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## Study of Water Quality Index to Assess Chemical Parameters of Deep Tube wells, Shallow Tube Wells and Open Ponds of Nagaur District, Rajasthan

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### ABSTRACT

*The present study deals with the chemical analysis and study of water quality index to assess fluoride, nitrate, chloride, Mg, Ca, pH, hardness, alkalinity and TDS of deep tube wells, shallow tube wells and open ponds of Nagaur District. The presence of problematic salts contains in ground water due to local pollutants and geological reasons affect the ground water quality adversely. In these adverse conditions open ponds are the best alternates of water for domestic use. These open ponds are considered as the best storage tanks for rain water.*

**Keywords:** Chemical analysis, water quality, pollutants, tube well, open pond, rain water harvesting.

### INTRODUCTION

Rajasthan is India's largest state with an area of 3,421 km<sup>2</sup>, which is 10.41% of the total area of our country and with an estimated population of 54 million spread over its 41,583 villages, which is 5.5% of nation's population but being just 1% of the total water sources of the century. Due to the scarcity of the surface water in Rajasthan[1-3], 70% of its population is dependant on groundwater resources for drinking, irrigation and other purposes. Water is not only essential for the lives of living things but also useful in irrigation[4], sanitation, power and steam generation[5], air conditioning, navigation, ecology and afforestation needs and recreation[6,7]. It is also used as a coolant in power and chemical plants, production of paper, sugar, steel, atomic energy[8], textile, chemicals[9], ice[10]. Water is universal solvent so it has the capability to dissolve nearly all natural compounds. So alarming salts contain in ground water due to local pollutants and affect the ground water quality adversely[11].

### MATERIALS AND METHODS

15 water samples were collected from deep tube wells; shallow tube wells and open ponds out of these, 3 samples were collected from five different places Amarpura, Balwa, Barangaon, Barani and Bher of Nagaur district. All samples were examined for fluoride, nitrate, chloride, Mg, Ca, hardness, alkalinity, pH and TDS (total dissolved solids). The Samples collected areas and Sample codes are presented in table 1.

**Table1.** Sample Codes

Sample	Coding
Amarapura, Nagaur-Deeptubewell-1	S-1
Amarapura, Nagaur-Deeptubewell-2	S-2
Amarapura, Nagaur-Deeptubewell-3	S-3
Balwa, Nagaur-shallow tubewell-1	S-4
Balwa, Nagaur-shallow tubewell-2	S-5
Balwa, Nagaur-shallow tubewell-3	S-6
Barangaon, Nagaur-pond-1	S-7
Barangaon, Nagaur-pond-2	S-8
Barangaon, Nagaur-pond-3	S-9
Barani, Nagaur-shallow tubewell-1	S-10
Barani, Nagaur-deep tubewell-2	S-11
Barani, Nagaur-shallow tubewell-3	S-12
Bher, Nagaur-deep tubewell-1	S-13
Bher, Nagaur-deep tubewell-2	S-14
Bher, Nagaur-pond-3	S-15

All the Samples were analysed for nine parameters by following Standard Methods of Analysis. The results and the comparative study of 9 chemical parameters of 15 samples are given in table 2.

