

STUDY OF PHYSICO- CHEMICAL PARAMETERS OF GROUND WATER QUALITY OF SARMATHURA TOWN IN RAJASTHAN, INDIA

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ABSTRACT

Analysis Physico-chemical Parameters of different ground water sources of Sarmathura Town, Dholpur District Rajasthan have been taken up to evaluate its suitability for domestic purpose 12 ground water samples were collected from different places of Sarmathura town of Dholpur district. The quality analysis has been made through the BOD, COD, EC, TDS, DO, Total hardness, Sodium, Potassium, Calcium, Chloride, Magnesium, Sulphate, Nitrate, Fluoride and Alkalinity, pH. A systematic calculation of the correlation coefficient has also been carried out between different analyzed parameters. Comparative studies of samples in different seasons were determined and it was found that electrical conductivity and total dissolve solids were decreased. Alkalinity and total Hardness were increased after the rainfall.

Keywords: COD, BOD, Total Hardness, Sodium, Potassium, Calcium, Dissolve Oxygen, Magnesium.

Introduction

Water is extremely essential for survival of all living organisms on the earth planet. The assessment of groundwater is very important before it's used for domestic, drinking, agriculture or Industrial purposes. Although earth is blue planet and 80% of earth's surface (80% of the total 51000 million hectare in area) is covered by water, the hard fact of life is that about 97% of its locked in Oceans, Sea which is two saline to drink and direct use for agriculture or industrial purposes. Groundwater is an important source of freshwater having a balanced concentration of minerals. Human activities such as overpopulation, agricultural activities and mining have greatly affected this balance. An analysis revealed that about 70% of all the available water in our country is polluted due to the discharge of effluents from the industries, domestic water, land and agricultural drainage. During the last decade, it was observed that groundwater got polluted drastically because of Increased human activities. Consequently a number of cases of water borne diseases has been seen that is cause of health Hazards. Unavailability of good quality drinking water is widespread and this has serious health implications. In developing nations of the world, 82% of all diseases and over 31% of deaths are related to drinking water quality.

The present study involves the analysis of water quality in terms of physico-chemical parameters of ground water near 10 villages of Sarmathura town in Dholpur district Rajasthan State.

The study was carried out to assess the groundwater quality and portability for drinking purposes of Sarmathura town in Dholpur district (Rajasthan). For the approximate 10 samples were collected from different groundwater sources and analyzed Physico-chemical parameters.

Geography and Demography

The nearest town is Bari and the nearest district is Karauli, Dholpur. It is situated near the river Chambal in Rajasthan State. The Damoh waterfall is 300 ft. height and is visible during monsoon season, July to September. Sarmathura has a population of 22922 in 3239 households.

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Material and Methods

Survey was conducted during the months of January, February and March (Winter Season) and August, September and October (rainy season) of year 2021 of the ten different areas all around Sarmathura town in Dholpur Rajasthan.

Name of locations at Sarmathura town in Dholpur district used for water sampling:

Table 1

S.No.	Sampling area	S.No.	Sampling area
1.	Barman	6.	Baragaon
2.	Nadanpur	7.	Leelauti
3.	Pohai	8.	Madasil
4.	Amanpura	9.	Pabaini
5.	Angai	10.	Mallapura

Physico-Chemical Analysis

The collected samples were analyzed for different physico-chemical parameters such as :- Electrical conductivity, TDS, Total Alkalinity, Chloride, DO, COD, Total hardness, Temperature, pH, Nitrate, Sulphate, Fluoride.

Water samples from 10 selected sites namely Barman (S1), Nadanpur (S2), Pohai (S3), Amanpura (S4), Angai (S5), Baragaon (S6), Leelauti (S7), Madasil (S8), Pabaini (S9), Mallapura (S10) were collected during January to March (winter season) and August to October (rainy season) of year 2021.

Groundwater samples were collected in sterilized plastic bottles (PVC 1 Liter) after flushing out the tube wells (minimum 15 minutes) to get the fresh groundwater. Each sample bottle was clearly labeled with a permanent marker and relevant details were recorded. All the samples were preserved by diluting with HNO₃ solution and these water samples were analyzed within 24 to 48 hrs. after collection.

