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# Assessment of Ground Water Quality of Pali District (Rajasthan)

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***Abstract:*** *Evaluation of the physical and chemical properties of ground water drawn from 22 sites in the Pali district of Rajasthan. In total, 18 factors were studied. Many sites had maximum values well within the allowable range; nevertheless, 59% of the sample sites had fluoride concentrations that were too high, and 36% of the water samples had TDS concentrations that were too high. Sodium bicarbonate and sodium chloride were discovered to predominate in the hydro-chemical data of ground water in this region.*

**Keywords:** Ground Water; Pollution; Fluoride

## I. INTRODUCTION

Despite the fact that our country is one of the wettest in the world and has a sizable fresh water resource, there is a chronic shortage of safe water, especially in some of the major towns where urbanisation has taken place, making water the second most important natural resource responsible for the existence and development of life on Earth, after air. Depending on characteristics including location, topography, climate, hydrogeology, and more, the shortage can range from being light to extremely severe. The present investigation will focus on the Pali district of Rajasthan. The study region is one of the most important industrial districts of Rajasthan due to the presence of a high number of small-scale companies and the usage of fertilisers and pesticides. It is located in the south-west of the state, between 24° 45' and 26° 27' N Latitude and 72° 48' and 74° 24' E Longitude. The Bandi River, which has contributed to a worrying decline in the quality of the area's ground water. In addition to the chemical steel, paper, and dye industries, this region is home to a few more. Along the main river and the channels of other streams in the area, the hydro-geological formation encountered is younger alluvium, which consists of unconsolidated sand, gravel, silt, and clay. These deposits are patchy and of a uniform thickness only. The sand is predominantly a light brown colour, is fine to medium in grain size, is composed primarily of quartz with trace amounts of ferromegnesium minerals and feldspar, and has been effectively sorted by wind.It is the broken-down remnants of earlier rocks in the area. The Pali district is located in the dry, western part of Rajasthan, which receives infrequent rainfall and has minimal ground water supplies. Bassi, Nimaj, Sojat, Kirwa, Perwa, Radawas, Sumerpur, Jaitran, Khudala, Birani, etc. are all included.

Due to low annual precipitation and depleted aquifers, the region's subtropical dry forest reserves are quite small. The primary nullaha species are the Khejra, Babul, Gular, Kair, and Jamum. The district is located in the watershed of the Luni River and its branches, including the Jawai, Mithri, Bandi, Lilri, Guhia, Radi, and Raipur Luni. These streams are ephemeral in that their flow is entirely precipitation-driven.

As a result of the existence of tanneries, Vijayram et al. (1989) discovered unsafe levels of total hardness, calcium, chloride, magnesium, and sulphate in the ground water at sembattu, Tiruchirappalli. Total dissolved solids, total hardness, chloride, and calcium levels in the ground water of Madras city were found to be over the maximum allowable by Shankar and Muthukrishaman (1994).

Ground water in the Jeedimetala (AP) industrial zone was researched by Prasad and Ramchandra (1997), who discovered elevated levels of dissolved solids, fluoride, and nitrate. The physicochemical condition of water in the Uttar Kannada district of Karnataka is described in a work by Bhat and Ganesh Hegde (IJEH, 1997). According to the results of the study, moderately hard to extremely hard water types account for about half of the whole water range. The article "Hydro geochemistry of underground water in and around Hattpur city (M.P. )" by Tiwari5 (IJEH, 2001) details the physico-chemical properties of the water samples that were collected.The elements of ground water and their relation to

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water consumption are described in the study of ground water quality. The physicochemical properties of ground water and effluents in Sanganer, Jaipur district, Rajasthan were investigated by Kulshresta (2002).

The fruit powder of the Tamarindus indica tree has been found to have the highest defluoridation capacity at room temperature, according to studies7 conducted in our lab. We conducted a geochemical analysis of fluoride in Rajasthan's ground water and a research of the physico-chemical features of ground water in the area adjacent to NH-8 in Jaipur district, Rajasthan, and found that the fluoride value is significantly higher than the allowable limit in several locations. Here, we provide the results of our research into the physicochemical properties of the ground water in the Pali district of Rajasthan.

