



## WATER QUALITY ANALYSIS IN PILANI OF JHUNJHUNU DISTRICT (RAJASTHAN) – THE PLACE OF BIRLA’S ORIGIN

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### ABSTRACT

Ground water is increasingly being sought as a source of drinking water due to the scarcity, non-availability and bacteriological pollution of surface water. This paper describes the important results of the Physico-chemical analysis of the ground water samples of the open wells, tube wells and hand pumps of the urban areas in Pilani, District – Jhunjhunu of Rajasthan State. The different parameters determined are p<sup>H</sup>, TDS, fluoride, chloride, nitrate, sulphate, total alkalinity and total hardness. It has been observed that nitrate values are higher compared to ICMR standards. Other parameters were found within desirable limits. The interesting fact is that the nitrate alone is making ground water unfit for drinking.

**Key Words:** *Physico-chemical analysis, Ground water, Pilani, Nitrate, Water born disease, Blue baby disease.*

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### INTRODUCTION

Pilani is the world famous name popularly known for birla Institute of Technology and Science (BITS) and Central Electronics Engineering Research Institute (CEERI). The town was birth place of India’s famous and influential industrialist, G.D. Birla. Pilani is a town situated in the Jhunjhunu district of Rajasthan, India. Pilani houses one of India’s finest technical school, BITS Pilani. In 1964, the Birla colleges of Arts, Commerce, Engineering, Pharmacy and Science were merged to form the Birla Institute of Technology and Science (BITS). BITS is reputed to be the top ten colleges in India. Another institute in Pilani is the G.D. Birla Memorial Polytechnic Institute known as BTTI was established in 1988 in memory of Late Shri G.D. Birla. The institute was founded by Ghanshyam Das Birla in 1929 as an intermediate college.

Pilani also houses some good boarding schools like Birla Public School, Birla Senior Secondary School and Birla Balika Vidyapeeth. Pilani is also flooded with number of other English and Hindi medium schools making it a prominent education centre. The nearest rail stations are Chirawa (16 km) and Loharu (25 km). Jaipur is 220 km from Pilani and Delhi is 210 km and well connected by road.

98% of the planet Earths water is in the Oceans, remaining 2% is fresh water, but 98% of, which is stored in ice caps at the poles. In other words only 0.04% of water is available for human being use. Ground water is the important source for irrigation and drinking purpose. Water pollution is an important aspect of environmental pollution ground water is an important natural resource worldwide that exists only on our planet, without this precious resource life on earth would be non-existent.

Good quality water is inadequate even for normal living and is getting contaminated due to domestic wastes, industrial wastes, agricultural wastes, runoff from urban areas and soluble effluents.<sup>1-3</sup> Study and interpretation of the chemical characteristics of natural water was done by Hem.<sup>4</sup> Water quality parameters of ground water, river water and industrial effluents has been reported by several workers.<sup>5-6</sup> The human body is very sensitive to fluoride in the diet. According to Indian Council of Medical Research (ICMR)<sup>7</sup>, it is essential for growth of bones and teeth, when it is upto 1 ppm. Nitrate occurs in trace quantities in surface waters but may attain high level in some ground water. Concern about elevated concentrations of nitrate in drinking water is growing especially in rural areas where runoff from nitrate rich fertilizers and animal manure often finds its way into the water supply.

The ICMR (1975) has recommended highest desirable level of 500 mg/L and maximum permissible limit of 1500 mg/L for total dissolved solids<sup>8</sup>, which are in good agreement with the WHO international standards.

### EXPERIMENTAL

The present study provides a detailed description of the chemical criteria of ground water. Ten representative samples of entire study area were collected and analyzed for p<sup>H</sup>, total dissolved solids (TDS), fluoride, chloride, nitrate, sulphate, total alkalinity, total hardness. The sampling sites were identified and then the samples were collected from different sources after allowing some amount of water to flow out. The samples were collected in clean plastic bottles, which were pre cleaned, dried in dust free environment and sterilized. The instruments were used in the limit of précised accuracy and chemicals used were of analytical grade. All the water sample were properly labeled as 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 and a record was prepared indicating the source of the sample, location of the source and data of collection.

**Locations from where water samples were collected are as follows :-**

1. Hari Devi Jhutharam Shishu Sadan Senior Secondary School, Pilani
2. Birla Sarwajanic Hospital, Pilani
3. Birla Senior Secondary School, Pilani
4. Birla Institution of Technology and Science (BITS), near to Museum, Pilani
5. Central Electronics Engineering Research Institute (CEERI), Pilani
6. Neema –House, Rajgarh Road, Pilani
7. Near R.S.E.B., Pilani
8. Dr. Bedwal’s Hospital, Pilani
9. Chanda Bal Niketan school, Pilani
10. Dev Colony, Pilani

The Parameters and methods selected for the water sample analysis are detailed in Table-1.

