

STUDY ON THE PHYSICO-CHEMICAL CHARACTERISTICS OF GROUND WATER OF GULBARGA CITY (KARNATAKA)

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ABSTRACT: A systematic study has been carried out to explore the water quality index of ground water of various locations of Gulbarga city. Ten water samples from tube wells, open wells and hand pumps at various locations were collected using standard procedural methods and analyzed for p^H, nitrate, turbidity, total hardness, alkalinity, fluoride, sulphate, sulphide, COD and DO. Biological examinations were extensively carried out on each sample using known standard methods. In this study overall water quality of Gulbarga city is very poor and unsuitable for drinking purposes. Present study recommends that the top priority should be given to water quality monitoring and indigenous technologies should be adopted to make water fit for drinking after treatment such as desalination and defluoridation.

Key words: Ground water, Gulbarga city, Desalination, Defluoridation

INTRODUCTION

The world is facing the challenge of purification of water and air resources. In spite of many uses the organic compounds are toxic in nature and environmental contamination by these toxic chemicals is emerging as a serious global problem. Organic compounds containing industrial effluents from textile, dyeing and printing industries may cause skin cancer due to photosensitization and photodynamic damage. On the contrary, degradation products of these organic compounds are relatively less toxic and in some cases, these are almost harmless. Secondly polluted water is of almost no use, but if these organic compounds are degraded to smaller fragments, then this treated water may be used for washing, cooling, irrigation and cleaning purposes¹.

Water, the essential element for all living beings, is invariably polluted in all countries. India is no exception to this phenomenon². Rivers are the life line of the country. When they are affected, the consequences are detrimental to humanity at large. In this context to create environmental awareness among the students and public, study of the pollution of the ground water of Gulbarga city is the district head quarter and which in the north region of the Karnataka has been undertaken.

In recent times the environment activists of this area, especially ground water of Gulbarga city have often demonstrated against the excessive pollution. The Karnataka pollution control board has taken some measures to contain pollution of the city water and river water. In this background it has become an important social awareness activity to examine the quality of the ground water of Gulbarga city

Experimental

Samples were collected at ten different sampling points of the Gulbarga city (Table-1). The samples were collected as per the standard procedural method³⁻⁴ for the chemical analysis of various constituents. The river water samples were collected in sterilized neutral glass bottles of 250 ml capacity and closed with a sterilized glass stopper and properly sealed for biological investigation.

The samples were collected as composite samples. At every point four samples were collected and then the samples were mixed together and composite samples were obtained. The samples were collected down the stream nearly 4 km away to allow thorough mixing. The samples were given the serial numbers as follows (Table-1).

All reagents were analytical grade and solutions were made of distilled water. Various water quality parameters such as p^H, alkalinity, hardness, BOD, COD etc., were determined using standard analytical methods⁵. The instruments used were calibrated before use for observing readings. The repeated measurements were made to ensure precision and accuracy of results.

Table-1. Sampling Points in the Gulbarga city

S.No.	Place of sampling	Source of Water Samples	Sample numbers
1.	Sharanbasveswar Premise	Open well	1
2.	Brahmpur	Hand pump	2
3.	Shahbazar	Tube well	3
4.	Jewargi colony	Hand pump	4
5.	Badepur	Tube well	5
6.	Basaveswarcolony	Hand pump	6
7.	Durga	Tube well	7
8.	Nehru Gunj	Open well	8
9.	Aland colony	Hand pump	9
10.	Jayanagar	Tube well	10

Results and discussion

The physico-chemical tests and biological examinations were conducted employing standard scientific methods so as to minimize the determinate errors. Following are some of the observations revealed from the study of the various water quality parameters (Table-2 & 3) and few results were also analyzed graphically (Fig.1-2).

The p^H values of the samples varied between 7.30 and 7.92. It is observed that the pH of the water was slightly alkaline (7.6 to 8.3) and only minor fluctuation in pH was recorded. The pH levels were within the limits set by the World Health Organization (WHO)⁶ and Indian Council of Medical Research (ICMR) prescribed the limiting value of p^H as between 6 and 8.5 for a sample of water to be used for industrial, agricultural and domestic purposes.

Table-2. Water Quality parameters of Gulbarga city

Sample No	p^H	Total Alkalinity (mg/l)	Hardness of water (mg/l)	Ca ²⁺ ions (mg/l)	Mg ²⁺ Ions (mg/l)	Sulphate Ions (mg/l)
1.	7.33 (6.5-8.5)	74.5 (100-200)	110.05 (500)	60.83 (75)	30.20 (50-150)	230.0 (400)
2.	7.88	47.5	150.03	68.83	34.21	225.6
3.	7.66	53.0	200.64	55.42	28.21	220.6
4.	7.92	73.5	250.85	82.43	40.42	190.1
5.	7.30	72.5	230.48	95.24	45.24	219.7
6.	7.36	70.5	220.69	70.45	36.24	241.0
7.	7.39	78.5	190.11	58.06	28.05	210.0
8.	7.41	68.5	230.31	62.85	32.45	220.8
9.	7.43	68.0	225.12	75.87	36.25	222.5
10.	7.58	67.0	228.98	80.29	46.69	215.9

