

“Analysis of water quality parameters of ground water near Chittorgarh Industrial area, Rajasthan, India”

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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. Ground water is a major source for all purposes of water requirements in India and it plays a vital role to human life and economic activity. The occurrence and distribution of ground water in the country varies significantly depending on geology, rainfall and geomorphology. The unplanned and non-scientific development of ground water resources has led to sharp depletion of the resources and also degradation of quality at many places. The present work describes the important results of the physico-chemical analysis of ground water sample of different villages of district Chittorgarh in Rajasthan. The different parameters determined are pH, TDS, Chloride, Total alkalinity and Total hardness, Electrical conductivity, Free carbon dioxide. The obtained results are compared with Indian Standard Drinking Water specification IS: 10500-2012 and it indicates that parameters of all ground water samples are in permissible limits except Hardness of Nimbaheera. The interesting fact is that the hardness alone is making ground water unfit for drinking.

Keywords: Physicochemical analysis, Nimbaheera, Ground water, Hardness

I. Introduction

Chittorgarh is a city and a municipality in Rajasthan state of western India. It lies on the Berach River, a tributary of the Banas, and is the administrative headquarters of Chittorgarh District and a former capital of the Sisodia Dynasty of Mewar. The city of Chittorgarh is located on the banks of river Gambhiri and Berach. Chittorgarh has an average elevation of 394 metres (1292 ft). It is located in the southern part of the state of Rajasthan, in the northwestern part of India. It is located beside a high hill near the Gambheri River and between 23° 32' and 25° 13' north latitudes and between 74° 12' and 75° 49' east longitudes in the southeastern part of Rajasthan state.

98% of the planet Earth's water is in the Oceans, remaining 2% is fresh water, but 98% of, which is stored in ice caps at the poles. In other words only 0.04% of water is available for human being use. Ground water is the important source for irrigation and drinking purpose. Water pollution is an important aspect of environmental pollution ground water is an important natural resource worldwide that exists only on our planet, without this precious resource life on earth would be non-existent.

Good quality water is inadequate even for normal living and is getting contaminated due to domestic wastes, industrial wastes, agricultural wastes, runoff from urban areas and soluble effluents.^[1-3]

In the last few decades, there has been a tremendous increase in the demand for fresh water due to rapid growth of population and the accelerated pace of industrialization. Human health is threatened by unsanitary conditions through open drain carrying and disposing waste water into natural water bodies. Rapid urbanization, especially in developing countries like India, has affected the availability and quality of groundwater due to its overexploitation and improper waste disposal, especially in urban areas. According to WHO organization, about 80% of all the diseases in human beings are caused by water.^[4] Once the groundwater is contaminated, its quality cannot be restored back easily and to device ways and means to protect it.^[5-7]

II. Experimental

The present study provides a detailed description of the chemical criteria of ground water. Seven representative samples of entire study area were collected and analyzed for pH, chloride, total dissolved solids (TDS), total alkalinity, total hardness, electrical conductivity, free carbon dioxide. 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. The instruments were used in the limit of precise accuracy and chemicals used were of analytical grade. All the water samples were properly labeled as 1, 2, 3, 4, 5, 6, 7, and a record was prepared indicating the source of the sample, location of the source and data of collection.

Locations from where water samples were collected are as follows :-

- Sample 1. Mewar university, acadmic block
- Sample 2. Mewar university, mess area
- Sample 3. Adarsh colony, Nimbahera
- Sample 4. Chogawdi
- Sample 5. Chanderia
- Sample 6. Rawlia
- Sample 7. Shambhupura

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

Table-1: Different analytical water quality parameters and guideline values as per Indian standard IS 10500:2012.^[8]

Sr no	Parameter	Indian standard (Desirable)	Indian standard (Maximum)
	Temperature	-	-
	pH	6.5-8.5	No relaxation
	Total Hardness (mg/l)	300	600
	Total Alkalinity(mg/l)	200	600
	Chloride(mg/l)	250	1000
	Odour	Unobjectionable	
	Total Dissolved Solids(TDS) (mg/l)	500	2000

III. Results And Discussion

The results obtained for urban areas pilani are reported in Table-2. Eight water samples were analyzed for the following eight parameters – pH, temperature, TDS, chloride, total alkalinity, total hardness, free carbondioxide, electrical conductivity.

