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PHYSIO-CHEMICAL ANALYSIS OF BORE-WELL WATER OF TIRUPATHI ENVIRONS IN CHITTOOR DISTRICT, ANDHRA PRADESH, INDIA

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Abstract

The water quality parameters in ground water differ from different areas. Hence the present study was undertaken to characterize the physiochemical nature of ground water in Tirupathi surrounding by taking water samples from different places. Evaluation of physio chemical parameters was carried out. Correlation analysis has been used to establish relationship among the parameters. To assess the quality of ground water, each parameter was compared with the standard desirable limit of those parameters in drinking water.

Key Words: Water Pollution, Bore well water, Well water, Correlation analysis.

Introduction

Fresh water has become a scarce commodity due to over exploitation and pollution of water. Increasing population and its necessities have lead to the deterioration of surface and sub surface water. Groundwater is the major source of drinking water in both urban and rural areas. The importance of groundwater for the existence of human society cannot industrial sector. Till recently it had been considered a dependable source of uncontaminated water. Groundwater crisis is not the result of natural factors. It has been caused by human actions. Much of ill health which affects humanity, especially in the developing countries can be traced to lack of safe and whole some water supply.

The quality of ground water is the resultant of all the processes and reactions that act on the water from the moment it condensed in the atmosphere to the time it is discharged by a well or spring and varies from place to place and with the depth of the water table. Ground water is particularly important as it accounts for about 88% safe

drinking water in rural areas, where population is widely dispersed and the infrastructure needed for treatment and transportation of surface water does not exist. Standard desirable limit of water quality parameters in drinking water prescribed by different agencies is shown in Table 1. In Tirupathi, industrialization and urbanization have major impact on groundwater environment. Both surface and subsurface water sources are getting polluted due to developmental activities. In western areas of Tirupathi, particularly in Renigunta (Fig.1), there are numerous pharma and small scale industries. The effluents from these industries greatly distress the geochemistry of the soil. The discharged chemicals interact with ground water and alter the pH and other water quality parameters. Hence the western areas of Tirupathi were selected to study the effect of sanitary conditions on ground water quality. The social relevance of the problem has encouraged us in carrying out this work. The quality of ground water has been assessed by comparing each parameter with the standard desirable limit of that parameter in drinking water as prescribed by different agencies and sources.



Fig.1 Location Map of the Tirupathi Environs

Methodology

Study area

The physiochemical parameters of ground water of 5 stations in Tirupathi. The ground water was collected from the bore wells located in these stations during the months of January 2009 to March 2009. The depth of the bore wells ranged from 90-130 feet in all these stations. The sampling locations, source and corresponding habitats are shown in Table 1.

Preparation of water samples

The samples were collected in clean polythene bottle without any air bubbles. The bottles were rinsed before sampling and tightly sealed after collection and labeled in the field. The temperatures of the samples were measured in the field itself at the time of sample collection. The samples were kept in refrigerator maintained at 5°C.

Table 1: Sampling Location and Corresponding Habitat Analysis of water sample.

Sl.No.	Sampling Location	Habitat	Source
1	K.T.Road Area	Residential Area	Borewell And Well
2	Bhavani Nagar	Residential Area	Borewell And Well
3	L.I.C.Office Street	Residential Area	Borewell And Well
4	M.R.Palli Area	Commercial Area	Borewell And Well
5	S.V.Nagar	Commercial Area	Borewell And Well

Analysis was carried out for various water quality parameters such as pH, total dissolved solids, total hardness, total alkalinity, calcium, chloride and chemical oxygen demand (COD) as per standard procedures.

Determination of water quality parameters

The water quality parameters analyzed were: pH measured using standard pH- meter, total dissolved solids (TDS) by standard methods, calcium content by EDTA titrimetric method, methyl orange alkalinity and chemical oxygen demand (COD) by open reflux method.

Results and Discussion

The results of the physiochemical analysis of the groundwater samples S1 to S5 collected from 5 places in Tirupati presented in table 2.

pH

The pH is considered as an important ecological factor and provides an important piece factor and piece of information in many types geochemical equilibrium or solubility calculation. pH is an important parameter in water body since most of the aquatic organisms are adapted to an average pH and do not withstand abrupt changes. The pH values fluctuated between 7.5 and 8.4 (Table 2). The limit of pH value for drinking water is specified as 6.5 to 8.5. The pH shows slightly alkaline trend. Generally pH of water is influenced by geology of catchments area and buffering capacity of water.

Temperature

The temperature was found to be in the range between 26.3 to 27.9°C during study. The higher value of water temperature observed in the present study could be attributed to the early summer months prevailed during the period of investigation.

