



ChemTech

International Journal of ChemTech Research

CODEN (USA): IJCRGG, ISSN: 0974-4290, ISSN(Online):2455-9555
Vol.13 No.03, pp 107-110, 2020

Physico–Chemical analysis of groundwater quality near the salt-pans of Thoothukudi Districts, Tamilnadu, India

Jacob Vincent^{1*}, Chandra Lekha¹, Bagavathi²,
Bala Vijaya², Bhuvaneshwari², Guru Lakshmi²

^{1*}AP/ Chemistry, Kamaraj College, Tuticorin – 628002, TamilNadu, India

¹AP/ Chemistry, Kamaraj College, Tuticorin – 628002, TamilNadu, India

²III B.Sc. Chemistry, Kamaraj College, Tuticorin – 628002, TamilNadu, India

Abstract : The present hydrogeochemical study was confined to the Thoothukudi District in Tamilnadu, India. The groundwater quality near the salt-pans are polluted due to intensive pumping of fresh groundwater which has caused salt water to intrude into the fresh water aquifers. The major water quality parameters such as pH, Electrical conductivity, Total Dissolved Solids, Total Hardness, Calcium, Magnesium, Sodium, Chloride and Sulphate etc. were analyzed.

Keywords : Groundwater, BIS, TDS, Chloride, hardness, alkalinity, etc.

Introduction

Due to its wide distribution and ease of access, Ground water is an important resource for water. The actions on the environment have been intensified by the human beings and so they have become a primary cause for the impact on the chemical characteristics of the groundwater in certain locations [1]. In India, most of the population is dependent on groundwater as the only source of drinking water supply. The quality of groundwater is as important as its quantity, owing to the suitability of water for various purposes. Variation in groundwater quality in an area is a function of physical and chemical parameters that are greatly influenced by geological formations and anthropogenic activities [2]. In many coastal towns or cities, groundwater seems to be the only source of fresh water to meet domestic, agricultural and industrial needs. But groundwater is under constant threat of saline water incursion, which seems to have become a worldwide concern. The main objective of the present study is to evaluate the groundwater quality and its suitability for drinking, irrigation and domestic purpose in Thoothukudi District, as the groundwater is the only major source of water for drinking, irrigation and domestic purposes due to the lack of surface water in this region.

Jacob Vincent *et al*//International Journal of ChemTech Research, 2020,13(3): 107-110.

DOI= <http://dx.doi.org/10.20902/IJCTR.2019.130306>

Experimental

The groundwater samples (boreholes) were collected 300 meter away from the saltpans of Mullakadu (Tuticorin district), Palayakayal (Tuticorin district) and Arumuganeri (Tuticorin district). The sample bottles were labeled, sealed and transported to the laboratory under standard preservation methods. The major anionic and cationic concentrations were determined in the laboratory using the standard analytical procedures as recommended by the American Public Health Association (APHA 1995). Alkalinity and physical parameters such as temperature, pH and TDS were measured in the field. Ca^{2+} , Mg^{2+} , Cl^- , hardness and alkalinity were determined by volumetric titration methods. These parameters are tabulated in Table 1 and Table 2.

Table 1: Parameters measured for the water sample

	Parameters	Mullakadu Ground Water	Palayakayal Ground water	Arumuganeri Ground water
1	Appearance	Clear	Clear	Clear
2	Odour	None	None	None
3	pH	7.36	7.12	7.46
4	EC	2920	2564	3080
5	TDS	1256	1298	1500
6	Cl^-	1124	1890	2841
7	Total Alkalinity	1021	1230	1043
8	Total Hardness	2392	585	825

Table 2: Correlation Matrix for different parameters of Ground water of selected areas of Thoothukudi District

	pH	EC	TDS	CL	TA	TH
pH	1					
EC	0.999847	1				
TDS	0.620694	0.620694	1			
CL	0.345082	0.361466	0.955399	1		
TA	-0.92637	-0.91964	-0.26286	0.033796	1	
TH	0.348515	0.332047	-0.53347	-0.75946	-0.67585	1

Results and Discussion

The results of physicochemical analysis of different ground water samples are presented in Table 1. These results were compared with values of prescribed standard quality parameters of BIS (Bureau of Indian Standards).

1. pH

In our study area, all the pH values are within the desirable limit and suitable range. The maximum value of pH was recorded at Arumuganeri and minimum value at Palayakayal.

2. Electrical conductivity

The electrical conductivity of all the water samples exceeded the domestic water standards of $300\mu\text{mho/cm}$. These high values of electrical conductivity may be due to the high concentration of ionic constituents present in the water bodies. So these water samples cannot be used for drinking or domestic purposes.

