	7.82	2.85	1.27
9	Rajapuram (a)	6.98	2.64	1.54
10	Rajapuram (b)	7.97	2.51	2.06
	Aravakurichi block			
11	Nagamballi	7.93	1.48	4.42
12	Kodaiyur	7.63	2.33	1.30
13	Pungambadi (East)	7.69	1.98	3.28
14	Pallapatti	7.37	2.12	3.06
15	Eurumarpatti	7.75	1.94	0.65
16	Sendamangalam	7.92	2.31	1.50
17	Santhapadi (a)	7.97	1.95	1.65
18	Santhapadi (b)	7.77	2.36	1.16

Table.6 Salinity hazard classification based on USSL classification

Sr. No	Village		EC dS m^{-1}	Classification
		K.Paramathi block		
1	Puthukkanalli		1.37	C3
2	Thennilai		1.13	C3
3	Vairamadai		3.01	C4
4	Kodanthur		0.71	C2
5	Poondipalayam		1.15	C3
6	Kuppam		1.56	C3
7	Chinnadharapuram (a)		2.06	C3
8	Chinnadharapuram (b)		1.27	C3
9	Rajapuram (a)		1.54	C3
10	Rajapuram (b)		2.06	C3
		Aravakurichi block		
11	Nagamballi		4.42	C4
12	Kodaiyur		1.30	C3
13	Pungambadi (East)		3.28	C4
14	Pallapatti		3.06	C4
15	Eurumarpatti		0.65	C2
16	Sendamangalam		1.50	C3
17	Santhapadi (a)		1.69	C3
18	Santhapadi (b)		1.16	C3

Table.7 Classification of Groundwater as per Sodium Adsorption Ratio (SAR)

Sr. No	Village		SAR	Classification
		K.Paramathi block		
1	Puthukkanalli		3.24	S1
2	Thennilai		3.29	S1
3	Vairamadai		1.09	S1
4	Kodanthur		0.72	S1
5	Poondipalayam		1.41	S1
6	Kuppam		2.63	S1
7	Chinnadharapuram (a)		1.85	S1
8	Chinnadharapuram (b)		2.85	S1
9	Rajapuram (a)		2.64	S1
10	Rajapuram (b)		2.51	S1
		Aravakurichi block		
11	Nagamballi		1.48	S1
12	Kodaiyur		2.33	S1
13	Pungambadi (East)		1.98	S1
14	Pallapatti		2.12	S1
15	Eurumarpatti		1.94	S1
16	Sendamangalam		2.31	S1
17	Santhapadi (a)		1.95	S1
18	Santhapadi (b)		2.36	S1

Fig.1 Water sample location map

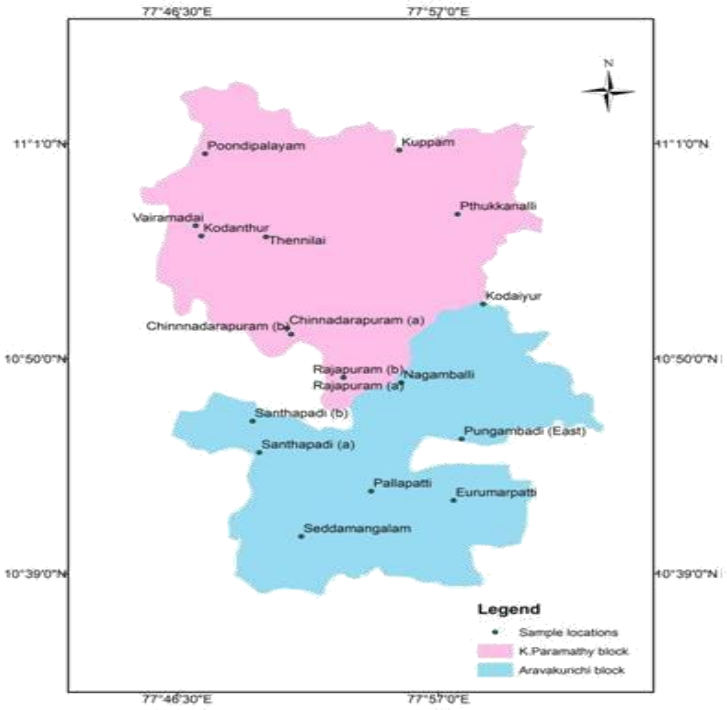


Fig.2 Thiessen polygon map showing the rain gauge stations and observation wells in Aravakurichi and K. Paramathi block

