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Original Research Paper

Fluoride Concentration in Groundwater of Arsikere Taluk, Hassan District, Karnataka, India

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ABSTRACT

Fluoride is often referred to as a two edged sword, with 0.6 to 1.5 ppm regarded as an essential constituent of drinking water mainly because of its role in prevention of dental caries, and its concentration more than 1.5 mg/L leading to dental and skeletal fluorosis. When the concentration of fluoride in water exceeds 10 mg/L, crippling fluorosis can ensue. Apart from fluorosis, it may also cause gastrointestinal complaints, namely loss of appetite, nausea, vomiting, pain in stomach, constipation and intermittent diarrhoea and flatulence in expectant and lactating mothers. Fluorosis has been considered as one of the incurable diseases and prevention is the only solution. In this paper an attempt has been made to determine the fluoride concentration in the groundwater of Arsikere taluk and the investigation revealed that its concentration varied between 1.1mg/L and 2.3 mg/L.

INTRODUCTION

Fluoride is widely dispersed in nature and a common constituent of most soils, rocks, plants and animals. Due to its high electro-negativity, it forms only fluorides and no other oxidation states are found (Hem 1992). Fluorine is a common element representing about 0.38 g/kg of the earth's crust (WHO 1973), which exists in the form of fluoride in a number of minerals. Fluorides are used in the production of aluminium, bricks, tiles, ceramics, phosphate fertilizers and toothpaste (GCDWK 1979). The high concentration of fluoride causes mottling of teeth, skeletal fluorosis, bending of vertebral column, deformation of knee joints and other bones of the body and even causes paralysis.

Phosphate fertilizers like super phosphate and rock phosphate, being extensively used in India, are the major culprits for fluoride concentration of the environment. These contain fluoride as an impurity and lead to high fluoride accumulation in soil. Fluoride enters human beings through drinking water, food, air, industrial exposure, drugs, cosmetics, tooth paste and mouth rinses etc.

Industries like oil refinery, plastic, pharmacy, cosmetics, glass, refrigeration and automobile use fluoride containing salts as raw material or produce fluoride in any form which emits exhaust gas, dust or fumes rich in fluoride as by-product.

Fluoride enters environment through natural as well as anthropogenic sources. The chief sources of fluoride are minerals viz., fluorite, fluorospar, fluorapatite, crylolite, mica and hornblende; rocks and sediments. Fluoride bearing minerals occur in all geological rocks such as sedimentary, metamorphic and igneous deposits (Korting 1979, Hem 1985). The ordinary soil that contains clay minerals may be the main source of fluoride. Natural concentration of fluoride in groundwater depends on the availability of fluoride in rocks and minerals encountered by the water as it moves along the flow path. The distribution of fluoride in groundwater depends on a number of factors, such as amount of soluble and insoluble fluorine in source rocks, rainfall, vegetation, redox potential, pH and ion exchange process. Fluorides are more common in groundwater than surface water.

Naturally, fluorides occurring in groundwater are a result of the dissolution of fluoride containing rock minerals by water while artificially high soil fluoride levels can occur through contamination by application of phosphate fertilizers, sewage sludge or pesticides (EPA 1997).

STUDY AREA

Arsikere is one of the important taluks of Hassan district in Karnataka State of India. The geographical location of Arsikere taluk lies between the latitude 13°19'48" N and longitude 76°15'0" E. It has got an elevation of 807 m (2647 feet).

MATERIALS AND METHODS

A total of 20 groundwater samples from bore wells and dug wells from various residential, commercial and industrial areas of Arsikere taluk were collected in 1-L capacity polythene bottles. The sampling was carried out for 2 different

seasons that is monsoon and post monsoon to analyse the effect of seasonal variation on groundwater. Fluoride concentration was determined spectrophotometrically (Model: Systronic UV-VIS, Sparo-118) using SPADNS colorimetric method.

RESULTS AND DISCUSSION

Fluoride is required with 0.6 to 1.5 ppm as an essential constituent of drinking water, especially to prevent dental caries. The present study reveals that the concentration of fluoride ranges from 1.4mg/L to 2.3 mg/L during monsoon season and 1.1mg /L to 2.23 mg/L in post monsoon season (Table 1) in all the 20 sampling locations. However, the BIS (1998) acceptable limit is 1.5 mg/L.

Yadav et al. (2003) extensively worked on geochemical aspects of fluoride in groundwater of Behror tehsil of Alwar district in Rajasthan, and reported that the fluoride concentration varied from 0.2 ppm to 5.2 ppm and in this tehsil. Villagers were suffering from dental fluorosis, skeletal fluorosis and gut fluorosis. Authors have suggested these villagers to use alum and lime to treat fluoride containing water to avoid all type of fluorosis.

The study also revealed that maximum fluoride concentration of 2.3 mg/L was present during monsoon season, while minimum of 1.1 mg/L in postmonsoon season. The study revealed that fluoride concentration in groundwater was lower in postmonsoon season compared to monsoon season. This may be due to the dilution of fluoride concentration by rain water and increase in the ground water table.

Patel Paya & Bhatt (2006) reported that the fluoride concentration in monsoon ranged from 1.88 mg/L to 6.84 mg/L, and 1.82 mg/L to 6.81 mg/L in postmonsoon season.

Table1: Estimation of fluoride concentration in groundwater of Arsikere taluk during monsoon and post-monsoon seasons.

