

**WATER QUALITY ASSESSMENT OF GROUND WATER RESOURCES AROUND
SUGAR FACTORY OF JAMKHANDI TOWN, BAGALKOT DISTRICT, KARNATAKA
STATE**

Ratnakant C.Sheth and Basavaraj M.Kalshetty*

*Department of Chemistry, Com. BHS Arts and TGP Science College, Jamkhandi,587301.

ABSTRACT: Ground water samples collected from different locations around sugar factory area within the range of 4 kms. Ground water from nine different spots were collected during October-2009 to January-2010 and analyzed for their physical characteristics. The analyzed results were compared with the water quality standards of WHO and ISI. The parameter values were determined using standard procedures. The quality of ground water samples were discussed for their suitability for domestic purposes was examined by using standards. The main objective of this study is to identify the quality of ground water especially in the industrial area and to calculate water quality index for different ground water sources at industrialized area. The investigation of quality assessment of water resources around Jamakhandi sugars in different three unions.

Key words: water quality, Quality assessment, ground water resources.

INTRODUCTION

Water is one of the most indispensable resources and is the elixir of life. It is believed that ground water must possess degree of purity¹, free from chemical contamination and micro organisms. But the rapid increase in population and industrialization together with the lack of wisdom to live in harmony with nature has led to the deterioration of good quality of water²; thus, resulting water pollution. Ground water is the main resource for living organisms, due to short fall of rain, failure of monsoon and improper management of rain water results in the pollution of ground water. Hence, a continuous monitoring on ground water becomes mandatory to minimize and have control on the pollution causing agents.

Ground water as a source of drinking water, and even today more than half the world's population depends on ground water for survival². The assessment of water quality is very important for knowing the suitability for various purposes³. Water quality index (1970s) can be used to monitor water quality changes in a particular water supply over time, or it can be used to compare the water quality in the region.

The present investigation reveals the assessment of ground water quality around sugar factory near Jamkhandi town, people residing around were using Bore wells water for domestic purpose, the municipal water supply facilities are not made available. The industrial effluents percolating in to bore wells near factory (up to 2 kms.). The percolated chemical contamination may leave their residual amounts, getting mixed with ground water and may affect the water quality in a severe manner. The ground water samples collected from different locations, three bore wells are within the distance of 1 to 2 kms. (Union 1), three bore wells are at 3 kms. from factory unit (Union 2) and other three bore wells are at 3 to 4 kms. Away from factory unit (Union 3). Hence, it becomes essential to assess the quality of ground water in these regions.

Experimental

Ground water samples during October-2009 to January-2010 collected in sterilized cleaned plastic polyethylene bottles from bore wells of spots S1,S2,S3 (union 1),spots S4,S5,S6 (union 2) and spots S7,S8,S9 (union 3) around sugar factory area, near Jamkhandi town of Bagalkot district, Karnaraka State. The samples were analyzed for different physical, chemical and biological parameters such as pH, EC, TDS, TA, TH, BOD, COD, DO using standard methods ⁴⁻⁷.the dissolved nutrients were estimated by spectrophotometrically after filtration of samples, chloride, TH was determined by titration method while barium chloride method was employed for the determination of sulphate. The pH and EC were measured as per the procedures given⁸. EC, TDS were measured using conductivity meter SR. No. o511113, TCM 15, and pH was recorded by using pH meter systronics Model 335.

RESULT AND DISCUSSION

Physico-chemical parameters, biological parameters and dissolved nutrients determined are given in Tables 1 to 3. The samples Union 1 (S1 to S3) represent the water samples collected very close to factory unit within 2 kms. Union 2 (spots S4 to S6) represent the water samples collected from three locations away from factory unit (2-3 kms.). While the Union 3 samples S7 to S9 are of locations from 3-4 kms away from factory unit.

