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Evaluation of physicochemical parameters of ground water of Renigunta, Andhra Pradesh, India

Venkateswarlu P*, Suman M and Narasimha Rao C

Dept. of Chemistry, S. V. University, Tirupathi-517502, India

ABSTRACT

Physicochemical parameters of ground water of Renigunta, Andhra Pradesh, India were evaluated. Water samples were collected from 8 different areas of in and around Renigunta and analysis of physicochemical parameters such as pH, electrical conductivity, and total dissolved solids, total hardness, calcium, chlorides, sulphates, nitrates and dissolved oxygen were carried. The results of this analysis were compared with the World Health Organization water quality standards. Based on the analysis, some of the areas under study fall in polluted zone. The results revealed that the ground water was not suitable for drinking purpose. Thus the ground water of the area needs some degree of treatment before drinking.

Key words: Ground water, physicochemical parameters, contamination, permissible limit.

Corresponding author

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INTRODUCTION

Ground water is regarded to be the most valuable resources needed to sustain human life, animals and plants. Industrialization and urbanization affected the ground water quality due to over exploitation of resources and improper waste disposal practices. According to WHO, nearly 80% of all the diseases in human beings are caused by water. Many areas of Renigunta, Andhra Pradesh, India are facing the problem of drinking water quality. People of this area are suffering from health problems due to consumption of polluted water. The present study was initiated to determine the concentration of contamination and the suitability of ground water for drinking purpose.

EXPERIMENT

Water samples and chemicals

The ground water samples were collected from drug wells and bore wells located in and around the above mentioned areas. Samples were collected from shallow wells because the shallow wells are well oxygenated than deeper wells. The samples were collected during summer season because, the mineral content in water are likely to reach the maximum. Clean polythene bottles were collected and rinsed with sample water. The water samples were collected in each bottle. Each sample in the polythene bottle was filtered using Whatmann no.42 filter paper and stored.

METHODOLOGY

Electrical conductivity values were measured using Elico CM 180 Conductivity Bridge. Total alkalinity was evaluated by titration with standard 0.1M HCl using methyl orange and phenolphthalein as indicators [1]. Standard procedures [2] involving spectrophotometry, flame photometry and volumetry were used for the determination of hardness, total dissolved solids (TDS), sulphate, chloride, nitrate, calcium, magnesium and iron . All the chemicals used were of AR grade.

RESULTS AND DISCUSSION

The physicochemical parameters of water samples were presented in table l and the results were compared with limits prescribed by WHO.

pH:

The pH of the water samples analysed were within the desirable limit of 6.7 – 7.6 given by WHO and most of the samples were slightly alkaline in nature.

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Table1. Analytical results of physicochemical parameters.

Sample	Temp ^{0}C	pH	Total alkalinity mg/L	TDS mg/L	Ca^{2+} mg/L	Mg^{2+} mg/L	Hardness	Fe mg/L	Cl- mg/L	DO mg/L	So_4^{2-} mg/L	No_3^- mg/L	Conductivity $\mu s / cm$
S_1	30.5	6.8	360	812	82	86	480	0.15	120	4.1	96	34	1231
S_2	30.1	6.7	568	826	126	63	510	0.34	270	3.2	104	27	1612
S_3	31.6	7.0	478	1201	213	62	490	0.48	214	4.4	142	39	2410
S_4	31.4	6.9	393	912	196	82	390	0.39	310	3.9	121	84	1130
S_5	30.8	7.3	216	1170	253	66	510	0.28	156	4.8	84	67	983
S_6	31.2	7.6	380	1832	98	48	540	0.32	189	3.8	116	18	1236
S_7	31.1	7.1	432	894	313	69	480	0.48	215	2.7	92	21	898
S_8	30.9	6.9	614	1371	192	89	520	0.67	264	3.6	112	16	966
WHO	30.0	6.5-8.5	250	500	75	50	500	0.3	250	5.0	200	45	1800

Total alkalinity

Dissolved carbon dioxide, carbonate and bicarbonates produce alkalinity in water. The alkalinity varies from 216 to 614. Higher alkalinity gives unpleasant taste to water. The increased values of alkalinity in the studied area are due to the action of the carbonates on the basic material of the soil.

Electrical conductivity

Electrical conductivity of water is direct function of its total dissolved salts [3]. Hence it is an index to represent the total concentration of soluble salts in water [4]. Most of the inorganic substances present in water are in ionized form and causes electrical conductivity. The electrical conductivity ranges from 898 to 2410 in the studied area.

Total dissolved solids

Electrical conductivity of water is considered to be an indication [5] and it is a direct function[3] of the total dissolved salt content. Hence it is an index to represent the total concentration of soluble salts in water [4]. The permissible total dissolved salts for drinking water is 500 mg/L. High values of TDS in ground water are generally not harmful to human beings but high concentrations of these may affect persons who are suffering from kidney and heart diseases [6].

Calcium

Calcium usually comes from the leaching of rocks. It is fifth abundant element. It plays an important role in the formation of bones. In this study calcium concentration of water samples ranges from 82 to 313 mg/L. These values exceed the permissible limit proposed by WHO (75 mg/L). If concentration of calcium exceeds, it causes gastrointestinal diseases and stone formations.

Magnesium:

If the concentration of magnesium in drinking water is more than the permissible limit, it causes unpleasant taste to the water. In ground water, generally magnesium content will be less than calcium content. Human body contains less amount of magnesium than that of calcium. In the studied areas, drinking water contains more amount of magnesium than WHO standard. (50 mg/L)

Hardness:

Total hardness is the measure of the capacity of water to precipitate soap and is usually expressed as the equivalent of $CaCO_3$ concentrations. Excess hardness in water leads to heart

diseases and kidney stone formation [7]. In some of the studied areas total hardness exceeds WHO standards(500 mg/L).

Iron:

Iron is present in hemoglobin and myoglobin. It an important essential element to human body. When drinking water contains iron concentration above the permissible limit, it gives stringent taste to water. According to WHO standards, limit of iron concentration in drinking water is 0.3 mg/L exceeding which causes toxicity.

Dissolve oxygen:

The DO level in drinking water of the studied area is low when compared to WHO standard (5.0). This depletion of oxygen level is due to high amount of organic wastes.

Chlorides:

The concentration of chlorine in ground waters is high in those regions where the temperature is high and rainfall is less. Soil porosity and permeability also has a key role in building up the chloride concentration [8]. At concentrations above WHO standard (250 mg/L), drinking water acquires salty taste which is objectionable. The excess concentration of chloride in ground water is due to presence of soluble chloride from rocks.

Sulphates:

High amounts of sulphate cause laxative effect to the children in hot weather climates [9]. In the studied area, sulphate concentration in drinking water is below the WHO standard. (200 mg/L).

Nitrates:

Excessive concentration of nitrate in drinking water in considered hazardous for infants causing metheglobinaemia [10]. Some of the studied regions have high concentration of nitrates than WHO standard (45 mg/L) is due to over application of fertilizers and improper manure management practice.

CONCLUSIONS

Analysis of ground water samples collected from different locations of Renigunta revealed that, in some samples water quality parameters (Total alkalinity, pH, hardness, TDS, sulphate, chloride, nitrate, calcium, magnesium and iron) were beyond the permissible limit as per WHO standard. So, the proper environment management plan may be adopted to control drinking water pollution. The ground water of this area needs some degree of treatment before drinking and it needs to be protected from contamination so as to prevent adverse health effects on human beings.

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