Table-2: Physio-chemical parameters of sampled waters in Chittorgarh Industrial area.

Parameters	Sampling point						
	1	2	3	4	5	6	7
Temperature (°C)	23	24	31.6	31.4	32	30.5	31
pH	8	7.8	7.4	7.6	7.8	7.4	8.2
Total Alkalinity (mg/l)	200	230	145	197	202	165	153
Total Hardness (mg/l)	375	370	625	462.5	575	350	400
Chloride (mg/l)	250	250	270	260	310	260	280
EC (µmho/cm)	1180	1170	2296	1424	2020	1010	1128
TDS(mg/l)	596	591	1148	712	1010	510	564
Free CO₂(mg/l)	17	18	22	33	44	44	33

Temperature: Temperature is one of the most essential parameters in water. It has significant impact on growth and activity of ecological life and is greatly affects the solubility of oxygen in water and it also controls the physiological behavior and distribution of organisms. The temperature of ground water has found to be in the range of 23°-31°C.

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 water.^[10]

In the present study the pH values in all the samples range from 7.4 to 8.2, 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.^[11]

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 2000 mg/l (**IS 10500:2012**). Beyond the prescribed limit, it imparts a peculiar taste to water and reduce its potability. TDS was found in the range of 510 to 1148 mg/L, which is also within the limit.

Chloride: Chloride contents in fresh water are largely influenced by evaporation and precipitation.^[12] Chloride is the most trouble some anion in the irrigation water. They are generally more toxic than sulphate to most of the plants and are best indicator of pollution.^[13-14] Chloride contents varied from 250-310 mg/l in all the samples, which is all in the limit.

Total alkalinity: The desirable limit for total alkalinity is 200 mg/L (IS 10500:2012). The value of water samples varies from 145 to 230 mg/L. In ground water, most of the alkalinity is caused due to carbonates and bicarbonates.

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 350 to 625 mg/l which exceed the permissible limit. The maximum permissible limit for total hardness is 600 mg/l. (IS 10500:2012). Water hardness is primarily due to the results of interaction between and the geochemical formations.^[15]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.

Electrical Conductivity: Conductivity is the measure of mineral content and is a numerical expression ability of an aqueous solution to carry electric current. This ability depends on the presence of ions, their total concentration, mobility, valence, relative concentrations and temperature of measurement. In present investigation, lowest value was recorded 1010 $\mu\text{mho/cm}$ and high value was recorded 2296 $\mu\text{mho/cm}$.

Free CO₂: Free carbon dioxide showed an irregular pattern in the groundwater which reflects less load of organic matter in water. In present investigation, lowest value was recorded 17 mg/l and high value was recorded 44 mg/l.

