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PHYSICO AND HYDRO CHEMICAL ASSESSMENT OF GROUNDWATER QUALITY OF BARMER DISTRICT RAJASTHAN

PACHAK SK[1], PARIHAR S[2*] AND GEHLOT T[3]

1: Research Scholar Department of Chemistry Jai Narain Vyas University Jodhpur

2: Assistant Professor Department of Chemistry Jai Narain Vyas University Jodhpur

3: Assistant Professor (Civil Engineering) College of Technology and Agriculture Engineering Jodhpur

[*]**Corresponding Author: Dr. Sangeeta Parihar: E Mail: sp.ch@jnvu.edu.in**

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ABSTRACT

This research paper explored the physico and hydro chemical parameters of ground water samples of different sites of Barmer region in Rajasthan. Samples were collected to study various physico-chemical parameters like pH, electrical conductivity, chloride, sulphate, nitrate, alkalinity, hardness, calcium, magnesium etc. The results suggest that few samples contained chemical constituent beyond permissible limits prescribed by Bureau of Indian Standards (B.I.S), which cause various harmful effects. In this paper, regional ground water contamination will broadly refer to the types of ground water contamination that can be observed at the regional scale. Hydro chemical parameters like sodium adsorption ratio, kelly ratio etc. were evaluated which indicate suitability of groundwater for drinking and irrigation purpose. Based on these results, it is recommended that any ground water source in the study area should be tested before use for its portability and other domestic or industrial uses.

Keywords: Ground water quality, Physico and Hydro chemical parameters, Pollution, Barmer, Environment

INTRODUCTION

Water presents about 71% in a human body. Even though about 80% of earth's surface are covered from the water but in that only 3% water are usable and rest of 97 % is having saline water which is contain higher amount of mixture compound which

is not suitable for drinking purpose. As the WHO report about 82% of all the diseases in a human body are caused by the water only **[1]**. As the theorem of usages it's required for the domestic and industrial supplies and for irrigation on all over the world.

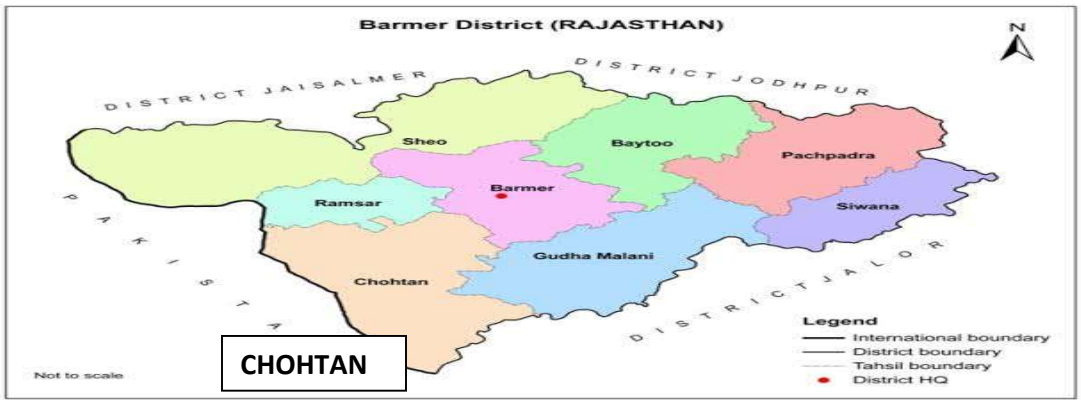
Water is very precious and required factor for the living things. Which contagious with the all living bodies on the Earth as the years passes the level of water on the earth is decreasing and the various unwanted parameters are likely mixed with water and making the water pollutant these substances happens due to industries and the unwanted destruction of the water and this may cause dangerous for the next generation **[2]**. The availability of better phase of water is likely helps to prevent from the disease and which help us to prevent the health and growth and also provide the better quality of the life **[3]**.