Table - 1: The Chemical Quality Results of Ground Water Samples in Pali Districts in Rajasthan

| S. No. | pH | EC (µsiemens /cm) | $CO_3$ (mg/l) | $HCO_3$ (mg/l) | Cl (mg/l) | $SO_4$ (mg/l) | $NO_3$ (mg/l) | $PO_4$ (mg/l) | TH (mg/l) | Ca (mg/l) | Mg (mg/l) | Na (mg/l) | K (mg/l) | F (mg/l) | Fe (mg/l) | $SiO_2$ (mg/l) | TDS (mg/l) | Alkanity (mg/l) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. | 7.20 | 2190 | 0 | 397 | 497 | 72 | 130 | 0.08 | 540 | 108 | 66 | 302 | 3.0 | 1.0 | 2.9 | 11.7 | 1424 | 325 |
| 2. | 7.36 | 4230 | 0 | 510 | 1110 | 301 | 80 | 0.18 | 840 | 180 | 95 | 640 | 110 | 1.3 | 0.3 | 16.1 | 2750 | 418 |
| 3 | 7.60 | 940 | 0 | 305 | 117 | 32 | 26 | 3.00 | 180 | 24 | 29 | 130 | 14 | 1.9 | 0.07 | 16.0 | 611 | 250 |
| 4 | 7.20 | 6610 | 0 | 494 | 1271 | 1248 | 35 | 0.11 | 1380 | 224 | 199 | 980 | 10 | 2.4 | 0.06 | 14.1 | 4296 | 405 |
| 5 | 8.05 | 1880 | 0 | 683 | 227 | 40 | 62 | 5.10 | 250 | 68 | 19 | 340 | 8 | 3.8 | 0.07 | 16.2 | 1222 | 560 |
| 6. | 7.80 | 1100 | 0 | 409 | 85 | 40 | 80 | 0.20 | 250 | 60 | 24 | 145 | 3 | 1.2 | 0.08 | 10.4 | 715 | 335 |
| 7. | 7.30 | 2300 | 0 | 610 | 248 | 216 | 125 | 0.08 | 300 | 48 | 44 | 405 | 1 | 1.7 | 0.11 | 17.0 | 1495 | 500 |
| 8. | 7.50 | 6910 | 0 | 800 | 1988 | 460 | 29 | 0.18 | 1360 | 140 | 246 | 1200 | 4.1 | 2.9 | 0.70 | 43 | 4492 | 655 |
| 9. | 8.20 | 2600 | 0 | 805 | 476 | 43 | 15 | 2.80 | 140 | 52 | 2.0 | 576 | 5.2 | 4.7 | 1.10 | 19.4 | 1690 | 660 |
| 10. | 8.00 | 3210 | 0 | 638 | 596 | 238 | 59 | 0.16 | 350 | 68 | 44 | 604 | 10 | 2.7 | 1.40 | 18.8 | 2087 | 523 |
| 11 | 8.06 | 2960 | 0 | 980 | 500 | 120 | 35 | 0.24 | 110 | 40 | 2.0 | 721 | 4.2 | 5.2 | 0.04 | 14.3 | 1924 | 804 |
| 12. | 7.70 | 1170 | 0 | 383 | 174 | 60 | 41 | 0.11 | 380 | 96 | 34 | 108 | 6.2 | 0.6 | 0.07 | 15.1 | 761 | 314 |
| 13. | 8.00 | 5320 | 0 | 1240 | 1264 | 210 | 33 | 0.18 | 540 | 60 | 95 | 1162 | 4.3 | 1.7 | 0.12 | 18.0 | 3400 | 1016 |
| 14. | 8.20 | 590 | 0 | 284 | 45 | 14 | 5 | 0.10 | 230 | 76 | 10 | 38 | 2.8 | 0.61 | 0.81 | 7.4 | 384 | 386 |
| 15. | 8.10 | 960 | 0 | 471 | 73 | 12 | 32 | 0.06 | 200 | 72 | 5.0 | 151 | 7.1 | 2.1 | 0.12 | 11.1 | 624 | 386 |
| 16. | 7.75 | 790 | 0 | 319 | 43 | 78 | 24 | 0.18 | 310 | 60 | 39 | 45 | 13 | 0.4 | 0.11 | 10.0 | 513 | 261 |
| 17. | 8.41 | 2310 | 48 | 311 | 525 | 252 | 19 | 1.20 | 190 | 40 | 22 | 535 | 5.4 | 0.95 | 0.06 | 25.0 | 1501 | 335 |
| 18. | 7.70 | 1910 | 0 | 439 | 391 | 19 | 40 | 0.17 | 330 | 64 | 41 | 298 | 7.1 | 0.3 | 1.70 | 13.5 | 1242 | 360 |
| 19. | 7.51 | 430 | 0 | 190 | 14 | 55 | 12 | 0.19 | 200 | 60 | 12 | 21 | 2.1 | 0.81 | 1.10 | 7.1 | 280 | 156 |
| 20. | 7.62 | 2950 | 0 | 730 | 665 | 225 | 64 | 2.74 | 350 | 72 | 41 | 680 | 2.4 | 3.5 | 0.07 | 16.3 | 1918 | 598 |
| 21. | 8.06 | 2130 | 0 | 790 | 270 | 48 | 19 | 0.04 | 290 | 72 | 27 | 381 | 1.4 | 3.7 | 0.08 | 12.0 | 1385 | 648 |
| 22. | 8.11 | 1880 | 0 | 732 | 240 | 24 | 18 | 2.60 | 170 | 56 | 7 | 380 | 3.3 | 6.8 | 0.05 | 13.4 | 1222 | 605 |