List of chemical parameters and their test methods:

Table 2

S.No.	Parameters	Unit	Test methods
1.	pH	-	Digital pH- meter
2.	Temperature	°C	Thermometric method
3.	Electrical conductivity	Siemens/cm ²	Digital conductivity meter
4.	Total dissolved solids	mg/L	Digital conductivity meter
5.	Chemical oxygen demand	mg/L	Open reflux method
6.	Dissolve oxygen	mg/L	Winkler method
7.	Sulphate	mg/L	Nephelometry
8.	Chloride	mg/L	Argentometric method
9.	Total hardness as CaCO ₃	mg/L	EDTA method
10.	Total Alkalinity	mg/L	Volumetrically by silver nitrate titrimetric method using potassium oxalate as Indicator.
11.	Fluoride	mg/L	Spectrophotometric method
12.	Nitrate	mg/L	UV spectroscopy

Result and Discussion

The physico-chemical analysis of groundwater samples of ten sampling sites of Sarmathura town in Dholpur district (Rajasthan) was carried out and their average value of seasonal variation are shown in table (3) and (4).

pH

pH is measurement of intensity of alkalinity of water. All chemical and biological reactions are directly dependent on the pH of the water system (Rao, 2006). In our finding pH varied between 6.51 to 8.01. Maximum pH was recorded at S10 in the rainy season and minimum at S5 in winter season; the groundwater samples showed the pH within the standard limit prescribed by BIS and WHO (6.5 to 8.5) and 6.9 to 8.5) respectively).

Temperature

Temperature is important for its effect on chemical and biological reaction in the organism living in water (Morrison et al., 2001). A rise in the temperature of water leads to the speeding up of chemical reactions in water, reduces the solubility of gasses and amplifies the taste and odor (Trivedi & Goel, 1984). The average temperature varied within the range 25°C to 28.6 °C.

Total Dissolved Solids (TDS)

Total dissolved solids are composed mainly of carbonate, bicarbonates, phosphate, chloride and nitrate of calcium, magnesium, potassium, sodium, manganese, organic matter salt and other particles (siebert et al., 2010). In the present finding TDS value varied from 959 ppm to 2212 ppm. Maximum TDS recorded at S4 in winter and minimum at S10 in rainy.

Electrical Conductivity

Electrical conductivity is a useful tool to evaluate the purity of water (Acharaya et al., 2008). Based on Electrical conductivity value the water quality can be classified as poor, medium or good (Gupta, Sunita and Saharan, 2009).

The electrical conductivity of ten Groundwater samples ranged from a minimum of S7 is 1427 imhos/cm in the rainy season to a maximum S9 is 2540 imhos/cm in winter season.

Dissolve Oxygen

Dissolved oxygen is important parameters in water quality assessment and reflect the physical and biological process prevailing in the water. The Dissolved oxygen value indicates the degree of pollution in water bodies (Rajmohan and Elango, 2005). DO value in the present finding varied from 3.4 to 6.9 minimum and maximum recorded at S8 in rainy and S7 in winter season respectively.

Chemical Oxygen Demand (COD):

The chemical oxygen demand indicates the extent of chemical pollution mainly from industrial effluents. Chemical oxygen demand values may be attributed to the amount of dissolved oxidizable organic matter including the non-biodegradable matter present in it (Siebert et al., 2010). In our present investigation chemical oxygen demand varied in the range of 2.9 to 8.7 ppm.

- **Chloride:** Chloride usually occurs as NaCl, CaCl₂ and MgCl in widely varying concentrations in all natural water sources. Chloride ions are generally more toxic than sulphate to most of the plants and are the best indicator of pollution (Rao, 2006). At present finding maximum chloride concentration were recorded at S3 in winter and minimum at S5 in rainy season.
- **Hardness:** Hardness is the property of water which prevents the lather formation with soap and increases the boiling point of water (Patil and Patil, 2010). Hardness of water mainly depends upon the amount of magnesium or calcium salt or both. In the present, finding hardness values varied from 475 ppm to 1236 ppm, which are beyond the permissible limit prescribed by WHO.

Physico-chemical parameters of groundwater at Sarmathura town in Dholpur district (average value) in winter and rainy season.

Table 3: Physico-Chemical Parameters of Groundwater of Sarmathura Town in Dholpur District Rajasthan

S. No.	Parameter	Average value of S1		Average value of S2		Average value of S3		Average value of S4		Average value of S5	
		Winter	Rainy	Winter	Rainy	Winter	Rainy	Winter	Rainy	Winter	Rainy
01	Temp °C	26.9	28.4	27.7	28.0	26.4	28.6	25.9	28.2	26.8	28.9
02	pH	6.72	7.01	7.79	7.86	7.21	7.79	6.71.	7.11	6.51	7.84
03	TDS (mg/L)	1485	1412	1008	1023	1205	1216	2212	1812	1519	1719
04	Electrical conductivity (imhos/cm)	2326	2216	1918	1719	1312	1112	1721	1605	1488	1298
05	Dissolved Oxygen mg/L	4.8	5.1	4.3	5.7	4.9	5.88	4.98	5.7	5.7	6.5