Sample No.	Concentration F (mg/L) Monsoon season	Concentration F (mg/L) Post-monsoon season	BIS 1998 Permissible limit	Excessive limit
S1	1.87	1.68	0.5	1.5
S2	2.30	1.68	0.5	1.5
S3	1.68	1.59	0.5	1.5
S4	1.43	1.52	0.5	1.5
S5	1.61	1.59	0.5	1.5
S6	1.57	1.53	0.5	1.5
S7	1.62	1.68	0.5	1.5
S8	1.63	1.10	0.5	1.5
S9	1.59	1.55	0.5	1.5
S10	1.68	1.58	0,5	1.5
S11	2.30	1.94	0.5	1.5
S12	1.64	1.65	0.5	1.5
S13	1.47	1.55	0.5	1.5
S14	1.57	1.50	0.5	1.5
S15	1.46	1.53	0.5	1.5
S16	1.43	1.65	0.5	1.5
S17	1.48	1.76	0.5	1.5
S18	1.78	1.84	0.5	1.5
S19	1.91	1.92	0.5	1.5
S20	1..97	1.96	0.5	1.5
max.	2.30	1.96	0.5	1.5
min.	1.43	1.10	0.5	1.5

The maximum value was observed during monsoon, and minimum value during postmonsoon.

The finding clearly revealed that the concentration of fluoride in the groundwater of Arsikere taluk is way beyond the permissible limit of 1.5 mg/L. The geological formation also contributes to an increase in the fluoride concentration.

The present study shows that fluoride concentration in

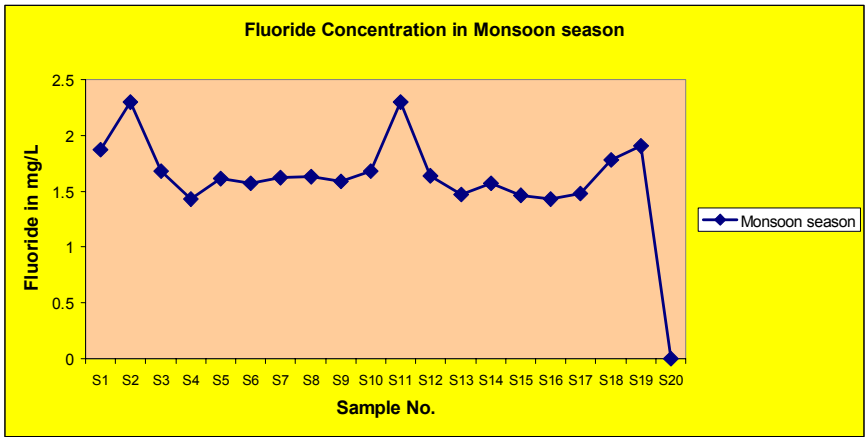

Fig. 1: Fluoride concentration in Arsikere during monsoon season.

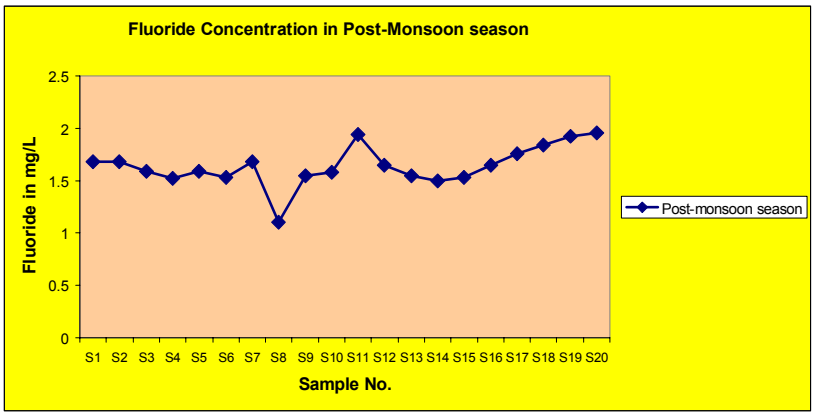

Fig. 2. Fluoride concentration in Arsikere during post-monsoon season.

most of the bore wells was more than the desirable limit except one groundwater sample. The maximum groundwater fluoride concentration in the study area was 2.3 mg/L in monsoon season, while minimum of 1.1 mg/L in postmonsoon season. The groundwater fluoride concentration in postmonsoon season was lower than the monsoon season due to dilution of fluoride concentration by rain water and increase in ground water table.

REFERENCES

Bisnoi, M. and Arora, S. 2007. Potable groundwater quality in some villages of Haryana, India. Focus on fluoride. J. Environ. Biol., 28: 291-294.

Choubisa, S.L., Choubisa, L. and Choubisa, D.K. 2001. Endemic fluorosis in Rajasthan. Indian J. Env. Health, 43(4): 177-189.

GCDWK 1979. Ground water quality. Commissioning Department, Ministry of Rural Development. New Delhi, pp. 45-48.

Hem, T. K. 1992. Marine pollution in India, An emerging problem. Current Science, 685: 495.498.

Korting 1979. Metal contamination of drinking water from corrosion of Distribution pipes. Environmental Pollution, 57: 167-178.

Meenakshi and Masheshwari, R.C. 2006. Fluoride in drinking water and its removal. J. Haz. Mat., 137(1): 456-463.

Patel Paya and Bhatt, S.A. 2006. Fluoride contamination in groundwater of Patan distract, Gujarat, India. International Journal of Engineering Studies, 2(2): 171-177.

Raina, Anil, K. and Shashi Kant 1995. Dental fluorosis - A case study in three villages of District Rojouri (J & K). Proc. Acad. of Environmental Biology, 4(2): 143-146.

WHO 1973. Trace Elements in Human Nutriation. Tech. Report, World Health Organization.

Yadav, Anil Kumar, Jain, P.K. and Sunder Lal 2003. Geochemical study of fluoride in groundwater of Behror tehsil of Alwar district (Rajasthan). Research Journal of Chemistry and Environment, 7(3): 43-46