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PHYSICOCHEMICAL ANALYSIS OF GROUND WATER SAMPLES OF JAMKHANDI TOWN IN BAGALKOT DISTRICT, KARNATAKA STATE

B. M. KALSHETTY*, R. C. SHETH, P. S. HIREMATH and M. B. KALASHETTI[a]

Department of Chemistry, Comm., B.H.S. Arts and T.G. P. Science College,
JAMKHANDI – 587302 (K.S.) INDIA
[a]P. G. Department of Studies in Chemistry, Karnataka University, DHARWAD (K.S.) INDIA

ABSTRACT

Ground water and municipal water samples were collected from five locations in Jamkhandi town and analyzed for their physicochemical characteristics. The study was carried out by collecting four ground water samples (two open wells and two bore wells) and one municipal water sample during March 2010 – June 2010. The present investigation and objective of this study was focused on the determination of physicochemical parameters, and to examine the quality of ground water and its suitability for domestic purposes by using WHO and ISI standards. It was found that the ground water was contaminated at few sampling sites namely APMC yard and Girish Nagar (open wells). The sampling sites Siddarameshwar Colony and Kadapatti showed physicochemical parameters within the water quality standards and quality of water is good & fit for drinking purpose.

Key words: Drinking water, Physicochemical characteristics, Municipal water.

INTRODUCTION

Water is extremely essential for survival of all living beings. Water sources available for drinking and domestic purposes must possess high degree of purity and free from chemical contamination and microorganisms. In India, most of the population depend on ground water as source of drinking water supply. It is believed that ground water is clean and free from pollution than surface water. But, domestic sewage, solid waste dump and discharge of industrial effluents causes the ground water to become polluted and created health problems[1,2] . Ground water is the only alternative option even for the urban centers having well planned, designed and executed water supply systems in towns.

*Author for correspondence; E-mail: drkalshetty@gmail.com

Water, a natural resource used for different purposes, mainly depends on its intrinsic quality. People around the world have used ground water as a source of drinking water, and even today more than half the world's population depends on ground water for survival[3]. Analysis of water quality is very important for knowing the suitability for various purposes[4]. Water Quality Index (WQI) is regarded as one of the most effective way to communicate water quality[5].

The present work was undertaken to investigate the possible impact of the ground water quality of some open wells, bore wells and municipal water samples in Jamkhandi town. Jamkhandi is in Bagalkot district situated at Northern part of Karnataka state. The people are using open well water, bore well water as well as municipal water for their daily need. The literature survey reveals that no water quality management studies are made in this area so far. Thus, in this paper, an attempt has been made to assess the physical and chemical properties of ground water (open well, bore well) and comparing it with municipal water.

EXPERIMENTAL

As per standard procedure, the water samples were collected from different sites in clean and dry polyethylene bottles of two liter capacity without any air bubbles. The temperatures of the samples were measured in the field itself at the time of sample collection. The samples were kept in refrigerator at 5^0C and the different analysis were carried out within 6 hours after collection.

Samples	Locations	Sources
S1	Siddarameshwar Colony	Bore well
S2	Kadapatti	Bore well
S3	APMC Yard	Open well
S4	Girish Nagar	Open well
S5	Hanuman Temple	Municipal water

Analysis was carried out for various water quality parameters such as pH, EC, TDS, TA, DO, TH, Ca^{2+} , Mg^{2+} , Na^{+}, K^{+}, Cl^{-}, SO_4^{2-}, and free NH_3 using standard methods[6,7].

All the reagents used for analysis were AR grade and double distilled water was used for preparation of required solutions.

RESULTS AND DISCUSSION

The various physicochemical parameters determined for the water samples **S1** to **S5** are given in Table 1. From the analyzed results, it was found that the quality of water varies from location to location. All water samples were clear and colorless.

