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Physico-Chemical Assessment of Groundwater Quality in Rural Areas of Jhunjhunu District (Rajasthan)

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ABSTRACT: Ground water is increasingly being sought as a source of drinking water due to the scarcity, non-availability and bacteriological pollution of surface water. This paper describes the important results of the Physico-chemical analysis of the ground water samples of the open wells, tube wells and hand pumps of the District – Jhunjhunu of Rajasthan State. The different parameters determined are pH, TDS, fluoride, chloride, nitrate, sulphate, total alkalinity and total hardness. It has been observed that nitrate values are higher compared to ICMR standards. Other parameters were found within desirable limits. The interesting fact is that the nitrate alone is making ground water unfit for drinking. Jhunjhunu is a city and capital of Jhunjhunu district in the state of Rajasthan. This city is in the northern state of Rajasthan, India and the administrative headquarters of Jhunjhunu District. In the 2011 India census, the town of Jhunjhunu had a population of 118,473 and a literacy rate of 73.58%. Jhunjhunu comes within the territory of the North Western Railway. Jhunjhunu city is connected through a broadgauge line to Sikar, Rewari, and Delhi. Railway Minister Suresh Prabhu flagged off two trains to mark the completion of Rs. 260 crore gauge conversion of the 122 km Loharu-Sikar railway line in Rajasthan. Both trains were flagged off by Prabhu through remote control by organising video conferencing between Rail Bhawan, New Delhi and Sikar, Rajasthan. Prabhu pointed out that sufficient funds have been provided in 2015–16 to complete this project, i.e., Jaipur-Ringas-Churu, by March, 2017. Rail service between Jhunjhunu and Dehli (14811/14812) Delhi Sarai Rohilla-Sikar Express (bi-weekly) began 2 September 2015. SH 8 proceeds from Jhunjhunu town to Sikar and connects to NH 52 in Sikar (Gokulpura) but direct way from Jhunjhunu town to Jaipur is via Udaipurwati, Sri Madhopur, Reengus this Super State Highway proceeds from Pilani to Reengus(Sri Madhopur tehsil) via Chirawa, Jhunjhunu, Udaipurwati and Sri Madhopur main city. The nearest airport to Jhunjhunu city is Jaipur International Airport.

KEYWORDS: physico-chemical, analysis, groundwater, jhunjhunu, rajasthan, standards, drinking

I. INTRODUCTION

The present study provides a detailed description of the chemical criteria of ground water. Ten representative samples of entire study area were collected and analyzed for pH, total dissolved solids (TDS), fluoride, chloride, nitrate, sulphate, total alkalinity, total hardness. The sampling sites were identified and then the samples were collected from different sources after allowing some amount of water to flow out. The samples were collected in clean plastic bottles, which were pre cleaned, dried in dust free environment and sterilized.



Jhunjhunu district guide map, Rajasthan



Rani sati temple

The instruments were used in the limit of précised accuracy and chemicals used were of analytical grade. All the water sample were properly labeled as 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 and a record was prepared indicating the source of the sample, location of the source and data of collection. 3 open wells, 3 tube wells and 4 handpumps in different areas were selected for sample collection. [1,2]

II. OBSERVATION

The Parameters and methods selected for the water sample analysis are detailed in Table-1.

Table-1: Parameters, methods, standard values and unit employed in physico-chemical examination of samples

S. No.	Parameter of water samples	Methods	Standard values as guided by ICMR		Unit
			Desirable concentration	Maximum permissible	
1.	pH	pH meter	7.0-8.5	6.5-9.2	-
2.	Total alkalinity	Titrimetric	200	600	mg/L
3.	Total hardness	Titrimetric	300	600	mg/L
4.	Chloride	Argentometric	200	1000	mg/L



5.	Sulphate	Turbidity meter	200	400	mg/L
6.	Total dissolved solids (TDS)	Conductivity meter	500	1500	mg/L
7.	Nitrate	Colorimetric	20	50	mg/L
8.	Fluoride	Ion selective electrode	1.0	1.5	mg/L

Table-2: Physico-chemical analysis of ground water of 3 open wells, 3 tube wells and 4 handpumps of different areas in Jhunjhunu district of Rajasthan

Sample no.	Source	pH	TDS	F mg/L	Cl mg/L	NO ₃ mg/L	SO ₄ ⁻² mg/L	Total alkalinity mg/L	Total hardness mg/L
1	T.W.	8.5	980	0.8	190	90	50	250	170
2	T.W.	7.8	1120	0.7	250	50	60	210	260
3	T.W.	7.9	1120	0.6	275	50	65	260	200
4	T.W.	7.8	1400	1.1	300	140	75	280	220
5	T.W.	8.0	1400	1.0	325	40	80	300	220
6	T.W.	8.5	1330	1.1	270	90	70	260	170
7	T.W.	7.4	1400	1.0	265	55	45	180	170
8	T.W.	7.3	1260	1.0	175	360	30	160	170
9	T.W.	7.5	1330	1.1	240	170	30	210	180
10	T.W.	7.7	1190	1.4	190	170	30	190	150