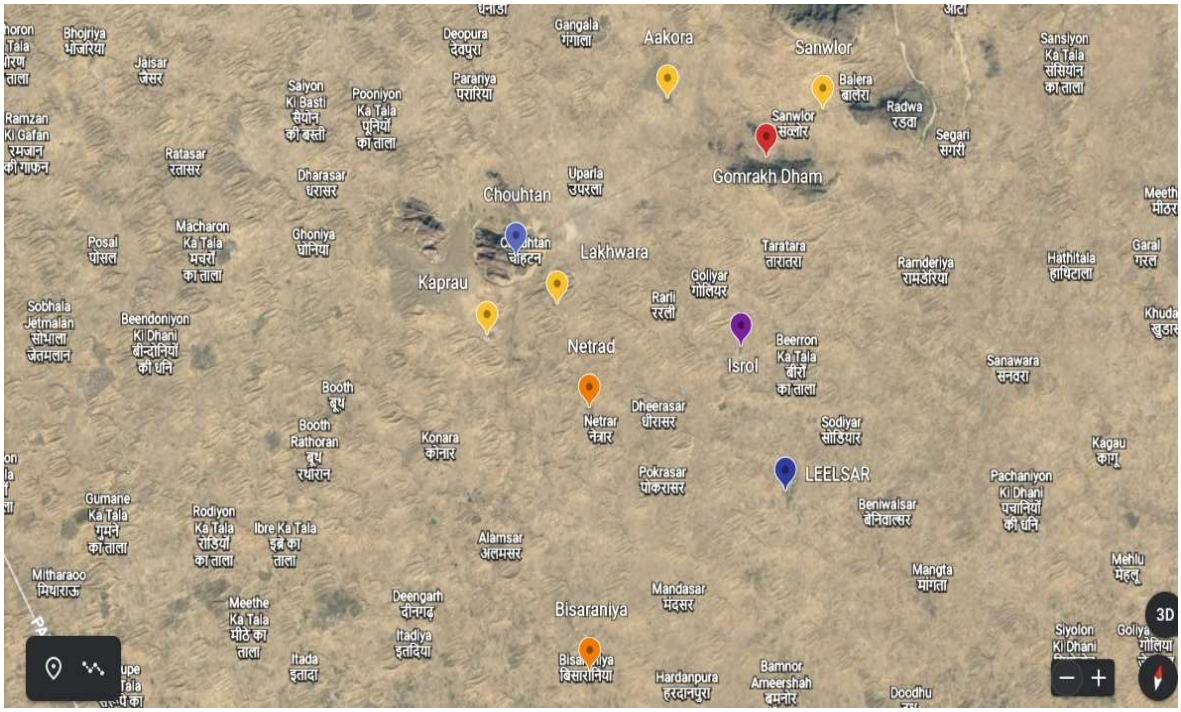
Ground water are having minerals and gases with them that produces the water taste little different from all others. If these mixers will not occurs then the water may tastes in different manners like taste flat. As the cycle of component the important substances of groundwater is it's performing a crucial role in hydrological cycle which leading the unique performing factor of the water substances on the continent **[4]**.

MATERIALS AND METHODS

1. STUDY AREA

Barmer District is located between 24°58' to 26°32'N latitudes and 70°05' to 72°52'E Longitudes. Barmer is located in Western Rajasthan with Jaisalmer to It's North, Jalore on it's South, Pali and Jodhpur in it's East and Pakistan to it's west.Chohtan Tehsil is a large town in the district of Barmer, which is in south eastern Rajasthan, India. It is located about 22 miles south east of the city of Barmer. The Chohtan Tehsil is situated about 25°48' N latitudes and 71°07'E longitudes. The proposed study would be carried out in different area of Chohtan Tehsil of Barmer district of Rajasthan to ascertain the suitability of water for drinking and irrigation purpose.





Sample Collection Series

1. Sanwlor 2. GomrakhDham 3. Isrol 4. Leelsar 5. Lakhwara

6. Bisaraniya 7. Netrad 8. Kaprau 9. Chouhtan 10. Aakora

1. METHOD OF WATER SAMPLING

Data selection:

Took total 10 plastic Bottles having 1ltr quantity and required Thermo meter for measuring the temperature of the water. The collective of water samples in the winter weather. Where overall 10 water samples collected from the different places in the choutan city after that collection we were able to conduct and performed the physicochemical parameters by the following required procedure for their outcomes **[5]**.

Table 1: Standard Ranges of the Chemical Parameters as IS [6-10].

Sr. No.	Parameters	Standard range
01.	pH	6.5-8.5
02.	EC (Electrical Conductivity)	2250
03.	TDS (Total Dissolved Solid)	500-2000
04.	Alkanity	200ppm
05.	Nitrate	45-100
06.	Sulphate	200-400
07.	Floride	1-1.5
08.	DO(Dissolve Oxygen)	4.28-7.83
09.	Total Hardness	300-600
10.	SAR	0-8.13

RESULT AND DISCUSSION

1. **PHYSICAL AND CHEMICAL PARAMETER**

Temperature: The temperature used to given as in between 24.3-31.0 °C in pre monsoon and whereas 24.3-30.4 °C in post

monsoon season. The overall nothing difference occurs when we consider to measure the temperature of groundwater it's may change slightly when we cover up the samples from two different season and somewhere its may affect the place different but it happens very less **[11-12]**.

pH: Since all biological responses are susceptible to pH changes, pH has no direct impact on human health. So according to the ICMR (1975), the given pH range for drinking water is between 6.5 and 8.5 which is perfect for the human and the animals. illustrates how the pH of several sample points varied from 7.2 to 8.5 in the post-monsoon season, with the exception of 5-8 samples , which were above 8 pH. Each sample station exhibits a wide range of pH fluctuation throughout the winter **[13]**.

