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**SEASONAL VARIATIONS IN PHYSICOCHEMICAL PARAMETERS
OF GROUNDWATER NEAR THAMIRABHARANI RIVER BAND IN
TIRUNELVELI DISTRICT, TAMILNADU, INDIA**

S.S. NAWAB ALI^{*}, M. MOHAMED SIHABUDEEN¹ AND S.S.SYED ABUTHAHIR²

PG & Research Department of Chemistry, Jamal Mohamed College (Autonomous),
Affiliated to Bharathidasan University, Trichy, Tamilnadu, India

***Corresponding Author: S.S. Nawab Ali; E Mail: nawabchemist@gmail.com**

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ABSTRACT

From last decade, the worth per barrel of drinking groundwater has outperforms the value of a barrel of oil in several areas of the world. Therefore, appropriate evaluation of groundwater potential and supervision practices were need of the day. Physicochemical assessment of groundwater in the Tirunelveli district, were determined with the parameters, like electrical conductivity (EC), Chloride (Cl), Calcium (Ca), Magnesium (Mg), Sodium (Na), Potassium (K), Sulphate (SO₄), Bicarbonate (HCO₃). The analyses results shows, that all the groundwater quality parameters on certain station found higher than the prescribed limit of WHO.

Keywords: Groundwater, Geochemistry, Water quality, Tirunelveli

INTRODUCTION

Water is an essential wealth of living beings and also a precious contribution of nature to mankind in addition to millions of further species alive on the globe. Since the past few decades, it is fast attractive an inadequate commodity in the majority part of the world. Ground water and coastal waters hold up all

livelihood together with human beings [1]. The amount of potable water demands does not reflect the problems associated with water quality parameters like metallic ions, pesticide and microbial contagion. River banks offer numerous uses in so many sectors of developmental activities like agriculture, industry, shipping, fishing and

potable water supplies [2]. Accessibility of water is a serious factor for the socioeconomic improvement in several countries and hence in most parts of the world potable water supplies are put to heavy use [3].

Once aqua gets contaminated, it cannot be restored by stopping the pollutants from their resources. According to WHO, almost eighty percentages of diseases in human beings are produced by water [4]. In modern decades, Indian states are being encountered fast financial development, population count increase and urbanization, these actions have stressed out the deficiency of water possessions in Tamil Nadu, particularly in the Southern districts. Water is a significant precious asset of world and plays a very important job in our life. Groundwater is the key sources of potable water [5].

Study area

The study is carried out along the river bank of thamarabharani on a length of 125 kms starting from its origin at karayar of tirunelveli district to punnaikayal, the point where it drains into Bay of Bengal. There are 20 groundwater sampling locations have been selected, which includes origin, major towns, cities and also where different tributary connects of the river. The sites are chosen after conducting review literature, seeking connoisseur opinion and several site visits.

Collection of groundwater Samples

Totally, 20 groundwater sampling locations were chosen, during our reconnaissance investigation for the collection of water samples to do physicochemical assessment. Outstanding care was given to distribution of spot throughout the study area during sampling point selection. Samples were taken throughout the pre monsoon and post monsoon of 2018. The samples were collected in 1 liter polythene bottles. Prior to the collection, bottles were thoroughly washed with dil. H_2SO_4 and then with distilled water before filling the bottle with the sample. Each bottle was rinsed thoroughly to avoid any possible contamination in bottling and every other protective measure was taken.

MATERIALS AND METHODS

Physicochemical analysis of Groundwater

The samples collected were assessment of various physicochemical parameters as EC is used to measure the hydro physical parameters, such as Electrical conductivity (EC) on site, Chloride (Cl), Calcium (Ca), Magnesium (Mg), Sodium (Na), Potassium (K), Sulphate (SO_4), Bicarbonate (HCO_3),

Sodium and Potassium ions were determined by Flame Spectrometer. Calcium, Carbonate, Bicarbonate and Chloride ions were analyzed by the

volumetric methods. Magnesium ion was calculated from Ca^{2+} contents. Sulphate ion was estimated by Spectrophotometer. All the ionic concentrations were expressed in milligrams per liter (mg/l), except Electrical Conductivity (EC). Concentration of EC is expressed in $\mu\text{S}/\text{cm}$. Minimum, Maximum and Average concentration of parameters of groundwater samples for two seasons are given in the **Table 1.a and 2.**

Analytical precision for measurements of cations and anions, indicated by the ionic balance error (IBE), was computed on the basis of ions expressed in mg/l. The value of IBE was observed to be within a limit of $\pm 5\%$.