**Table-2** Chemical Parameters of Samples

Sample	Fluoride	Nitrate	Chloride	Magnesium	Calcium	pH	Hardness	alkalinity	TDS	Total
S-1	1.37	120	1800	194	380	7.48	1760	300	4999	9561.8
S-2	1.67	122	1800	180	460	7.36	1900	300	5270	10041.
S-3	2.25	102	1650	187	392	7.65	1760	300	5060	9460.9
S-4	2.33	145	640	52.8	112	7.8	500	550	2420	4429.9
S-5	2.74	440	750	48	96	7.62	440	480	2640	4904.4
S-6	2.46	170	760	56.2	108	7.54	500	550	2730	4884.2
S-7	0.17	11	28	4.32	12	8.24	48	58	165	334.73
S-8	0.21	17	34	6.24	12.8	8.11	58	68	205	409.36
S-9	0.17	12	28	4.32	12	8.21	48	54	155	321.7
S-10	2.43	75.16	17800	504	1120	6.57	4900	70	32000	56478.
S-11	2.32	1140	4800	336	900	7.55	3650	70	14800	25705.
S-12	1.34	296	13200	446.4	1140	7.35	4710	90	25900	45791.
S-13	2.36	59.2	980	60	140	7.97	600	400	22850	25099.
S-14	2.28	31.5	1400	237.6	484	7.32	2200	280	4640	9282.7
S-15	0.17	12	32	14.8	10.4	8.22	46	52	159	334.59
Desirable limit	1.0	45	250	30	75	6.5	300	200	500	1407.5
Permissible limit	1.5	45	1000	100	200	8.5	600	600	2000	4555

The comparison of determined parameters of all the Samples are shown in figures 1-8.