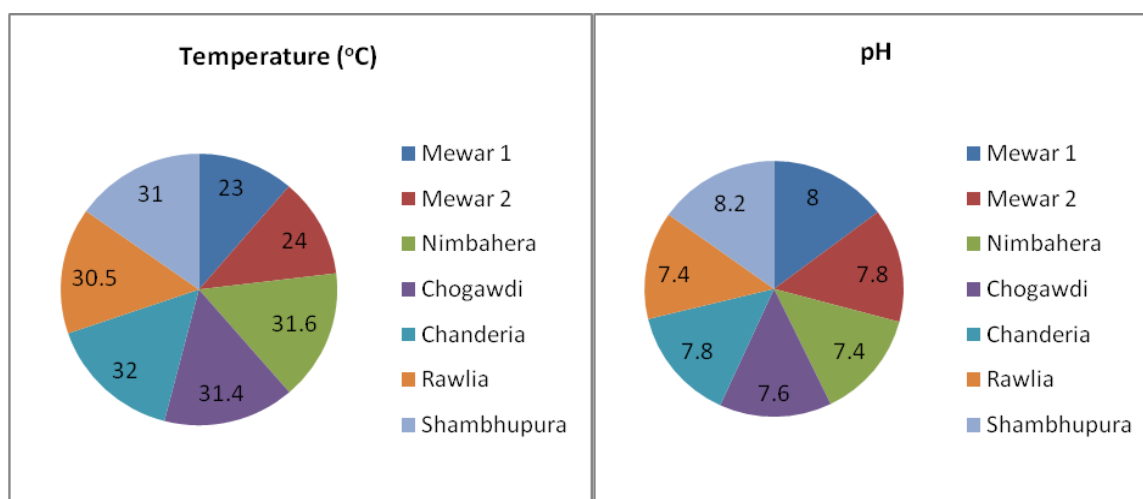


Fig 1: Comparison of the temperature and pH parameter between different samples of villages

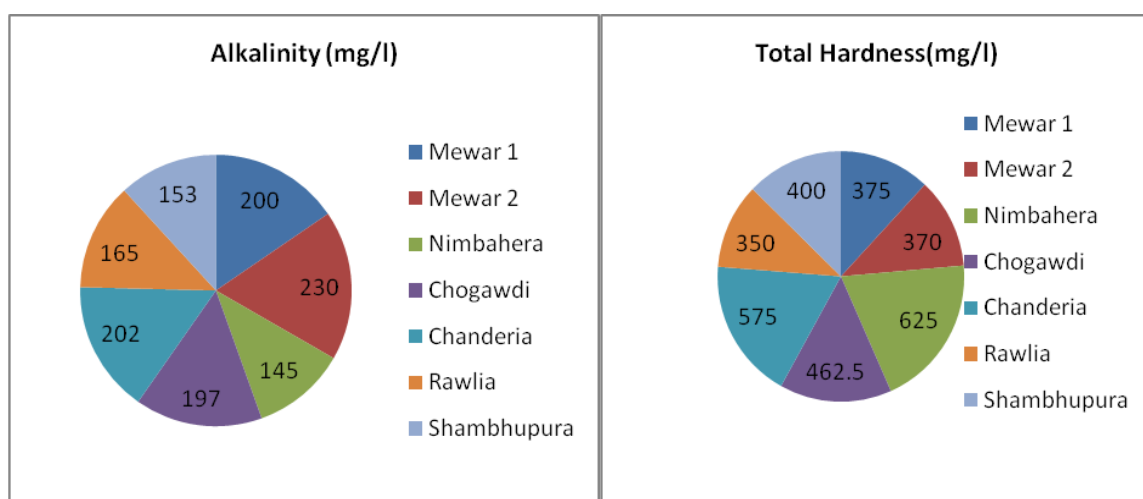


Fig 2: Comparison of the alkalinity and total hardness parameter between different samples of villages

