ISSN: 0975-833X

Available online at http://www.journalcra.com

International Journal of Current Research
Vol. 8, Issue, 05, pp.30981-30985, May, 2016

INTERNATIONAL JOURNAL OF CURRENT RESEARCH

RESEARCH ARTICLE

HYDROCHEMICAL ANALYSIS AND GROUNDWATER QUALITY IN TRICHIRAPPALLI DISTRICT, TAMIL NADU - AN GEOMATIC BASED APROACH

***Shanthi, D. and Sankar, K.**

Department of Industries and Earth Sciences, Tamil University, Thanjavur-613 010

ARTICLE INFO

Article History:
Received 10th February, 2016
Received in revised form
23rd March, 2016
Accepted 09th April, 2016
Published online 10th May, 2016

Key words:

Ground water,
Water quality,
Trichirappalli District.

ABSTRACT

Water is one of the most valuable natural resources, which supports human health, economic development and ecological diversity. Because of its several inherent qualities (Eg., consistent temperature, wider spread and continuous availability, excellent natural quality, limited vulnerability, low development cost, drought reliability etc.). It has become an immensely important and dependable source of water supplies in all climate regions including both urban and rural areas of development and developing countries. Major portion of the surface water and ground water is being consumed by agriculture and the left over portion is used for industrial and domestic requirements Trichy has located in centre of Tamilnadu (India). Its border populated upto Perambalur district. The people in the 40 villagers use kollidam river water and the ground water for drinking. Lot of work has been done and published already on the ground water quality of many villages in trichy district. But there is a need to undertake the study to assess the drinking water quality. Hence water samples of twenty five villages were subjected to physio-chemical parameters such as pH, electrical conductivity (EC), total dissolved solids (TDS), total hardness (TH), Calcium (Ca), Magnesium (Mg), Sodium (Na), Potasium (K), Chloride (Cl), Sulphate (SO_4) were analyzed and were compared with standard prescribed by WHO and suitable suggestion were made. The correlation coefficients were calculated for water quality assessment.

Citation: Shanthi, D. and Sankar, K. 2016. "Hydrochemical analysis and groundwater quality in Trichirappalli district, Tamil Nadu - An geomatic based aproach", *International Journal of Current Research*, 8, (05), 30981-30985.