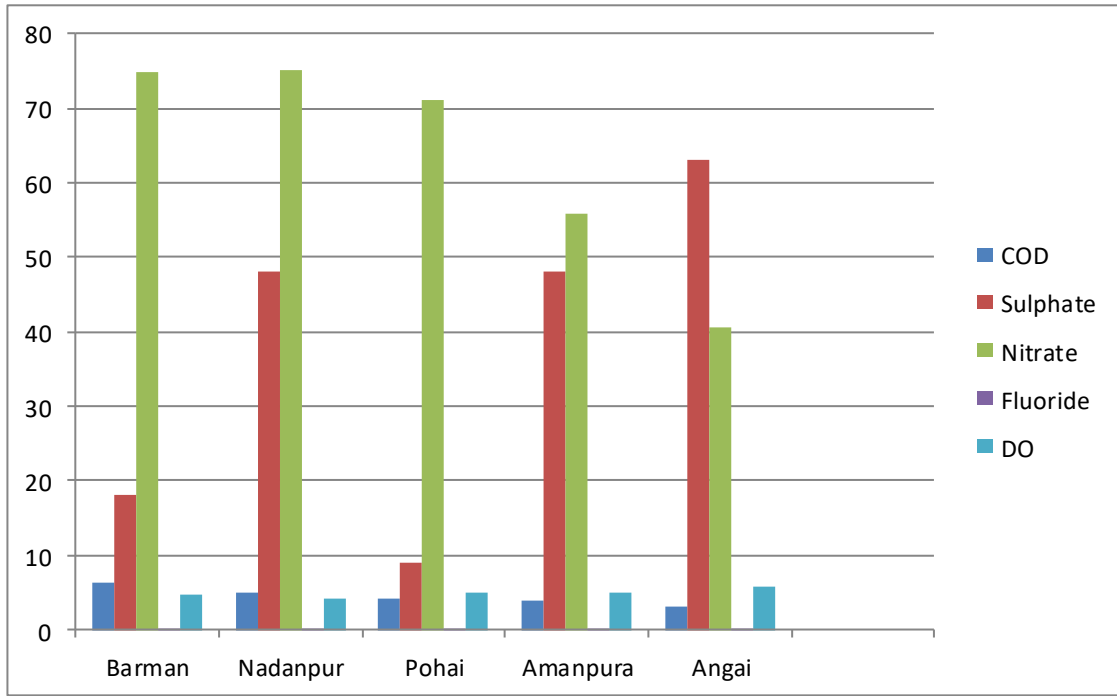
06	COD mg/L	6.2	7.1	5.1	6.1	4.2	5.3	3.8	4.1	3.2	4.2
07	Chloride (CaCO ₃ mg/L)	123.4	124.6	132.8	126.6	139.4	127.4	133.6	128.1	129.4	116.6
08	Total hardness (CaCO ₃ mg/L)	1026	935	630	490	1198	960	685	639	468	448
09	Total Alkalinity (CaCO ₃ mg/L)	685	719	579	556	1198	1225	698	716	478	516
10	Sulphate mg/L	18	22	48	68	9	12	48	39	63	72
11	Fluoride mg/L	0.09	0.71	0.018	1.0	0.06	1.04	0.22	1.12	0.04	0.78
12	Nitrate mg/L	74.8	71.8	75.15	64.8	73.2	62.8	55.9	44.8	40.5	44.2

Table 4: Physico-Chemical Parameters of Groundwater of Sarmathura Town in Dholpur District Rajasthan.

S. No.	Parameter	Average value of S6		Average value of S7		Average value of S8		Average value of S9		Average value of S10	
		Winter	Rainy	Winter	Rainy	Winter	Rainy	Winter	Rainy	Winter	Rainy
01	Temp °C	26.4	28.34	27.1	28.1	27.2	28.4	26.8	28.0	27.8	28.2
02	pH	6.81	6.95	7.14	7.85	7.12	7.92	7.12	7.32	7.01	8.01
03	TDS (mg/L)	2088	1986	1376	1478	1308	1275	1250	1150	1650	1959
04	Electrical conductivity (imhos/cm)	2410	2312	2480	1427	1822	1710	2540	1798	1650	1488
05	Dissolved Oxygen mg/L	4.5	6	6.9	6.4	3.4	6.2	3.8	4.88	5.6	5.8
06	COD mg/L	3.6	4.8	3.2	5.4	2.9	3.8	3.2	5.8	6.6	8.7
07	Chloride (CaCO ₃ mg/L)	138.2	128.4	151.3	146.6	140.4	137.7	142.5	136.8	124.6	117.2
08	Total hardness (CaCO ₃ mg/L)	1236	1098	655	592	1176	988	668	646	592	475
09	Total Alkalinity (CaCO ₃ mg/L)	788	667	788	662	1136	988	1035	1312	578	678
10	Sulphate mg/L	48	56	13	17	38	49	66	82	55	59
11	Fluoride mg/L	0.04	0.98	0.02	1.98	0.05	0.62	0.02	0.48	0.42	1.12
12	Nitrate mg/L	56	66.9	74	42	74.2	69	74	84	79	95.2