Alkalinity: For home usage, an alkalinity value of less than 120 mg/l is preferred. But when used in enormous levels, it gives water an unpleasant flavour. Alkalinity levels at several sample sites range from 100 to 400 mg/l. The ability of water to neutralise acidity is known as alkalinity, and the primary causes of alkalinity in water are carbonates, bicarbonates, and hydroxides. A rise in alkalinity causes a loss of colour that is inversely proportional to the water sample's alkalinity and frequently occurs close to its hardness value. Alkalinity levels in the study region range is less than 300 mg/L, where the average being 279 mg/L. The research found that the maximum permitted level set by BIS was exceeded by 27.77 percent. Drinking water with high alkalinity has a sour flavour and is salted **[14]**.

Dissolve Oxygen: It is a vital pollution indicator that is necessary for the oxidative respiratory metabolism of all aquatic life (Wetzel, 1975). In the post-monsoon season, the DO at various sample points ranges from 0 to 10 mg/l. The direct passage of DO from the air and the photosynthetic activity of autotrophs may be the causes of its presence in water (Shanthi *et al*., 2002) A broad range of DO fluctuation was seen during the winter monsoon. Oxygen may be quickly removed from water by discharging wastes that require oxygen (Desai and Tank 2011). The profile evolution of DO illustrates the contribution of the addition of sewage and industrial waste **[15]**.

Chloride: All forms of naturally occurring waters include a front Chloride. The high STP, amount of chloride is thought to be a sign of pollution because of the high levels of organic waste with an animal origin (Desai and Tank 2011). In both seasons, the chloride levels in various samples ranged from 2 to 23.8 mg/l. and It was determined that most every sampling was lower than the permissible level of 250 mg/l **[16]**.

Total Solids (Dissolved and Suspended solids): Total dissolved solids (TDS) affect

the characteristics of drinking water and are the most crucial parameter in irrigation water because they may be used to modulate osmotic pressure, which in turn controls what further water is made freely available to plants. The development of plants and wildlife might be inhibited by flocculated materials. According to ICMR, the maximum allowable amount of TDS and TSS for irrigation is 500 mg/l.in the observation the TDS of several sampling points ranges from 900 to 2251mg/l in the winter session **[17]**.

Table 2: Clean water TDS values for end user ratings [18]

Rating	TDS level (mg/L)	No. of Sample	% of Sample
Excellence	<300	-	-
Good	300-600	-	-
Poor	600-900	1	10%
Unacceptable	>1700	9	90%

Total Hardness: The capacity of water to extract insoluble calcium and magnesium salts of higher fatty acids from soap solutions is known as hardness. In the post-monsoon, the hardness of different sample points ranges from 150 to 440 m, Calcium in small concentrations helps prevent corrosion in water pipes. For people who are not used to it, the hardness of magnesium, especially when combined with the sulphate ion, has a laxative effect (Khursid, 1998). All sample points were found to have values that were within the standard during the winter **[19]**.

Table 3: Quality of groundwater as measured by total hardness [20]

Ratings	THasCaCO3	No. of Sample	% of sample
Soft	0-75	-	-
Moderate	75-150	1	10%
Hard	150-300	5	50%
Very Hard	>300	4	40%

Calcium (Ca2+) and Magnessium (Mg2+): In water, calcium is a naturally occurring element. It is a significant component in igneous rocks. Calcium is found in groundwater as soluble calcium carbonate, sulphide, and in very rare cases, chloride. The average calcium, magnessium concentration in the groundwater in the research region is 8.74 mg/L, ranging from 5.2 mg/L to 13 mg/L. All samples in the research region were under the BIS's maximum permitted standard **[21]**.

Chloride (Cl-) Sodium chloride, which dissolves in water from rocks and soil, is the precursor to all other chlorides. It is a reliable indicator of groundwater quality, and if it is combined with sewage or seawater, the concentration in the groundwater will rise. The research area's chloride concentration ranges from 2.0 mg/L to 23.8 mg/L the samples tested were

above the BIS-mandated maximum allowable level **[22]**.

Sodium (Na+): The sixth most common element in the crust of the Earth is sodium. In water samples, sodium is a significant cation. minerals that include sodium, such as albite and various plagioclase feldspars, nephelene, etc. The majority of sodium salts dissolve easily in water. The research area's salt concentration ranges from 2.6 mg/L to 25.88 mg/L. Therefore, every sample location was allowed by BIS **[23]**.

Irrigation water quality: Groundwater is the primary source of irrigation water for the whole study region. For plants to develop properly, an appropriate supply of water is very necessary. However, the irrigation water's quality must also be within acceptable bounds or the plant's development may be adversely affected. The quantity and content of dissolved salts have a major significance in determining the water irrigated with. The practicality of using water for irrigation was evaluated using EC, pH, sodium adsorption ratio (SAR), sodium percentage (SP), residual sodium carbonate (RSC), chlorides, and sulphate **[24]**.