Table 1: Results of physicochemical parameters*. May-2010

Parameter	S1	S2	S3	S4	S5	WHO	ISI
pH	7.01	6.9	7.1	7.4	7.9	7 – 8.5	6.5 -8.5
EC	1200	1748	1052	1441	1386	1400	--
TDS	980	1153	940	1080	880	1000	500
TA	248	160	312	218	160	120	200
TH	490	510	514	414	170	500	300
DO	5.2	4.2	4.6	5.3	5.1	7.0	5.0
NH_3	0.33	0.21	0.53	0.39	0.39	< 1	--
Cl^-	125	960	311.8	116.9	153.2	250	250
NO_3^-	0.481	0.751	1.25	1.91	0.410	5	45
SO_4^{2-}	24.53	65.92	89.8	73.5	25.3	250	200
Ca^{2+}	132	142	127	68.9	30.66	100	75
Mg^{2+}	40.9	44.3	48.7	20.95	23.39	150	30
Na^+	55.80	33.8	72.3	37.60	53.60	200	200
K^+	0.820	1.005	1.011	0.422	0.462	1.4	--

*Water sample were collected in all four months (March 2010 to June 2010) and their physicochemical characteristics were analyzed separately; Table 1 shows the samples analysis report of May 2010.

pH and EC

The term pH is used to express the intensity of the acid or alkaline condition of a solution. Water samples **S3**, **S4** and **S5** are slightly alkaline due to presence of carbonate and

bicarbonates. Water sample **S2** is slightly acidic, because, pH value was found to be 6.9. The pH values of water samples varied between 6.9 to 7.9 and were found within the limit prescribed by WHO and ISI.

Electrical conductivity is a measure of water capacity to convey electric current. EC is the significance of amount of total dissolved salts[8]. EC values were in the range of 1052 micromhos/cm to 1748 micromhos /cm. High EC values were observed for sampling points **S2** and **S4** (one bore well and one open well) indicating the presence of high amount of dissolved inorganic substances in ionized form. The EC values of **S1**, **S3** and **S5** were found to be within the value prescribed by WHO.

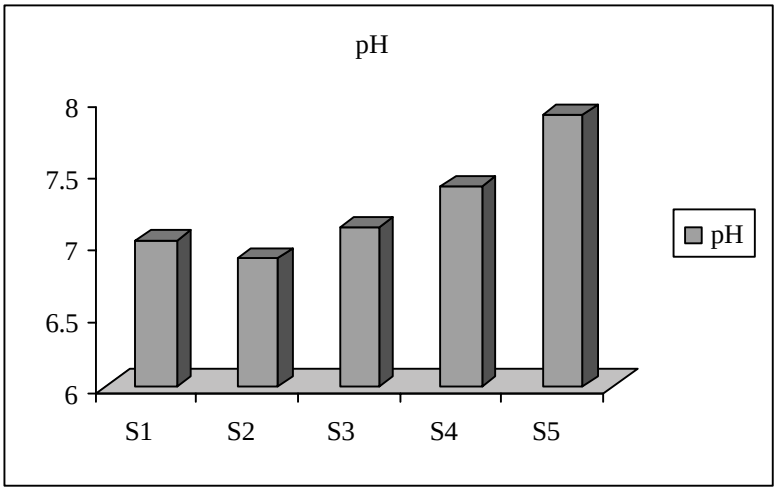

Fig. 1: pH of water samples

Total dissolved solids (TDS)

TDS indicates the salinity behavior of ground water. Water containing more than 500 ppm of TDS is not considered desirable for drinking purpose, but in unavoidable cases, 1500 ppm is also allowed[9]. The present study showed that the TDS values varied from 880 ppm to 1153 ppm. The sampling points **S2** and **S4** showed higher TDS values than the permissible limit given by WHO.

Dissolved oxygen (DO)

It is an important parameter in water quality assessment and reflects the physical and biological processes prevailing in the water. The DO values indicate the degree of pollution in water systems. Present investigation showed that the DO values varied from 4.2 ppm to

5.3 ppm. The sampling **S2** and **S3** showed low DO values. This may be due to contamination by some organic matter. But on average, the DO values of spots were found within the limit prescribed by WHO and ISI.