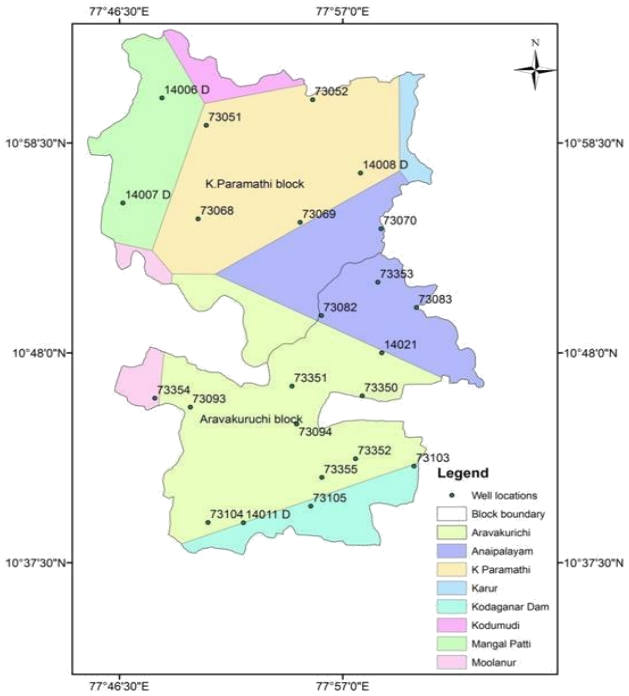


Fig.3 Water sample location map

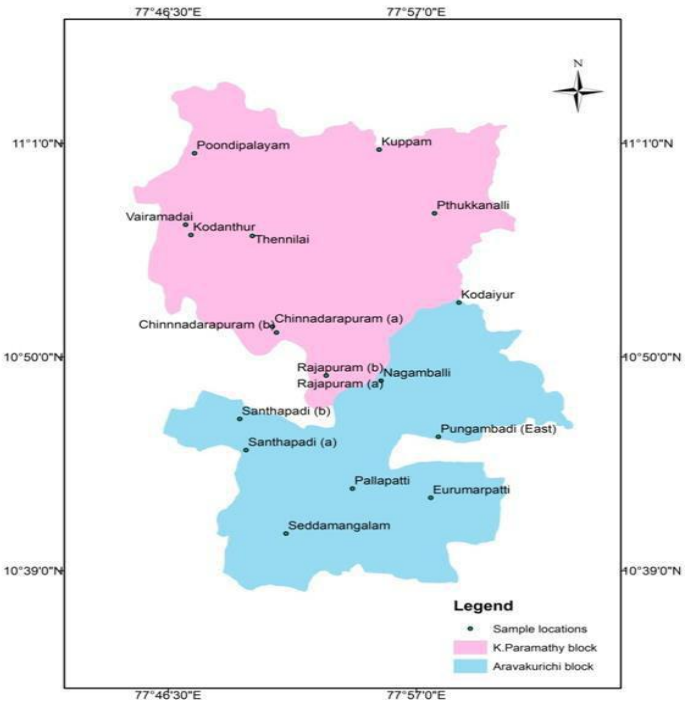


Fig.4 Thematic map of Sodium Concentration in water

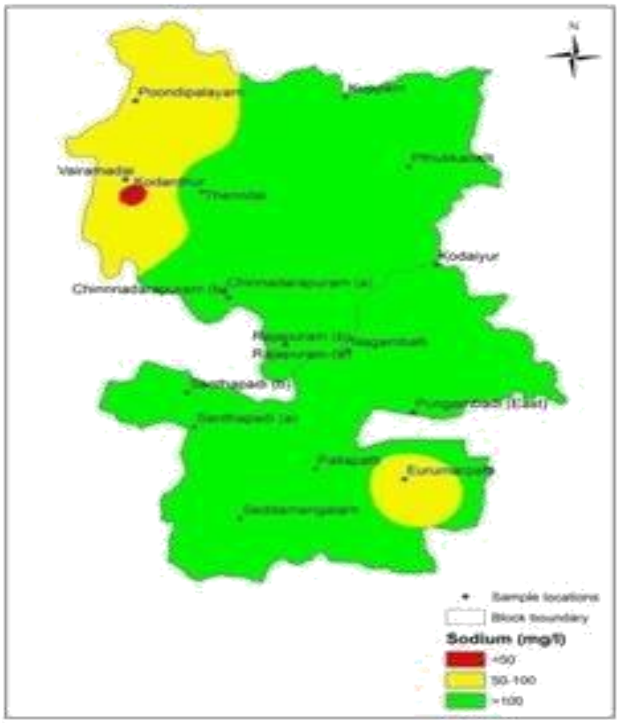


Fig.5 Thematic map of Potassium Concentration in water

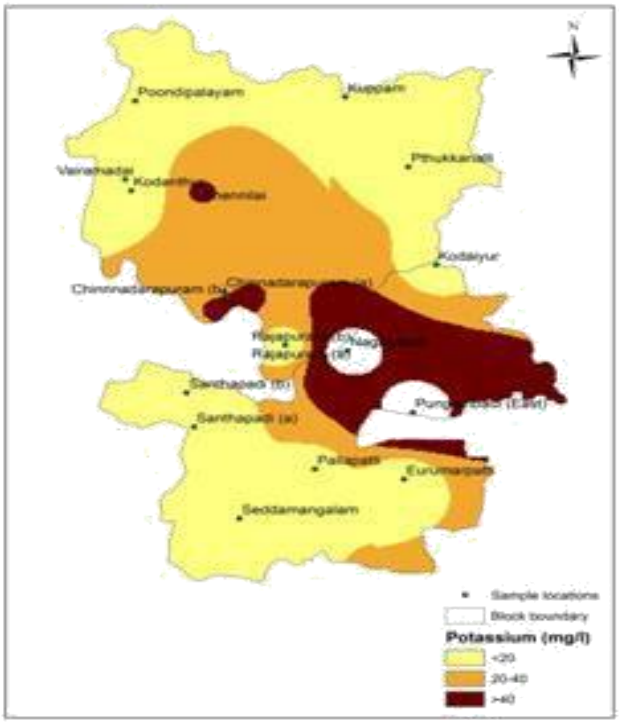


