JIGNASA STUDENTS' STUDY PROJECT

Estimation of Fluoride Concentration in Groundwater in some Villages of North Telangana

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Introduction

Fluoride is essential for the normal mineralization of bones and formation of dental enamel[1]. The principal sources of fluoride is drinking water and food such as sea fish, tea and chees[2]. Fluoride ion in drinking water is known for both beneficial and detrimental effects on health[3]. In potable water, a fluoride concentration of 1ppm (1mg/L) is necessary to prevent tooth decay. Inadequate intake of fluoride causes dental caries. About 96 per cent of fluoride in the human body is found in bones and teeth. The World Health Organization and Indian Council of Medical Research described the drinking water quality guidelines value for fluoride is 1.5 mg/L[4,5]. However, at higher concentrations (>2 ppm), it has adverse effects such as causing dental and skeletal fluorosis. Fluorosis is a slow, progressive, crippling malady, which affects every organ, tissue and cell in the body and results in health complaints having overlapping manifestations with several other diseases[6].

Fluorosis is an important health problem in many countries, including India, which lies in the geographical fluoride belt that extends from Turkey to China and Japan through Iraq, Iran and Afghanistan[7]. Of the 85 million tones of fluorine found in different forms on the earth's crust, about 12 million tones are present in India alone. Therefore, it is natural to expect the wide spread prevalence of excess fluoride in India. The available data suggests that about 15 states, including Telangana and Andhra Pradesh, in India are endemic for both dental and skeletal fluorosis. Available data suggests that around 20 million people were severely affected by fluorosis and around 40 millions are exposed to its risk in India[8]. Though Nalgonda District in Telangana is well known for fluorosis, there are many other places in which ground water contains fluoride more than permissible levels, which is evident from the symptoms of dental and skeletal fluorosis. Soluble fluoride present in water is easily absorbed by the gastrointestinal tract. So fluoride present in water is main factor of both dental and skeletal fluorosis. The number of people, the number of regions affected by fluorosis is steadily increasing. This is may be due to over exploitation of ground water in the form of tube wells and hand pumps. With persistent drought year after year, ground water is getting depleted and depth of digging bore wells is increasing. As a result fluoride in ground water is increasing. In many areas water from tube wells and hand pumps is the only source of potable water. In majority of cases the water is not tested for fluoride.

The severity of fluorosis

People suffering from dental fluorosis can be identified by the symptoms[9]. Tooth enamel is primarily hydroxyapatite and when exposed to fluoride, fluorapatite is formed by the displacement of hydroxide ion by fluoride. On prolonged and over exposure of fluoride causes dental fluorosis. As a result, teeth become hard and brittle and finally mottling of teeth. When affected by dental fluorosis, initially colour of teeth change from yellow to brown and finally to black. The coloration may be in the form of spots or as streaks. Depending upon the severity of exposure, pits on the teeth may also be observed[10].

Mild: The white opaque areas in the enamel of the teeth are more extensive but do not involve as much as 50% of the tooth.

Moderate: All enamel surfaces of the teeth are affected, and the surfaces subject to attrition show wear. Brown stain is frequently a disfiguring feature.

Severe: All enamel surfaces are affected and hypoplasia is so marked that the general form of the tooth may be affected. The major diagnostic sign of this classification is discrete or confluent pitting. Brown stains are widespread and teeth often present a corroded-like appearance.

Objective of the Study

A general observation of students coming from some villages indicates that they are suffering from dental fluorosis. Therefore, an attempt is made to analyze the water for fluoride content in the drinking water. The results are communicated to the students who in turn educate the villagers. The results are also submitted to Government authorities for necessary action.

Materials and Methods

A total of 18 ground water samples were procured from different villages in and around Jammikunta Mandal of Karimnagar district. The water samples brought in pre cleaned plastic bottles and labeled with information like the date of collection, source and place of collection. Most of the samples are from bore wells and some from the wells and used for drinking purposes in addition to agriculture. Fluoride concentration was analyzed with the help of a visual colorimetric reagent developed by Baba Atomic Research Centre (BARC). The reagent is purchased from Orlab Instruments Pvt. Ltd, Hyderabad, the authorized licensee of the reagent.

