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Quality of Groundwater in Bikaner District: A Geographical Study

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Abstract - In the present times, the way they are being depleted due to over-exploitation of surface water resources, human beings have greatly increased their dependence on underground water resources to meet their need, due to indiscriminate exploitation of groundwater through modern technology by human beings, the level of underground water is continuously going down, Due to this reason, the quality of underground water is also being negatively affected. This situation is often the same in Bikaner district, this research paper is based on an analysis of the quality of underground water in Bikaner district, in which the researcher found that the quality of underground water is being negatively affected by the continuous indiscretion and over-exploitation of underground water in many blocks here.

Keywords - Groundwater Quality, pH Scale, TDS, Total Hardness of Water.

I. Introduction:

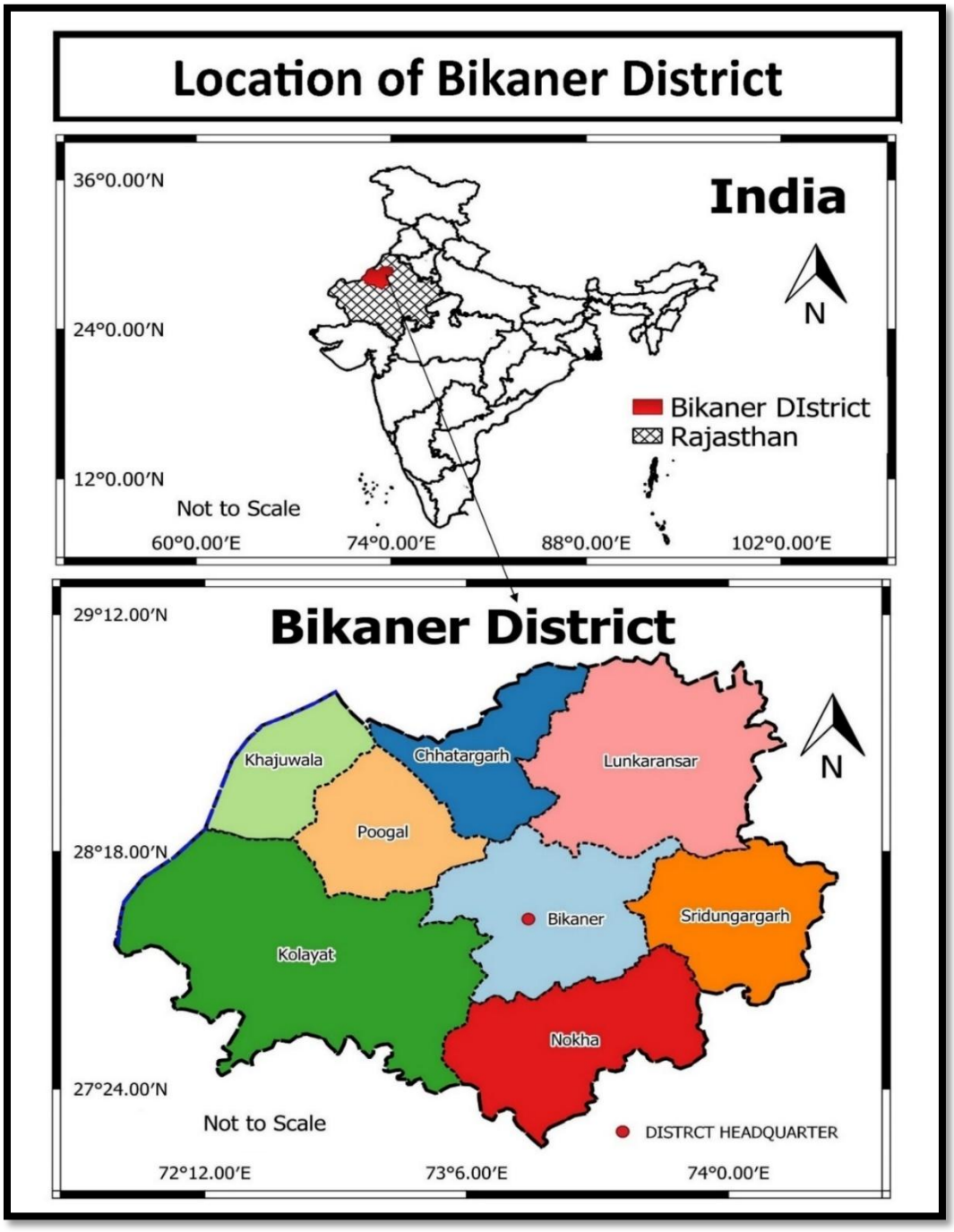
The research paper is based on secondary data on underground water quality in Bikaner district of Rajasthan. All these figures have been obtained from the Central Ground Water Board's annual "Ground Water Year Book, Rajasthan (2015-16)" report. It analyzes the ideal quantity and location quantities of various chemical elements affecting the quality of the development block underground water resources in Bikaner district. as pH values, Electrical Conductivity, Carbonate, Bicarbonate, Chloride, Fluoride, Magnesium, Potassium, Nitrate, Sulfate, Calcium And Total Dissolved Hardness.