Fig.6 Thematic map of sulphate concentration in water

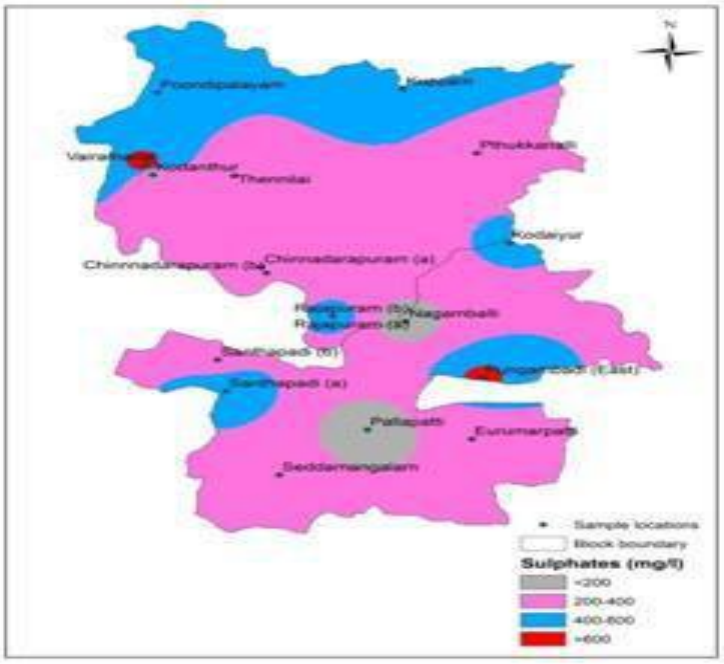


Fig.7 Thematic map of EC Figure 4.30 Thematic map of SAR

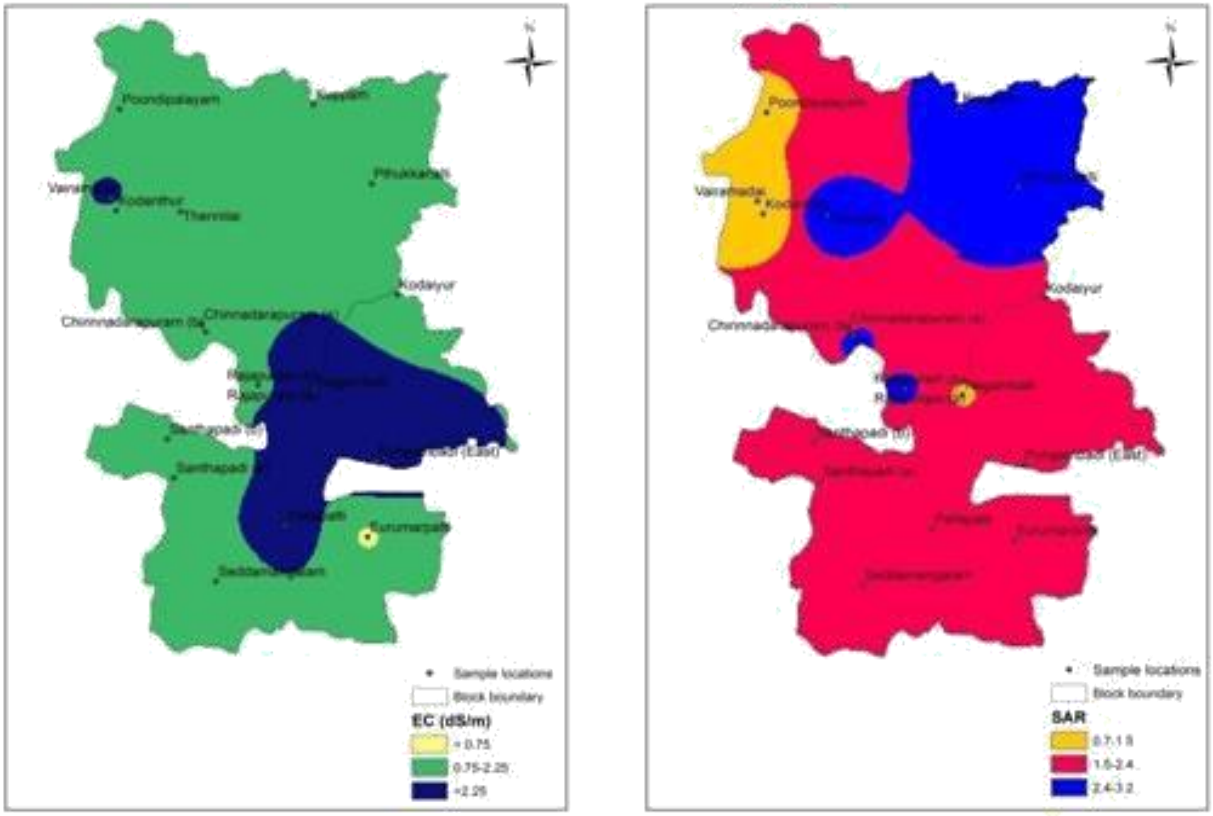


Fig.8 Thematic map of pH Concentration in water

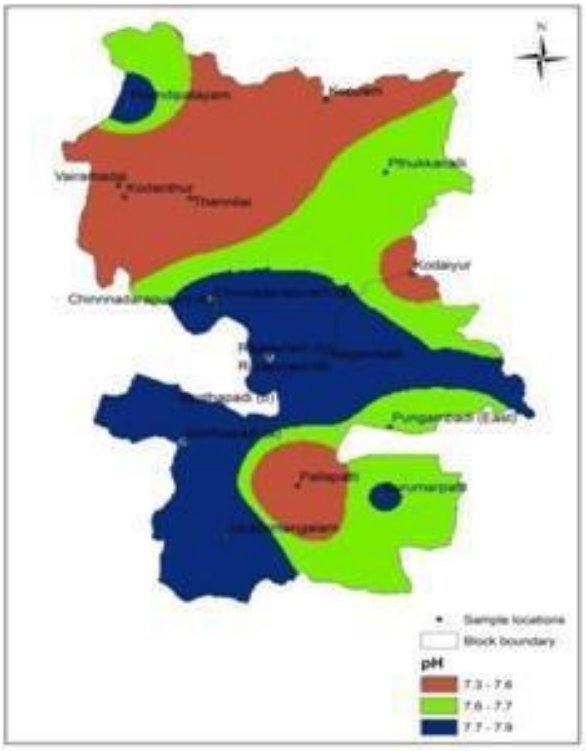