SAR Indicator: Using the sodium adsorption ratio (SAR) value with several classes determined on salinity and alkalinity harards, the appropriateness of ground water samples were examined. With regard to calcium and magnesium concentrations, the sodium adsorption ratio parameter assesses the sodium concentration. The ratio of sodium adsorption is used to forecast the likelihood of sodium accumulating in the soil. The average SAR value was 7.4, with SAR values ranging from 1 to 15.31 **[25-26]**.

Table 4: Salinity in the U.S. recommended four Na hazaed classifications depending on the SAR of irrigation water

Water class	No.	percentage	SAR value	Class of Water Suitability
Excellent	08	80%	<10	S1 Can be used on all soils
Good	02	20%	10-18	S2 can be used on textured soil
Doubtful	-	-	18-26	S3 Ordinary unsuitable water
Unsuitable	-	-	>26	S4 ordinary Unsuitable water

SSP indicator: In the study region, the sodium percentage varies from 16.25 to 82.33 percent, with an average value of 59.14 percent. Ca2+, Mg2+, and Na+ are the main trace elements found in irrigation water, with very little K+. The key contributing factor to the alkaline risk is the solubility and relative concentration of cations in irrigation water. Alkaline danger is higher if there is a higher concentration of Na+, but the risk is lower if Ca2+ and Mg2+ predominate **[27]**.

RSC indicator: Along with the SAR and Na percent, the amount of carbonate and bicarbonate throughout surface and groundwater relative to the sum of calcium

and magnesium defines whether or not it is suitable for irrigation. In the research region, the residual sodium carbonate value ranges from 0 to 6.6 meqL-1, with an average value of 0.92meqL-1. The majority of the samples (70%) have zero results, indicating that the concentrations of dissolved calcium and magnesium were greater than those of carbonate and bicarbonate **[28-29]**.

KR Indicator: Irrigation water may be assessed based on Kelley's ratio, which measures the concentration of Na+ in relation to Ca2+ and Mg2+. When Kelley's ground water has less than one, it is said to be suitable for irrigation. In the study region, the KR value ranges from 0.19 to 4.75, with an average value of 1.92 **[30]**.

Table 5: Ground water quality is distinguished as per KR value

Water class no.	No. of sample	percentage	KR
Good	03	30%	<1
Bad	07	70%	>1

Table 6: shows the electrical conductivity-based groundwater quality for agricultural production [31]

Water class	Water quality	No. of sample	% of sample	EC (µS/m)
Excellent	Low salinity	05	50%	<250
Good	Medium salinity	05	50%	250-750
Permissible	High salinity	-	-	750-2250
Unsuitable	Very high salinity	-	-	>2250

2. STATICAL ANALYSIS

Table 7: Observed parameters values

Sr.no	Temp. ^0C	EC dS/m	Ca^{++} $+Mg^{++}$ meg/lit.	Na^+ meg/lit.	Co_3^{--}+ Hco_3 meg/lit.$^-$	Cl^- Meg/lit.	TDS ppm	Nitrate	DO
01.	29.4	2.58	8.2	16.98	6.4	16.8	1740	111.8	9.18
02.	29.2	1.74	8.8	8.6	15.4	2.0	1160	32.75	8.91
03.	29.6	1.86	6.6	12.0	6.8	11.8	1290	56.9	3.67
04.	29.6	2.16	8.0	13.58	6.2	13.0	1545	126.1	3.54
05.	29.4	2.72	9.8	17.36	6.8	17.6	2045	74.45	4.59
06.	29.3	3.0	5.2	24.7	7.6	19.6	2251	159.8	6.88
07.	29.8	3.38	7.8	25.88	7.2	23.8	2195	131.0	4.91
08.	29.4	1.60	13.4	2.6	5.0	11.0	986	110.75	5.57
09.	29.6	1.76	10.2	7.4	7.6	10.0	1248	206.4	6.22
10.	29.7	2.74	8.8	18.58	7.8	17.4	1985	80.2	5.24

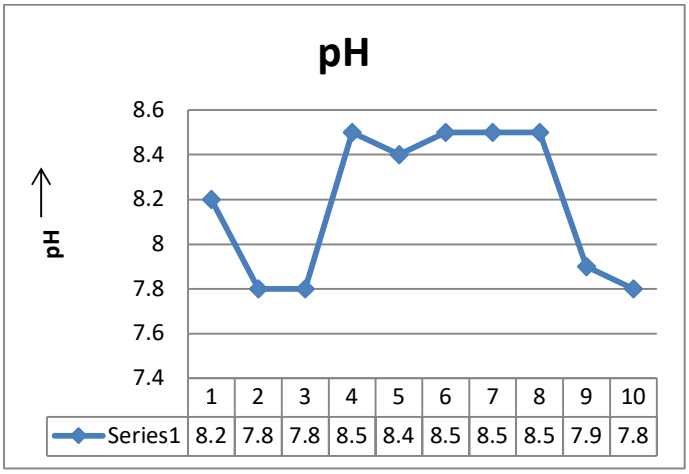


Figure 1: Indicating the value pH.