II. Study Area

Bikaner district is located in the northern-western part of the Rajasthan state. It is located between 27°11’ to 29°03’ North Latitude and between 71°54’ to 74°12’ East Longitude. (District

Statistical Outline Bikaner, 2015) Bikaner district is bounded by Sriganganagar district on the north, Churu district on the east, Jodhpur and Nagaur district on the south, Jaisalmer on the south-west and the international boundary adjoining Pakistan on the west. Bikaner district is spread over an area of 30,239 sq. km. (DCHB Bikaner, 2011)

Figure: 1



III. Findings

The results of the research work presented are discussed as under:

pH value

To find out the hardness of water, pH The value is a good indicator. It is known based on the concentration of hydrogen ions in underground water. pH of pure water is 7, water with less pH is considered to be acidic and water with more pH is considered to be alkaline. According to environmental protection agency (EPA) standards, the PH value of drinking water should be 6.5-8.5. In Bikaner district, generally, all the blocks have a pH of groundwater. The value is found to be between 6.5-8.5.

Electrical conductivity (EC)

The total amount of soluble salts in the underground water is found based on electrical conductivity. According to the Agriculture and Food Organization (FAO), the ideal range of electrical conductivity in water at a temperature of 25° C is 450 to 2000 S/cm. The average electrical conductivity in the study area is 1103.75 S/cm, with the highest electrical conductivity being 2160 S/cm in Poogal development block and 255 S/cm in Bikaner block.

