Better Management Of Ground Water Source For Drinking Purpose In Belgaum District Of Karnataka, India

SUNKAD. B. N.

Abstract: - Groundwater is a vital source that provides drinking water in rural areas of Belgaum district. People of rural areas depend on groundwater for all or most of their supply of their drinking water. Since ground water is the only source of drinking water, its protection and proper management becomes top priority. Further, this water being potable, it has a direct bearing on the health of those thousands of villagers. Hence, the present work is an attempt to investigate the physico-chemical variations and bacteriological studies of ground waters (bore wells & dug wells) collected from rural areas *viz* Halaga and Honaga, near Belgaum city. The water samples were analyzed for physico-chemical parameters such as pH, total solids, total hardness, total alkalinity, chloride, sulphate, nitrate, fluoride and iron and bacteriological study. Iron content showed high in 5 of 7 & 4 of 8 locations respectively in Honaga and Halaga villages. In 2 open wells of Halaga village TDS, TH & Chloride values are found to be high as compared with that of drinking water standards. In Honaga village out of seven, two sites are having E -coli and in Halaga village out of eight sites three sites are having E-coli. This study clearly indicated that the quality of ground water does not comply with both Indian and WHO standards for drinking purpose. Findings also reveal that almost 70 – 75% of the analyzed ground waters are found to be not useful for human consumption. After having enquiry with the representatives of the rural areas, some suggestions have been made.

Key words: Ground water, water quality, bore-well waters, physico-chemical parameters

Introduction

Biological production in any aquatic body gives direct correlation with its physico-chemical status which can be used as trophic status andfisheries resources potential (Jhingran et al., 1965).Ground water is the major source of water in the country, more than 80 % population depend on it. Providing drinking water is a challenging task, because of various reasons like poverty, illiteracy, lack of awareness, improper sanitation and socio-economic status of the population. The excessive use of this precious natural source and the large production of wastes is leading to both contamination and depletion of ground water. Ground water has unique features, which render it particularly suitable for human use. It accounts for about 88% safe drinking water in rural areas. Unfortunately, the availability of ground water is not unlimited nor it is protected from deterioration. In most of the instances, the extraction of excessive quantities of ground water has resulted in drying up of wells and depletion of ground water table. Researchers such as Bhadale et, al. (1996) and Suresh (1996) have carried out ground water quality studies in Belgaum city. The present investigation attempt to study of water quality in two villages for drinking.

*Dr.B.N.Sunkad.
R.L.Science Institute College Road Belgaum, Karnataka
bnsunkad@yahoo.co.in

Materials and Methods

The observations of ground water quality parameters of Honaga and Halaga villages were made in the month of December 2009. Halaga is a village 5 kms away from Belgaum city and lies in between 15^0 49'8" North latitude and 74^0 33' 53" East longitude. Honaga is an industrial area of Belgaum city which lies between 15^0 56' 59" North latitude and 74^0 30' 59" East longitude. Fifteen water samples were collected from bore wells (hand pump) and open wells from two villages near Belgaum city in December 2009 in two liter PVC containers and were analyzed for the physico-chemical parameters in the laboratory. Eight samples were analyzed for bacterial contamination also. The physical parameter pH was determined at the time of sample collection. The chemical parameters such as total hardness, chloride, TDS, sulphate, Fluoride, nitrate, alkalinity and iron and bacteriological analyses were carried out following procedures of standard methods. The results were evaluated in accordance with the standards prescribed under Indian standard Drinking water specifications of 1991 of Bureau of Indian standards and WHO standards.

Results and Discussion

The observations of ground water quality parameters of Honaga and Halaga villages were made in the month of December 2009. Halaga is a village 5 kms away from Belgaum city and lies in between 150 49'8" North latitude and 740 33' 53" East longitude. Honaga is an industrial area of Belgaum city which lies between150 56' 59" North latitude and 740 30' 59" East longitude. Fifteen ground samples were drawn from the open wells and bore wells from two villages in December 2009 and the water samples were analyzed for physic-chemical parameters. Further, all samples drawn for the bacterial analysis are presented in Table 1& 2. These fifteen samples were analyzed for physico-chemical and bacteriological study, of these ten samples were found to be non potable, as per on Bureau of Indian Standards and WHO standards for drinking water. In Honaga (Industrial area of Belgaum) , of the seven samples, five samples (site number 1,3,4,6 & 7) were found to have iron in excess of the maximum permissible limit of 1 mg/l. The high values may be due to rusting of casing pipes, non-usage of bore wells for long period and disposal of scrap in open areas by the industries. Similar observations were recorded by Shankar et, al. (2007). pH, TDS, total hardness, chlorides, sulphate, fluoride, nitrates, alkalinity and iron were well below the permissible limits; these observations tally with the observations made by Gupta.S(2004) in Sanganer area of Jaipur of Rajastan, Bhat and Hegde (1997) in Uttar Kannada District of Karnataka. In site number 3, 5 & 7 water is contaminated with pathogenic bacteria and hence, water is not potable. Halaga is a small village, is 5 kms away from Belgaum city on National Highway-4. Totally eight samples were collected for physic-chemical and biological study, of which six samples are found to be non potable. pH range is between 6.5 to 7.8. This factor is well below the permissible limit but TDS, chloride, TH and iron are found above the permissible limit. Total dissolved solids and TH, each accounted for 50% of the samples being non potable. Water with high dissolved solids are of inferior palatability and may induce an unfavorable physiological reactions and gastro-intestinal irritation in transient consumer. Similar observations were recorded by Ranjit Singh and Ajit Kumar (2004).Chloride is high in some sites due to animal excreta which is percolated into the ground water, Jain et al (2003). Besides this, septic tanks and garbage may also be responsible for high content of chlorides. Iron accounted for 37.5% of non potability of samples. This is due to the non usage of bore wells for long period. All samples were analyzed for bacteria, of them 2 (25%) were found to be contaminated.

