RJC

RASĀYAN *J. Chem.*
Vol. 6 | No.1 | 20-23 | January-March | 2013
ISSN: 0974-1496 | e-ISSN: 0976-0083 | CODEN: RJCABP
http://www.rasayanjournal.com
http://www.rasayanjournal.co.in

POTABLE GROUNDWATER QUALITY IN JORVE VILLAGE OF SANGAMNER, MAHRASHTRA, INDIA: FOCUS ON FLUORIDE

K.T. Bharati*
Postgraduate Department of Chemistry, Sangamner Nagarpalika Arts, D.J. Malpani Commerce & B.N. Sarda Science College, Sangamner – 422605,(MS), India.
*Email: bharatik007@gmail.com

ABSTRACT
Health diseases occurring due to high fluorine concentration in drinking water are a widespread problem in the world. To get the information of the fluoride concentration in ground water was determined in 10 samples of Jorve village Sangamner, Maharashtra, India. The fluoride concentration in the underground water of these village varied from 0.01-2.13 mg/L. various other water quality parameters, *viz.*, Temperature, pH, electrical conductance, total dissolved solids, fluoride, sodium, potassium, chloride, calcium hardness, magnesium hardness, sulphate, nitrate, DO, etc. were also measured. TDS and Hardness of the samples do not comply with Indian as well as WHO standard for most of the water quality parameters measured. Overall water quality was found unsatisfactory for drinking purpose. Fluoride content was higher than the permissible limit in 50% samples.
Keywords: Fluoride, Groundwater, Water Quality Parameters.

INTRODUCTION

Water is an elixir of life, which contains minerals depending upon the natural mineral quality of earth curst. Minerals are good for human health but in appropriate quantity. If minerals are consumed in high or low intake, it may impose life threatening risk to human health[1]. Among all the minerals, fluoride is one of the important in ground water that prevents the tooth decay and controls the metabolic bone diseases[2].The problem of excessive fluoride in groundwater in India was first reported in 1937 in the Andhra Pradesh State[3]. Fluorosis, which was considered to be a problem related to teeth only, has now turned up to be a serious health hazard and skeletal fluorosis. It only affects the body of a person but also renders them socially and culturally crippled[4]. Fluoride is well recognized as an element of public health concern. Fluoride is present universally in almost every water, earth crust, many minerals, rocks etc. It is also present in most of everyday needs, *viz.* toothpaste, drugs, cosmetics, chewing gums, mouthwashes and so on.[5,6].Though a small amount of it is beneficial for human health for preventing dental carries, it is very harmful when present in excess of 1.0 ppm. Higher concentration of fluoride also causes respiratory failure, fall of blood pressure and general paralysis. Loss of weight, anorexia, anemia, wasting and cochexia are among the common finding in chronic fluoride poisoning. Fluoride ions inhibit a variety of enzymes often by forming complexes with magnesium ions and other metal ions[7, 8, 9]. The fluoride levels in drinking water and its impact on human health in many parts of India have increased the importance of defluoridation studies. The major sources of fluoride in groundwater are fluoride bearing rocks such as fluorspar, cryolite, fluorapatite and hydroxylapatite[10].The fluoride content in the groundwater is a function of many factors such as availability and solubility of fluoride minerals, velocity, of flowing water, temperature, pH and concentration of calcium and bicarbonate ions in water, etc.[11, 12]. The permissible limit of fluoride level is generally 1 mg/l[13] and 1.5 mg/l (Indian standard). In some parts of India the fluoride concentration are below 0.5 mg/l, while at certain other places, fluoride levels are as high as 30 mg/l have been reported[14]. The present study has been undertaken to assess the quality of underground water of Jorve village in Sangamner tehsil, (MS) India.

EXPERIMENTAL

10 water samples of different locality were collected from jorve village of Sangamner tehsil (MS), India for analysis. For collection of water, the clean plastic bottles having 1 liter capacity has been used. The methods of water analysis were used as prescribed[15]. The fluoride concentration in the groundwater samples was determined by the "SPANDS" methods. The SPANDS colorimetric method is based on the reaction between fluoride and zirconium dye-lake and formation of colorless complex between anion and the dye takes place. As the amount of fluoride increases, the color produce becomes progressively lighter. Fluoride standard from 0 to 1.40 mg /L were prepared and were diluted to 50 ml with double distilled water. SPANDS and zirconil acid regent each 5.00 ml mixed with each standard and spectrophotometer was set to zero Absorbance with the reference solution. Absorbance was measured spectrophotometrically at 570 nm.

