THE EFFECT OF BOD, COD, CALCIUM, CHLORIDE AND SULPHATE CONTENTS OF GROUNDWATER NEAR THAMIRABARANI RIVER BAND IN TIRUNELVELI DISTRICT, TAMILNADU, INDIA.

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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 BOD, COD, Calcium (Ca), Chloride (Cl), Sulphate and (SO_4) were analysed quantitatively using standard methods. The investigations indicated that the concentration variations were recorded in site to site and in sample to sample and also season to season. The present study reveals that the water is contaminated at selected points which are not suitable for drinking. The pulp of paper mill, textile industry and temple waste and small scale industries are added to the sampling points. These are the main pollutant sources of thamirabharani river in addition to anthropogenic activities. Tirunelveli Corporation, supplies water to towns from thamirabharani river. The analyses results shows, that all the groundwater quality parameters on certain station found higher than the prescribed limit of WHO.

Keywords: Groundwater, pollutant, Water quality, Tirunelveli.

1. 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 [7]. 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 [6]. 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 [5].

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 [10]. 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 [8].

1.1 Rivers

Usually, rivers are the source of potable water, irrigation, fishery, and power production. Just above all, the aquatic bodies are being polluted by growing population, urbanization, industrialization, demanding agricultural practice and disposal of a huge amount of discharges which results in deterioration of water quality [16]. Water is a vital natural resource of the earth which plays a very important role in the living system. Groundwater is the most significant sources of potable water. The uniqueness of ground water is changed by the municipal and industrial waste discharges into the soil [15]. Rainy water runoff the surface with soil, mud and humus enter into water bodies such as river and reservoirs, etc., water bodies bearing the inorganic minerals and heavy metals pollutants above the permissible limit are harmful [14].

1.2 River Thamirabharani

The river thamirabharani is also known as the Porunai nathi (Tamil), which is one of the most significant perennial rivers among the 33 rivers of tamilnadu. The river thamirabharani originates from the peak of Periyapothigai hill in the Western Ghats on Papanasam in the Ambasamudram taluk. It trespasses through Tirunelveli and Tuticorin districts before flowing into the Gulf of Mannar. Its total area of the catchment is 4500 km2. It travelling up to 125 km (24 km in hilly ranges of Tirunelveli district and 40 km in Tuticorin district). It forms a delta in Punnaikayal village before falling into the Bay of Bengal, whose delta area is around 140.93 sq.km. It has about 50 large and small islands, the largest is with an area of 20 sq.km and the smallest is with an area of 0.1 sq.km. The river thamirabharani basin lies between 08° 8′ to 09° 23′ N latitude and 77° 09′ to 77° 54′ E longitude [17].

1.3 Need for present study

According to [11] mixing of sewage, municipal effluents, industrial discharges and low water flow reduces the water quality. In south India the thamirabharani is a symbol of Tamil culture and civilization. Number of peoples depends on the river for their routine activities and for satisfying their needs. Local complaints and newspaper reports on the cleanliness less of the river have made the subject a major problem to converse. Although Tirunelveli authorities have taken steps to evict encroachments near the thamirabharani river yet the problem not has been completely solved from other areas and sewage being still let into the river. To preserve the quality of water, it is important to analyze the parameters continuously.

1.4 Study Area

The study is carried out along the river bank of thamirabharani 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 (table-2).

Table: 2 Sampling Stations

S.No	Towards the left side bank of the thamirabharani river	Towards the right side bank of the thamirabharani river
1	Karayar (LB1)	Sivanthipuram (RB1)
2	Papanasam (LB2)	Mukkudal (RB2)
3	Settimedu (LB3)	Ambasamuthiram (RB3)
4	Harikesavanallur (LB4) (Thalaianai dam)	Bazhavoor (RB4)
5	Pathamadai (LB5	Suthamalli vilakku (RB5)
6	Gopalasamuthiram (LB6)	Kunnathoor (RB6)
7	Cheranmahadevi (LB7)	Senthimangalam (RB7)
8	Karung kulam (LB8)	Kallidaikurichi (Bridge) (RB8
9	Melapattam (LB9)	Seevalaperi (RB9)
10	Keelapattam (LB10)	Tirunelveli town (RB10)

1.5 **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.