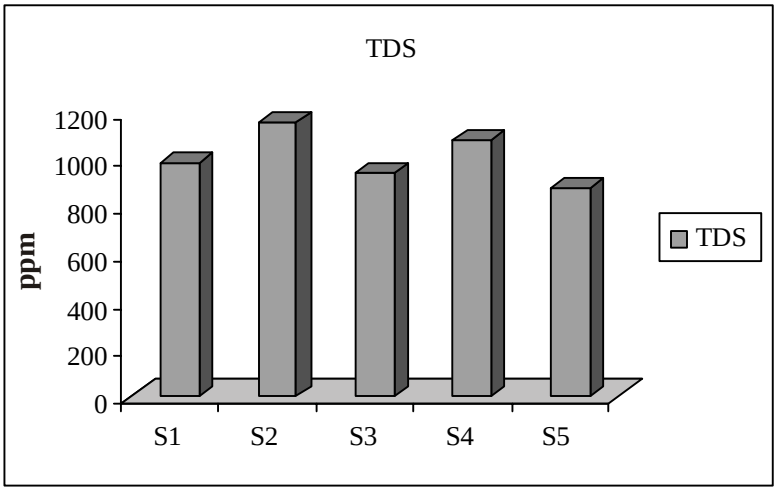

Fig. 2: Total dissolved solids of water samples

Total alkalinity (TA)

Alkalinity of water is its capacity to neutralize a strong acid and it is normally due to the presence of CO_3^{2-}, HCO_3^- and OH^- compounds of Ca^{2+}, Na^+ and K^+. Total alkalinity values for all the investigated samples were found to be greater than the value prescribed by WHO. i.e., DO values were found in between 160 ppm to 312 ppm, which are higher than permissible standards.

Total hardness (TH)

Hardness is the property of water, which prevents the lather formation with soap, and increases the boiling point of water[10]. Hardness of water mainly depends upon the amount of calcium and magnesium salts or both. In the present study, the hardness values of water were in between the range from 170 ppm to 514 ppm. The hardness values for bore well sample **S2** and open well sample from spot **S3** were higher than the prescribed limit.

Calcium and magnesium (Ca^{2+} and Mg^{2+})

Calcium and magnesium are directly related to hardness. Calcium in the selected samples ranges between 30.66 ppm to 142 ppm. Calcium content was found to be higher

than permissible limit for spots **S1**, **S2** and **S3**. Sampling points **S4** and **S5** showed that the concentration of calcium was below prescribed limit.

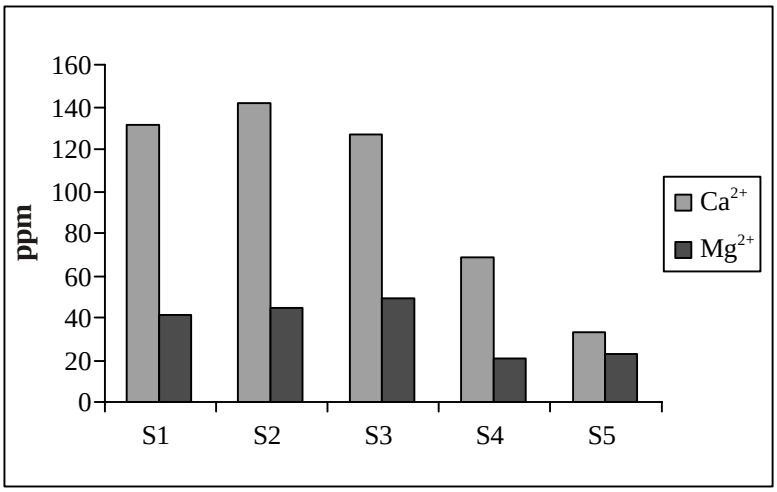

Fig. 3: Calcium and magnesium hardness

Magnesium content in the investigated water samples was ranging from 20.95 ppm to 48.7 ppm, which were found within WHO standards.

Sodium and potassium (Na^+ and K^+)

Sodium concentrations were found in between 33.8 ppm to 48.7 ppm in the investigated water samples, which were within WHO and ISI standards.

The major source of potassium in natural fresh water in weathering of rocks but the concentration of potassium increases in the polluted water, due to disposal of waste water[10]. Potassium contents in the water sample varied from 0.422 ppm to 1.011 ppm.