INTRODUCTION

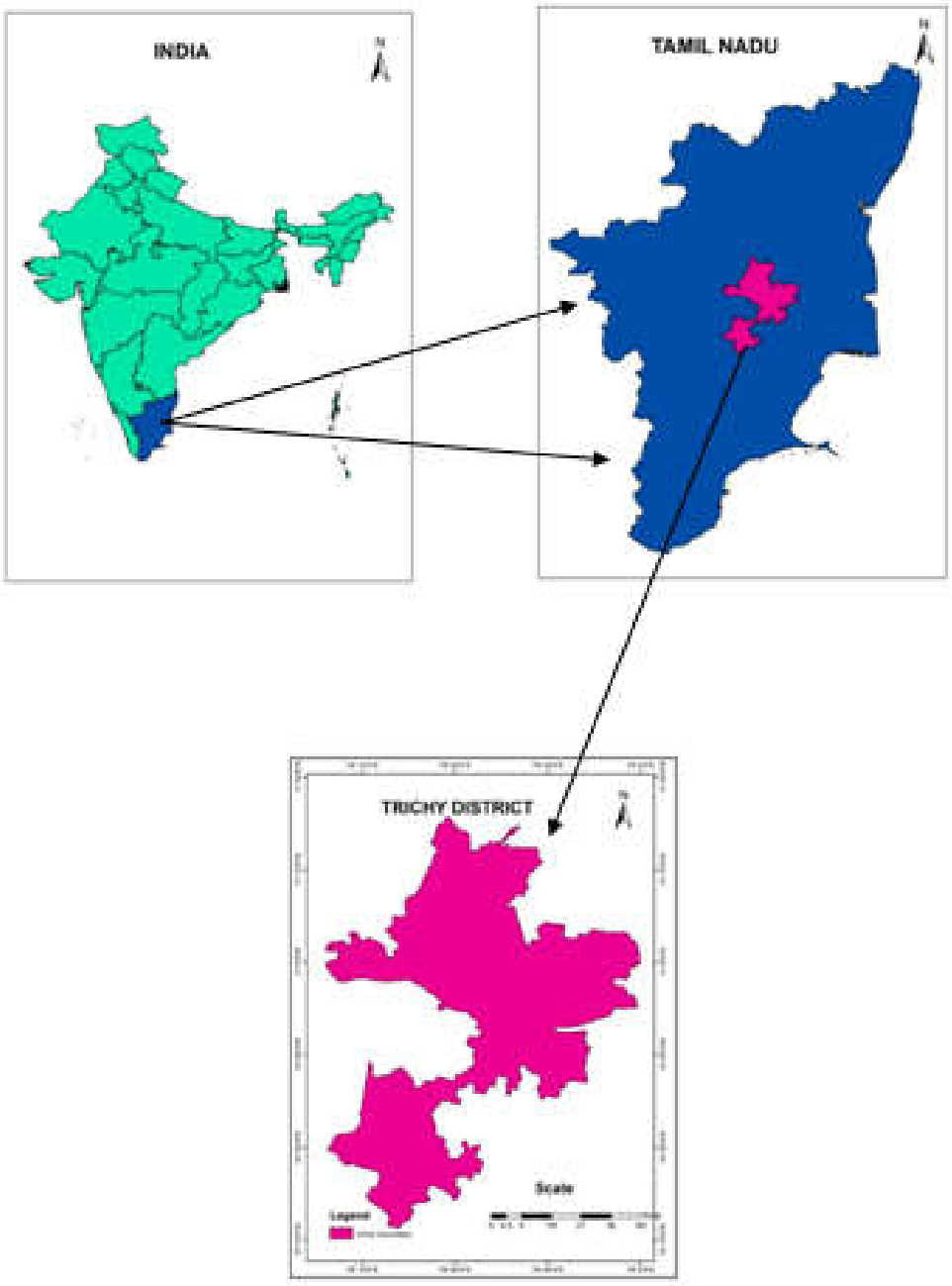
Water is a common chemical substance that is essential for the survival of all known forms of life. In typical usage, water refers only to its liquid form or state, but the substance also has a solid state, ice, and a gaseous state, water vapor or steam. Water covers 71% of the Earth's surface. On Earth, it is found mostly in oceans and other large water bodies, with 1.6% of water below ground in aquifers and 0.001% in the air as vapor, clouds (formed of solid and liquid water particles suspended in air), and precipitation. Saltwater oceans hold 97% of surface water, glaciers and polar ice caps 2.4%, and other land surface water such as rivers, lakes and ponds 0.6%. A very small amount of the Earth's water is contained within biological biological bodies and manufactured products. Other water is trapped in ice caps, glaciers, aquifers, or in lakes, sometimes providing fresh water for life on land. Clean, fresh drinking water is essential to human and other life. Access to safe drinking water has improved steadily and substantially over the last decades in almost every part of the world. However, some observes have estimated that by 2025 more than half of the world pollution will be facing water-based vulnerability, a situation which has been called a water crisis by the United Nations. Water plays an important role in the world economy, as it functions as a solvent for a wide variety of chemical substances and facilitated industrial cooling and transportation. Approximately 70 percent of freshwater is consumed by agriculture. Water in this zone is always on the move getting recharged by rainwater and discharged either through pumping (or) by flow to the lower sections of the valley and contributing to the base flow of rivers. There is however, a larger reservoir of water at depth extending perhaps to 500 m below ground level. Generally, groundwater is found to be more hard compared to surface water. In most regions, ground water in recharge areas percolated down ward under the pull of gravity.