Total alkalinity

The standard desirable limit of alkalinity in potable water is 120 mg/L. The maximum permissible level is 600 mg/L. The mean value of alkalinity in the ground water of Tirupati area was 150.85 mg/L (Table 3) which exceeded the desirable limit in all stations. The value of alkalinity in water provides an idea of natural salts present in water. The cause of alkalinity is the minerals which dissolve in water from soil. The various ionic species that contribute to alkalinity include bicarbonate, hydroxide, phosphate, borate and organic acids. These factors are characteristics of that source of water and natural processes taking place at any given time. The small scale pharma units present in Tirupati do not have proper drainage system. They discharge the waste waters into the soil. This may lead to increase in alkalinity of ground water in these areas.

Table 2: Comparison of Physic Chemical Parameters of Groundwater, Tirupati Area (Mg/L) with Standard Values (WHO).

Sl. No.	PARAMETERS	S1			S2			S3			S4			S5			WHO
		BORE	WELL	MEAN	BORE	WELL	MEAN	BORE	WELL	MEAN	BORE	WELL	MEAN	BORE	WELL	MEAN	
1	pH	7.4	7.5	7.25	7.3	7.7	8.05	7.6	8	7.7	8.6	7.9	8	8.4	8	8.06	7.0 - 8.5
2	E.C	0.098	0.085	0.091	0.104	0.102	0.103	0.085	0.063	0.074	0.065	0.055	0.07	0.125	0.125	0.125	
3	TDS	386.2	289	337.6	285	388.3	336.6	217	225.5	233.5	149	225.5	185	351.2	350.1	350.7	500
4	TOTAL ALKALINITY	177.7	175.6	176.7	163.3	161.1	162.2	124.9	120.5	122.7	153.7	150.4	152	134.5	125.2	129.8	120
5	CHLORIDES	190.9	180.2	180.5	148	156	152	128.8	131.1	129.9	102.2	104.3	103	276.8	256.7	266.7	250
6	TOTAL HARDNESS	94.5	92.5	93.5	160.2	154.2	157.2	180.6	161.1	159.8	171.4	170.5	171	235.5	230.2	232.9	200
7	CALCIUM	49.1	34.2	41.6	39.4	43.9	41.7	40.1	49.2	44.6	7.8	5.15	6.5	71.7	50.2	61	75
8	BOD	249.1	234.2	241.6	339.4	343.9	341.7	240.1	249.2	244.6	307.8	325.1	317	471.7	450.2	461	
9	COD	17.88	17.65	17.76	8.65	8.5	8.57	5.69	6.25	5.97	14.9	14.7	14.8	16.2	16.15	16.2	255

Chloride

Chlorides are important in detecting the contamination of ground water by waste water. The permissible limit of chloride in drinking water is 250 mg/L. The values of chloride observed in S1, S2, S3 and S4 were very low i.e. within the permissible limit, whereas the chloride value observed in S5 was well above the standard desirable limits prescribed by WHO (1984). The presence of chloride in slightly higher amounts in S5 may be due to natural processes such as the passage of water through natural salt formations in the earth or it may be an indication of pollution from industrial or domestic use.

Total hardness (TH)

ISI has specified the total hardness to be within 300 mg/L of CaCO₃. Regarding total hardness fluctuating trends in its value were observed in all the 5 stations. The observed total hardness values were well within the limits. S1 has comparatively high TH value than S4.

Total dissolved solids (TDS)

The average value of TDS in the ground water of tirupati was 351 mg/l. ISI prescribed the desirable limit of TDS is 500 mg/l. the maximum permissible levels is 2000 mg/l. TDS values observed in S1, S2, S3, S4, S5, were within the desirable limit but the TDS value observed in S5, was well above the standard desirable limit. High TDS in ground water may be due to ground water pollution when waste waters from both residential and industrial are discharged in to pits, ponds and lagoons enabling the waste migrate down to the water table.

Calcium

Calcium concentration were found to vary from 7-71mg/l. The upper limit of calcium concentration for drinking water is specified as 75mg/l (ISI1983). The calcium hardness observed in all the 5 station are well within the desirable limits with a maximum of 61mg/l in S4 to a maximum of 39.2 mg/l.

Chemical oxygen demand (COD)

The observed COD values in all 5 stations are varying from 8-9mg/l. The permissible limit of COD for drinking water is 255mg/l. Hence the observed COD values in all the 5 stations are well within the desirable limit.

Conclusion

The analysis of the water quality parameters of groundwater from five different stations in Tirupati shows that the pH, chloride ion, total hardness, calcium and COD values are well within the permissible limits. The TDS of S.V.Nagar was well above the desirable limit and the average of alkalinity has exceeded the desirable limits which are due to improper drainage system of the pharma units. In conclusion from the results of the present study it may be said that the groundwater of Tirupati is though fit for domestic and drinking purpose need treatments to minimize the contamination especially the alkalinity. The values of correlation coefficients and their significance levels will help in selecting the proper treatments to minimize the contaminations of groundwater of Tirupati. There is an increasing awareness among the people to maintain the groundwater at their highest quality and purity levels and the present study may prove to be useful in achieving the same.

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