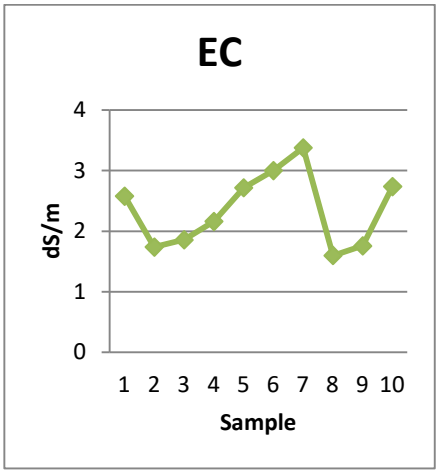


Figure 2: Indicating the value of EC

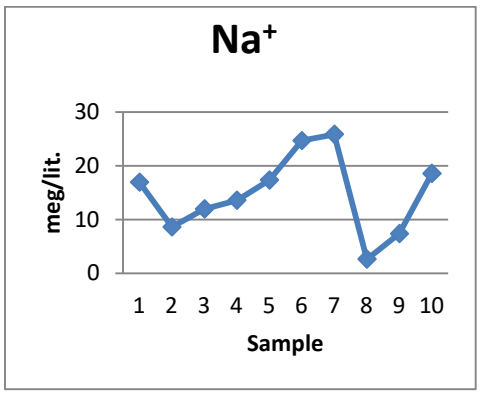


Figure 3: Indicating the value Na^+

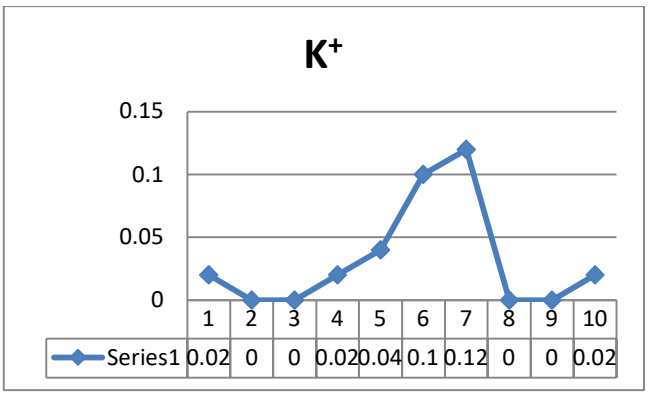


Figure 4: Indicating the value K^+

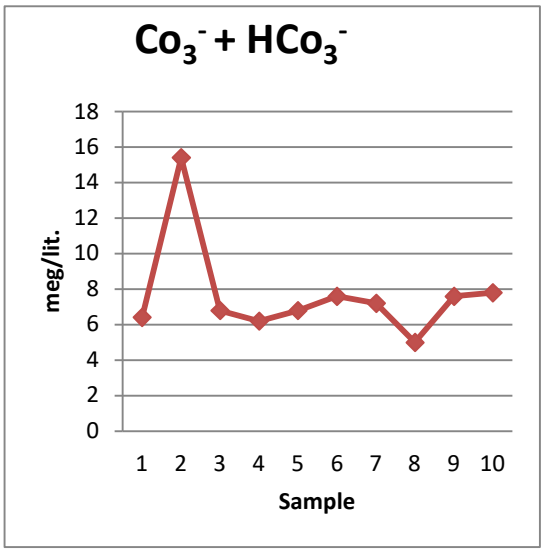


Figure 5: Indicating the value of $Co_3^- + HCo_3^-$

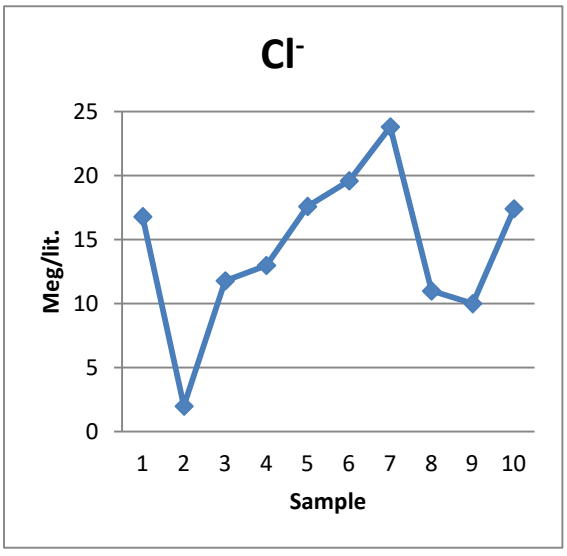


Figure 6: Indicating the value of Cl^-

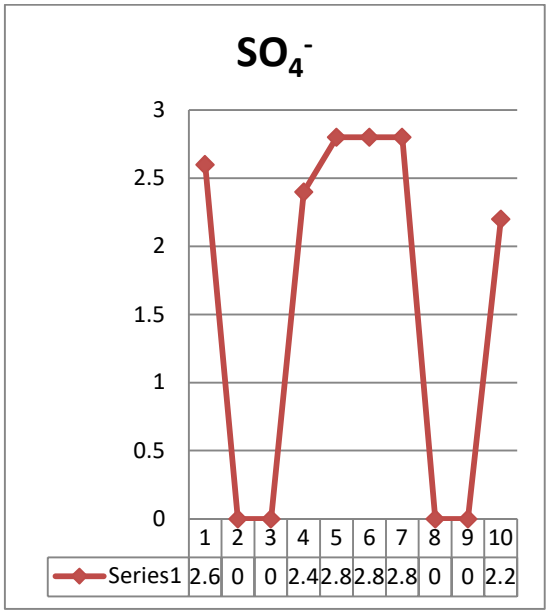


Figure 7: Indicating the value of SO_4^-

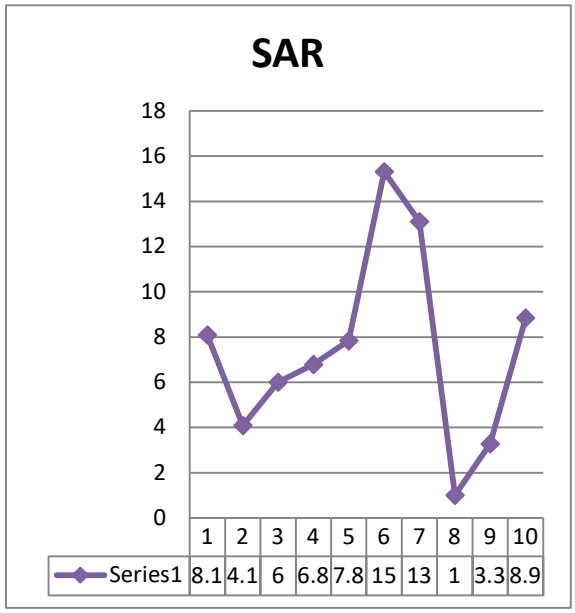


Figure 8: Indicating the value of SAR

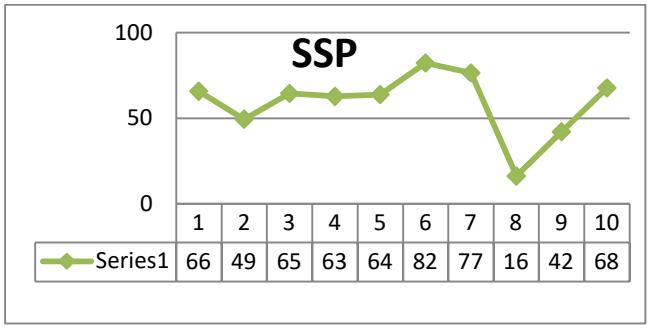