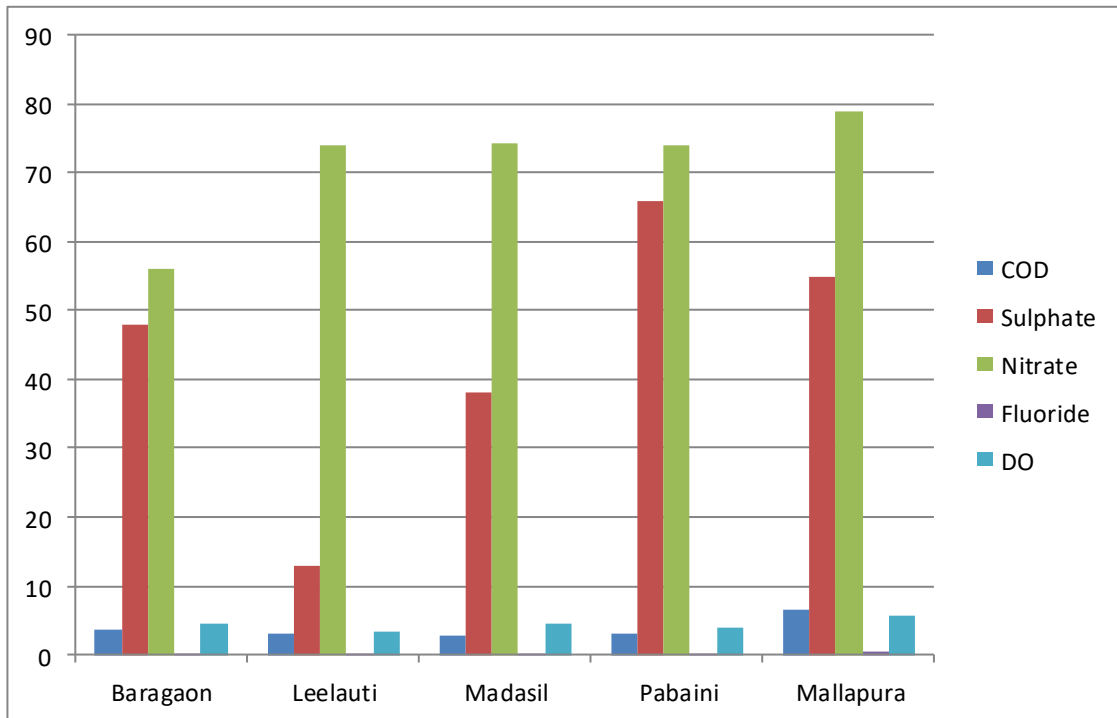
- **Sulphate:** In present study the concentration of sulphate was found within the limit between 9 to 82 ppm. Minimum at S3 in winter and maximum at S9 in rainy season.