3. Chloride

The maximum allowable limit of chloride is 1000 mg/L as per BIS classification. The groundwater samples of Tuticorin, Palayakayal and Arumuganeri Kayalpatinam have high chloride content than the permissible limits of BIS which is due to the effect of salt water intrusion from the salt pan.

4. Hardness

The maximum allowable limit of hardness is 500 mg/L as per BIS classification. The hardness value ranges from 585 to 2392 ppm. The total hardness values of some samples are found higher than the prescribed limit. This may be mainly due to the contamination by large quantities of sewage and detergents and high total hardness would lead to heart disease and kidney stone formation[3].

8. Total Dissolved Solids

TDS values varied from 1256 to 1500ppm. Water containing more than 500 mg/L of TDS is not desirable for drinking water purpose. In the present investigation TDS values are higher than the prescribed limit. The TDS concentration found to be above the permissible limit may be due to the leaching of various pollutants into the ground water which can decrease the potability and may cause gastrointestinal irritation in human and may also have laxative effect. High level of TDS may aesthetically be unsatisfactory for bathing and washing. The accumulation of organic and inorganic solids also contributes to high total dissolved solids[4].

9. Coefficient of Correlation (r):

The mathematical models used to estimate water quality require two parameters to describe the realistic groundwater situations. Correlation analysis measures the closeness of the relationship between chosen independent and dependent variables. This analysis attempts to establish the nature of the relationship between the variables and thereby provides a mechanism for prediction of forecasting[5]. In this study, the relationship of water quality parameters on each other in the data of water analyzed was determined by calculating correlation coefficient, R, by using the formula as given [6-7].

$$R = n \frac{\sum(x_i y_i) - \sum x_i \sum y_i}{\sqrt{[n \sum x_i^2 - (\sum x_i)^2][n \sum y_i^2 - (\sum y_i)^2]}}$$

Where, x (x=values of x-variable) and y (y=values of x-variable) represents two different water quality parameters. N=number of data points.

In statistics, correlation is a broad class of statistical relationship between two or more variables. The correlation study is useful to find a predictable relationship which can be exploited in practice. It is used for the measurement of the strength and statistical significance of the relation between two or more water quality parameters [8].

The correlation between the various parameters is studied using Pearson's Correlation coefficient Matrix [9]. Correlation is the mutual relationship between two variables. Direct correlation exists when increase or decrease in the value of one parameter is associated with a corresponding increase or decrease in the value of other parameter. The regression analysis explored the pattern of the relationship between the variables and the subsequent application of correlation analysis determined the extent to which the variables are related.. Considerably, significant positive correlation has been observed between pH and electrical conductivity (R= **0.99**), TDS and Cl (R=**0.95**). Similarly negative correlation has been observed between the parameters pH and Total alkalinity (R= **-0.92**). In our study the correlation is said to be perfect as the deviation in one variable is followed by a corresponding and proportional deviation in the other. The value of correlation coefficient lies between -1 and +1.

Conclusion

In the present study, the correlation study of groundwater revealed that all the parameters were more or less correlated with one another. In the light of correlation study, we can conclude that all the parameters are more or less correlated with each other, especially strong correlations observed between pH and electrical conductivity ($r=0.99$). The values of correlation coefficients and their significance levels will help in selecting the proper treatments to minimize the contaminations of the under ground water of Thoothukudi districts. The correlation study is very useful to get fairly accurate idea of the quality of the groundwater by determining just a few examples experimentally and then predicting the remaining from correlation equation.

References

1. Jacob V, Physico chemical analysis of ground water near municipal solid waste dumping sites in Arumuganeri, Thoothukudi District, Tamilnadu, India, Green Chemistry & Technology letters, 2016, 2(1), 35-37
2. Subramani T; Elango L, Damodarasamy S R, 2005, Groundwater quality and its suitability for drinking and agricultural use in Chithar River Basin, Tamil Nadu, India, Environ Geol, 47,1099–1110
3. Sirajudeen.J and KhadarMohideen.M Advances in Applied Science Research, 2014, 5(2):49-54
4. IndrajitSen and Shandil Advances in Applied Science Research, 2011,2(2) :161-166.
5. N Kumar; DK Sinha,International Journal of Environmental Sciences,2010, 1(2), 253-259.
6. VT Patil; PR Patil, Electronic Journal of Chemistry,2010. 7(1), 111-116.
7. K Jothivenkatachalam; A.Nithya; S.ChandraMohan,Rasayan Journal of Chemistry, 2010.
8. V.Kiran Mehta, Journal of Chemical pharmaceutical Research, 2010. 2(4), 663-670.
9. Jacob V,A correlation analysis on the ground water at selected areas of Thoothukudi district, tamilnaduindia, International Journal of ChemTech Research, 2019, 12(5), 281-284