## II. MATERIAL AND METHODS

To test for elements like carbonate (CO3), bicarbonate (HCO3), chloride (Cl), sulphate (SO4), nitrate (NO3), phosphorus (PO4), and dissolved silica (SiO2), as well as total hardness (TH), calcium (Ca), magnesium (Mg), sodium (Na), potassium (K), and fluoride (F), we collected water samples from irrigation wells and household taps in polythene bottles

The water samples were tested for pH and EC using a portable field lab. Sulphate (SO4), Nitrate (NO3), Phosphate (PO4), and Dissolved Silica (SiO2) were assessed using an Ultraviolet-Visible Spectrophoto-meter-108 Systronic manufacture; Sodium (Na), Potassium (K), and Calcium (Ca) were measured with a flame photometer. The procedures followed are those detailed in detail in APHA 1992 (see Section 10).

## III. RESULTS AND DISCUSSION

You can see the distribution of the primary quality characteristics in Table -2, and you can see the results of the chemical analysis of the ground water samples in Table 1.

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**pH**

A common and crucial water chemistry test is the measuring of pH. At its lowest, the pH of the study region was 7.2 at Jaitpura, and at its highest, 8.41 at Kriwa. The results are generally on the alkaline side and are within India's permissible range for water quality standards (between 6.3 and 9.2).

**Fluoride**

Sumerpur samples averaged 0.30 mg/L lower than Birani samples, while Birani samples averaged 6.8 mg/L higher. With the widespread implementation of fluoridating publicly-available water supplies, the acute determination of fluoride ion has become increasingly relevant. A safe and effective way to lower dental strength without posing any health risks is to consume water with a concentration of about 1.0 mg/L of fluoride. It has been shown that 59% of ground water sankers had values that are higher than the allowable maximum. When fluoride levels exceed safe thresholds, they become toxic. People who drank this water developed dental fluorosis.

**Chloride ion**

The presence of chloride is an indicator of pollution from sources such septic tank runoff, animals, and potash fertilisers, as well as an indicator of eutrophication. When the chloride concentration in drinking water rises above 1000 mg/L, corrosion in the piping that carries the water may occur; when it rises above 250 mg/L, the water's flavour may change. Excessive amounts of chloride are lethal to both plants and mammals. Chandarwar samples taken in Bassi ranged from 14 to 1988 milligrammes per litre over the course of the project's duration. Since the highest allowable level of chloride in water is 1000 mg/L and the minimum allowable level is 250 mg/L, it is recommended that water be treated prior to its usage for various purposes.

**Nitrate**

According to BIS (Bureo of Indian standards), the maximum amount of nitrate that can be present in drinking water is 100 mg/L. Nitrate concentrations as low as 5 mg/L were recorded in Sandera, while concentrations as high as 130 mg/L were recorded in Sojat. The majority of the sample values were determined to be within the allowable range for nitrate, with only three samples having values that were higher than allowed.

**Iron**

This element, the fourth most abundant on Earth, is found globally in the ground water of the research region, with concentrations ranging from 0.04 to 2.9 mg/L. Haemoglobin and cytochrome levels drop in response to iron deficiency, while iron overload damages tissues through iron buildup. Sojat's water sample has an iron maximum value of 29 mg/L, which is too high and makes it unfit for several household uses.