Table-1: Fluoride concentration with respect to other parameters of water samples.

Parameters	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10
Temp.	30.1	29.5	30.2	30.4	30.0	30.5	30.2	29.8	29.0	30.4
pH	8.21	8.01	7.95	8.41	7.74	7.64	7.64	7.45	7.78	7.54
TDS	10,500	13,900	6570	10,300	10,000	2130	18,900	1904	1500	21,200
Ca.HAR	16.32	27.68	20.0	9.92	8.15	7.04	17.12	13.28	10.4	21.12
Mg.HAR	7.87	14.87	13.8	5.05	6.99	3.11	8.94	3.49	3.8	13.41
HAR Total	73.1	130	107	45.5	49.0	30.4	79.5	47.5	41.6	108
EC	2.38	2.54	1.085	1.924	1.860	0.378	3.29	0.314	0.283	3.50
Fluoride	2.13	1.45	0.31	1.61	1.40	0.07	0.98	0.01	0.02	1.09
Nitrate	7.20	6.70	3.03	6.48	6.38	0.81	6.94	1.29	0.01	7.01
DO	3.5	4	2.2	2.5	2	2.8	2.9	2.6	2.5	3
Sodium	65	66	34	54	50	11	74	11	04	76
Potassium	1	1	12	1	1	00	1	1	1	1
Chloride	17.75	23.43	14.2	17.04	14.91	5.68	48.7	7.1	2.13	49.7

*All Values are in mg/l, expect pH and EC. Units of EC are ms/cm

Table- 2: Comparison of groundwater quality at the village under study with drinking water standards (Indian and WHO)

Parameters	Values from the collected samples		Indian standard		WHO standard
	Minimum	Maximum	Acceptable	Maximum	
pH	7.45	8.41	7.0-8.5	6.5-9.2	6.5-9.2
EC	0.283	3.50			
TDS	1500	21,200	500	1500	500
TH	30.4	130	200	600	500
Na^+	04	76	-	-	-
K^+	00	12	-	-	-
Ca as $CaCO_3$	7.04	27.68	200	1000	500
Mg as $CaCO_3$	3.11	14.87	200	400	50
Cl^-	2.13	49.7	200	1000	200
F^-	0.01	2.13	1.0	1.5	1.0
NO^{3-}	0.01	7.20	-	-	
DO	2	4.5	-	-	4.6-6.0

Table- 3: Classification of underground water on the basis of Total Dissolved Solids

S. No.	Description of ground water	Salinity(mg/l)	No. of samples	Percentage
1	Non saline	<1000	0	0
2	Slightly saline	1000-3000	3	30
3	Moderately saline	3000-10,000	2	20
4	Very saline	>10,000	5	50

Table- 4: Classification of underground water on the basis of total hardness

S. No.	Description of ground water	Total hardness (mg/l)	No. of samples	Percentage
1	Soft	0-60	5	50
2	Moderately hard	61-120	4	40
3	Hard	121-180	1	10
4	Very hard	>180	0	0

RESULTS AND DISCUSSION

Most of the water samples are slightly alkaline due to presences of carbonates and bicarbonates. All the sampling points showed pH value between the 7.45-8.41, these values within the limit prescribed by WHO. When electrical conductivity values exists at 3000µmho/cm, the generation of almost all the crops would be affected and it may result in much reduced yield[16]. It is considered to be an induction of the total dissolved salt content. Conductivity value in the studied area varied between 0.283-3.50 mhos/cm.

Total Dissolved Solids is important parameter in drinking water quality standard. It develops particular taste to the water and at higher concentration reduces its potability water with more than 500 mg/L usually has a disagreeably strong taste. High TDS levels generally indicate hard water, which can cause buildup in pipes, valves and filters. In the present study, TDS in the studied area varied between the 1500-21,200 mg/L. 50% sampling sites showed the very saline water, 30% sampling sites showed slightly saline and 20% sampling sites showed moderately saline which higher prescribed by WHO. So it can conclude that water is hard at these sampling sites, which necessities the softening of water prior to its use.

Hardness of water depends upon the amount of calcium and magnesium salts. Hardness value in the studied area between 30.4-130 mg/L. 50% sampling points showed soft water, 40% sampling points showed moderately hard and 10% sampling points showed the hard water these values within the limit prescribed by WHO.