RESULTS AND DISCUSSIONS

Analytical outcome of 20 groundwater samples collected from the sampling locations be discussed in this paper. Maximum and minimum concentrations of major ions for groundwater samples collected within the study area for the pre-monsoon and post monsoon season of 2018 are given in **Table 1(a) and 1(b).** In the concentration values of major elements in the groundwater are compared to WHO (2018) standards for potable water. The groundwater is classified in to three class viz., 1. Desirable, 2. Permissible and 3. Not Permissible.

Table 1: Range in concentration of physicochemical parameters for Pre monsoon 2018

Parameters	Minimum	Maximum	Average	WHO(2004)		No of samples Exceeding allowable limits
				Most desirable limits	Maximum allowable limits	
EC	210	5500	2714.17	860	4210	4
Na	10	520	206.75	-	310	12
K	2	235	24.72	-	23	8
Ca	22.3	411.9	213.61	80	290	3
Mg	8	273	68.35	41	261	3
HCO_3	35	925	432.17	-	410	6
Cl	39	2364	395.16	320	680	7
SO_4	23	386	82.17	280	420	Nil

Table 2: Range in concentration of physicochemical parameters for Post monsoon 2018

Parameters	Minimum	Maximum	Average	WHO(2004)		No of samples Exceeding allowable limits
				Most desirable limits	Maximum allowable limits	
EC	368	4530	2104.65	840	2900	7
Na	7	390	205.35	-	310	5
K	1	310	21.04	-	23	3
Ca	58	925	365.14	84	190	19
Mg	41	815	352.41	41	261	16
HCO_3	215	621	391.29	-	410	12
Cl	27	2615	442.81	310	720	6
SO_4	4	617	95.59	301	510	2

Electrical Conductivity (EC)

The Electrical Conductivity (EC) in water depends on the function of dissolved mineral contents, if TDS is high then EC will be high accordingly [6]. EC is not direct measure of ionic strength and mineralization of natural water [7]. The Electrical Conductivity (EC) of the groundwater samples found between the ranges from 210 to 5500 $\mu\text{S}/\text{cm}$ in pre monsoon and 368 to 4530 $\mu\text{S}/\text{cm}$ in post monsoon. According to WHO water standards, desirable limit is less than 750 $\mu\text{S}/\text{cm}$; permissible limit is between 750 to 3000 $\mu\text{S}/\text{cm}$. 3000 $\mu\text{S}/\text{cm}$ is the maximum permissible limit. EC value of water greater than 3000 $\mu\text{S}/\text{cm}$ is classified as not suitable for potable water. Out of 20 samples, 4 samples in pre monsoon and 7 samples in post monsoon season exceeds the maximum permissible limit of WHO standards.

Sodium (Na)

The cation exchanges through water and rock interaction in addition to human activities are the main cause for the increase in Na^+ ion concentration in groundwater [8]. The probable source of sodium ion may be from deep percolating water from the surface soil layers owed to atmospheric rainfall that has been subjected to Concentration such effects (Herman Bower, 1978). The Sodium ion concentration of the groundwater samples

were found in between the ranges from 10 to 520 mg/L in pre monsoon and 7 to 390 mg/L in post monsoon. According to WHO water standards, there is no desirable limit but permissible limit is 200 mg/L. Out of 20 samples collected, 12 samples in pre monsoon and 5 samples in post monsoon season exceeds the maximum permissible limit of WHO standards.

Potassium (K)

The most important source of potassium in natural fresh water is withering of rocks but the quantities increase in the polluted water due to disposal of waste water [9]. The Potassium ion concentration of the groundwater samples varied from the .ranges from 2 to 235 mg/L in pre monsoon and 1 to 310 mg/L in post monsoon (**Table 1.a and 1.b**). According to WHO water standards, there is no desirable limit but permissible limit is 12 mg/L. Out of 20 samples collected, 8 samples in pre monsoon and 3 samples in post monsoon season exceeds the maximum permissible limit of WHO standards.