**Silica**

There is no recommended range for silica in this study (7.4-25 mg/L), as it has no known adverse effects on human or animal health.

**Total Hardness**

Calcium carbonate hardness is a useful indicator of water contamination. Value growth is associated with an increase in the concentration of calcium, magnesium, and iron salts. An increase in the use of soap and detergents due to insoluble curdy precipitation brought on by hard water can be another issue in the home. Magnesium in ground water from igneous rock comes predominantly from ferromagnesian minerals like olivine and pyroxines, while calcium is found in minerals like silicates and pyroxenes. Magnesium is found in sedimentary rock as magnetite and other carbonates, and is sometimes found along with calcium carbonate. Water hardness can be either temporarily or permanently attributed to the presence of calcium and magnesium carbonate, sulphate, and chloride. Some samples have been shown to have a rather high concentration of these ions, which means that this water contributes to both short- and long-term hardness. CaCO3 total hardness might be anything between 110 and 1380 milligrammes. Ca and Mg are the primary ions responsible for it. According to BIS, the maximum allowable hardness is 600 mg/L. At 1380 mg/L, hardness is the

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highest, and it was measured in Jaitpura. Most of the water samples in the current investigation were found to have hardness readings that were well within the safe range, with only a small number of outliers

Table -2: Distribution of major quality parameters

| | | | | |
|---|---|---|---|---|
| | Total No. of samples | IRON | | |
| | 22 | (1) 0-0.3 | (2) 0.31 -1.0 | (3) > 1.0 |
| No. of Sample | | 15 | 2 | 5 |
| | Total No. of samples | TDS | | |
| | 22 | (1) 0-500 | (2) 501-2000 | (3) > 2000 |
| No. of Sample | | 2 | 15 | 5 |
| | Total No. of samples | CHLORIDE | | |
| | 22 | (1) 0-250 | (2) 251-1000 | (3) > 1000 |
| No. of Sample | | 11 | 7 | 4 |
| | Total No. of samples | FLUORIDE | | |
| | 22 | (1) 0-1.0 | (2) 1.1-1.5 | (3) > 1.5 |
| No. of Sample | | 7 | 2 | 13 |
| | Total No. of samples | SULPHATE | | |
| | 22 | (1) 0-200 | (2) 201-400 | (3) > 400 |
| No. of Sample | | 14 | 6 | 2 |
| | Total No. of samples | NITRATE | | |
| | 22 | (1) 0-45 | (2) 46-100 | (3) > 100 |
| No. of Sample | | 15 | 5 | 2 |
| | Total No. of samples | TOTAL HARDNESS | | |
| | 22 | (1) 0-300 | (2) 301-600 | (3) > 600 |
| No. of Sample | | 12 | 7 | 3 |
| | Total No. of samples | CALCIUM | | |
| | 22 | (1) 0-75 | (2) 76-200 | (3) > 200 |
| No. of Sample | | 16 | 5 | 1 |
| | Total No. of samples | MAGNESIUM | | |
| | 22 | (1) 0-30 | (2) 31-100 | (3) > 100 |
| No. of Sample | | 11 | 9 | 2 |
| | Total No. of samples | ALKANITY | | |
| | 22 | (1) 0-0.3 | (2) 0.31 -1.0 | (3) > 1.0 |
| No. of Sample | | 15 | 2 | 5 |

(1)Within permissible limit (2) Maximum permissible limit
(3) Beyond permissible limit. These above limits Indicated as (1),(2),(3) in tab

**Alkanity**

The alkanity in the studied region ranges from 156 to 1016 mg/L, and it is caused mostly by bicarbonate ions produced by bacterial breakdown of organic materials and mineral ion exchange. In the studied location, 22.2% of water samples exhibited Alkanity levels over the maximum allowed. At Pritevipura, the Alkanity concentration peaked at 1016 mg/L.

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**Salinity**

The values for conductivity are from 430 micromhos/cm to 6910 micromhos/cm.High concentrations of Na and Cl ions in the water samples account for the elevated conductivity observed in numerous locations. Bassi had the highest conductivity, measuring in at 6910 micro mhos/cm. Water's saltiness rises when its total dissolved solids (TDS), chloride, sulphate, and so on concentrations rise.

