

**NOTE****Studies on Some Physico-Chemical Characteristics of Ground Water Used in Some Rural Areas of Hardwar**

ANJALI GOEL

*Department of Chemistry, Kanya Gurukul Mahavidyalaya, Hardwar-249 407, India*

The physico-chemical studies of ground water of some villages of Hardwar, Uttaranchal, India has been made for parameters as pH, conductivity, turbidity, total hardness, ammonia, nitrate, chloride, sulphate and some metal ions. It was found that these water samples are not suitable for drinking purpose as they have high dissolved ions concentration, alkalinity, total hardness etc.

**Key words:** Physico-chemical, characteristics, ground water, Hardwar.

With the advent of development, there is exponential increase in the demand for water. The main source to fulfill this demand for irrigation, industrial and drinking purposes is ground water. About 95% of the total available water all over the world is in the form of ground water. Thus the quality of ground water is of vital concern for mankind since it is directly linked with human welfare<sup>1</sup>. In villages the main source of water is ground water available in the form of wells or hand pumps. Water intended for human consumption should be safe, palatable and aesthetically pleasing. Most people of such areas use water directly from available source without any treatment and therefore are exposed to a variety of water related diseases<sup>2</sup>. The objective of the present study was to determine the quality of drinking water supplied to the rural community in order to estimate the health implications.

Water samples were collected in the first week of September and October, 2000 from three villages of Hardwar, Uttaranchal, India. The villages are situated in the north-west of Hardwar. The sampling sites were: well water of a temple of Orangabad village (SS<sub>1</sub>), well water of field area of Hetumpur village (SS<sub>2</sub>), handpump water in agricultural land of Annekey village (SS<sub>3</sub>), well water of a temple in a home of Annekey village (SS<sub>4</sub>), and well water in a home of Orangabad village (SS<sub>5</sub>). The samples were collected in pasteurized bottles for analysis purposes. Parameters were analyzed as prescribed by APHA<sup>3</sup>.

The parameters studied of all the five sites are within the BIS-10500-1991 permissible limits except a few as reported by the previous workers<sup>4-6</sup>. The pH of the natural water is of importance in a number of chemical reactions. The pH range of all the samples was 7.35–7.80. Sample SS<sub>1</sub> was slightly alkaline showing the presence of sufficient carbonates in the water. Turbidity is a measure of degree of opaqueness of water. Turbidity of all the five samples was not higher than the BIS permissible value of 10 NTU. The highest turbidity observed was of the well water of Hetumpur village which had not been used for a long time. The electrical conductivity, which measures the dissolved ion concentration, was much higher

than the BIS permissible limit for samples SS<sub>3</sub> and SS<sub>4</sub>. The highest conductivity was 955.36 S cm<sup>-1</sup> for sample SS<sub>4</sub>. In this well the materials used for worship as rice, flowers, roli, etc. were dropped daily.

It was observed that total alkalinity of all samples ranged from 260 to 497.50 mg/L. It is higher for all the samples than the prescribed limits. Such values may cause excessive encrustation in distribution pipes.

In general, water with hardness less than 120 mg/L as CaCO<sub>3</sub> is desirable for drinking purposes. Total hardness of water sample SS<sub>3</sub> is much higher than the BIS permissible values (300 mg/L). Previous workers have also reported higher values of hardness in ground water. The maximum concentrations of calcium and magnesium were found 185.97 mg/L and 63.83 mg/L respectively at site SS<sub>3</sub>, which are much higher than the permissible limits. The calcium concentration was higher in case of all the samples than the prescribed value. The highest concentrations of sodium and potassium were determined 85.00 mg/L and 8.8 mg/L in samples SS<sub>3</sub> and SS<sub>2</sub> respectively. The results are summarized in Table-1.

TABLE-1  
PHYSICO-CHEMICAL ANALYSIS OF GROUND WATER OF  
SOME VILLAGES OF HARDWAR (Mean values are given)

S.N.	Parameters	Units	Site SS <sub>1</sub>	Site SS <sub>2</sub>	Site SS <sub>3</sub>	Site SS <sub>4</sub>	Site SS <sub>5</sub>
1.	pH	NTU	7.80*	7.53	7.40	7.35	7.45
2.	Turbidity	S cm <sup>-1</sup>	2.00	7.50*	2.00	3.50	1.00
3.	Conductivity	mg/L	543.77	647.35	953.78	955.36*	637.87
4.	Alkalinity	mg/L	260.00	497.50*	418.80	265.00	340.00
5.	Total hardness	mg/L	290.00	262.00	728.00*	196.00	304.00
6.	Calcium	mg/L	85.77	72.14	185.97*	56.91	92.98
7.	Magnesium	mg/L	18.52	19.97	63.83*	12.66	34.10
8.	Nitrate	mg/L	0.07	0.07	2.72*	1.35	2.28
9.	Ammonia	mg/L	10.50	21.28*	0.42	10.95	1.54
10.	Chloride	mg/L	26.88	36.92	133.46*	18.46	44.02
11.	Sulphate	mg/L	21.75	21.00	48.00*	22.50	38.25
12.	Sodium	mg/L	51.00	63.50	85.00*	28.50	45.50
13.	Potassium	mg/L	4.60	8.80*	6.85	3.25	1.36

\*Highest value.

Ammonia of mineral origin is rare in natural waters. The most important source of ammonia is ammonification of organic matter. The highest value of ammonia (21.28 mg/L) was found in sample SS<sub>2</sub>. High concentration of ammonia is harmful to aquatic life and also to mankind. The nitrates owe their origin mainly to anthropogenic sources. The nitrate concentration of the five sites ranged from 0.07 mg/L to 2.72 mg/L which is much less than the BIS permissible limit of 45.0 mg/L. Similar type of results are reported by Ramchandra *et al.*<sup>8</sup> Chlorides and sulphates at all sites are within the permissible limit of BIS.

The physico-chemical studies of ground water of the five sites of Hardwar suggest that the ground water of these sites is contaminated. The most con-

taminated site is  $SS_3$ . The water samples of these sites should not be used for drinking purposes. Hence, it is necessary to develop a suitable technique to protect water resources from contamination as a national concern.

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Wallingatan 24 3tr.

SE-111 24 Stockholm, Sweden

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Fax: (+46-8) 106-678

E-mail: [monica@chemsoc.se](mailto:monica@chemsoc.se)

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