Fig.9 Thematic map of Chloride Concentration in water

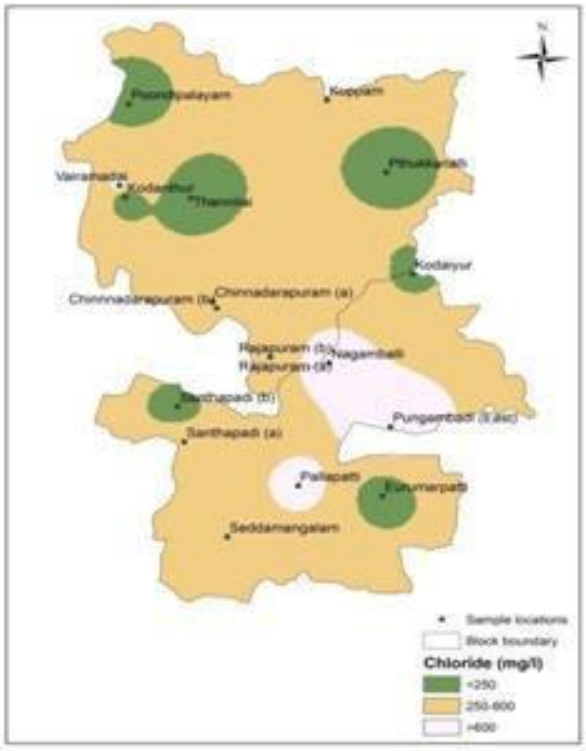
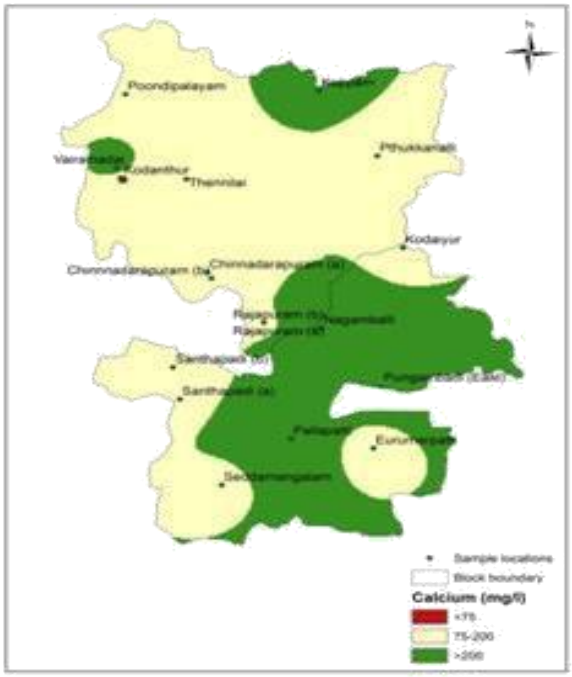
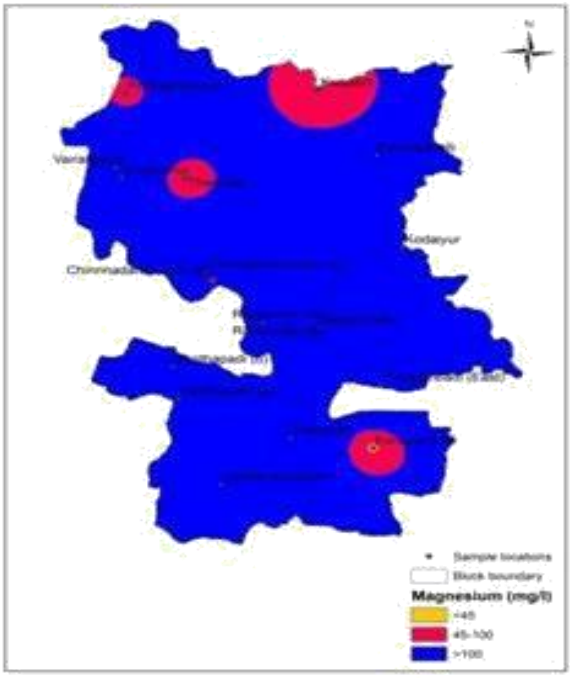


Fig.10 Thematic map of Calcium concentration in water **Figure 11** Thematic map of Magnesium concentration in water





Thematic maps for irrigation suitability (EC and SAR)

The thematic maps for spatial distribution are generated on the basis of different categories of groundwater samples, depicting the places of Saline and Alkali waters in the blocks. The prepared thematic maps of Aravakurichi and K. Paramathi blocks for EC and SAR are shown in Figures 9 and 10.