Calcium (Ca)

The majority common bivalent cations in water are Calcium (Ca^{2+}) and Magnesium (Mg^{2+}) [10]. Calcium is one of the most important cation in groundwater. The major sources of Calcium in groundwater are pyroxene, amphiboles, feldspars, lime stone and gypsum. The

Calcium ion concentration of the groundwater samples were found in between the ranges from 22.3 to 411.9 mg/L in pre monsoon and 58 to 925 mg/L in post monsoon (Table.1.a and 1.b). According to WHO water standards, desirable limit is less than 75 mg/L permissible limit is 75 to 200 mg/L. Out of 20 samples collected, 3 samples in pre monsoon and 19 samples in post monsoon season exceeds the maximum permissible limit of WHO standards.

Magnesium (Mg)

Magnesium is an essential element for the development and growth of human beings [10]. The Magnesium ion concentration of the groundwater samples were found in between the ranges from 08 to 273 mg/L in pre monsoon and 41 to 815 mg/L in post monsoon (Table 1.a and 1.b). According to WHO water standards, desirable limit is less than 30, but permissible limit is 30-150 mg/L. Out of 20 samples collected, 3 samples in pre monsoon and 16 samples in post monsoon season exceeds the maximum permissible limit of WHO standards.

Bicarbonate (HCO₃)

Bicarbonate concentration present in water may be due to intrusion of sewage nearby area. The main source of bicarbonate ions in groundwater is the dissolved CO₂ in rain water. Which get into

the soil and dissolves in groundwater. The Bicarbonate ion concentration of the groundwater samples were found in between the ranges from 35 to 925 mg/L in pre monsoon and 215 to 621 mg/L in post monsoon. According to WHO water standards, there is no desirable limit, but permissible limit is 300 mg/L. Out of 20 samples collected, 6 samples in pre monsoon and 12 samples in post monsoon season exceeds the maximum permissible limit of WHO standards.

Chloride (Cl)

Enrichment of chlorine may affect the taste of water. Potable water with high range of chloride may cause gastrointestinal problems, irritation, diarrhea and dehydration to consumers. The Chloride ion concentration of the groundwater samples were found in between the ranges from 39 to 2364 mg/L in pre monsoon and 27 to 2615 mg/L in post monsoon. According to WHO water standards, desirable limit is less than 200 mg/L permissible limit is 200 to 600 mg/L. Out of 20 samples collected, 07 samples in pre monsoon and 06 samples in post monsoon season exceeds the maximum permissible limit of WHO standards.

Sulphate (SO₄)

Sulphate contributes to the permanent hardness of the water along with Calcium and Magnesium. Sulphate is one of the slightest toxic anions. But, catharsis,

dehydration and gastrointestinal irritation have been observed at high concentration of sulphate. The Sulphate ion concentration of the groundwater samples were found in between the ranges from 23 to 386 mg/L in pre monsoon and 04 to 617 mg/L in post. According to WHO water standards, desirable limit is less than 200 mg/L permissible limit is 200 to 400 mg/L. Out of 20 samples collected, none of the sample in pre monsoon and only two samples in post monsoon season exceeds the maximum permissible limit of WHO standards.

CONCLUSION

The present work is an incorporated with the attempt to analyze the results of physicochemical studies of groundwater proximity Thamirabarani River Bank. A number of conclusions have been on hand now in sequence. Main resource of groundwater recharge is by rainwater. Rainfall is more throughout the NE monsoon between October and December. In order to assess the qualitative individuality of groundwater in the sampling locations, groundwater samples have been collected from 20 locations. The physicochemical analysis results shows, among the cations except sulphate, rest of the cations found high in Pre monsoon, but in Post monsoon all the cations found high in selected locations. So the groundwater samples collected within the study area can

be categorized as sample showing below the desirable and within permissible are fit for potable water, others are not suitable for potable water.

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