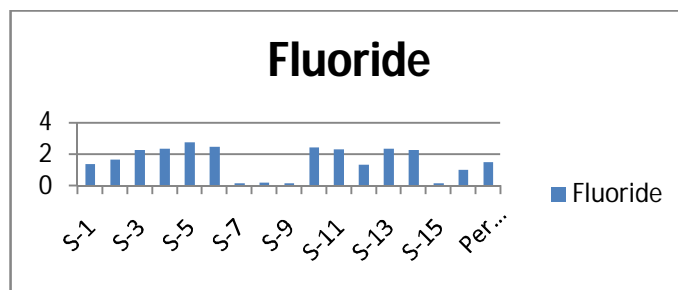


Fig.1 Comparative study of 15 samples in terms of Fluoride contents

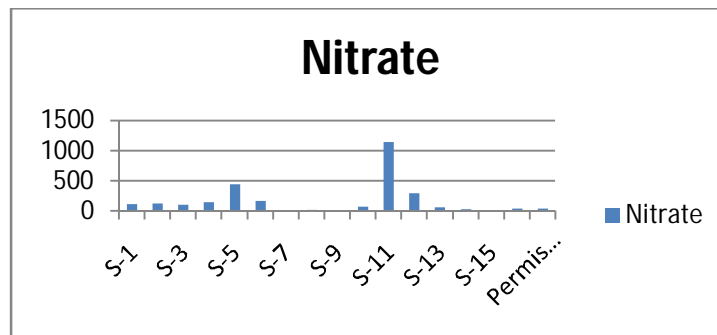


Fig.2 Comparative study of 15 samples in terms of Nitrate contents

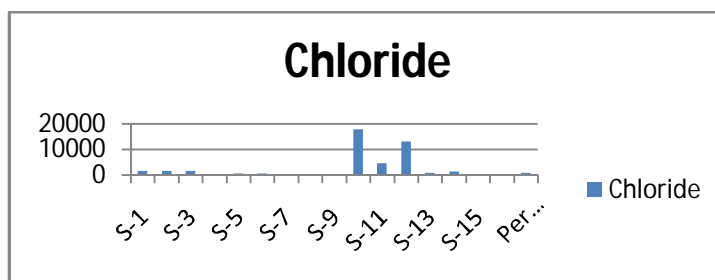


Fig.3 Comparative study of 15 samples in terms of Chloride contents

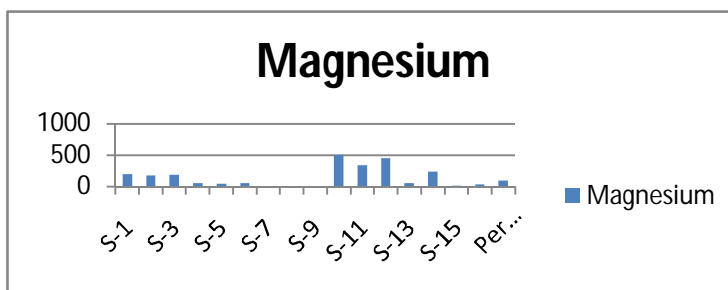


Fig.4 Comparative study of 15 samples in terms of Magnesium contents

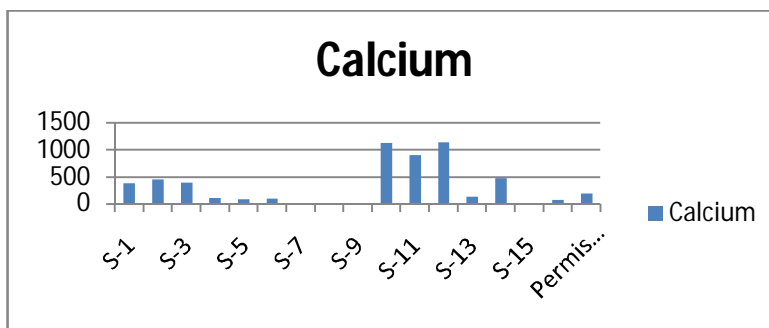


Fig.5 Comparative study of 15 samples in terms of Calcium contents

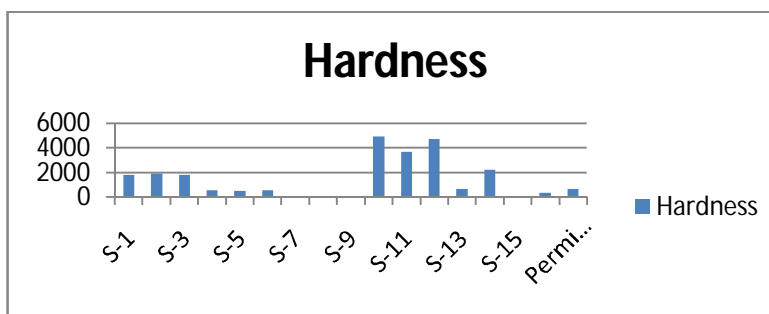


Fig.6 Comparative study of 15 samples in terms of Hardness contents

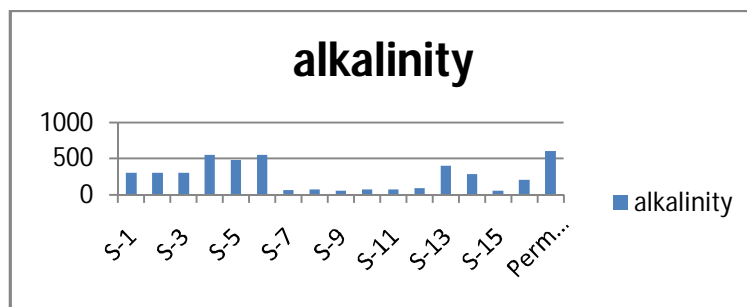


Fig.7 Comparative study of 15 samples in terms of alkalinity contents

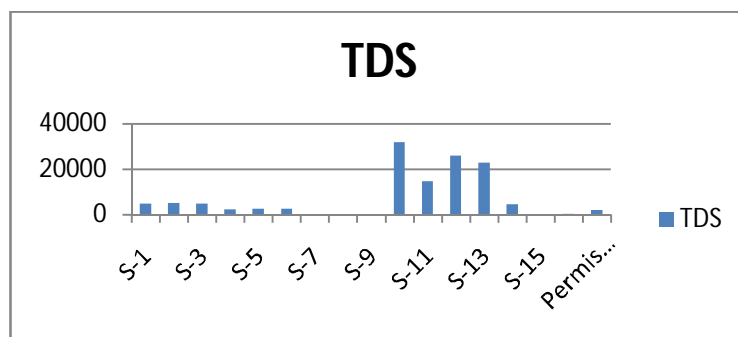


Fig.8 Comparative study of 15 samples in terms of TDS contents

## RESULTS AND DISCUSSION

On the basis of results obtained the following discussion can be made:

The contamination level in S-10 is highest due to high values of all chemical parameters except alkalinity. Contamination level in S-11, S-12 and S-13 is considerably very high. S-12 has high values of nitrate, chloride, Mg, Ca, hardness and TDS. Fluoride content is quite satisfactory. S-11 has high values of fluoride, nitrate, chloride, Mg, Ca, hardness and TDS. S-13 has high values of fluoride, nitrate and TDS. The contents of chloride, Mg, Ca, hardness and alkalinity are quite satisfactory.

Contamination level in S-1, S-2, S-3, S-5, S-6 and S-14 is high. S-1 has high values of nitrate, chloride, Mg, Ca, hardness and TDS. Fluoride content is quite satisfactory in S-1. S-2 and S-3 have high values of all chemical parameters except alkalinity. S-5 and S-6 have high values of fluoride, nitrate and TDS but chloride, Mg, Ca, hardness and alkalinity levels are quite satisfactory. S-14 has high values of fluoride, chloride, Mg, Ca, hardness and TDS. Nitrate content is quite satisfactory in S-14.

S-4 is found high values of fluoride, nitrate, magnesium and TDS above permissible limit.

S-7, S-8, S-9 and S-15 are found quite satisfactory. All chemical parameters are below permissible limit.

The order of chemical parameters in Water Samples contain above the permissible limit is presented in table 3.

**Table 3.**

	<b>Decreasing order of chemical parameters in water samples which are found to contain above permissible limit</b>
Fluoride	S-5>S-6>S-10>S-13>S-4>S-11>S-14>S-3>S-2
Nitrate	S-11>S-5>S-12>S-6>S-4>S-2>S-1>S-3>S-10>S-13
Chloride	S-10>S-12>S-11>S-1=S-2>S-3>S-14
Hardness	S-10>S-12>S-11>S-14>S-2>S-1=S-3
Alkalinity	ALL SAMPLES ARE BELOW PERMISSIBLE LIMIT
TDS	S-10>S-12>S-13>S-11>S-2>S-1>S-14>S-6>S-5>S-4
Total of all chemical parameters value	S-10>S-12>S-11>S-13>S-2>S-1>S-3>S-14>S-5>S-6

## APPLICATIONS

The results of water sample analysis are applicable to assess the water quality, so water can be used at an appropriately according to the needs.

## CONCLUSIONS

In all tube well water samples fluoride, nitrate and TDS levels are very high. High concentrations of fluoride are expected in groundwater from Calcium poor aquifers and areas where fluoride-bearing minerals like fluorapatite and fluorite are most common. Nitrate contamination of ground water is the most common problem throughout the world. Most nitrate contamination is a result of intensive agriculture and the use of nitrogen containing fertilizers.

Out of 5 different places of Nagaur district, water samples from tube wells of Barani place were found highly polluted and open ponds of Barangoan place were found least polluted. All chemical parameters of open ponds are found quite satisfactory but underground water was found contaminated.

Ground water of Nagaur district required chemical treatment before use for drinking purposes. A large number of chemical treatment devices for household purification are available in the world. Chemical coagulation with various salts of aluminium, iron, lime and other inorganic or organic chemicals are widely used processes to treat water for the removal of turbidity, hardness and microorganisms. Various defluoridation methods like Nalgonda process, ion-exchange, reverse-osmosis and activated alumina based

sorption processes are available to reduce fluoride content up to desirable level in the drinking water. There are number of treatment technologies available for the reduction of nitrates such as- Biological denitrification using methanol or ethanol addition, electrolysis or electro dialysis method. Ion-exchange using strong base anion resins regenerated with NaCl and reverse osmosis methods are also used to decrease nitrate level in water.

Open ponds are the excellent storage tanks for rain water harvesting and water from these sources can be used for domestic purposes after primary treatment.

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