Conductivity, Calcium, Magnesium, Sodium, Potassium, Chloride, Sulphates, Carbonate and Bicarbonate.

To determination EC, SAR and classify the groundwater for irrigation suitability as per USS (iii) to generate various thematic maps of water quality parameters using Remote Sensing and Geographical Information system. Eight samples from Aravakurichi block and ten samples from K. Paramathi block were selected for the present study. Latitude and Longitude values for all locations were measured with Global Positioning System (GPS) and plotted in the base map. The collected groundwater samples have been analyzed in Water Technology Centre Laboratory, Tamil Nadu Agricultural University using standard methods given by American Public Health Association (APHA). Samples were also classified representing salinity and alkalinity as per the criteria suggested by the US Salinity Laboratory. Finally ArcGIS10.1 software has been used for generating thematic maps for various water quality parameters, SAR map.

The results derived from the groundwater quality are summarised and given below

The final output has been given in the spatial representation of groundwater quality in the study area. The analysis indicates that the groundwater of the study area needs some degree of treatment before consumption. The study helps to understand the quality of water as well as to develop suitable management practices to protect the groundwater sources.

All the locations are having pH within the permissible limit (6.5-8.5).

Most of the locations are under high salinity category, whereas a few locations like Vairamadai, Pallapatti Pungambadi (East), Nagamballi have very high salinity.

It is found that majority of the locations in both the blocks have high levels of calcium, magnesium, chloride and sulphate concentration.

Chloride concentration in most of the sample was found to be more than desirable level (250 mg L^{-1}) stipulated by BIS.

Most of the area (78%) had chloride in the range of 250-600 mg L^{-1} followed by <250 mg L^{-1} of 13.5%, 8.24% of area is having concentration of >600 mg L-1.

EC Calcium concentration of 75-200 mg L-1covered about 61% of Electrical Conductivity (EC) is classified into four categories the area, which covers almost Aravakurichi block. Only 5.3% of namely, <0.75, 0.75-2.25 and >2.25 dS m-1. About 79.9% of area the area is within the desirable value of 75 mg L-1.The rest of the is having EC ranging from 0.75-2.25 dS m-1, which is classified area (38%) is having concentration >200 mg L-1 under C3 class by USSL as per salinity hazard class.

SAR

Sodium Adsorption Ratio (SAR) is within the permissible limit, and is classified under S1 class as per USSL. It is mapped based on three classes viz., 0.7-1.5 (6.68%), 1.5-2.4 (72.08%) and 2.4-3.2 (21.22%).

Assessment of groundwater quality

Groundwater is the major source of drinking water in Karur district, Tamil Nadu, India. Due to industrialization and urbanization the problem of providing good quality water for drinking and irrigation has become very critical

now in Karur district. The present study was an attempt to study the current groundwater quality of the two blocks, Aravakurichi and K. Paramathi of Karur district. The objectives of the study were (i) to analyze ten water quality parameters such as pH, Electrical

About 6.36% of area is having magnesium concentration in the range 45-100 mg L^{-1}. 93% of the area is having very high concentration more than maximum permissible value of 100 mg L^{-}

The concentration of sulphate was found to be more than the permissible limits (200 mg L^{-1}) in all the locations except Pallapatti, Nagamballi and Kodanthur. About 70% of the area is having concentration 200-400 mg L^{-1} and 24.9% with 400-600 mg L^{-1}. Two locations Pungambadi (E) and Vairamadai in Aravakurichi and K. Paramathi block respectively were found to have very high concentration of sulphate (>600 mg L^{-1}). About 79.9% of area is having EC ranging from 0.75-2.25 dS m^{-1}, which is classified under C3 class by USSL as per salinity hazard class.

Sodium Adsorption Ratio (SAR) is within the permissible limit, and is classified under S1 class as per USSL.

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