

Research Article

Study on Determination of Physicochemical Parameters of Ground Water in Industrial Area of Pydibheemavaram, Vizianagaram District, Andhrapradesh, India

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Received: July 15, 2014; Accepted: August 11, 2014;

Published: August 13, 2014

Abstract

An assessment of the ground water quality was carried out in industrial area of Pydibheemavaram, Vizianagaram District, Andhrapradesh, India. The study was aimed at examining the various samples of ground water and the quality of the ground water as it relates to public health. Eight ground water samples were taken from boreholes and open wells and PH, EC, Chloride, Total Alkalinity, Total Dissolved Solids (TDS) and Total Hardness contents were measured. The results were compared with WHO, and IS: 10500-91 standards. The usefulness of these parameters in predicting ground water quality characteristics were studied. Thus an attempt has been made to find the quality of ground water in industrial area of Pydibheemavaram suitable for drinking purposes or not.

Keywords: Analysis; Alkalinity; Electrical conductivity; Total Dissolved solids; Total Hardness

Introduction

Water is a prime need for human survival and industrial development. Ground Water quality is very essential in a sense of practical utility for domestic, agricultural and industrial purposes and plays significant role in the living organism that existing in this world water. For many rural and small scale communities, ground water is the only source of drinking water. Assessment of ground water for drinking and irrigation has become a necessary and important task for present and future ground water quality management. Ground water quality depends on the quality of recharged water, atmospheric precipitation, inland surface water and subsurface geochemical processes. Temporal changes in the origin and constitution of the recharged water, hydrologic and human factors may cause periodic changes in ground water quality. The geology of a particular area has a great influence on quality of water and its environment. The quality of ground water varies due to a change in chemical composition of the underlying sediments and aquifer. The modern civilization and urbanization, frequently discharging industrial effluent, domestic sewage and solid waste dump causes ground water gets pollute [1]. This pollute water not only affects water quality but also threatens human health, economic development and social prosperity. So, the assessment of water quality is very important factor for knowing the suitability for various purposes and continuous monitoring of ground water is necessary for the health of human, animals and crops. Hence an assessment of the ground water quality in Pydibheemavaram industrial area is taken in the present study as the most of the people are using well water for drinking. The objective of present work was to study the water quality of ground water in Pydibheemavaram industrial area of Vizianagaram district, Andhra Pradesh (India).

Materials and Methods

In the present investigation ground water samples were collected from eight locations in the month of November 2013. Samples

were collected in polythene bottles, pre-cleaned by washing with non-ionic detergents, rinsed with water, 1:1 hydrochloric acid and finally with de-ionized water. Before sampling, the bottles were rinsed three times with sample water. Tube wells were operated at least five minutes before collection of the water samples. The water quality parameter determination was done using standard methods and techniques. Samples were brought to the laboratory for analysis of physico-chemical parameters. The temperatures of the samples were measured at the point of collection using mercury in glass thermometer and Systronics digital pH meter model-361 was used to determine the PH values [2] Electrical conductivity of the samples was determined using an EI digital conductometer model 611 and. Total Alkalinity was determined by titrimetric method using standard solution of 0.01M HCl and methyl orange as indicator.

Total Hardness was measured using EDTA (Ethylene Diamine Tetra Acetic Acid) as titrant with ammonium chloride and ammonium hydroxide buffer solution (PH-10) and Erichrome Black T as indicator. Chloride content was determined by Mohr's method using silver nitrate as titrant and potassium chromate solution as indicator. Total Dissolved Solid was determined by evaporation method in an oven maintained at 200°C for 2hrs (Gravimetry).

Results

The results obtained from analysis of different ground water samples are shown in Table-1. The statistical evaluations are given in Table-2.

Discussions

In the present investigation most of the water samples are colorless and odorless. However some water samples are slightly colored due to muddiness. The temperature of water samples is varied from 27.1°C to 29.4°C the variation of the water temperature having more effect directly or indirectly on all life processes.