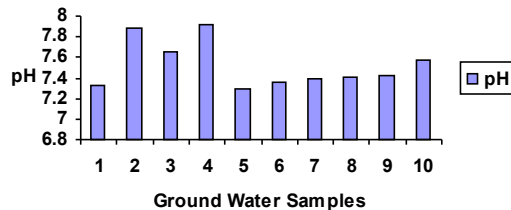


Figure 1. pH

Sample No	Concentration of Cl ⁻ ions (mg/l)	Concentration of F ⁻ ions (mg/l)	Total Solids (mg/l)	DO (mg/l)	COD (mg/l)	Total Count (per 100 ml)
1.	7.00 (250)	0.442 (1.0-1.5)	78.0 (1000)	5.00 (1.0-5.0)	4.5 (10)	50
2.	10.33	0.421	95.0	6.20	2.4	60
3.	14.20	0.584	97.0	6.44	6.2	Nil
4.	9.80	0.626	99.0	5.52	4.9	Nil
5.	20.55	0.626	110.0	5.56	7.0	40
6.	25.66	0.584	87.0	5.32	5.5	80
7.	29.54	0.484	96.0	6.52	7.8	Nil
8.	32.87	0.524	121.0	5.64	4.5	Nil
9.	33.00	0.505	135.0	5.28	7.4	Nil
10.	28.92	0.526	85.0	5.80	8.8	80

Table-3. Water Quality parameters of Gulbarga city

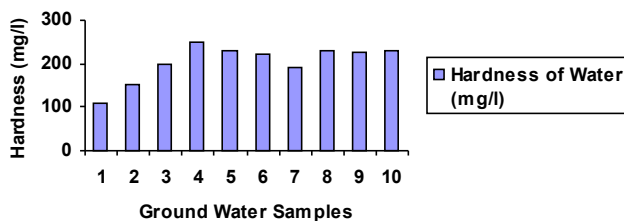


Figure 2. Hardness of water (mg/l)

The total alkalinity of the water samples was below the permissible and desirable criteria for domestic water supply. The observed alkalinity was due to methyl orange alkalinity since phenolphthalein alkalinities were zero in all the water samples. Consequently, the water samples are not polluted with respect to alkalinity.

The WHO has suggested a limiting value of 500mg/L of TDS for potable water. In the present investigation this limit is not crossed on either side by any of the samples under study⁷.

The total hardness value lies between 110 and 250 mg/L, the variation of these values from sample to samples are shown in Fig.2. Hence the raw water cannot be used for boiler feed and also for laundering purposes. The amounts of calcium and magnesium vary between 60 to 95 ppm and 28 to 45 ppm respectively. The limiting values prescribed by WHO are much greater than reported. The water used for industrial purposes should be free from calcium since it will cause the formation of scales in boilers.

A significant presence of anions like chloride and sulfate is also observed in the water samples under investigation. It has been observed that greater amount of sulfate in drinking water causes diarrhea. The chloride and sulfate amounts in the samples range from 7-33 mg/l and 190-241 mg/l respectively. Here it is observed that the sulfate concentration in the samples fall well within the prescribed limit by WHO and ISI.

Dissolved oxygen present in drinking water adds taste and it is highly fluctuating factor in water. In this study dissolved oxygen content varied in a limited range of 5 to 6.5. The maximum allowed value of chemical oxygen demand (COD) is 10mg/l in drinking water. The present samples have registered a range of 2.4 to 8.8 mg/l. These values are fall well within that expected for good quality potable water⁸.

The concentration of fluoride in drinking water is critical considering health problems related to teeth and bones. High fluoride concentration causes dental fluorosis and skeletal fluorosis whereas the absence or low concentration of fluoride in drinking water results in dental caries in children particularly when the fluoride concentration is less than 0.5 mg/l. In India fluoridation is not needed since we are getting sufficient fluorides from other food items. The recommended desirable limit of fluoride is 1 mg/l. In present investigation, fluoride content in all samples are fall well within that expected for good quality potable water¹⁰⁻¹¹.

Varieties of water borne diseases are attributed to untreated or inadequately treated ground water containing pathogenic forms of bacteria. Biological contamination of ground water may occur when human or animal waste enters an aquifer. Standard test to determine the safety of ground water for drinking purposes involves identifying whether or not bacteria belonging to coliform group are present.

The recent faecal pollution of water sources are indicated by the presence of coliform bacteria viz., *Escherichia coli*. The result of coliform test is reported in terms of Most Probable Number (MPN/100 ml) of coliform group of organism present in a given volume of water. The count must not be detectable in any 100 ml sample¹²⁻¹⁴.

On analysis presence of coliform bacteria has been established in all the samples. This very clearly establishes the pollution of ground water aquifers by surface water pollution and in such areas one cannot go unscathed even if open well water is used.

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