Figure 9: Indicating the value of SSP

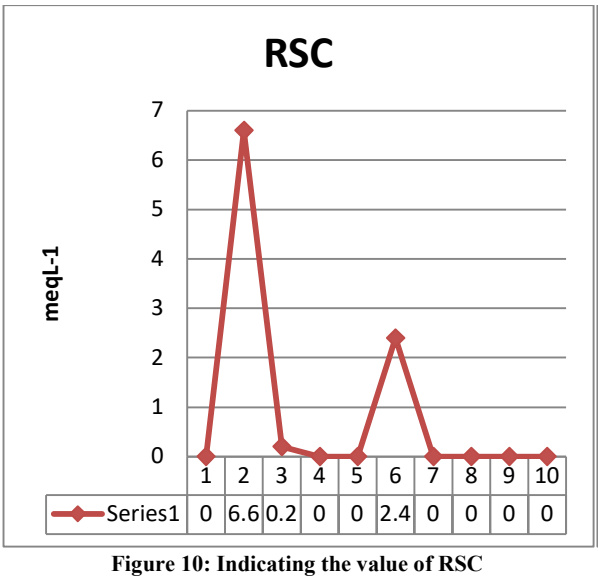


Figure 10: Indicating the value of RSC

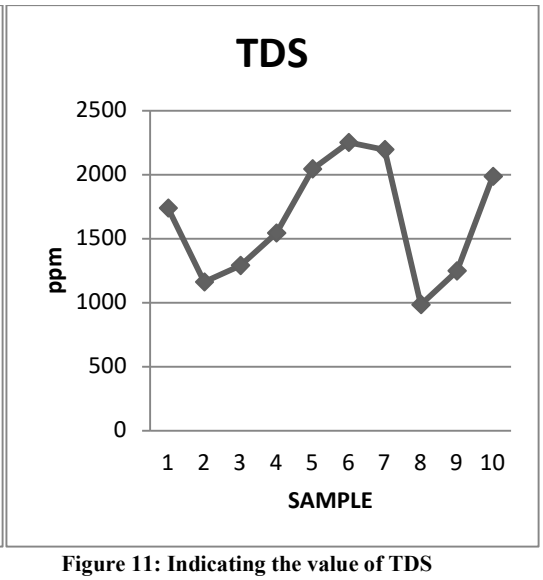


Figure 11: Indicating the value of TDS

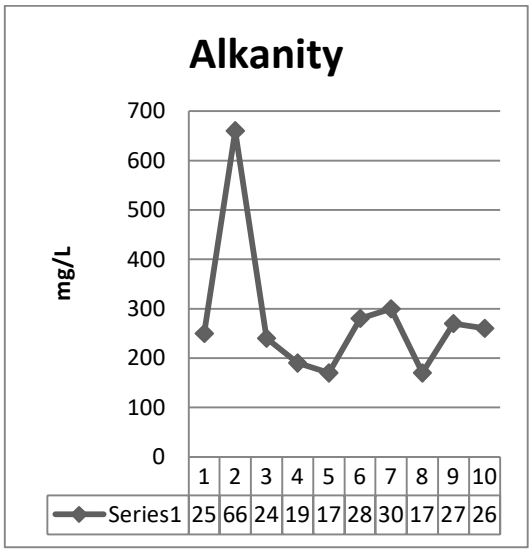


Figure 12: Indicating the value of Alkanity

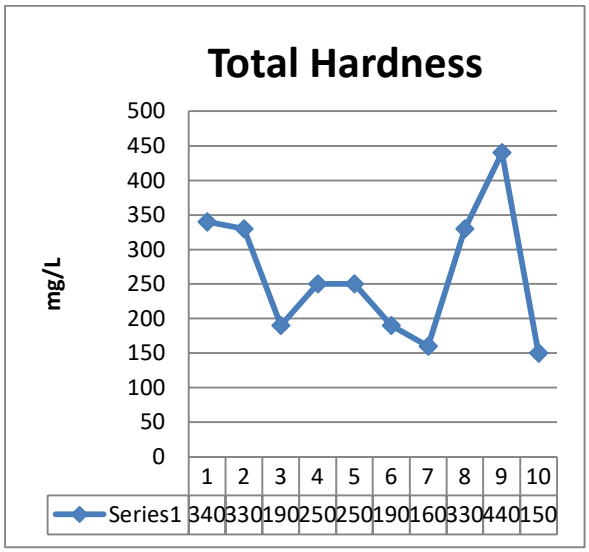


Figure 13: Indicating the value of Total Hardness

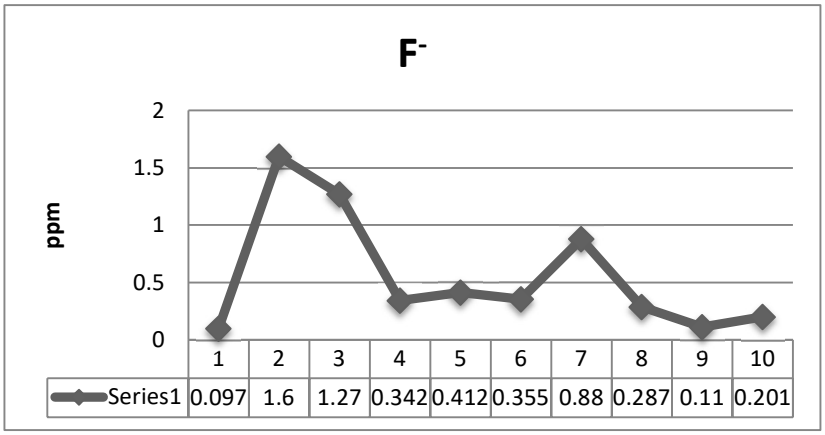


Figure 14: Indicating the value of F^-

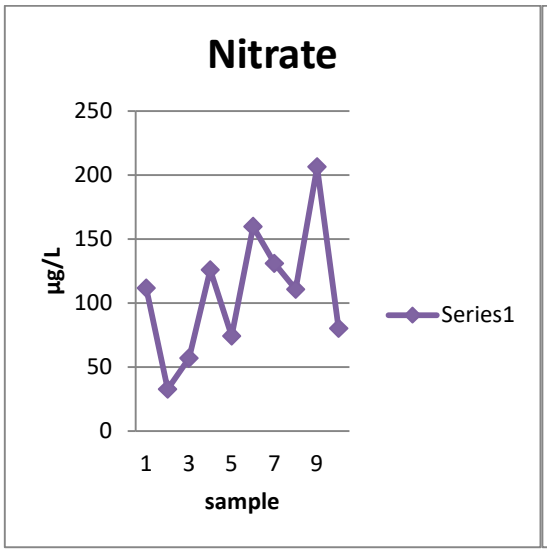


Figure 15: Indicating the value of Nitrate

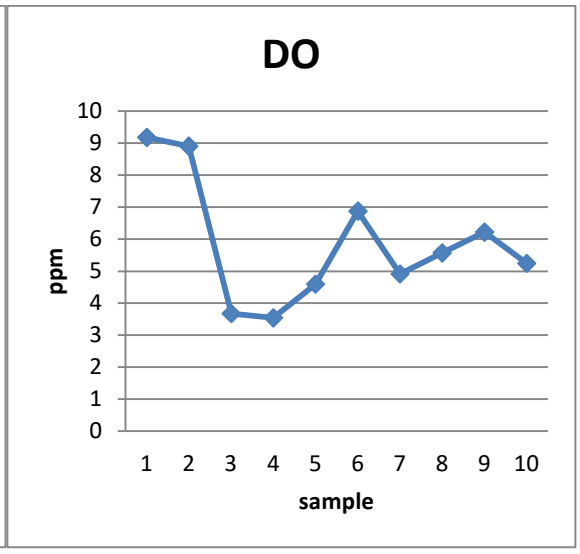