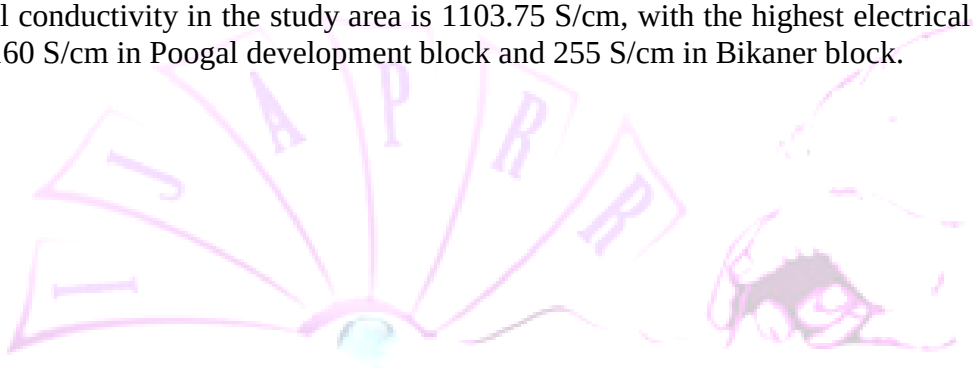


Table 1: Quality of Ground Water in Bikaner District, 2016

BLOCK NAME	PH	EC	TH	Total ALKALINITY	CA	MG	NA	K	CHLORIDE	SULPHATE	NITRATE	FLUORIDE	TDS
Bikaner	8.28	255	120	100.00	24	14.62	15	4	14	132	13	1.3	426.36
Lunkaransar	7.92	750	36	125.96	12	12.69	140	4	50	160	12	3.78	487.5
Kolayat	7.47	1000	170	169.67	32	21.88	164	4.5	134	158	3.54	1.053	698.36
Nokha	7.03	445	140	108.20	33	13.98	47	5	49	65	2	0.22	289.25
Shri Dungargarh	7.38	900	180	109.84	16	34.04	134	0.6	213	41	17.68	0.97	254.36
Poogal	7.42	2160	760	123.36	144	97.31	175	31	206	60	180.36	2.33	1404.21
Chhatargarh	7.67	1420	700	240.16	140	85.27	25	2	234	155	28	0.16	636.14
Khajuwala	7.39	1900	70	119.67	24	2.43	407	1.2	305	349	41	1.85	1125.36
Average	7.57	1103.75	272	137.11	53.12	35.24	138.37	6.53	150.62	127.5	118.40	1.45	665.19

Source: Ground Water Year Book, Rajasthan (2015-16), CGWB

Chloride (CL)

Chloride is one of the most important ions dissolved in groundwater. The main source of chloride in groundwater is sedimentary rocks. In addition, the amount of chloride in the underground water increases even when sewage water flows into the groundwater. The desirable level of chloride in drinking water is 250 mg/l. The average chloride content in Bikaner district is 150.62 mg/l, with the highest chloride content being 305 mg/l in Khajuwala Block, while the minimum chloride content is 14 mg/l in Bikaner Block.

Fluoride (F)

When the amount of fluoride in drinking water is high, fluoride in the human body accumulates itself by removing the hydroxide from the bones and gives rise to a serious disease called bone fluorosis. The fluoride content in water abroad is considered normal at 0.5 mg/l per liter, while in India it is fixed at 1.0 mg/l. The average fluoride content in Bikaner district is 1.45 mg/l, with the highest amount of fluoride being 3.78 mg/l in Lunkaransar block, while the minimum quantity of fluoride is 0.16 78 mg/l in the Chattargarh development block.

Nitrate ($NO_{3)}$

It is an essential component of organisms, which is present in organisms in the form of proteins. The ideal range of nitrogen content in the groundwater ranges between 1 and 10 mg/l. According to the ECAPE, UNESCO 1963 report, 50 mg/l of nitrate is harmful to infants, it leads to a serious disease called 'Blue Baby Syndrome in infants. The average nitrogen content in the groundwater under the Bikaner district is 118.40 mg/l, with the highest amount of nitrogen content being 180.36 mg/l in Poogal block. In contrast, the minimum amount of nitrogen content is 12 mg/l in the Lunkaransar growth block.

Sulfate (SO_4)

The sulfate is obtained by oxidation of Fe, Mg, Mn and Cu sulfide minerals. A particular amount of sulphate in the water makes the taste of the water bitter. The desirable limit of sulfate is 150 mg/l according to ISI norms, if there is a sulphate content of more than this in the water, gastrointestinal disease can occur in the organisms. The average quantity of sulphate in groundwater in Bikaner district is 127.5 mg/l, while the highest quantity is 349 mg/l in Khajuwala block and the minimum is 41 mg/l in Sridungargarh.

Calcium (Ca)

Calcium is a major element present in groundwater; it is incorporated into the groundwater with rain water by seeping from an alkaline soil. Water containing concentrations below 60 mg/l of calcium in groundwater is often considered soft, water containing concentrations between 60 and 120 mg/l is considered moderately hard, water containing concentrations between 120 and 180 mg/l is considered to be hard and water with a concentration of more than 180 mg/l is considered to be extremely hard (McGowan, 2000)

The average calcium content in Bikaner district is 53.12 mg/l, with the highest concentration of calcium being 144 mg/l in Poogal Block and the minimum concentration of 12 mg/l in Lunkaransar Block.