Sodium values in the studied area between 4-76 mg/L. The higher the concentration of sodium can be related to cardiovascular diseases and in woman toxemia associated with pregnancy. 5 sampling sites showed higher sodium concentration than the prescribed by WHO and Potassium values 0-12 mg/L. 1 sampling sites showed higher potassium concentration than the prescribed by WHO.

Calcium value in the studied area varied between 7.04-27.68 mg/L. If calcium is present beyond the maximum limit causes the incrustation of pipes and deterioration of clothes. All sampling sites showed lower calcium values than the prescribed limit by WHO.

Too high magnesium causes the nausea, muscular weakness and paralysis in human body when it reaches a level of about 400 mg/L[17]. Magnesium value in the studied area varied between the 3.11-14.87mg/L. All sampling sites showed lower magnesium value than the prescribed limit by WHO.

Chloride values in the studied area between 2.13-49.7 mg/L. All sampling sites showed the lower chloride concentration than the prescribed by WHO.

50% sampling sites had fluoride content higher than the permissible limit of 1.0 ppm. The fluoride content in the groundwater is a function of many factors such as availability and solubility of fluoride minerals, velocity of flowing water, temperature, pH and concentration of calcium and bicarbonate ions in water, etc[18].

Nitrate values in the studied area between 0.01-7.20 mg/L. All sampling sites showed the lower nitrate concentration than the prescribed by WHO.

DO value in the studied area varied between 2.0-4.5 mg/L. All sampling sites showed the lower DO concentration than the prescribed by WHO.

CONCLUSION

On the basis of physico-chemical analysis of the studied 10 water sample in Jorve, sangamner, Maharashtra, India, it has been concluded that the groundwater quality varied spatially. Water at most of the locations showed the higher concentration of fluoride, TDS and hardness as per the WHO and ISI guidelines. Hardness, TDS and fluoride were major health related issues. It is further suggested that some kind of treatment for hardness, fluoride and salinity removal is immediately required in the studied village to avoid waterborne health problems in residents.

ACKNOWLEDGEMENTS

The author is thankful to Dr. K.K. Deshmukh for his valuable guidance and constant encouragement. The author is also thankful to Post-Graduate Research Centre in Chemistry, Sangamner College, Sangamner for providing necessary research facilities.

REFERENCES

1. M. Sumalatha, R. Kumanan, P. Prabhakar, S. Sahanti, K. Ravikumar and B. Santhosh, *Int.J.Chem.Sci*, **10,** 239 (2012).
2. K. Brindha, R. Rajesh, R. Murgan and L. Elango, *Environ. Monit. Assess*. **172,** 481 (2011).
3. H. E. Short, Mc Robert, T.W. Bernard and A.S. Mannadinayar, *Ind. J. Med. Res., **25, 553***(1937).
4. http:/www.krassindia.org/downloads/ebook1.pdf
5. Census of India, Data from the 2001 Census, Including Cities, Villages and Towns.
6. C. D. J. Thatte, IWWA. **26**, 67 (1994).
7. N.V. Ramamohana Rao and K. Rajyalakshmi, Proceeding of the Symposium on Fluorosis, Hyderabad, 477, (1974).
8. V. Ramesam and K. Rajagopalan, *J. Geol. Soc*. India, **26**, 125 (1985).
9. R.J. Rao and M.G.C. Naidu, Symposium on Recent Researches and Application of Geochemistry, Patna, India 6 (1973).
10. V. Agarwal, A.K. Vaish and P.Vaish, *Curr. Sci.,* **73,** 743 (1997).
11. S.J. Chandra, V.P. Thergaokar and R. Sharma, *Ind. Pub. Hlth, **25,*** 45 (1981).
12. E. J. Largent: The health aspects of Fluoride compound, Ohio State University Press, Columbus, O.H. (1961).
13. WHO, International standards for drinking water, 3rd edn. WHO, Geneva, (1971).
14. B.K.Handa, *Groundwater*, **13**, 278 (1975).
15. Standard Methods for the Examination of Water and Waste, American Public health Association. (17th Edn.)
16. R.K. Trivedy and P.K. Goel, *Chemical and Biological Methods for Water Pollution Studies, Environmental Publication*, Karad, **7**, (1986).
17. M.G.Adak, and K.M.Purohit, *Poll, Res*., **20,** 575 (2001).
18. R.Khaiwal, and V.K. Garg, *Int.J.Environ. Hlth.Res*., **16,**163 (2006).

[RJC-998/2013]