****Corresponding author: Shanthi, D.***
Department of Industries and Earth Sciences, Tamil University, Thanjavur-613 010

Location and Administrative Setup

The district has an area of 4404 Sq. Kms and it is bounded by Perambalur district on the north, Thanjavur district on the east, Pudukkottai and Dindigul districts on the south and Karur

district on the west. Being a place located centrally in the State, it has excellent transport link to all other districts in the State.



Location map of the Study area

The district lies between 10^0 to 11^0 30' north latitude and between 77^0 45'to 78^0 50' east longitude.

MATERIALS AND METHODS

The water samples were collected from open and boreholes in the study area. One liter of water samples were collected polythene bottles from various wells during the month of February and March 2014. Totally twenty five samples were collected from 25 locations, for analysis various physiochemical parameters, pH were measured by portable pH meter, EC were measured Electrode, then TDS were done by calculation method, With respect to cation, Calcium, Magnesium was analyzed volumetric method. Sodium, potassium were analyzed by flame photometry, with respect to anions chloride, Bicarbonate were done by volumetric method, Nitrate, Sulphate were estimated turbidity method. Analyzing method followed (AAPHA, 1998).

RESULTS AND DISCUSSION

The results of the analysis are presented in the Table 1 & 2. The pH value of all samples falls within the permissible limit (ie) minimum of 7.2 and maximum of 8.4. Electrical conductivity (EC) of water is direct function of its total dissolved salts. EC range varies between 367 to 3355 in the study area.