Table-1: Parameters, methods, standard values and unit employed in physico-chemical examination of samples

S.No.	Parameters of Water Samples	Methods	Standard Values as guided by ICMR		Unit
			Desirable concentration	Maximum Permissible	
1.	p <sup>H</sup>	p <sup>H</sup> meter	7.0-8.5	6.5-9.2	-
2.	Total alkalinity	Titrimetric	200	600	mg/L
3.	Total hardness	Titrimetric	300	600	mg/L
4.	Chloride	Argentometric	200	1000	mg/L
5.	Sulphate	Turbidity meter	200	400	mg/L
6.	Total dissolved solids (TDS)	Conductivity meter	500	1500	mg/L
7.	Nitrate	Colourimetric	20	50	mg/L
8.	Fluoride	Ion selective electrode	1.0	1.5	mg/L

### RESULTS AND DISCUSSION

The results obtained for urban areas pilani are reported in Table-2. Ten water samples were analyzed for the following eight parameters – p<sup>H</sup>, TDS, fluoride, chloride, nitrate, total alkalinity, sulphate, total hardness.

Table-2: Physico-chemical analysis of ground water for urban areas, pilani :-

Sample Number	Source	p <sup>H</sup>	TDS mg/L	F <sup>-</sup> mg/L	Cl <sup>-</sup> mg/L	NO <sub>3</sub> <sup>-</sup> mg/L	SO <sub>4</sub> <sup>2-</sup> mg/L	Total alkalinity mg/L	Total hardness mg/L
1.	T.W.	8.5	980	0.8	190	90	50	250	170
2.	T.W.	7.8	1120	0.7	250	50	60	210	260
3.	T.W.	7.9	1120	0.6	275	50	65	260	200
4.	T.W.	7.8	1400	1.1	300	140	75	280	220
5.	T.W.	8.0	1400	1.0	325	40	80	300	220
6.	T.W.	8.5	1330	1.1	270	90	70	260	170
7.	T.W.	7.4	1400	1.0	265	55	45	180	170
8.	T.W.	7.3	1260	1.0	175	360	30	160	170
9.	T.W.	7.5	1330	1.1	240	170	30	210	180
10.	T.W.	7.7	1190	1.4	190	170	30	190	150

- p<sup>H</sup>** : All chemical and biological reactions are directly dependent upon the p<sup>H</sup> of water system.<sup>9</sup> The lower values of p<sup>H</sup> may cause tuberculation and corrosion while the higher values may produce incrustation, sediment deposit and difficulties in chlorination for disinfection of water<sup>10</sup>. In the present study the p<sup>H</sup> values in all the samples range from 7.3 to 8.5, which are all within the limit. The p<sup>H</sup> of water is very important indication of its quality and provides information in many types of geochemical equilibrium or solubility calculations.<sup>11</sup>
- TDS** : Total dissolved solid is an important parameter for drinking water and water to be used for other purposes. The maximum permissible limit of TDS is 1500 mg/L (ICMR). Beyond the prescribed limit, it imparts a peculiar taste to water and reduce its potability. TDS was found in the range of 980 to 1400 mg/L, which is also within the limit.
- Fluoride**: Fluoride is important in human nutrition for the normal development of bones. The required level of fluoride is 1.0 to 1.5 mg/L. Due to higher concentration of fluoride in ground water may develop molting of teeth, skeletal fluorosis, deformation in knee joints etc. In the Present study, it is observed that the fluoride content varied from 0.6 to 1.4 mg./L. Thus, it is completely in the permissible range and there is no threat to human health due to fluoride in drinking water.
- Chloride**: Chloride contents in fresh water is largely influenced by evaporation and precipitation.<sup>12</sup> Chloride is the most trouble some anion in the irrigation water. They are generally more toxic than sulphate to most of the plants and are best indicator of pollution.<sup>13-14</sup> Chloride contents varied from 175 to 325 mg/L in all the samples, which is all in the limit.
- Sulphate**: The sulphate ion is one of the major anions occurring in natural water. Sulphate in most of the samples was found to be lower than highest desirable level i.e., 200 mg/L. Sulphate was found in the range of 30 to 80 mg/L, which is also within limit. Higher value of sulphate may cause intestinal disorder.
- Nitrate**: The nitrate concentration in the studied area varied from 40 to 360 mg/L. The maximum permissible limit is 50 mg/L (ICMR). Due to higher concentration (over 100 mg/L) of nitrate in water, infants, less than six month old, are suffering from methamoglobinemia or blue baby disease.
- Total alkalinity** : The desirable limit for total alkalinity is 200 mg/L (ICMR). The values of water samples varies from 160 to 300 mg/L. In ground water, most of the alkalinity is caused due to carbonates and bicarbonates.
- Total hardness**: Hardness is an important criterion for determining the usability of water for domestic, drinking and many industrial supplies. The value of water samples varies from 150 to 260 mg/L. The desirable limit for total hardness is 300 mg/L. (ICMR). Water hardness is primarily due to the results of interaction between and the geochemical formations.<sup>15</sup> The

hardness of water is due to the presence of alkaline earths such as calcium and magnesium. Higher values of hardness is responsible for incrustation and scalling in pipelines.

### CONCLUSION

Although it was a representative sample study of the ground water quality of Birla's home town, but the results are very alarming. All parameters except nitrate were found within permissible limits. The general taste of water is also good. A layman cannot determine the possible hazards of water quality. This fact makes the study important. There is no industrial growth in Pilani, no dense population but the higher nitrate concentration in ground water indicates some other source. Irrigation is the main occupation of the surrounding population and chemical fertilizers are more commonly being used. The higher nitrate concentration may be attributed to the chemical fertilizers.

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