Conclusions:

Open wells are not contaminated with pathogenic bacteria but some physico-chemical parameters such as TDS, TH and chlorides show maximum value than the permissible limit. The present study clearly indicates the quality of ground waters do not comply with both ICMR and WHO standards for drinking purpose. Findings also reveal that almost 70–75% of the analyzed ground waters are found to be not useful for human consumption. So, to prevent this, strict legislation and effective implementation of these measure should be made mandatory for the industries. The Karnataka Act for Ground Water (Regulation for protection of sources of Drinking water) Bill passed in 1999 proposes vesting of authority to some officers (DC) to regulate the use of ground water for public. The role of this authority is to monitor:

- **a)** Compulsory registration of the open wells and tube wells by the respective owner.
- **b)** To seek permission from the concerned authority to use the ground water.
- **c)** To obtain permission from the authority to dig a well or drill a tube well.
- **d)** Failing to abide by these rules, the water body should be taken possession by the authority and stop the power supply.
- **e)** Any violation would lead to imprisonment of six months and penalty of rupees 500/-.

Apart from these, it would be important to involve Geologists systematically to evaluate the ground water status at regular intervals. Rain water harvesting is the need of the hour. Some states of India have already enacted legislation almost making it compulsory. Creating awareness through campaign on water conservation through mass media among the common people is of urgent need to save the precious resources and safeguard it against the perils of water borne–diseases. Along with this the damaged pipelines must be replaced. Establishment of water quality testing centre in each ZP area with due publicity to the people will help overcome this problem. Setting up a taskforce exclusively to regulate water supplies. This taskforce may also come up with clear guidelines, innovative measures to govern the water resources. Such measures will definitely go a long way in sustaining the use of natural resources, its conservation and prevention from contaminants. Moreover, the better management is assured as the Government bodies and the local populace get voluntarily involved in this great task.

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Table1. Variations in Physico-chemical parameters of Halaga village

Site No.	source	pH	TDS mg/l	TH mg/l	Cl mg/l	SO4 mg/l	Fl mg/l	NO3 mg/l	TA mg/l	Fe mg/l	Bacteria/100 ml	Remarks
1	Open well	6.5	1300	**1200**	**800**	15	0.3	9	90	**2**	0	NP
2	Open well	7	**1600**	**1400**	**760**	12	0.3	36	300	**1.8**	0	NP
3	BWHP	7	**1630**	**1410**	**800**	11	0.2	12	250	0.1	0	NP
4	BWHP	7.3	800	400	250	40	0.4	6	300	0.8	0	P
5	BWHP	7.2	350	180	60	40	0.2	40	120	0.8	0	P
6	BWHP	7.1	1400	**1500**	560	12	0.3	18	280	0.2	28	NP
7	BWHP	7.8	300	150	68	11	0.1	4.3	68	**1.8**	10	NP
8	BWHP	7.5	280	160	140	10	0.1	5	160	**1.2**	0	NP

BWHP= bore well hand pump, TH=Total hardness, Cl=Chloride, SO4=Sulphate,Fl=Fuoride,NO3=Nitrate,Fe=Iron TA=Total alkalinity. Bold figures indicates above permissible limit. NP= Not permissible, P=Permissible.

Table2. Variations in Physico-chemical parameters of Honaga village

Site No.	Source	pH	TDS mg/l	TH mg/l	Cl mg/l	SO4 mg/l	Fl mg/l	NO3 mg/l	TA mg/l	Fe mg/l	Bacteria/ 100 ml	Remarks
1	BWHP	6.8	180	128	30	4	0.6	9	82	**1.2**	0	NP
2	BWHP	7.8	220	96	52	9.3	0.1	9	106	1	0	P
3	BWHP	6.7	170	110	32	10	0.4	6	55	**1.8**	10	NP
4	BWHP	6.8	210	140	30	11	0.1	7	96	**2**	0	NP
5	BWHP	6.8	280	160	38	14	0.2	8	110	0.3	1	P
6	BWHP	6.6	310	184	48	18	0.4	4.8	110	**3.8**	0	NP
7	BWHP	7	416	140	130	11	0.5	8	90	**2**	2	NP

BWHP= bore well hand pump, TH=Total hardness, Cl=Chloride, SO4=Sulphate, Fl=Fuoride, NO3=Nitrate, Fe=Iron TA=Total alkalinity, Bold figures indicates above permissible limit. NP= Not permissible, P=Permissible.

Table3. Drinking Water Standards (1971)

Physico-chemical parameters	World Health Organization,(WHO)		ICMR standards	
	Highest Desirable	Maximum permissible	Highest Desirable	Maximum permissible
Turbidity	5.0	25.0	5.0	25
pH	7.0 – 8.5	6.5 – 9.2	7.0	8.5
Total solids	500 mg/l	1500 mg/l	500 mg/l	1500 mg/l
Total hardness	100 mg/l	500mg/l	300 mg/l	600 mg/l
Iron	0.1 mg/l	1.0 mg/l	-	-
Chloride	200 mg/l	600 mg/l	200 mg/l	1000 mg/l
Sulphate	200 mg/l	400 mg/l	-	-
Fluoride	1.0 mg/l	1.5 mg/l		

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