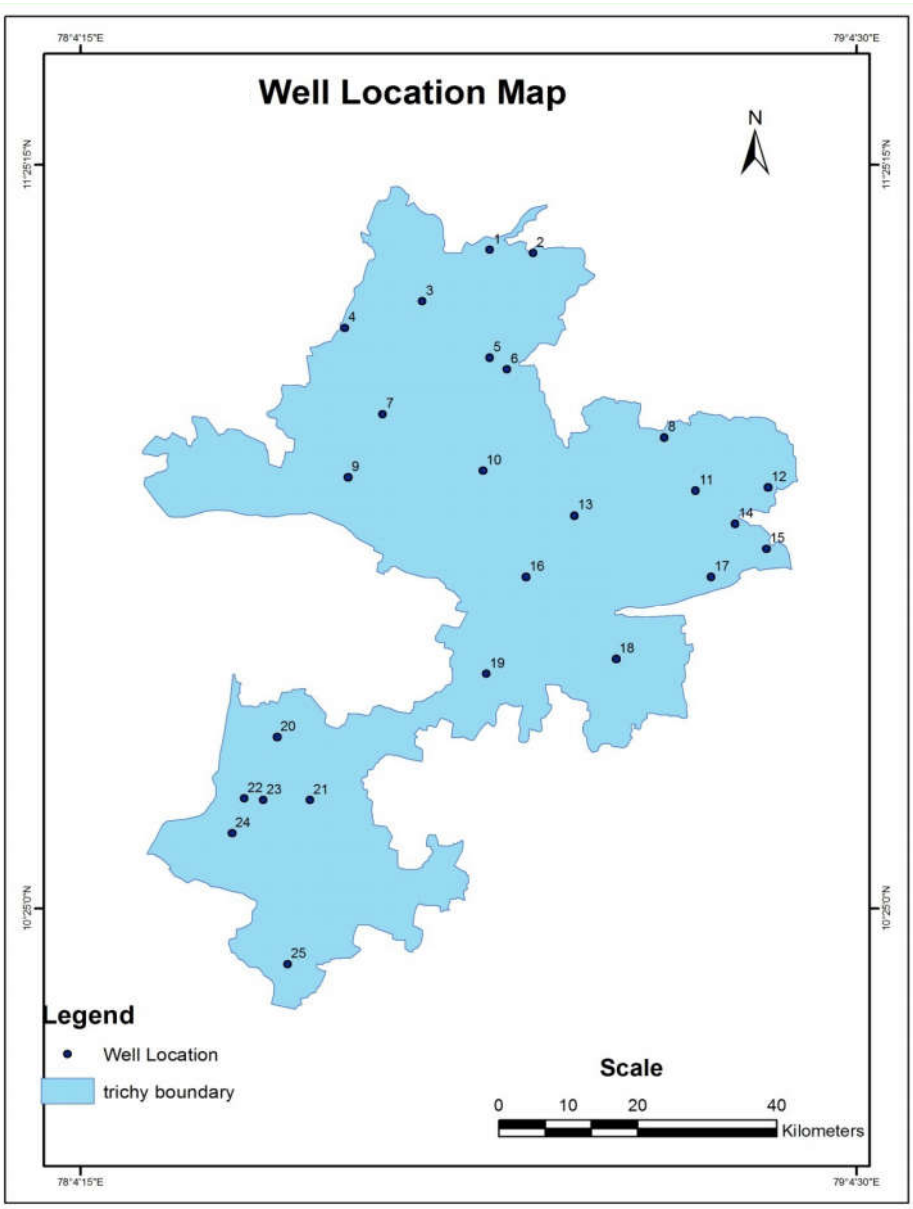


Table 1. Chemical concentration of the sample collected in Trichirappalli District, Tamilnadu (in ppm) value

Well No	Village	EC	pH	Ca	Mg	Na+K	Cl	SO_4	HCO_3	CO_3	TDS
1	Teranippalaiyam	2966	7.3	168	84	390.8	992.6	1.7	427	0	1898.24
2	Murungapatti	1196	7.5	28	4.8	114.9	106.3	1.5	444	0	765.44
3	Kanjirimalai	1137	7.4	48	33	114.6	248.1	3	280	0	727.68
4	Kallatukombai	840	7.7	16	7.3	114.8	159.5	4.2	207	0	537.6
5	Venkatacgalapuram	882	7.8	28	3.4	97.4	128.4	3	268	0	564.48
6	Uppliyapuram	737	7.4	24	2.4	298.2	124.8	1.7	207.1	0	471.68
7	Angiyam	1750	7.3	16	26.4	620.6	230.4	4.7	597.3	0	1120
8	Sangampatti	3355	7.6	188	69.6	645.7	129.2	10.3	146.4	0	2147.2
9	Kirambur	3302	7.2	44	26.4	20.7	744.3	8.1	707.4	0	2113.28
10	Anjalam	369	7.4	28	4.8	73	342.5	4.3	134.2	0	236.16
11	Devanur	623	7.2	24	9.8	104.3	88.9	3	195.2	0	398.72
12	Kannurpalaiyam	881	7.8	56	7.2	160.8	106.3	2.2	305	0	563.84
13	Pagalavadi	1416	8.1	72	2.5	123.3	248.1	2.3	427	0	906.24
14	Nallavannipatti	565	7.5	18	26.8	160.9	70.9	4.3	195.2	0	361.6
15	Maniyankurichchi	717	7.2	44	16.6	183.3	106.3	24	207.4	0	458.88
16	M.Kannanur	1232	7.6	64	26.4	57.7	265.8	2.5	305	0	788.48
17	Unniyur	3343	7.7	224	115.3	73.5	113.6	6.5	244	0	2139.52
18	Vendanpatti	1228	8.3	68	19.2	183.9	301.3	24	231	0	785.92
19	Arangur	555	7.7	16	7.3	98.9	87.4	3	195	0	355.2
20	Sittilarai	367	8.4	96	55.5	135.6	319.5	43	292.3	0	234.88
21	Tadampatti	892	7.5	132	31.2	143.4	124.1	32	293.4	0	570.88
22	Tandalaiputhur	884	7.4	72	36.5	136.5	212.7	48	292.4	0	565.76
23	Kurikkarankulam	1300	7.6	45	158.2	156.7	191.3	13	146.4	0	832
24	Talutalaipatti	940	7.3	140	57.7	67.9	98.5	12	135	0	601.6
25	Reddimangudi	565	7.2	73	53.3	192.3	167.5	24	319	0	361.6

