

Short Communication

## Fluorides in groundwater and its impact on health

K. Shailaja\* and Mary Esther Cynthia Johnson

Department of Botany, Limnology Laboratory, Osmania University College for Women, Koti, Hyderabad-500 195, India

(Received: March 01, 2005 ; Revised received: August 10, 2005 ; Accepted: September 14, 2005)

**Abstract:** Fluoride is a naturally occurring toxic mineral present in drinking water and causes yellowing of teeth, tooth problems etc. Fluorspar, Cryolite and Fluorapatite are the naturally occurring minerals, from which fluoride finds its path to groundwater through infiltration. In the present study two groundwater samples, Station I and Station II at Hyderabad megacity, the capital of Andhra Pradesh were investigated for one year from January 2001 to December 2001. The average fluoride values were 1.37 mg/l at Station I and 0.91 mg/l at Station II. The permissible limit given by BIS (1983) 0.6–1.2 mg/l and WHO (1984) 1.5 mg/l for fluoride in drinking water. The groundwaters at Station I exceeded the limit while at Station II it was within the limits. The study indicated that fluoride content of 0.5 mg/l is sufficient to cause yellowing of teeth and dental problems.

**Key words:** Fluorides, Groundwater, Yellowing of teeth

### Introduction

Fluorosis is a worldwide health problem. It is endemic in those areas where the fluoride content of drinking water is very high (Teotia and Teotia, 1984). In India, more than fifteen states are declared as endemic for fluorosis by Rajeev Gandhi National Drinking Water Mission (Susheela, 1993). Fluorosis in human beings was reported by (Azcurra, *et al.*, 1995; Chari and Naidu, 1998; Choubisa *et al.*, 1995; Choubisa, 1997; WHO, 1970; Johnson and Sudha, 1996; Lan *et al.*, 1995; Meng and Chin, 1996; Perez and Sanz, 1999). In Hyderabad city scanty work has been done on groundwater quality and its impact on health. Hence in order to fill this lacuna the present work was initiated.

The present paper analyses the quality of groundwater of Hyderabad megacity and its effect on the health of the consumer.

### Materials and Methods

Two borewells, one situated around ESI, Station I located at a distance of 9 km from Hyderabad city and another Koti, Station II 1.5 km from it were selected and analysed for a period of one year from January 2001 to December 2001. The 24 samples per station were analysed for fluorides, dissolved oxygen, nitrites, nitrates, phosphates, chromium *etc.* The depth of borewells at Station I and Station II were 140ft and 170ft respectively.

Standard methods for the examination of water and waste water APHA *et al.* (1995) were followed for all the chemical parameters. Statistical analysis was done according to Sukatme and Amble (1978).

### Results and Discussion

The fluoride content of Station I, ESI ranged from 0.60 mg/l to 2.30 mg/l with a mean value of 1.37 mg/l and at Station II, Koti ranged from 0.06 mg/l to 2.05 mg/l with an average of 0.91 mg/l.

The seasonal variations of fluorides at Station I were 1.60 mg/l, 1.01 mg/l and 1.52 mg/l in summer, monsoon and winter respectively. At Station II the variations were 1.04 mg/l, 0.65 mg/l and 1.05 mg/l in summer, monsoon and winter respectively.

During the monsoon season at both the stations the fluoride concentration decreased this may be due to the increase of ground water during.

Correlation coefficient *r* values were calculated between fluoride and certain chemical parameters at Station I and Station II. Fluorides showed positive correlation with pH, dissolved oxygen, total solids and total dissolved solids at the two stations.

Fluorides at ESI, Station I and Koti, Station II showed positive correlation with pH  $r = 0.399$ ,  $r = 0.226$ , dissolved oxygen  $r = 0.405$  and  $r = 0.742$  total solids  $r = 0.303$  and  $r = 0.721$  and total dissolved solids  $r = 0.417$  and  $r = 0.706$  at Station I and II can be related to the leaching effect of the fluoride salts from adjacent landmass into the borewells which is statistically proved.

