RJC

RASĀYAN *J. Chem.*
Vol. 6 | No.4 | 288 - 291 | October- December| 2013
ISSN: 0974-1496 | e-ISSN: 0976-0083 | CODEN: RJCABP
http://www.rasayanjournal.com
http://www.rasayanjournal.co.in

# HIGH FLUORIDE CONTENT IN THE GROUND WATER OF BELORA UNION:A COMPARATIVE STUDY

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**ABSTRACT**

Most of the people in rural areas depend on groundwater for drinking water. The aim of this present investigation is to study the level of fluoride in the groundwater of Belora union of Nandgaon (Khandeshwar) tehsil in Amravati district of Maharashtra state and its comparison with the water of Bembala river by collecting four samples of the groundwater from four different villages and one sample of river water during November 2012 to August 2013. The fluoride level in the underground water of Belora union was exceeding the permissible limit (>1.5 mg/L).It was found that all the four villages of Belora union was under serious fluoride contamination than Bembala river water which causes adverse effect like dental and skeletal fluorosis. Removal of excess fluoride by defluoridation techniques and supply of high-quality groundwater with safe concentration of fluoride is urgent necessity.

**Keywords:** Groundwater, Fluoride level, Belora union, Fluorosis, Defluoridation.



## INTRODUCTION

Fresh water occurs as surface water and ground water. In this, groundwater contributes only 0.6 % of total water resources on earth[1]. The sources of surface water are like pond, river and sea are available for agricultural, domestic and industrial purposes. The sources of ground water are bore wells, open wells and hand pumps which are available for drinking water in urban as well as in rural areas because more than 90% of the rural population uses ground water for domestic purposes. Fluoride is a common constituent of groundwater. It is the most electronegative of all chemical elements and is never encountered in nature in the element form[2]. Fluoride is an ion of the chemical element fluorine which belongs to the halogen group of minerals and is natural constituents of the environment. Fluorine is the 13$^{th}$ most abundant element of the earth's crust and represents about 0.3 g/kg of earth's crust[3]. It occurs mainly in the form of chemical compounds such as sodium fluoride or hydrogen fluoride which are present in minerals like fluorspar, fluorapatite, topaz and cryolite. Gardean in 1992, reported high concentrations of fluoride is caused by excess alkalinity and low calcium content[4].In India, the states of Rajasthan, Madhya Pradesh, Andhra Pradesh, Haryana, Bihar, Chhattisgarh, Karnataka, Maharashtra, Orissa, Punjab, Tamilnadu and Delhi are affected by fluoride contamination in water. This involves about 9000 villages affecting 30 million peoples[5].Estimation finds that 65% of India's villages are suffer from fluorosis.Use of phosphatic fertilizers in agriculture and industrial activities like clays used in ceramic industries or burning of coal also contribute to high fluoride content in groundwater. The fluoride from the groundwater can be removed by defloridation technique namely Nalgonda technique (flocculation and sedimentation) and Activated Alumina (adsorption) technique. Fluoride at lower concentration (0.6-1.5mg/L) is essential

element for the development of teeth and bones in growth, fertility, prevention of anaemia in pregnancy and infancy[6].Excess intake of fluoride taken over a long period of time exerts negative effects on the course of metabolic processes and an individual may suffer from skeletal fluorosis, dental fluorosis, non skeletal manifestation or combination of the above[7-8]. This can cause joint pain, restriction of mobility, bending of vertebral column, deformation of knee joints, bone fracture and even paralysis.

**Study Area**

Belora is a small village in Nandgaon (Khandeshwar) taluka of Amravati district, Maharashtra State (India). It is located 32 Km towards south from Amravati district surrounded by Chandur (Rly) taluka towards east, Ner taluka towards south, Amravati taluka towards north, Dhamangaon (Rly) taluka towards east. Also it is bounded by small villages like Dhamak, Kurhegaon, Sultanpur and collectively known as Belora union. This place is in the border of the Amravati and Yavatmal district. The river Bembala flow skirting these district and forming the district boundaries.Total population of Belora is 1155.Males are 573 and females are 582 living in 263 houses. Total area of Belora is 459 hectares. The area experiences hot summer and general dryness throughout the year except during the south west monsoon season (i.e. June to September). The area under study is mostly cultivated where cotton, soyabean, jawar, groundnut are grown. The main purpose of this study is to highlight the excess fluoride level in the groundwater of this area.

## EXPERIMENTAL

The study was carried out in four villages of Belora union because the people of this region use ground water for drinking and also for irrigation fields. The groundwater samples were collected from hand pumps and open wells at every month during the study year from November 2012 to August 2013 from five different sampling stations of village Belora, Dhamak Kurhegaon, Sultanpur and river Bembala. The water samples were collected in clean polyethylene plastic bottles of 100 ml capacity and before filling, bottles were rinsed with water under study. They were labeled, coded and brought to the laboratory for fluoride determination on the same day. Water sample were analysed by using the Sodium-2-parasulphophenylazo-1-8-dihydroxy-3, 8 naphthalene disulphonate (SPADNS) spectrophotometric method[9]. The AR-grade reagent and chemicals, distilled water and Borossil glassware's were used throughout the work.

