

Assessment of Physico-Chemical Quality of Groundwater in rural areas of Thoothukudi District, Tamilnadu, India

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Abstract: Ground water is one of the major resources of drinking water in Thoothukudi District (Tamilnadu). In the present study ground water samples were collected from 7 different places in Thoothukudi rural areas and Physico-chemical parameters such as pH, alkalinity, hardness, total dissolved solids, calcium, sodium and potassium were assessed for their suitability for human consumption. The obtained values were compared with the standard values of WHO.

Keywords: TDS, Chlorides, Total hardness, Physiochemical parameters, drinking water quality etc.

Introduction

Groundwater is one of the prime natural resources upon which the mankind depends for its survival of life [1]. Water sources available for drinking and other domestic purposes must possess high degree of purity, free from chemical contamination and microorganisms. But the rapid increase in population and industrialization together with the lack of wisdom to live in harmony with nature has led to the deterioration of good quality of water thus resulting in water pollution. Therefore, pollution of water resources needs a serious and immediate attention through periodical checkup of water quality [2]. The present study aims at the assessment of water quality in Thoothukudi district, Tamilnadu, India. Agriculture is the main occupation of the people residing there. They cultivate coconut, paddy, banana *etc.* Bore well water is used for irrigation as well as drinking and cooking purposes. Even though all kinds of requirements are met by the ground water, the status of the water is a factor to be considered. There are no major industries to concern but these rural areas's lack proper drainage system and all the domestic sewage are drained in to the nearby canals, which are closer to the bore-well point at some places. Also, the use of fertilizers and pesticides may leave their residual amounts, which along with the domestic wastes percolate in to the ground, getting mixed with groundwater and may affect the quality in a severe manner. Hence, it becomes essential to assess the quality of drinking water in this area.

Experimental

In the present investigation 7 groundwater samples were collected from seven bore wells of different rural areas of Thoothukudi District namely Vallanadu (Loc.no.1) , Seydunganallur (Loc.no.2), Alwarthirunagari (Loc.no.3), Nalumavadi (Loc.no.4), Eral (Loc.no.5), Autoor (Loc.no.6) and Arumuganeri (Loc.no.7).

Collection of samples

Polythene cans of 2 L capacity were made use for collection of water samples. These polythene cans were first washed with tap water, soaked in chromic acid solution for about 10-15 minutes to remove any

impurities, again washed with tap water. Finally, they were rinsed with deionised distilled water. Then the polythene cans were taken for sample collection.

Physicochemical analysis

The samples collected were analyzed for important physical and chemical parameters such as pH, total dissolved solids (T.D.S.), total hardness (T.H.), Cl^- , Ca^{2+} , Na^+ , K^+ as per the procedures given in "Standard methods for the examination of water and waste water", American Public Health Association (APHA) [3]. The parameters seen in the samples of water were determined by following various methods [4-6].

Results and Discussion

The results of physicochemical analysis of different groundwater samples are presented in Table 1. These results were compared with values of prescribed standard quality parameters of WHO.

Table 1: Parameters measured for the water samples

Location	Appearance	Odour	pH	TDS (ppm)	Cl^- (ppm)	Total Alkalinity (ppm)	Total Hardness (ppm)	Na^+ (ppm)	K^+ (ppm)	Ca^{2+} (ppm)
L ₁	Clear	None	6.9	1380	847.4	1337	978	>100	>100	>100
L ₂	Clear	None	7.1	680	187.9	668	449	92.1	95.4	97
L ₃	Clear	None	7.0	260	460	642	190	28.8	32.5	30.8
L ₄	Clear	None	7.2	520	912	963	317	93.1	96.0	96.9
L ₅	Clear	None	7.3	350	561	775	227	49.1	60.1	56
L ₆	Clear	None	7.3	1360	421.2	1230	497	>100	>100	>100
L ₇	Clear	None	7.8	1270	365	1043	455	>100	>100	>100

The appearance of ground water sample is clear in all locations except loc. No. 5 and all the observed samples didn't have any odour. The pH values of water samples varied between 6.9 to 7.8 and were found within the limit prescribed by WHO (6.5-8.5). The entire sample shows neutral values.

TDS values varied from 260 to 1380 ppm. 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 given by WHO. 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 [7]. 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 [8].

Chloride imparts salty taste to water, depending on the presence of cation constituents. In the present investigation chloride content varies from 187 to 912 ppm. WHO permissible limit is 200 ppm. Except L₂, in all the other samples chloride concentration exceeded the WHO permissible limit. Higher chloride concentration in samples from sites may be due to discharge of sewage near the sampling sites.

Alkalinity is due to the presence of carbonate. Alkalinity itself is not harmful to human beings [9]. Alkalinity value in the study area varied between 642 to 1337 ppm. High values of alkalinity shows that it is not fit for domestic purposes.

The hardness value ranges from 190 to 978 ppm. The total hardness values of some samples are found higher than the prescribed limit by WHO (500 ppm). 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 [10].

The main source for sodium in groundwater resources is plagioclase feldspars, feldspathoids and clay minerals. Sodium content around 200 ppm may be harmful to persons having cardiac and renal diseases and in

women with toxemia associated with pregnancy [11]. Here the concentration of sodium varies from 28.8 ppm to greater than 100ppm.

The values of potassium exceed permissible limit of greater than 100ppm. High concentration of potassium may be attributed to the contamination by sewage [12].

The values of calcium range from 30.8 to greater than 100 ppm. The calcium is a major constituent of most igneous, metamorphic and sedimentary rocks. The principal source of Ca^{2+} in groundwater is members of the silicate mineral groups like plagioclase, pyroxene and amphibole among igneous and metamorphic rocks and limestone, dolomite and gypsum among sedimentary rocks.

Conclusion

The ground water samples were collected from seven different places in and around Thoothkudi rural areas. The samples were subjected to physico- chemical analysis. The results showing most of the parameters like pH, TDS, TH, Cl^- , alkalinity, Na^+ , K^+ and Ca^{2+} are well above the permissible limit prescribed by WHO. The ground water sample is unfit for drinking and domestic purposes. So people should be made aware of the water quality importance on sanitation and economical water treatment methods like filtration and boiling would prove beneficial to avoid waterborne disease. The remedial measure must be taken immediately to safeguard and conserve the precious water resources from pollution.

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