The main aim of the study was to see the effect of fluoride in groundwater on the health of the consumer. This was done with the help of a questionnaire / feedback to the consumer. One hundred individuals belonging to various age groups of 3-12 yrs, 13-19 yrs, 20-49 yrs and 50 and >50 years per station were observed. At station I, 5 children, 15 teenagers, 10 middle aged and 20 aged group complained yellowing of teeth. 10 children, 8 teenagers and 20 middle aged and 25 aged had tooth problems. This was confined with the help of the local doctor. Similarly at Station II 12 and 10 children, 5 and 15 teenagers, 12 and 14 middle aged and 10 and 5 aged group complained about yellowing of teeth and tooth problems respectively. The study revealed that teenagers and children are most effected and fluoride

\*Corresponding author: E-Mail: [k\\_shailaja2001@yahoo.com](mailto:k_shailaja2001@yahoo.com), Tel.: 9885136976



concentration of 0.5mg/l in groundwater can cause yellowing of teeth and dental problems. Johnson (2001); Johnson and Manoranjani (2004) worked on the fluoride content in different parts of India. Environmental awareness is a must and the general public must be educated on the health problems particularly when a person consumes fluoride rich waters 0.5 mg/l and above. This must be done through the mass media like radio, television, pamphlets, cartoons etc.

#### Acknowledgments

The authors are thankful to the Department of Botany, Osmania University College for Women, Koti, Hyderabad, for the facilities given.

#### References

- APHA, AWWA and WPCF: Standard methods for the Examination of water and Wastewater 19<sup>th</sup> Edn. Published by American Public Health association, 1015, fifteen street NW Washington, D.C. 200015 (1995).
- Azcurra, Ana Isabel and Louis Jose Battelino: State of oral health among school children living in towns supplied with drinking water containing very high and very low levels of fluoride. *Revista de Sande publica.*, **29(5)**, 364-375 (1995).
- Bureau of Indian Standards: Indian Standard Drinking Water Specifications. IS:10500, New Delhi (1983).
- Chari, K.V.R. and S.V.P. Naidu: Fluorine and human health. *Environ. geochemistry*, **1(2)**, 63-66 (1998).
- Choubisa, S.L., K. Sompura, D.K. Choubisa, H. Pandya, S.K. Bhatt, O.P. Sharma and L. Parmar: Fluoride content in domestic water resources of Dungarpur district of Rajasthan. *Indian J. Environ. Hlth.*, **37(3)**, 154-160 (1995).
- Choubisa, S.L.: Fluoride distribution and fluorosis in some villages of Banswara district of Rajasthan. *Indian J. Environ. Hlth.*, **39(4)**, 281-288 (1997).
- Johnson, M.E.C.: Fluoride distribution in the groundwater of Hyderabad city, Andhra Pradesh. *J. Indian Acad. Geosci.*, **44**, 27-29 (2001).
- Johnson, M.E.C. and C. Manoranjani: Fluoride distribution in the groundwater of Ramachandrapuram and Patancheru areas, Andhra Pradesh, India. *Environ. Geochem.*, **7(1)**, 57-58 (2004).
- Johnson, M.E.C. and J. Gnana Sudha : Fluoride content in drinking water around Hyderabad city. *J. Aquat. Biol.*, **2(1 and 2)**, 48-50 ( 1996).
- Lan, Chung – Fu, I-Fenglin and Shyh - Jen Wang: Fluoride in drinking water and the bone mineral density of women in Taiwan. *Int. J. Epidemiology*, **24(6)**, 1182-1187 (1995).
- Meng, Y.C., P.Z. Chin: Skeletal change in Osteofluorosis patients after defluoridation of drinking water. *Fluoride*, **29(1)**, 25-28 (1996).
- Sukatme, P.V. and V.N. Amble: Statistical methods for agricultural workers, Indian Council of Agricultural Research, New Delhi (1978).
- Perez, Eugeniosanz and Jesus Sanz: Fluoride concentration in drinking water in the province of Soria (Central Spain) and caries in children. *Environ. geochem. Hlth.*, **21(2)**, 58-62 (1999).
- Susheela, A.K.: Prevention and control of fluorosis in India. Rajeev Gandhi National Drinking Water Mission. New Delhi (1993).
- Teotia, S. P.S. and Teotia, M. Endemic fluorosis in India: A challenging National Health problem. *J AP I.*, **32(4 )**, 347-352 (1984).
- World Health Organization: Fluorides and human health, Geneva. (Monograph Series No. 59) (1970).