Figure 16: Indicating the value of DO

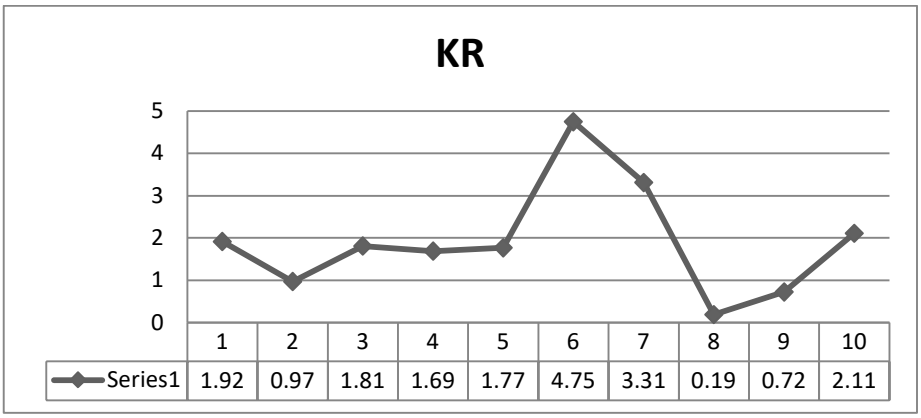


Figure 17: Indicating the value of KR

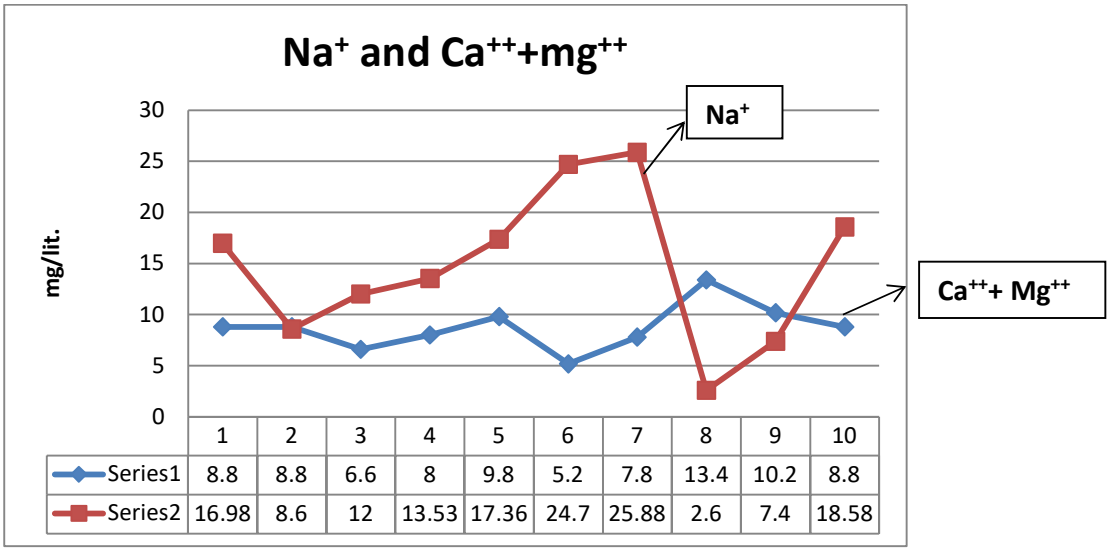


Figure 18: Indicating the value of Na^+ and Ca^{++}+mg^{++}

CONCLUSION

In the entire investigation, which focused on groundwater samples, we discovered that the water's quality varied around the city of Choutan, where physicochemical characteristics also continuously vary. Thus, more samples in the Choutan City's quantity of pH are displaying higher values as more than 8.4. In Choutan, water purification is necessary; therefore, the water required the proper amount of purification as the minerals are present in the water and that things change the taste and odour of the drinking water. Considering these places for sampling and determining the physicochemical parameter is showing quite bit higher chances of getting the required water purification as these are the places where dunes were presented. Analysis of ground water reveals that various water parameters have greater levels in the drinking water in the Barmer area.

To ensure the citizens' health in these places, therapeutic methods must be used.

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