



QUALITY ASSESSMENT OF GROUND WATER RESOURCES IN BANAHATTI AND RABAKAVI AREAS OF BAGALKOT DISTRICT, KARNATAKA

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ABSTRACT

Ground water samples collected from different locations of Rabakavi and Banahatti towns of Bagalkot district, and analyzed for their physiochemical characteristics. The results of the analysis were compared with the water quality standards of WHO, ISI. Ten locations of ground water samples were collected and analyzed during two months for the period September 2009 and October 2009, before and after the flood in this area. The various physiochemical parameters were determined using standard procedures. The quality of ground water samples were discussed. The suitability for domestic purposes was examined by using standards in Banahatti town near spinning mills. The main objective of this study is to identify the quality of ground water especially in the industrialized area used for domestic purposes.

Key words: Water quality, Ground water resources, Assessment.

INTRODUCTION

Rural population living in India depends on ground water for domestic purpose. Ground water must possess degree of purity, 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 water; thus, resulting in water pollution. Hence, water resources need a serious attention for their water quality. The ground water is the only source for the different locations, due to short fall of rain or its non-occurrence. Urbanization, industrialization and the failure of

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monsoon and improper management of rain water results in the pollution of the ground water and wide changes in physico-chemical parameters. Hence, a continuous monitoring on ground water becomes mandatory to minimize and have control on the pollution causing agents.

The present study aims at the assessment of ground water quality in Rabakavi and Banahatti. Both are urbanized and industrialized towns in Bagalkot district, where about three lakhs people are living. Many of them are working in spinning, textiles, small-scale industries, which is the main occupation of the people residing here. Bore well water is used for drinking and cooking purpose, whenever, the municipal water supply facilities are not made available. This area lacks proper drainage system and all the domestic sewage and spinning mills effluents are drained into the nearby canals, which are closer to the bore well points at Banahatti town. The use of chemicals may leave their residual amounts and domestic wastes also percolate into the ground, getting mixed with ground water and may affect its quality in a severe manner. Hence, it becomes essential to assess the quality of drinking water in this area.

EXPERIMENTAL

The samples were collected from the bore wells of five locations of Banahatti, an industrialized town and five spots of Rabakavi areas. The distance between each locations was maintained more than half km in order to carry out a broad study on water quality in these areas.

Collection of samples

Samples from different sites (**S1** to **S5**) were collected from Banahatti location during September 2009 and October 2009. Preserved samples were immediately processed for analysis within 6 hours after collection. During same months, the samples of different sites (**S6** to **S10**) were collected from Rabakavi location, and analyzed immediately after collection.

Physicochemical analysis

The samples collected were analyzed for important physical and chemical parameters such as pH, EC, TDS, ammonia, chloride, total alkalinity, total hardness, NO_3^- , phosphate, DO, COD, calcium, magnesium, potassium and iron as per the procedures¹ and by following various methods²⁻⁴ The pH and EC were measured as per the procedures given⁵.

EC was measured using conductivity meter Model SR. No. 0511113 TCM 15, and pH was recorded by using pH meter Systronics Model 335.

RESULTS AND DISCUSSION

Various physicochemical parameters determined are given in Tables 1 to 4. The samples **S1** – **S5** represent the water samples collected from Banahatti location while the samples **S6** – **S10** are of Rabakavi locations. All samples were analyzed during monitoring periods (September 2009, before flood and October 2009 after the flood). As far the physical parameters are concerned, all samples appeared colorless and have pH around 7.10 to 7.92. The values found in the collected samples of Rabakavi were within the tolerable limits of ISI and WHO standards. The water samples collected in Banahatti location were found to be more basic. pH was found to range between 7.28 to 7.92.

Table 1: Location : Banahatti

Parameters	Unit	Period	S1	S2	S3	S4	S5	Limits
pH	--	Sept.2009	7.90	7.92	7.52	7.32	7.28	6.5-8.5
		Oct.2009	7.61	7.68	7.46	7.42	7.34	
EC	Um/cm	Sept.2009	1440	1940	1260	1108	780	1400
		Oct.2009	1590	1980	1230	1089	1082	
TDS	ppm	Sept.2009	932	1274	952	937	560	500-1000
		Oct.2009	980	1004	966	819	458	
TA	ppm	Sept.2009	312	352	312	300	262	120
		Oct.2009	352	368	325	321	289	
TH	ppm	Sept.2009	510	566	386	318	297	300-500
		Oct.2009	472	484	362	296	236	
DO	ppm	Sept.2009	1.1	1.2	2.1	2.7	5.2	7
		Oct.2009	1.9	1.8	2.2	3.9	4.1	
COD	ppm	Sept.2009	47	58	29	21	13	10
		Oct.2009	54	74	89	34	16	