Table 2. Geochemical Characteristics of Trichirappalli District, Tamilnadu

Well No	Village	RSC	SAR	PI	MR	CR	TH
1	Teranippalaiyam	-10.77	2.14	37.57	53.57	3.69	0.6
2	Murungapatti	-10.73	2.13	37.47	51.66	3.69	0.012
3	Kanjirimalai	-35.06	1.13	14.94	18.19	3.17	1.8
4	Kallatukombai	-11.98	2.11	35.8	51.88	3.64	0.7
5	Venkatacgalapuram	-10.61	1.86	35.36	53.78	3.15	0.6
6	Uppliyapuram	-11.86	2.04	35.43	49.68	3.43	0.7
7	Angiyam	-13.68	1.83	31.5	62.24	3.23	0.79
8	Sangampatti	-10.81	2.31	39.04	51.56	3.53	0.6
9	Kirambur	-12.76	1.61	30.63	62.24	2.82	0.7
10	Anjalam	-10	2.11	38.16	47.64	3.42	0.5
11	Devanur	-10.71	1.78	34.21	53.11	4.05	0.6
12	Kannurpalaiyam	-11.51	1.74	32.98	53.39	3.11	0.6
13	Pagalavadi	-9.16	2.11	39.7	48.33	2.81	0.5
14	Nallavannipatti	-13.6	1.8	31.27	62.25	3.33	0.7
15	Maniyankurichchi	-14.76	2.32	41.65	47.64	3.17	0.5
16	M.Kannanur	-9.74	1.2	29.54	48.73	3.88	0.5
17	Unniyur	-10.49	2.05	37.21	53.4	3.38	0.6
18	Vendanpatti	-11.56	1.92	34.46	53.98	3.53	0.6
19	Arangur	-10.45	1.99	28.02	37.37	3.04	0.6
20	Sittilarai	-8.52	1.11	30.4	45.62	3.21	0.5
21	Tadampatti	-10.26	1.89	35.96	48.13	3.65	0.6
22	Tandalaiputhur	-11.16	2.12	36.67	48.59	3.75	0.6
23	Kurikkarankulam	-10.46	1.9	36.34	50.91	0.29	0.6
24	Talutalaipatti	-10.57	1.91	37.97	52.04	3.78	0.6
25	Reddimangudi	-10.33	1.9	32.93	62.26	3.25	0.7

Table 3. International Standards

	WHO Standards 1977		Study area		
Parameter	Highest Desirable	Maximum permissible	Range		Polluted samples
			Maximum	Minimum	
pH	7.0 – 8.5	6.5 –9.2	8.4	7.2	-
TDS	-	-	2139	355.2	-
Calcium	75	200	224	16	17
Magnesium	30	150	158.2	2.4	23
Chloride	200	600	992.6	70.9	1,9
Sulphate	200	400	48	1.5	-
Sodium	200	400	645.7	20.7	7,8

Table 4. Values obtained for chemical parameters in BIS standard in the study area

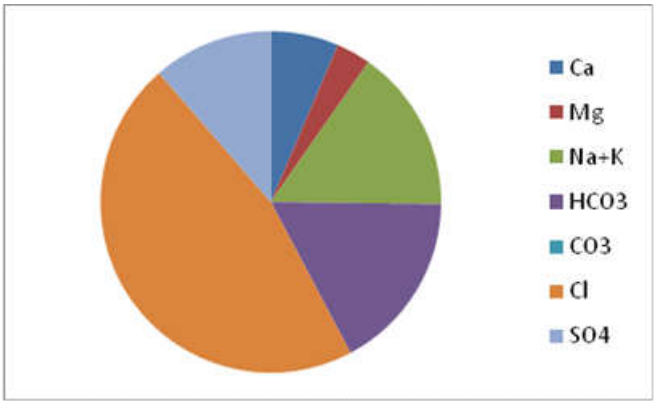
S.No	Parameters	BIS Standard	Polluted samples
1	pH	6.5-8.5	-
2	TH	300	-
3	Ca	75-200	17
4	Mg	50-150	23
5	Na	200	1,6,7,8
6	Cl	200-600	1,9
7	SO_4	200	-

