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Research Article

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Physio-chemical analysis of bore-well water of Kurnool environs, Andhra Pradesh

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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 Kurnool surrounding by taking water samples from different places. Evaluation of physio-chemical parameters was carried out to assess the quality of ground water. Each parameter was compared with the standard desirable limit prescribed by WHO. The quality of bore well water of Kurnool environs has been assessed and discussed in this paper.

Key words: Water Pollution, Bore well water, Physio-chemical parameters, Desirable limit

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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. Groundwater is very important for the existence of human society and industrial sector from times immemortal[1]. 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 human health, especially in the developing countries can be traced to lack of safe water supply[2].

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. In Kurnool, 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 Kurnool (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, these areas of Kurnool 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 WHO.

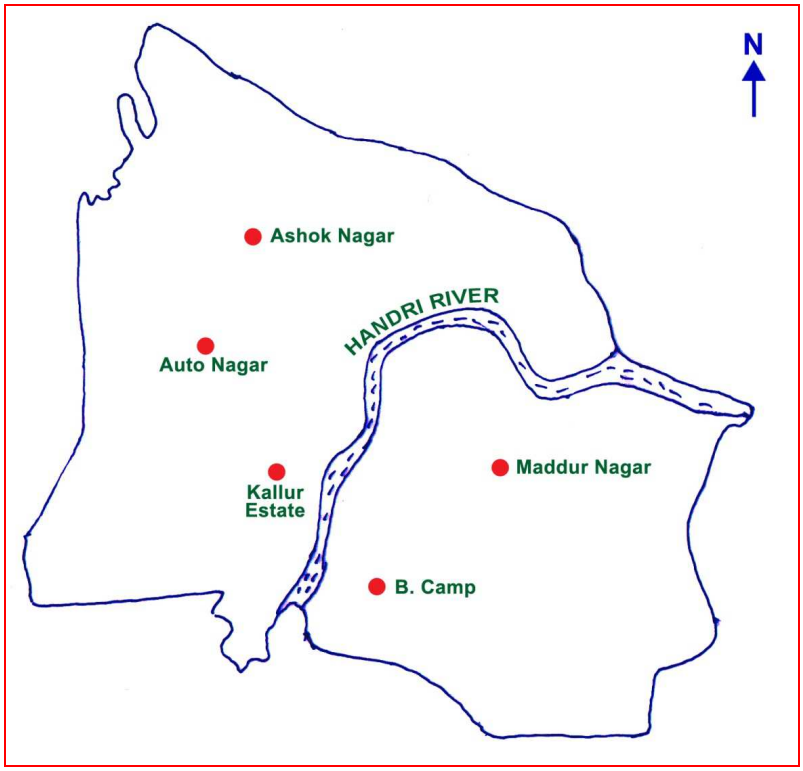

Fig.1 Location Map of the Kurnool Environs

EXPERIMENTAL SECTION

Study area

The physiochemical parameters of ground water of 5 stations in Kurnool environs were considered for the present investigation. The ground water was collected from the bore wells located in these stations during the months of January 2014 to March 2014. 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 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 and maintained at 5°C.

Table 1 Sampling location and corresponding habitat

Sl. No.	Sampling Location	Habitat	Source
1	B. Camp	Residential Area	Bore well
2	Maddur Nagar	Residential Area	Bore well
3	Ashok Street	Commercial Area	Bore well
4	Kallur Estate	Industrial Area	Bore well
5	Auto Nagar	Industrial Area	Bore well

Analysis of water samples

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

Determination of water quality parameters

The water quality parameters analyzed were as follows: pH was measured using standard pH- meter, total dissolved solids (TDS) by standard methods, calcium content by EDTA titrimetric method, biochemical oxygen demand (BOD) and chemical oxygen demand (COD) by open reflux method and chloride by turbidity method.

RESULTS AND DISCUSSION

The results of the physiochemical analysis of the groundwater samples S_1 to S_5 collected from 5 places in Kurnool are presented in table 2.

pH

The pH is considered as an important ecological factor and provides an important information for geochemical equilibrium. 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. In the studied areas, the pH values fluctuated between 7.3 and 8.6 (Table 2) and shows slightly alkaline trend. According to WHO guidelines, the limit of pH value for drinking water is specified as 7.0 to 8.5. 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 and 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 Kurnool area was 150.85 mg/L 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. The small scale soap, alkalies and distellery units present in Kurnool 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 physico chemical parameters of groundwater, Kurnool area (mg\l) with standard values (WHO)

Sl. No.	Parameter	S1	S2	S3	S4	S5	WHO
1	pH	7.4	7.3	7.6	8.6	8.4	7.0 - 8.5
2	EC	0.098	0.104	0.085	0.065	0.125	---
3	TDS	351.2	285	217	149	386.2	500
4	Total alkalinity	177.7	163.3	124.9	153.7	134.5	120
5	Chlorides	190.9	148	128.8	102.2	276.8	250
6	Total hardness	94.5	160.2	180.6	171.4	235.5	200
7	Calcium	49.1	39.4	40.1	70.8	71.7	75
8	BOD	2.49.	3.39	2.79	3.78	4.71	5
9	COD	17.88	8.65	5.69	14.9	16.2	255

Chloride

Chlorides are important in detecting the contamination of ground water. The permissible limit of chloride in drinking water is 250 mg/L. The values of chloride observed in S1, S2, S3, S4 and S5 were very low i.e. within the permissible limits prescribed by WHO (1984)[3]. The presence of chloride in slightly higher amounts in S_5 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 waste.

Total hardness (TH)

ISI[4] has specified the total hardness to be within 300 mg/L of $CaCO_3$. 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. But S_5 has comparatively high TH value of 235.5 mg/l which is beyond the prescribed limits of 200 mg/l.

Total dissolved solids (TDS)

The ISI prescribed the desirable limit of TDS as 500 mg\l. The maximum permissible levels is 2000 mg\l. TDS values observed in S_1, S_2, S_3 and S_4 were within the desirable limit but the TDS value observed in S_5,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 areas are discharged in to pits, ponds and lagoons enabling the waste migrate down to the water table.

Calcium
Calcium concentrations were found to vary in the range 7-71mg\l. The upper limit of calcium concentration for drinking water is specified as 75mg\l (ISI 1983). The calcium hardness observed in all the 5 stations is well within the desirable limits with a minimum of 39.4 mg\l in S_2 to a maximum of 71.7 mg\l in S_5.

Biological Oxygen Demand(BOD)
The BOD varies from 2.49mg/l in S_1 to 4.71 in S_5. The BOD values are within the WHO limits of 5 mg/l.

Chemical Oxygen Demand (COD)
The observed COD values in all 5 stations are varying from 5.69 to 17.88 mg\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 Kurnool shows that the pH, chloride, total hardness, calcium and COD values are well within the permissible limits. The TDS of Industrial Estate is higher than the remaining areas and the average of alkalinity has exceeded the desirable limits which are due to improper drainage system of the soap, distellery units. It is concluded that the groundwater of Kurnool is though fit for domestic and drinking purpose, need treatments to minimize the contamination especially the alkalinity. There is need to increase 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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