Chloride (Cl^-)

Chloride content in the water quality serves as an indicator of pollution by sewage. People accustomed to higher chloride in water are subjected to laxative effects[8]. In the present analysis, chloride content was found in the range of 125 ppm to 960 ppm. The values were found within the limit of standards in cases of spots **S1**, **S4** and **S5**. The maximum chloride content was found at spot **S2** i.e. 960 ppm. The concentration of chloride at spot **S3** (open well) was recorded to be 311.8 ppm, which is also more than the permissible limit. The higher chloride concentration in samples **S2** and **S3** may be due to discharge of waste water (sewage) near the sampling sites.

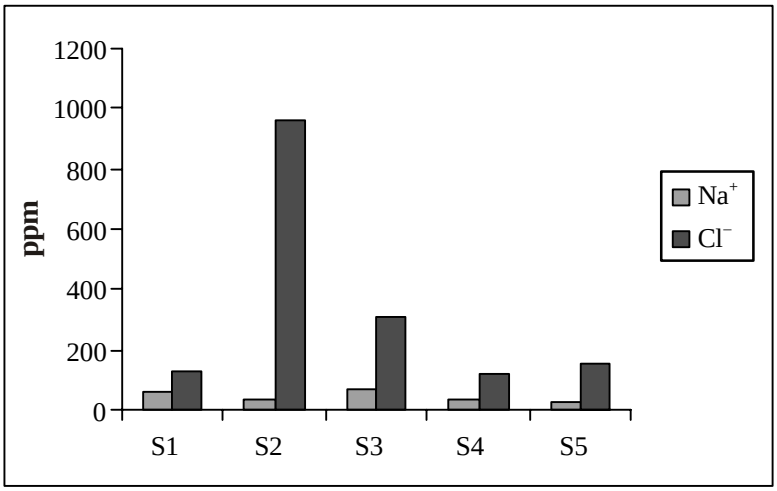

Fig. 4: Na^+ and Cl^- ions in water samples

Nitrate (NO_3^-)

Percolating water also makes the change in fresh water quality. Ground water contains nitrate due to leaching of nitrate with percolation. The sewage and other waste water makes the ground water rich in nitrates. In the present work, it was found that the concentration of nitrate in the areas varied in between 0.410 ppm to 1.91 ppm. Little amount of nitrates were recorded from the sampling points and it was found well within the standard limits.

Sulphate (SO_4^{2-})

Sulphate occurs naturally in water as a result of leaching from gypsum and other common minerals[11]. In the present analyzed water samples, spots **S2**, **S3** and **S4** showed more SO_4^{2-} contents, which may be due to discharge of domestic sewage. The sulphate concentration varied between 24.53 ppm to 89.8 ppm and it was within the prescribed limit.

Ammonia (NH_3)

Ammonia is present naturally in surface waste water. Its concentration is generally low in ground water, because it is absorbed on soil particles and clays and is not leached readily from soils. It is largely produced by deamination of organic nitrogen containing compounds and hydrolysis of urea. From the present investigation, it was observed that the ammonia values of selected spots were less than prescribed limit. The water samples showed the ammonia in the range between 0.21 ppm to 0.53 ppm.

The free ammonia is produced naturally in water by reduction of nitrates under anaerobic conditions and by microbiological degradation of organic nitrogenous matter. Concentration of ammonia at spot **S3** was 0.53 ppm due to sewage flow near the location.

CONCLUSION

The ground water samples of two bore wells, two open wells and one municipal water samples from the different spots in Jamkhandi areas of Bagalkot district, Karnataka state were analyzed for various physicochemical characteristics. The deviations were observed in ground water samples from municipal water and water quality standards indicating that the municipal water samples showed these parameter values within the WHO and ISI limits. Hence, municipal water was found to be fit for drinking purpose than ground water.

The water sample from site **S2** (bore well) showed higher values of TDS, TH, Cl^-, and Ca^{2+} contents and need some treatment for minimization of these parameters. Hence, some scientific filters should be used. All most all the parameters for most of the samples were reported lower than the permissible values. The low concentrations of ions do not have any considerable adverse impact in the use of these water samples for drinking and cooking purposes.

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