Table 5. Chemical parameters concentration in percentage of (ppm) pie diagram in Trichirappalli district, Tamilnadu

Ca	Mg	Na+K	HCO3	CO3	Cl	SO4
6.42	3.26	15.53	17.08	0	46.4	11.35

Table 6. Quality classification of irrigation water

Water Class	Salinity hazard mhos		Alkali hazard SAR	RC in me/l
	EC in μ mhos/cm at 25^{0}C	Salt concentration (me/l)		
Excellent	<250	<0.25	Up to 10	<1.25
Good	250-750	0.25-7.50	10-18	1.25-2.50
Medium	750-2250	7.50-22.50	18-26	>2.50 poor
Bad	2250-4000	22.50-40.00	>26	
Very bad	>4000	>40		



Pie diagram of ppm concentration in Trichirappalli district, Tamilnadu

The total dissolved solids indicate the salinity behavior of ground water. The minimum and maximum recorded were 355.2 and 2139. The total hardness is the measure of the capacity of water to precipitate soap. The maximum level of total hardness is due to presence of carbonate and non carbonate hardness.

Conclusion

The Electrical conductivity of the study area shows that it varies from 367 to 3355 µs/cm. But, most of the groundwater samples have EC higher than 1000 µs/cm. Sodium is the dominant cation and Chloride is the dominant anion in the study area. Based on hardness, the groundwater samples are moderately hard to very hard in nature. Based on the water quality standards, all the ions are present within the permissible limits except in EC and calcium. The quality of the groundwater is verified with WHO standards, which shows most of the groundwater samples are well within the suitable drinking purposes.

REFERENCES

Amadi, U.M.P. 1987. Mixing phenomenon in groundwater systems and its relevance in water quality assessment in Nigeria. In: Klwugon (Ed.), paper presented at the 2nd annual symposium of Nigeria Water and Sanitation Association 17:1-17.31.

Davies, S.N. and Dewiest, R.J.M. 1966. Hydrogeology John Wiley and Sons New York 436p.

Lohnert, E.P. 1970. Grundwasserchemismus and Kationentaush in Norddeutschen Flachland Z.dt geol. Ges. Sonderheft. Hydrogeochem 139-159 Hanover.

LOHNERT, E.P. 1973. Austauskhwaesser in H. Schneider (Hrsg) Die Grunwassererschiessung 2nd Edition, 138-144 vulkan verlag. Essen

Nton, M.E., Adejumo, S.A. and Elueze, A.A. 2007. Hydrogeochemical assessment of surface and groundwater quality in Agbowo-Orogun area of Ibadan Southwestern Nigeria. *Global Jour. Geol. Sci*., v.5 (1&2), pp.13-24.

WHO 2004. Guidelines for drinking water quality (2nd ed., Vol. 1, p. 188). Recommendations, Geneva: World Health Organization.

Singh, A.K., Mondal, G.C., Kumar, S., Singh, T.B., Tewary, B.K. and Sinha, A. 2008. Major ion chemistry, weathering processes and water quality assessment in upper catchment of Damodar River basin, India. *Environ. Geol*., v.54, pp.745-758.

Todd, D.K. 1980. Groundwater Hydrology. John Wiley and Sons.

Tijani, M.N 1994. Hydrological Assessment of Groundwater in Moro Area, Kwara State, Nigeria. *Environmental Geology,* 24: 194-202.

Vasanthavigar, M., Srinivasamoorthy, K., Vijayaragavan, K., Rajiv-Ganthi, R., Chidambaram, S. Anandhan, P. Manivannan, R. and Vasudevan, S. 2010. Application of water quality index for groundwater quality assessment: Thirumanimuttar sub-basin, Tamil Nadu, India. Environmental Monitoring Assessment.

WHO 2004. Guidelines for drinking water quality (2nd ed., Vol. 1, p. 188). Recommendations, Geneva: World Health Organization.

****