Data Variation in Winter Season



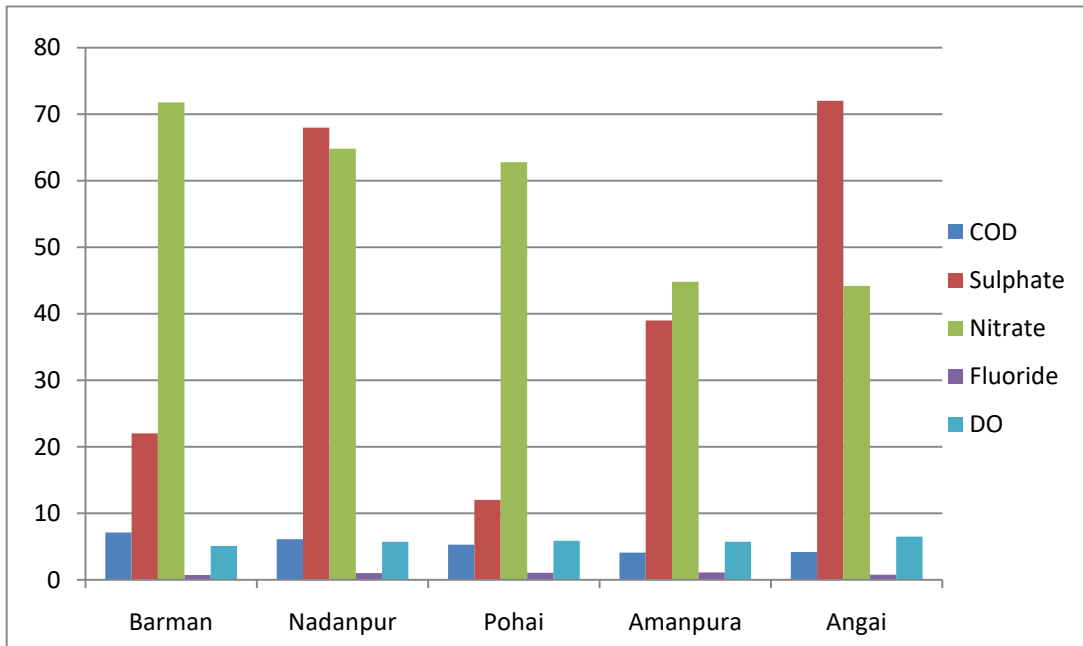
(Analysis of parameters in different areas)

Data Variation in Winter Season



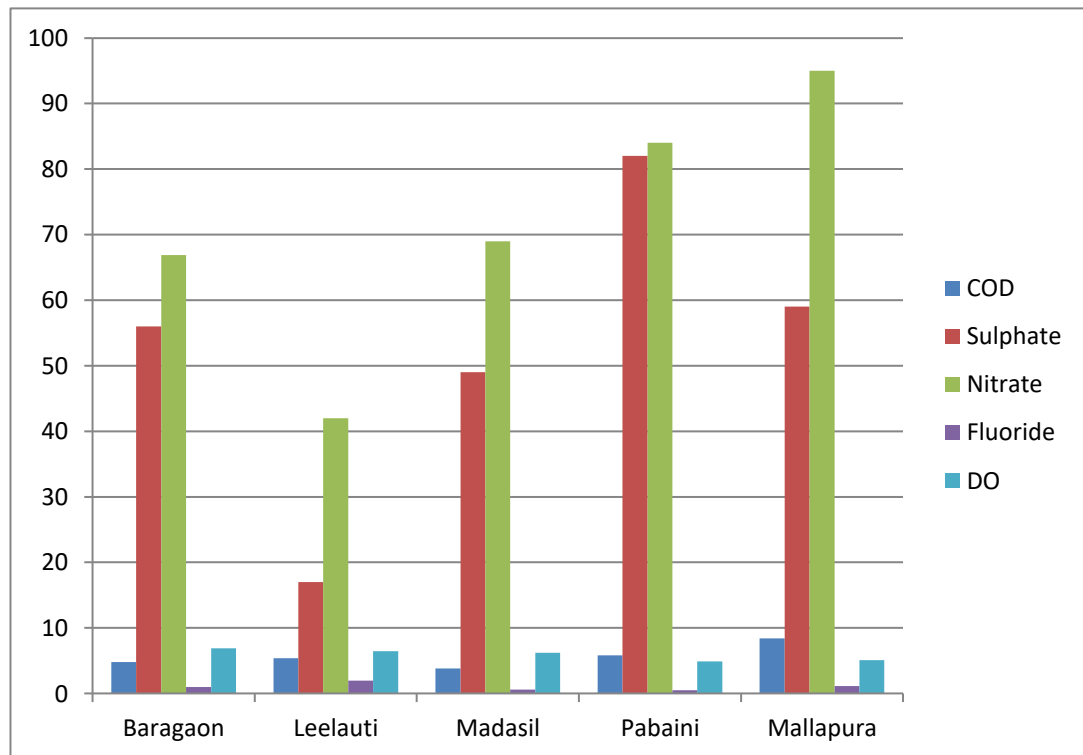
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Data Variation in Rainy Season



(Analysis of parameters in different areas)

Data Variation in Rainy Season



(Analysis of parameters in different areas)

Conclusion

In the study area the collected groundwater samples of Sarmathura town in Dholpur district were analyzed for physico-chemical parameters. The pH level of all the groundwater samples were within the limit. On the basis of present findings it can be concluded that the water quality in a few selected areas is found suitable for drinking and irrigation purposes.

Most of the groundwater samples' physico-chemical parameter values were found beyond the permissible limits of WHO and BIS such as TDS, EC, Total hardness, nitrate etc. A proper planning and execution is required to mitigate the problem of drinking water contamination in the selected area.

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