Table 1: Parameters at different sampling stations.

Parameters	GW1	GW2	GW3	GW4	GW5	GW6	GW7	GW8
Temp° C	28.9	27.1	28.1	28.7	29.2	28.8	29.4	28.6
PH	6.9	7.1	7.4	7.2	7.8	8.1	7.7	8.2
EC μ mho/cm	980	850	780	880	800	750	870	890
Alkalinity(mg/L)	150	180	271	289	220	230	251	235
Total hardness(mg/L)	300	510	310	520	370	540	350	560
TDS(mg/L)	460	950	480	1170	450	1240	470	1350
Chloride(mg/L)	131.5	176.4	152.4	145.2	180.5	154.1	164.2	195.4

Table 2: Descriptive statistics of parameters.

Parameters	Min	Max	Mean	SD
Temp° C	27.1	29.4	28.6	0.721
PH	6.9	8.2	7.55	0.475
EC μ mho/cm	750	980	850	72.89
Alkalinity(mg/L)	150	289	228.25	45.675
Total hardness(mg/L)	300	560	441.25	105.21
TDS(mg/L)	450	1350	821.25	396.64
Chloride(mg/L)	131.4	195.4	162.45	20.84

Acid pH of water may be due to dissolved carbon dioxide and organic acids such as fulvic and humic acids which are derived from decay and subsequent leaching of plant materials [3-4] pH is mainly influenced by volume of water, soil type. PH of studied ground water samples is in the range of 6.9-8.2. Acceptable range of pH for drinking water is 6.5-8.5 [5]. In the present study, pH was within this limit. Low pH of groundwater can cause gastrointestinal disorders especially hyperacidity, ulcers and burning sensation [6]. Water having pH below 6.5, causes corrosion of metal pipes, resulting in the release of toxic metals such as zinc, lead, cadmium, copper etc. Higher values of pH hasten scale formation in water heating apparatus and decrease germicidal potential of chlorine.

The main sources of natural alkalinity are rocks, which contain carbonate, bicarbonate, hydroxide compounds and phosphates. The value of alkalinity in study area is ranged from 150 to 289 ppm with mean value of 228.25 \pm 45.68. Alkalinity in itself is not harmful to human being, but in large quantity, alkalinity imparts bitter taste to water and may cause eye irritation in human.

The mean value of total hardness of studied ground water samples is 441.25 ppm with the standard deviation of \pm 105.21 ppm which indicates that most water samples are hard.

TDS is an important parameter which imparts a peculiar taste to water and reduce its potability. Desirable limit of TDS is 500mg/l (IS: 10500 standards) and maximum allowable limit is 1500 mg/l. The mean value of TDS of studied ground water samples is 821.25 ppm with the standard deviation of \pm 396.64. All the values obtained are much higher than the limits.

Chloride is an important quality parameter that affects the aesthetic property of water including taste and renders it unsuitable for drinking purpose if present in high concentration. The chloride concentration in study area ranged from 131.4 to 195.4 with mean values of 162.45 \pm 20.84 ppm. The values in the present study are on lower side considering WHO (1971) maximum permissible limit of 200ppm and maximum allowable limit of 600ppm.

The specific conductivity of water samples under study varies between 750 to 980 μ mho/cm. The maximum permissible limit of this parameter for drinking water is 300 μ mho/cm. However, the average specific conductivity exceeds this limit because of its high values during rainy season. In rainy season due to floods and rains, water level in the well increases, which contains more electrolytes.

Conclusion

In the present work, an assessment of the ground water suitability for drinking purposes or not at Pydibheemavaram, industrial area, Vizianagaram district, Andhrapradesh (India) were studied and found that GW1 and GW3 are safe for drinking purposes and GW5, GW7 may be used for drinking purposes after boiling or some treatment. GW2, GW4, GW6 and GW8 is not used for drinking but can be used for irrigation.

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