Table 1 Water Samples Collected Near Sugar Factory (within 2 kms) **Union 1** (Spots S1, S2,S3)

Parameters	Unit	Period	S1	S2	S3	Limits
pH	-----	Oct-09	6.2	6.4	6.8	6.5-8.5
		Jan-10	6.3	6.4	6.7	
EC	Mm/cm	Oct-09	2456	2700	2856	1400
		Jan-10	2215	2128	2097	
TDS	ppm	Oct-09	2750	2950	2430	500-1000
		Jan-10	2310	2304	2247	
TA	ppm	Oct-09	421	425	451	12
		Jan-10	325	386	352	
TH	ppm	Oct-09	5222	537	539	300-500
		Jan-10	472	388	421	
DO	ppm	Oct-09	0.2	0.1	0.1	7
		Jan-10	0.4	0.7	0.9	
COD	ppm	Oct-09	201	197	194	10
		Jan-10	287	371	290	
Free NH ₃	ppm	Oct-09	0.94	0.80	0.90	<1
		Jan-10	0.86	0.74	0.49	
Chloride	ppm	Oct-09	392	372	364	200-1000
		Jan-10	377	349	302	
Sulphate	ppm	Oct-09	212	197	211	150-250
		Jan-10	123	134	194	
Calcium	ppm	Oct-09	165	120	178	75-100
		Jan-10	193	121	139	
Magnesium	ppm	Oct-09	64	56	65	30-150
		Jan-10	93	97	102	
Potassium	ppm	Oct-09	3.9	4.3	4.4	1.4
		Jan-10	3.4	2.7	2.1	
Iron	ppm	Oct-09	1.64	1.47	1.27	<1
		Jan-10	1.46	1.98	1.61	

All samples were analyzed during four months October-2009 to January 2010. But, in the tables the parameter values of October-2009 and January-2010 were recorded and used for discussion. All samples appeared colourless and have pH around 6.2 to 7.94. The values found in the collected samples of locations Union 3 were within the tolerable limits of WHO and ISI standards. The water samples collected from Union 1 were found to be slightly acidic, pH found to be in the range of 6.027 to 6.89.

Table 2 Water Samples Collected Near Sugar Factory (2 - 3 kms) Union 2 (Spots S4, S5, S6)

Parameters	Unit	Period	S4	S5	S6	Limits
pH	----	Oct-09	7.4	7.6	7.4	6.5-8.5
		Jan-10	7.3	7.5	7.5	
EC	Mm/cm	Oct-09	1790	1640	1764	1400
		Jan-10	1792	1866	1856	
TDS	ppm	Oct-09	1856	1759	1445	500-1000
		Jan-10	1987	1387	1213	
TA	ppm	Oct-09	412	452	421	12
		Jan-10	386	352	321	
TH	ppm	Oct-09	181	197	112	300-500
		Jan-10	131	127	101	
DO	ppm	Oct-09	3.9	3.7	3.5	7
		Jan-10	4.1	3.9	3.2	
COD	ppm	Oct-09	159	143	136	10
		Jan-10	136	172	122	
Free NH3	ppm	Oct-09	0.21	0.18	0.17	<1
		Jan-10	0.11	0.12	0.10	
Chloride	ppm	Oct-09	284	212	276	200-1000
		Jan-10	226	293	256	
Sulphate	ppm	Oct-09	102	94	85	150-250
		Jan-10	101	82	89	
Calcium	ppm	Oct-09	122	114	119	75-100
		Jan-10	123	118	106	
Magnesium	ppm	Oct-09	44	46	47	30-150
		Jan-10	24	28	34	
Potassium	ppm	Oct-09	1.8	1.7	1.9	1.4
		Jan-10	1.8	1.4	1.5	
Iron	ppm	Oct-09	0.88	0.97	0.89	<1
		Jan-10	0.89	0.86	0.69	

EC values records maximum at Union 1 (spots S1,S2,S3) as 2456,2700,2856 micromhos / cm during October-2009. While it was found to be 2215, 2128, 2097 micromhos / cm during January 2010. These spots located just near the Jamkhandi sugars. The EC values mainly depends on TDS, the TDS values during Oct-2009 were recorded 2750, 2950, 2430 ppm at spots S1,S2,S3 and 2310, 2304, 2247 ppm found on the same spots during Jan-2010 respectively.