A visual colorimetric method developed by NCCCM/BARC for the estimation of fluoride in ground water uses a single reagent solution and standard for both qualitative and quantitative estimation without any instrument. The main features of this method are fast color development (<30 secs.), good color contrast at three levels (deficient, normal and toxic limits).

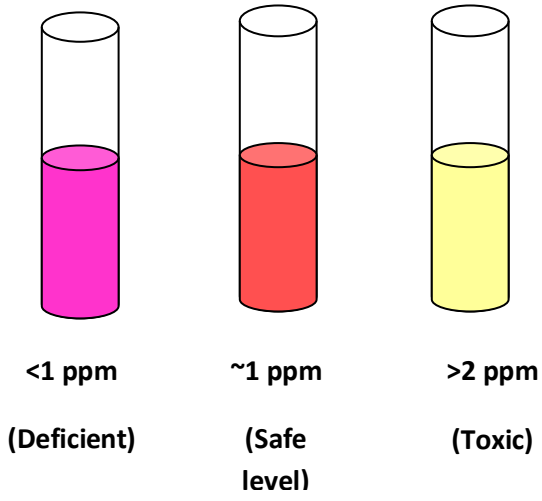

Fig. 1. Colour chart for three different fluoride concentrations

Results and Discussion

Ground water was collected from 18 different sources. Eight samples are from wells and remaining are from bore wells. Water from almost all the sources is being used for drinking and agriculture purposes. Water from 11 different villages from three different mandals is tested for the presence of fluoride. These villages are from Veenavanka, Jammikunta and Kamalapur mandals. The results were shown in Table.1. Out of 18 water samples analyzed, 9 samples were found to contain fluoride. Of the twenty water samples tested, nine samples were found to contain more than permissible level (>2mg/L) of fluoride in drinking water. The villages are Kishtampet and Betigal from Veenavanka Mandal; Sriramulapally from Jammikunta mandal; Uppal and Bhimpet from Kamalapur Mandal. It appears that three out four mandals covered were found to contain excess fluoride in ground water. It is interesting to note that the Reverse Osmosis (RO) processed water is also found to contain excess fluoride.

Conclusion

This study identified 45 percent of the villages in the study area are fluoride affected. High concentration of fluoride in the water may e due to geological formation. In many villages people are using water from RO plants for drinking purposes, which is also not devoid of excess fluoride. Therefore, the water from bore wells or wells in the affected villages is not safe either natural or RO processed. Purified surface water may be the best option for drinking.

Acknowledgement

We acknowledge the efforts of students and faculty in procuring the water from different villages. We also acknowledge the principal Kakatiya Government College, Hanamkonda for providing lab facilities.

Table.1: Fluoride levels in ground water of some villages of North Telangana

S.No.	Mandal	Village	Source of Water	<1 ppm Deficient	1 ppm (Safe level)	>2 ppm (Toxic)
1	Veenavanka	Narsingapur	Well		√	
2		Challur	Bore		√	
3		Kishtampet	Manair River		√	
4		**Kishtampet**	Well			√
5		Kishtampet	Bore		√	
6		**Kishtampet**	Bore			√
7		**Kishtampet**	Well			√
8		**Kishtampet**	Well			√
9		**Bethigal**	Bore			√
10		**Bethigal**	Well			√
11	Jammikunta	Illanthakunta	Bore		√	
12		Gandhinagar (Malyala)	Well		√	
13		**Sriramulapally**	Bore			√
14		Jammikunta	Bore	√		
15		Abadi Jammikunta	Bore		√	
16	Kamalapur	Uppal	Well		√	
17		**Bhimpet**	Well			√
18		**Uppal**	Bore			√

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Students performing the experiment in the laboratory

Students testing water samples for fluoride

Water samples after addition of the Reagent