Table-1: Fluoride in ground water from different villages of Belora Union

| Months | Fluoride Ion Concentration | | | | |
|---|---|---|---|---|---|
| | Belora ( mg/L) | Dhamak ( mg/L) | Kurhegaon ( mg/L) | Sultanpur ( mg/L) | Bembala ( mg/L) |
| Nov 2012 | 2.11 | 2.00 | 1.81 | 2.09 | 1.09 |
| Dec 2012 | 2.08 | 1.98 | 1.80 | 2.05 | 1.07 |
| Jan 2013 | 2.02 | 1.98 | 1.76 | 1.99 | 1.01 |
| Feb 2013 | 1.93 | 1.91 | 1.67 | 1.78 | 0.93 |
| Mar 2013 | 1.78 | 1.66 | 1.46 | 1.62 | 0.99 |
| Apl 2013 | 1.70 | 1.49 | 1.41 | 1.55 | 1.04 |
| May 2013 | 1.73 | 1.38 | 1.53 | 1.46 | 1.09 |
| Jun 2013 | 2.02 | 1.55 | 1.61 | 1.60 | 1.12 |
| Jul 2013 | 2.10 | 1.82 | 1.72 | 1.87 | 1.16 |
| Aug 2013 | 2.14 | 2.04 | 1.86 | 2.03 | 1.21 |

## RESULTS AND DISCUSSION

The monthly values of fluoride ion concentrations in groundwater of the study area are tabulated in the Table-1 and compared statistically as shown in Figure-1.

The fluoride concentration values were variable during the study period (Figure-1). The higher concentration was found in the groundwater of Belora union. The fluoride concentration at Belora ranged from 1.70 to 2.14 mg/L with highest fluoride level in month August (2.14 mg/L) and lowest in April (1.70 mg/L). Fluoride concentration at Dhamak, Kurhegaon and Sultanpur were shows similar observations and ranged from 1.38 to 2.04 mg/L, 1.41 to 1.86 mg/L and 1.46 to 2.09 mg/L respectively with maximum in the month of monsoon and winter and minimum in the months of summer. Out of total samples of 4 villages, only five samples were observed below the permissible values of fluoride. On the other hand, fluoride concentration of Bembala river water were shows contrast results and ranged from 0.93 to 1.21 mg/L which were very low as compared to the values of 4 villages. Most of the water samples analysed for fluoride had higher concentrations of fluoride compared to the prescribed permissible values (>1.5 mg/L) while all the samples of Bembala water analysed had fluoride concentration below the permissible limit (< 1.5 mg/L). It was found that all these different villages were under serious fluoride contamination. This paper also investigates the health risks involved with higher concentrations of fluoride in drinking water. Deformations of bones in children as well as in adults, weakening of joints and knees in adults, teeth moulting in inhabitants were observed in the study area indicating the consequences of excess fluoride concentration. This fact is confirmed by taken through a questionnaire to peoples of this union and also to those peoples who were admitted to nearby primary health centre as well as rural hospital.

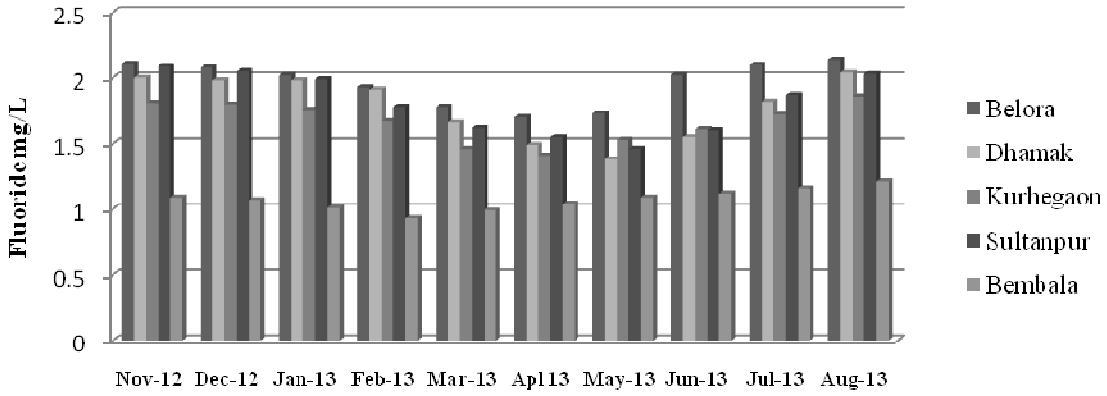


Fig.-1: Comparative analysis of fluoride in the groundwater of Belora union

## CONCLUSION

In this region probable source of fluoride in ground water is due to weathering and circulation of water in rocks and soils. Fluoride is leached out and dissolved in ground water. According to World Health Organization WHO 1994 and Indian Standard Drinking Water specification ISI 1991 the maximum permissible limit of fluoride in drinking water is 1.5 mg/L and highest desirable limit is 1.0 mg/L[10-11]. Fluoride concentrations above 1.5 mg/L in drinking water cause fluorosis. It was found that among these five different locations, ground water of villages are under serious fluoride contamination where fluoride concentration in most of the months was exceeding the permissible limit whereas fluoride in Bembala river water was within a permissible limit throughout the study period. After evaluating the data of the

study, it is concluded that the ground water of Belora union is polluted with excess amount of fluoride and can result in dental and skeletal fluorosis.To reduce the adverse effects removal of excess fluoride by defluoridation techniques from drinking ground water of Belora, Dhamak, Kurhegaon and Sultanpur villages and supply of clean fluoride free water is urgent necessity. Also the ground water management as well as environmental awareness in public through educational programmes is suggested.

## ACKNOWLEDGEMENTS

Authors are thankful to Principal, Jawaharlal Darda Institute of Engineering and Technology, Yavatmal (Maharashtra) for providing laboratory facilities during the course of this work. The authors gratefully acknowledge the support of Prof. K.M.Rathod, Prof.A.Y.Deshmukh for their valuable help and continuous encouragement.

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[RJC-1076/2013]