Figure 1,2,3 showed the comparative study of pH, EC and TDS of spots S1, S4 and S7. The suspended solids in water generally re of inferior portability and may induce an unfavorable physical reaction in the transient consumer. Therefore, the TDS limit of 500 ppm to 1000 ppm is desirable for drinking purpose

Table 3 Water Samples Collected Near Sugar Factory (3 to 4 kms) Union 3 (Spots S7, S8,S9)

Parameters	Unit	Period	S7	S8	S9	Limits
pH	-----	Oct-09	7.7	7.6	7.9	6.5-8.5
		Jan-10	7.6	7.5	7.5	
EC	Mm/cm	Oct-09	1656	1880	1826	1400
		Jan-10	1986	1756	1644	
TDS	ppm	Oct-09	2647	2156	2120	500-1000
		Jan-10	1847	1274	1957	
TA	ppm	Oct-09	312	352	300	12
		Jan-10	352	368	352	
TH	ppm	Oct-09	94.5	91.8	59.2	300-500
		Jan-10	51.2	64.2	71.0	
DO	ppm	Oct-09	5.2	4.8	5.1	7
		Jan-10	4.9	4.7	4.8	
COD	ppm	Oct-09	130	179	132	10
		Jan-10	181	141	127	
Free NH ₃	ppm	Oct-09	0.18	0.17	0.21	<1
		Jan-10	0.11	0.09	0.04	
Chloride	ppm	Oct-09	212	192	181	200-1000
		Jan-10	123	98	69.7	
Sulphate	ppm	Oct-09	85	96	89	150-250
		Jan-10	69	83	63	
Calcium	ppm	Oct-09	88.9	64	94	75-100
		Jan-10	87	71	69.7	
Magnesium	ppm	Oct-09	21	18	19.4	30-150
		Jan-10	9.5	10.7	10.4	
Potassium	ppm	Oct-09	1.2	1.1	1.3	1.4
		Jan-10	1.9	1.4	1.0	
Iron	ppm	Oct-09	0.48	0.44	0.42	<1
		Jan-10	0.41	0.48	0.68	

The chemical parameters such as free ammonia, Cl, SO₄, Ca, Mg, K, Fe of the water samples of all Unions (spots S1 to S9) were found to be within the permissible limits of various standards except potassium values at Union 1 (S1,S2 S3) during Oct-2009 and Jan-2010. The potassium values in these spots ranging in between 2.1 to 4.4 ppm, which is more than the permissible limits of standards. The exceed potassium content in water more than 20 ppm will cause effect on nerves system⁸. The TA values for samples of union 1 were found to be 325 to 451 ppm, and at Union 2 the TA values found in between the range 321 ppm to 452 ppm. The spots at Union 3 the values found to e in between 300 ppm to 368 ppm, these values were found to be more than permissible limits of standards. The total hardness (TH) values were recorded higher in water samples collected from Union 1 during Oct-2009. The TH values crossed the maximum tolerance limit of standards. The higher values due to the dissolved salts in water samples near factory unit. The hardness may be due to chloride, sulphate and other factory effluents percolation in ground water. Chloride and sulphate and other chemical parameters were found to be lesser than permissible values of various standards in other samples.

The DO was recorded 0.1 to 0.9 in spots of Union 1. DO values at Union 2 spots found in between 3.2 ppm to 4.1 ppm which is also less than permissible limit, the DO values 4.7 ppm to 5.2 ppm found in the spots of Union 3. The DO values at Union 1 spots were low because of effluent flow. The solubility of oxygen in fresh and pure water ranges from 14.6 ppm at 0oC to about 7 ppm at 35oC under 1 atm. Pressure⁹.

Figure-1: Comparative study of pH Values in different spots (S1, S4, S7) During October-2009.

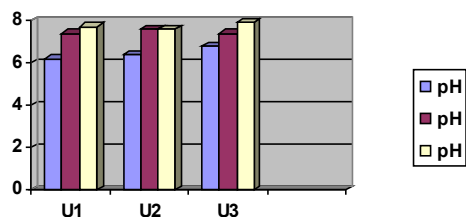


Figure-2: Comparative study of EC Values at different spots (S1, S4, S7) During October-2009.

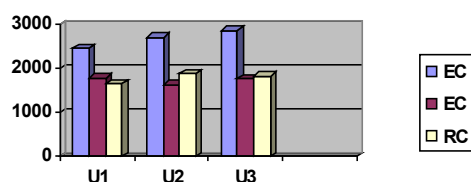
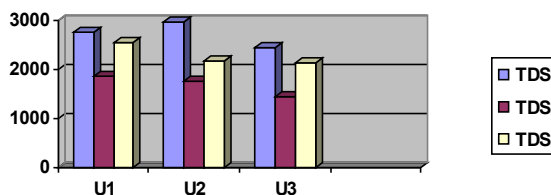


Figure-3: Comparative study of TDS Values at different spots (S1, S4, S7) During October-2009.