Total Hardness (TH)

According to Todd (1980), the hardness of groundwater depends on the intensity of rainfall and the nature of the soil. Sawwer and McCarty (1967) have divided the hardness of water into four parts, namely soft water between 0-75 mg/l, moderate hard water between 75-150 mg/l, hard water between 150-300 mg/l and extremely hard water over 300 mg/l.

The average total hardness in Bikaner district is 272 mg/l, with the highest total hardness being 760 mg/l in Poogal block, while the minimum total hardness is 36 mg/l in Lunkaransar development block.

Magnesium (Mg)

2.08% of the earth's upper surface is magnesium. The concentration of magnesium in normal groundwater is often lower than that of calcium. The concentration of magnesium in normal groundwater ranges from 1 to 40 mg/l. Bikaner district has an average magnesium concentration of 35.24 mg/l, with the highest concentration of magnesium at 85.27 mg/l in Chattargarh block, while the minimum concentration is 2.43 mg/l in Khajuwala block.

Sodium (Na)

Before the rainwater seeps into the soil layers, sodium treatment comes in contact with minerals such as plagioclase, nepheline, sodalite, glycophene, azarin, etc. and when it seeps into the groundwater, it increases the concentration of sodium there. The presence of sodium in groundwater is very important for determining water quality, the concentration of sodium in groundwater ranges between 1 and 50 mg/l (Garg, 1982;

The average quantity of sodium in Bikaner district is 138.37 mg/l, with the highest concentration of sodium being 407 mg/l in Khajuwala Block, while the minimum concentration of sodium is 15 mg/l in Bikaner Block.

Potassium (K)

Potassium in groundwater is found in smaller amounts than sodium due to its low solubility. Potassium silicates reach the groundwater through igneous and metamorphic rocks containing minerals such as orthoclase, Microline, nepheline, leucite, biotite, muscovite, etc. Potassium concentrations in groundwater are generally only up to 10 mg/l. The average quantity of potassium in Bikaner district is 6.53 mg/l, with the highest potassium concentration being 31 mg/l in Poogal Block, while the minimum potassium concentration is 0.6 mg/l in Sridungargarh Block.

Total Dissolved Solids (TDS)

TDS refers to the total solids dissolved in water. In water, essentially various elements of calcium, magnesium and sodium are dissolved in the solid state. The salinity of the water is due to these solid elements. Despite the low amount, some dissolved solids are extremely dangerous to human health, such as arsenic, fluoride and nitrate. According to the World

Health Organization (WHO), TDS levels below 300 to 600 mg/l are considered excellent, TDS levels between 300 and 600 mg/l are good, TDS levels between 600-900 mg/l are reasonable, TDS levels between 900-1200 are poor and TDS levels above 1200 mg/l are unacceptable. The average TDS in Bikaner district is 665.19 mg/l with the highest TDS level being 1404.21 mg/l in Poogal Block, while the minimum level of TDS is 254.36 mg/l in Sridungargarh Development Block. Thus, substantial variation is reflected in the level of TDS level in groundwater under the Bikaner district.

Table 2: Standards prescribed by the Bureau of Indian Standards (BIS) for drinking water (ISO 10500: 1991)

standard	**Indian Standard for Drinking Water**
pH value	8.5
Electrical Conductivity	300 (μmhos)
Filth	5(NTU)
Alkalinity	120(mg/l)
Total Hardness	300(mg/l)
Calcium	75(mg/l)
Magnesium	30(mg/l)
Chloride	250(mg/l)
Fluoride	1(mg/l)
Sulfate	200(mg/l)
Nitrate	45(mg/l)
Total Dissolved Solids (TDS)	500(mg/l)
Dissolved Oxygen	5(mg/l)

Source: Indian Standard Drinking Water—Specification (Second Revision)

Table 2 shows the standard (IS 10500: 1991) set by the Bureau of Indian Standards (BIS) for drinking water.

IV. Conclusion

Analysis of groundwater quality in Bikaner district reveals that the quality of groundwater is comparatively better in Bikaner, Lunkaransar and Nokha development blocks, while in Kolayat, Sridungargarh, Poogal, Chhatargarh and Khajuwala, the quality of groundwater is comparatively poor.

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