Table 2: Location : Banahatti

Parameters	Unit	Period	S1	S2	S3	S4	S5	Limits
Free Ammonia	ppm	Sept.2009	0.18	0.33	0.21	0.01	0.02	< 1
		Oct.2009	0.17	0.30	0.11	0.02	0.02	
Chloride	ppm	Sept.2009	350	391	350	279	186	250-1000
		Oct.2009	284	397	377	272	157	
Nitrate	ppm	Sept.2009	52	75	57	45	15	40-100
		Oct.2009	61	51	49	29	15	
Sulphate	ppm	Sept.2009	82	94	45	56	18	150-250
		Oct.2009	59	58	39	32	14	
Calcium	ppm	Sept.2009	92	66	80	76	40	75-100
		Oct.2009	80	68	73	64	60	
Magnesium	ppm	Sept.2009	47	69	64	49	58	30-150
		Oct.2009	46	57	56	54	48	
Potassium	ppm	Sept.2009	4	3	2	3	1	1.4
		Oct.2009	3	4	1	2	2	
Iron	ppm	Sept.2009	1.15	1.27	0.99	0.74	0.41	< 1
		Oct.2009	1.14	1.14	0.96	0.94	0.34	

Table 3: Location: Rabakavi

Parameters	Unit	Period	S6	S7	S8	S9	S10	Limits
pH	--	Sept.2009	7.2	7.5	7.3	7.1	7.2	6.5-8.5
		Oct.2009	7.8	7.6	7.5	7.7	7.8	
EC	Um/cm	Sept.2009	868	649	425	33	225	1400
		Oct.2009	894	376	200	222	290	
TDS	ppm	Sept.2009	626	630	679	560	589	500-1000
		Oct.2009	758	651	458	601	648	
TA	ppm	Sept.2009	279	262	212	250	289	12
		Oct.2009	297	257	282	214	249	
TH	ppm	Sept.2009	236	297	218	272	298	300-500
		Oct.2009	262	263	284	229	248	
DO	ppm	Sept.2009	5.2	4.9	3.2	3.5	3.1	7
		Oct.2009	3.9	3.1	2.7	2.8	4.1	
COD	ppm	Sept.2009	34	21	16	14	29	10
		Oct.2009	29	24	14	19	32	

Table 4: Location : Rabakavi

Parameters	Unit	Period	S1	S2	S3	S4	S5	Limits
Free Ammonia	ppm	Sept.2009	0.80	0.30	0.21	0.35	0.08	< 1
		Oct.2009	0.94	0.29	0.25	0.49	0.10	
Chloride	ppm	Sept.2009	164	118	126	130	168	250-1000
		Oct.2009	114	111	87	80	103	
Nitrate	ppm	Sept.2009	27	24	15	21	24	40-100
		Oct.2009	22	19	26	28	15	
Sulphate	ppm	Sept.2009	24	26	29	32	39	150-250
		Oct.2009	36	45	37	39	32	
Calcium	ppm	Sept.2009	86	73	94	46	40	75-100
		Oct.2009	80	60	80	36	35	
Magnesium	ppm	Sept.2009	18	12	11.6	9.6	7.2	30-150
		Oct.2009	19	22	13	12	13	
Potassium	ppm	Sept.2009	3	3	1	2	2	1.4
		Oct.2009	4	4	3	3	4	
Iron	ppm	Sept.2009	0.2	0.2	0.1	0.1	0.1	< 1
		Oct.2009	0.2	0.1	0.2	0.1	0	

EC values records maximum at spot S2 of Banahatti location (1940 micro mhos/ cm) during September 2009. while it was found to be 1980 micro mhos /cm during October 2009 after the flood. This spot S2 is located just near the Banahatti spinning mills. The EC mainly depends on TDS. The TDS values during September 2009 and October 2009 were recorded maximum at S2 spot as 1274 ppm and 1004 ppm, respectively. Figs. 1 and 2 show the comparative study of pH and EC values. Suspended solids in water generally are of inferior potability and may induce an unfavorable physical reaction in the transient consumer. Therefore, a limit of 500 ppm is desirable for drinking purpose.