III. RESULTS AND DISCUSSION

1. pH : All chemical and biological reactions are directly dependent upon the pH of water system.⁹ The lower values of pH may cause tuberculation and corrosion while the higher values may produce incrustation, sediment deposit and difficulties in chlorination for disinfection of water¹⁰. In the present study the pH values in all the samples range from 7.3 to 8.5, which are all within the limit. The pH of water is very important indication of its quality and provides information in many types of geochemical equilibrium or solubility calculations.[3]

2. TDS : Total dissolved solid is an important parameter for drinking water and water to be used for other purposes. The maximum permissible limit of TDS is 1500 mg/L (ICMR). Beyond the prescribed limit, it imparts a peculiar taste to water and reduce its potability. TDS was found in the range of 980 to 1400 mg/L, which is also within the limit. [4]

3. Fluoride:Fluoride is important in human nutrition for the normal development of bones. The required level of fluoride is 1.0 to 1.5 mg/L. Due to higher concentration of fluoride in ground water may develop molting of teeth, skeletal fluorosis, deformation in knee joints etc. In the Present study, it is observed that the fluoride content varied from 0.6 to 1.4 mg/L. Thus, it is completely in the permissible range and there is no threat to human health due to fluoride in drinking water.[5]



Sampling from tube well

4. Chloride: Chloride contents in fresh water is largely influenced by evaporation and precipitation. Chloride is the most troublesome anion in the irrigation water. They are generally more toxic than sulphate to most of the plants and are the best indicator of pollution. Chloride contents varied from 175 to 325 mg/L in all the samples, which is all within the limit. [6]

5. Sulphate: The sulphate ion is one of the major anions occurring in natural water. Sulphate in most of the samples was found to be lower than the highest desirable level i.e., 200 mg/L. Sulphate was found in the range of 30 to 80 mg/L, which is also within the limit. Higher values of sulphate may cause intestinal disorder. [7]



Sampling from bore well

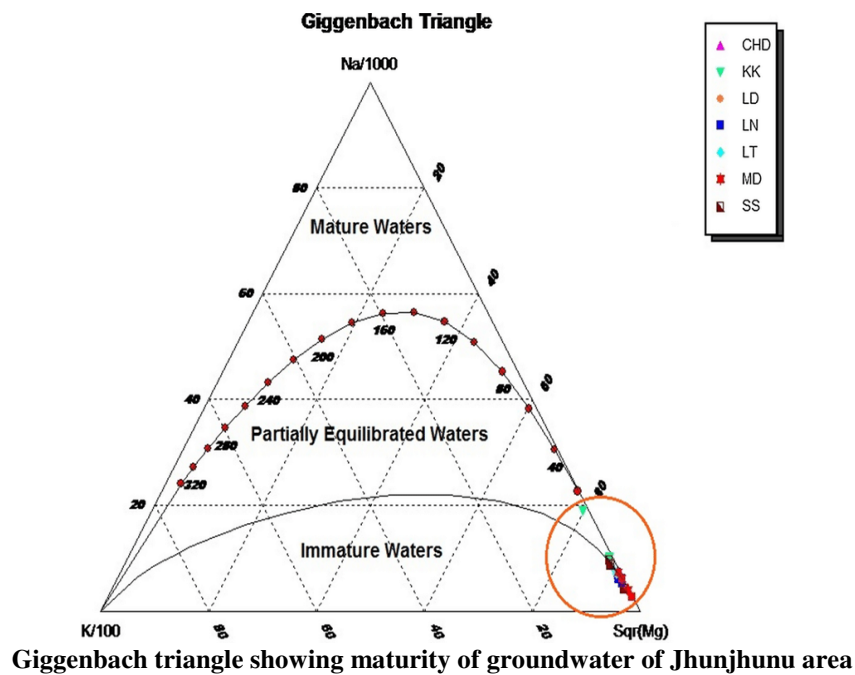
6. Nitrate: The nitrate concentration in the studied area varied from 40 to 360 mg/L. The maximum permissible limit is 50 mg/L (ICMR). Due to higher concentration (over 100 mg/L) of nitrate in water, infants, less than six months old, are suffering from methemoglobinemia or blue baby disease. [8]

7. Total alkalinity : The desirable limit for total alkalinity is 200 mg/L (ICMR). The values of water samples vary from 160 to 300 mg/L. In ground water, most of the alkalinity is caused due to carbonates and bicarbonates. [9]

8. Total hardness: Hardness is an important criterion for determining the usability of water for domestic, drinking and many industrial supplies. The value of water samples varies from 150 to 260 mg/L. The desirable limit for total hardness is 300 mg/L (ICMR). Water hardness is primarily due to the results of interaction between and the geochemical formations. The hardness of water is due to the presence of alkaline earths such as calcium and magnesium. Higher values of hardness are responsible for incrustation and scaling in pipelines. [10]



Sampling from handpump



IV. CONCLUSION

Although it was a representative sample study of the ground water quality of Birla's home town, but the results are very alarming. All parameters except nitrate were found within permissible limits. The general taste of water is also good.[11,12] A layman cannot determine the possible hazards of water quality. This fact makes the study important. There is no industrial growth in Jhunjhunu no dense population but the higher nitrate concentration in ground water indicates some other source.[13,14] Irrigation is the main occupation of the surrounding population and chemical fertilizers are more commonly being used. The higher nitrate concentration may be attributed to the chemical fertilizers.[15]

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