COD values of all samples collected from all spots were more than the maximum tolerance limits. i.e., in between 122 ppm to 371 ppm at S6 and S2 respectively during Jan-2010. In the present investigation the free ammonia was found to be less than 1 ppm in all spots during monitoring periods under studies the proportion of two forms of NH₃-Nitrogen in water depends on pH.

Ground water is dominated by its hardness (Calcium, carbonates and bicarbonates ions) due to lime stone in rain catchments and ground water beds¹⁰. The maximum permissible limits of Calcium and Magnesium hardness as per WHO, ISI standards are 75 – 100 ppm and 30 – 150 ppm respectively. All the samples analyzed have the Mg hardness well below these limits at all three Unions. Where the Calcium hardness was found to be in the permissible limit in Union 3, but, in case of Union 1 and Union 2 the Calcium hardness was found more than the standard limits, the Calcium values ranges 120 ppm to 193 ppm in Union 1 and 106 ppm to 123 ppm in Union 2 during monitoring months.

The samples of all three Unions were having the concentrations of chloride within the permissible limits of standards. But, the Sulphate content comparatively exceed the minimum permissible limits of standards in Union 2 and Union 3, the Sulphate ions in Union 1 were found to be within permissible limits.

The Potassium and Iron content in all the water samples of Union 1 and Union 2 were found well above the permissible limits of various standards during the monitoring months. Hence, these ions concentrations in the samples of Union 3 found to be low, based on all these facts, it is considered a good sign for the quality of the ground water of Union 3 (spots S7,S8,S9).

Conclusion

Bore wells water collected from the various spots (Union 1 to Union 3) around Jamkhandi Sugars of Bagalkot district of Karnataka State were analyzed for various Physical, Chemical and Biological parameters. The parameters of the Union 1 found more than permissible limits of various standards. The higher concentrations of ions and parameter values such as pH, EC, TDS, TA, TH, and COD have harmful and considerable impact on quality of ground water as its use for drinking and cooking purpose. Hence, the awareness may be given to the public not to drink the bore wells water of Union 1 (spots S1, S2, S3) and Union 2 (spots S4, S5, S6).

The ground waters of Union 3 (spots S7, S8, S9) are not harmful for human beings. However, the quality assessment of water samples showed the water quality of spots at Union 3 is superior to that of the spots of Union 1 and Union 2. WHO ISI limits and weighting factor by using NSF information software and compared with standard water quality rating it reveals that the quality of water of Union 1 showed poor water quality, probably due to very close to factory unit, the water samples were highly polluted and unfit for drinking purpose, need of some treatment for minimizing of the parameters. The water samples of Union 2 showed average water quality, but the ground water of Union 3 showed parameters within the water quality standards and quality of water is good and it is fit for drinking and cooking purposes.

Acknowledgements

Authors are thankful to the Director, Rohini Bio-Tech. Mahalingapur (Karnataka) for his kind support. Further the authors take this opportunity to thank Administrative Officer Prof. S.H.Lagali and Principal Dr. S.S.Suvanakhadi of their college for the financial support and encouragements.

REFERENCES

- 1.Goel P.K. Water Pollution- Cases, Effects and Control, New age Int.(p) ltd.New Delhi,2000.
- 2.Mohrir A. ramteke D.S., Moghe C.A., Wate S.R. and Sarin R. Surface and ground Water Quality Assessment in Binaregion, IJEP.2002.22(9).
- 3.Ram Krishnaiah S. and Sri Y. Babu Rao, Environmental and Water Quality studies in A,P. State- A case study, 1991.
- 4.APHA, Standard Methods for the examination of water and waste water. 17th Ed., American Public Health Association. Washington, DC. 1989.
5. Ram Krishnaiah S. and Sri Y. Babu Rao, Environmental and Water Quality studies in A,P. State- A case study, 1991.
6. Proceeding of International conference on water and environmental (WE-2003). Bhopal India, Allied Publishers pvt.ltd.Dec.15-18.2003.
7. Kanna K. fundamentals of environmental Pollutions S. Chand and Company ltd. New Delhi, 1991.
8. S.N. Shivalingappa, thesis submitted to KUD for the degree of Ph.D. 2003,pp.133-135.
9. B.M.Kalshetty et al., Quality Assessment of Ground Water, Int.J.Chem.Sci.:8(4),2010,2180-2188.
10. A.K.De, Environmental Chemistry, wiley Eastern Ltd,(2003).