The chemical parameters of these samples of Banahatti and Rabakavi locations were found to be within the permissible limits of various standards. The total alkalinity (TA) values determined for all samples of both areas exceeded the permissible limits of standards (120 ppm). The TA values for all samples were found to be in between 262 ppm to 368 ppm and 212 ppm to 297 ppm in Banahatti and Rabakavi locations, respectively. The high values

of alkalinity found in water samples are due to carbonates and bicarbonates, which may be ranked in order of their association with high pH values.

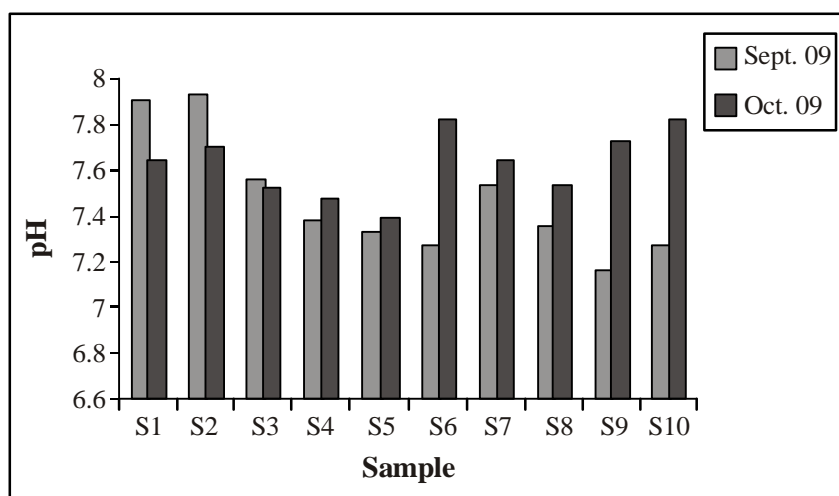


Fig. 1: pH of water samples collected from Banahatti and Rabakavi areas

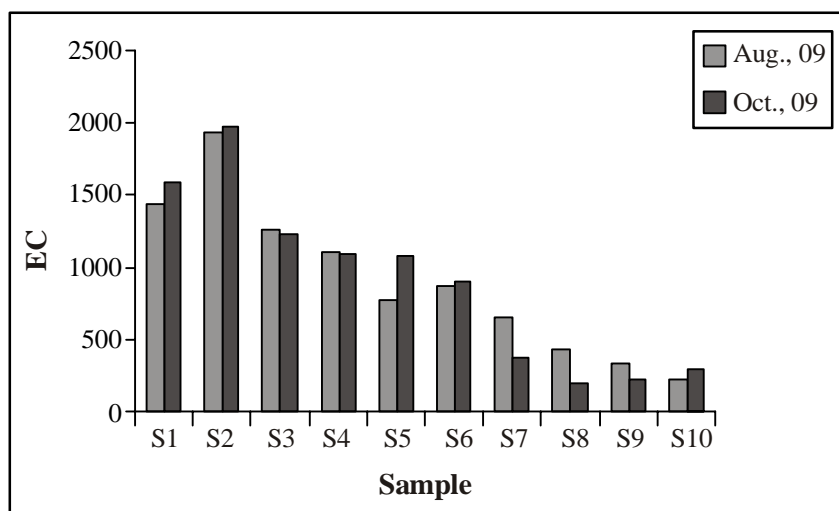


Fig. 2: EC of water samples collected from Banahatti and Rabakavi areas

In the samples collected from bore wells **S1** to **S5** of Banahatti area, the total hardness (TH) values were recorded higher than the water samples collected from **S6** to **S10** of Rabakavi union. In the samples collected at **S1** and **S2** spots of Banahatti, the TH values crossed the maximum tolerance limit of standards. These were higher depending on the

dissolved salts. The hardness is because of chloride, nitrate and sulphate and these were found to be lesser than permissible values of various standards in other samples.

DO was recorded as 1.1 ppm and 1.2 ppm in the samples at spots **S1** and **S2**, respectively and 5.2 ppm. DO was recorded in the sample **S5** of Banahatti location. This type of variation may be due to the fact that **S1**, **S2** bore wells spots were close to the effluent flow, whereas the sample spot **S5** is away from the spinning mills. The DO values of all the sample spots **S6** to **S10** of Rabakavi location were mostly found within the permissible limits and close to the limits of various standards (Solubility of oxygen in fresh and pure water ranges from 14.6 ppm at 0°C to about 7 ppm at 35°C under 1 atm. pressure).