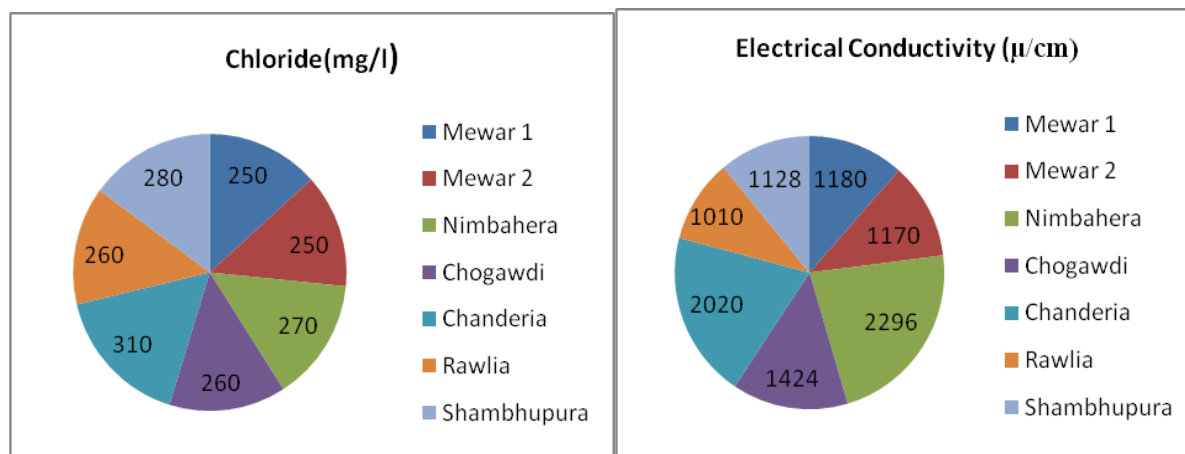


Fig 3: Comparison of the chloride and electrical conductivity parameter between different samples of villages

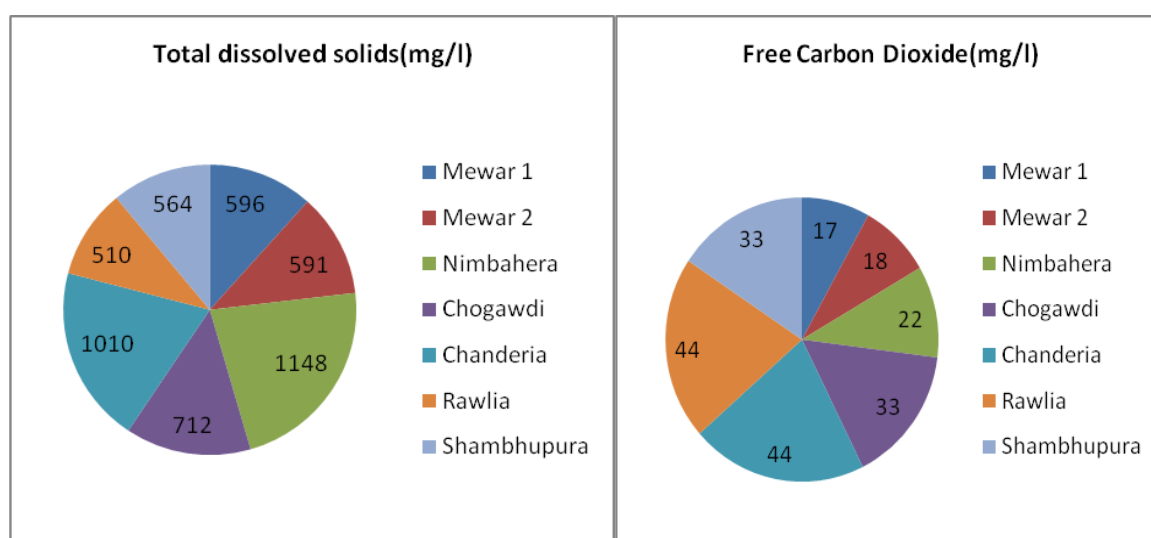


Fig 4: Comparison of the TDS and free Carbon Dioxide parameter between different samples of villages

IV. Conclusion

Although it was a representative sample study of the ground water quality of surrounding villages of district Chittorgarh, but the results are very alarming. All parameters except hardness were found within permissible limits. The general taste of water is also good. A layman cannot determine the possible hazards of water quality. This fact makes the study important. There is some industrial growth in Chittorgarh and Nimbahera region and the water of Nimbahera is hard, because of this, people of this area are prone for the immediate health problems such as stomach diseases, gastric troubles etc. Irrigation is the main occupation of the surrounding population and chemical fertilizers are more commonly being used. Apart from Nimbahera’s ground water, the physical and chemical properties of ground water of rest of the areas were within desirable limits and shall be useful in future management of the reservoir.

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