**Total Dissolved Solids**

Insoluble colloidal or finely split suspended matter contributes to elevated TDS levels because it does not readily settle. An unfavourable taste, laxative effects, and foaming might result from too much TDS in your drinking water. Too much of it may be bad for aquatic life and ineffective for watering crops. Extremely low concentrations of dissolved salts in drinking water are unsuitable for human consumption. Total hardness is a measure of how much salt is present in a given volume of water. The ICMR standards for drinking water set the maximum allowable total hardness concentration as 1500 mg/L, with a general acceptability concentration limit of 500 mg/L. For agricultural use, concentrations below 3000 mg/L are preferable. The total hardness values in the current investigation fall within the range of 384–4492 mg/L. In the studied location, overall hardness is higher in 36% of the water samples.

**Sodium**

Sodium concentrations can range from 21 to 1200 mg/L. At the Bassi site, sodium levels were measured at 1200 mg/L; in the Chandarwar area of the Pali district, they were measured at just 21 mg/L.

**Sulphate**

A sulphate concentration over 200 mg/L is undesirable for many common household uses. Fertilisers are a major source of sulphate in ground water. The range of sulphate concentrations seen in this investigation was from 12 to 1248 mg/L. In the Pali district, the sulphate concentration ranged from a high of 1,248 mg/L in Jaitpura to a low of 12 mg/L at perwa.

**Phosphate**

Phosphate concentrations in the region under investigation range from 0.04 to 3.00 mg/L. Phosphate levels peaked at 3 mg/L in the Pali district town of Gunjoj.

## IV. CONCLUSION

According to the results of the water quality tests, only a small percentage of the water samples were good enough to drink and use for irrigation. Most parameters used in the study to evaluate water quality were found to be within acceptable ranges; however, TDS, F, and Alkanity were found to be excessive in 36%, 59%, and 22.2% of samples, respectively. The research area's ground water is saline and alkaline because of these elevated ion concentrations. Well water was tested and found to have unsafe levels of TDS, Cl, Fe, and F Alkanity, making it unfit for human consumption. An excessive amount of fluoride in drinking water has been linked to tooth mottling and other health problems. To maintain safe levels of fluoride in drinking water, appropriate defluoridization methods such as blending with low fluoride water, ion exchange, chemical treatment, etc., should be used. Phosphate and potassium fertilisers, in particular, should not be used in excess. Constant monitoring and strict vigilance are necessary for water quality maintenance.

## REFERENCES

[1]. Guidelines for drinking water quality, 1, recommendations, WHO Geneva (1993) (172-181) 53-79.
[2]. V Shankar Bhavani., N Muthu Vrishnana; Ground water study in Madras City, (Tamilnadu); J Env. Prot. (1994) 14(3), 176.
[3]. B.V.Prasad; P.Ramesh Chandra; “Ground water quality in an Industrial zone “Poll.Res. (1997) 16(2), 105.
[4]. D.R Tiwari., “Hydrogeo Chemistry of under ground water in and around Chhatarpur city, district Chhatarpur, IJEH (2001) 43, 176.

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**[5].** S.Kulshresta., "Physico-chemical character-istics of ground water and effluents in Sanganer town of Jaipur city 2002. National Envi. Poll. Tech. (2002) 1453.

**[6].** A.Kumar; M.K.Samota; Sanjay Gupta., Gita Seth; "Studies on defluoridation capacity of Tamarindus indica" Orient. J. Chem., (2005) 21(2), 291-294.

**[7].** A.Kumar., Mahesh. K Samota., Gita Seth; "Geochemical study of Fluoride in ground water of Rajasthan" Chemistry an Indian Journal, (2005) 2(6): 191-193.

**[8].** Jaipal Garg; Akhalesh Kumar; Kavita. Batheja, , Gita Seth; "Physico-chemical characteristics of ground water of adjoining area of NH-8 in Jaipur district ,Rajasthan" Chemistry an Indian Journal, (2006) 3(8).

**[9].** Standard method for examination of water and waste water American Public Health Association Washington DC, 1134 18th ed. (1992).

**[10].** D.M. Bhat; Ganesh R. Hegde; Ground water quality in Uttar Kannada district of Karnataka, IJEH (1997) 39, 61.

**[11].** K Vijayram., L Jamesh., P Geraldine., Varader Jan TS., Pollution studies of ground water in sembattu, Tiruchirappalli, Indian J. Env. Prot., (1989) 9(10), 746.