2. MATERIALS AND METHODS

2.1 Physicochemical analysis of Groundwater

The samples collected were assessment of various physicochemical parameters such as BOD, COD, Calcium (Ca), Chloride (Cl), Sulphate (SO_4). COD, BOD were analysed in the laboratory by using standard methods (APHA, 2005). Calcium, and Chloride ions were analyzed by the volumetric methods. Sulphate ion was estimated by Spectrophotometer. All the ionic concentrations were expressed in milligrams per liter (mg/l). Minimum, Maximum and Average concentration of parameters of groundwater samples for two seasons are given in the Table.1.a and 1.b.

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 ±5%.

3. LITERATURE REVIEW

I) O.V. Sheeba etal, 2018.

Polluted water affects the human health. In the present study in site three (Cheranmahadevi) the average dissolved oxygen and bio chemical oxygen demand values are not within the range of prescribed limit. Low dissolved oxygen was due to the less rainfall and mixing of waste water from industries and paper mill present in Cheranmahadevi. The average fluorides and nitrate-nitrogen are found to be well within the permissible limit in all sites, this was due to the surface runoff from nearby agricultural field not containing nitrate and fluoride. Chemical oxygen demand of site seven (Authoor) was within the permissible limit. This indicates that there was no introduction of exotic species, over fishing and also disposal of industrial and domestic wastes from new industries. COD values are higher than BOD values, because COD includes biodegradable and non- biodegradable substances whereas BOD includes only biodegradable substances. Rapid urbanization and industrialization can post threat to sustainability of river conservation. Routine Monitoring of pollution level of river water makes younger generation happy

II) K. Savithiri etal 2017.

The results of this study showed that the analysed data was compared with WHO standards. Rasipuram region generally affected by TDS problem. Puduchatram area water analysis showed that the area is a fluoride belt area. Vaiyappamalai water showed highly hard water and it contains large amount of calcium, nitrate and chloride salts. From this analysis, this area ground water is used for agriculture and domestic purpose only.

4. 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.a 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	
BOD	10	310	206.75	-	310	12
COD	102	679	124.72	-	23	8
Ca	22.3	411.9	213.61	80	290	3
Cl	39	2364	395.16	320	680	7
SO_4	23	386	82.17	280	420	Nil

Table1.b. 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	
BOD	40	299	205.35	-	310	5
COD	214	546	221.04	-	23	3
Ca	58	925	365.14	84	190	19
Cl	27	2615	442.81	310	720	6
SO_4	4	617	95.59	301	510	2

BOD and COD

Historically, organic stuff in impure water been calculated as Biochemical Oxygen Demand (BOD). This is a measure of the quantity of oxygen which is necessary to metabolize waste during a particular time, usually 5 days. Another measure of strength of organic waste is Chemical Oxygen Demand (COD), which is based on chemical rather than biological oxidation. COD will exceed the BOD demand value for animal wastes since, animal manure and other waste products contain organic materials which resist aerobic bacterial degradation. COD/BOD demand ratios vary from 3.5 to 6.5 depending on species and feed ratios [13]. The permissible limits of the BOD value are 10 mgL^{-1} [12]. Except for few of the stations, others seem to be a very high value of BOD than the permissible which may be due to an increase in the discharge of pollutants from the industries. The permissible limits of COD value are 10 mgL^{-1} [12]. All the stations show a very high value of COD which seems to be above the permissible value is due to an increase in the discharge of contaminants from the industries.

Calcium (Ca)

The majority common bivalent cations in water are Calcium (Ca^{2+}) and Magnesium (Mg^{2+}) [2]. 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.

Chloride (Cl)

Enrichment of chlorine may affect the taste of water [4]. Potable water with high range of chloride may cause gastrointestinal problems, irritation, diarrhea and dehydration to consumers [10]. 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 (Table.1.a and 1.b). 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 (SO_4)

Sulphate contributes to the permanent hardness of the water along with Calcium and Magnesium [4]. Sulphate is one of the slightest toxic anions. But, dehydration and gastrointestinal irritation have been observed at high concentration of sulphate [10]. 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 monsoon (Table.1.a and 1.b). 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.

5. 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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