COD values of samples collected from all the spots were more than the maximum tolerance limits. The values were recorded in between 13 ppm to 89 ppm in Banahatti union and 14 ppm to 34 ppm in Rabakavi location, respectively.

Free ammonia was found naturally in surface and waste water, but its concentration in ground water was found to be less than 1 ppm. The proportion of two forms of NH₃-nitrogen in water depends on pH. In the present study, free ammonia was found to be less than 1 ppm in all the spots of both unions during the monitoring periods.

Ground water is dominated by calcium, bicarbonate and carbonate ions due to lime stone in rain catchments and ground water beds⁷. The maximum permissible limits of calcium and magnesium hardness as per the ISI, WHO standards are 75 -100 ppm and 30-150 ppm, respectively. All the samples analyzed have the magnesium hardness well below these limits at Rabakavi union. But in case of Banahatti union, the values found to remain within the permissible limits of standards (46 – 69 ppm). Calcium hardness in Banahatti location was found to be within limits, as well as in the Rabakavi union, where the calcium hardness was also found to be in the permissible limit except spots **S9** and **S10**. Fig. 3 shows the calcium and magnesium hardness during study periods in Banahatti and Rabakavi locations.

The samples of Rabakavi area are having the concentrations of chloride, nitrate and sulphate ions comparatively lower than the samples of Banahatti location. The concentrations of these ions exceeded the minimum permissible limits of standards. As far as the chloride and nitrate ions concentrations are concerned, in Banahatti location, these were found to be within the permissible limits in some spots (**S1**, **S2** and **S3**), but in few spots, the values are lesser than the minimum tolerance (**S4** and **S5**). The sulphate ion concentrations found in all samples collected at Banahatti union were less than permissible limits.

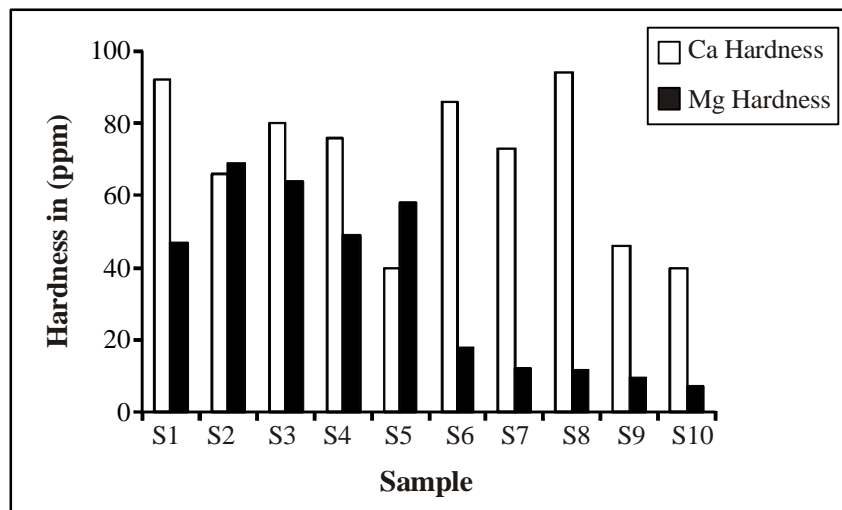


Fig. 3 Calcium and magnesium hardness (ppm) of water collected from Banahatti and Rabakavi locations during Aug. 2009

The concentrations of potassium and iron were found well above the permissible limits of various standards in all most all the spots of both locations during both the monitoring periods.

Except few spots of this study area, the ground water has very low concentrations of ions and based on all these facts, it is considered a good sign for the quality of the ground water for drinking and cooking purposes.

CONCLUSION

Bore wells water samples collected from the various spots in Rabakavi and Banahatti locations of Bagalkot district of Karnataka state were analyzed for various physiochemical parameters such as pH, EC, TDS, TA, TH, DO, COD, NH_3 , Cl^- , NO_3^- , SO_4^{2-} , Ca^{2+} , Mg^{2+} , K^+ and Fe. The parameters for most of the samples were lower than the permissible limits of various standards. The lower concentration of ions do not have any harmful and considerable impact on quality of water for its use for drinking and cooking purposes.

Water samples of spots **S1** and **S2** of the Banahatti locations, just nearer to spinning mills effluent flow and sewage flow, have slightly excess ions concentration due to dissolved salts. Hence, the awareness may be given to the public not to drink the bore wells water of these spots.

Generally, the ground water in these study spots is not harmful for human beings. However, the quality assessment of water samples shows that the water quality in Rabakavi locations is slightly superior to that of Banahatti locations.

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