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TO EVALUATE THE SIGNIFICANCE OF GROUND WATER IN RURAL AREAS AT BILASPUR PARTICULAR POSITION TO FLUORIDE ATTENTION

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ABSTRACT

Fluorine is a common element that does not occur in the elemental state in nature because of its high reactivity. Fluoride is a key aspect of water quality in rural water supply system, which potentially affects the sustainability of water if it exceeds its prescribed limit. Excess intake of fluoride through drinking water causes fluorosis on human beings in many states of India, including Chhattisgarh .This study aims to identify the hydro geochemical processes influencing the high fluoride concentration in ground water of rural areas of Bilaspur (Chhattisgarh, India). For this purposes ten ground water samples were collected during the post monsoon session of 2010. The fluoride concentration in ground water was determined, where it is the only source of drinking water. our laboratory Fluoride concentration was determined SPANDS method. In this method fluoride concentration was determined spectrophotometrically by using acid Zirconyl and Sodium -2 para sulfophenyl azo -1, 8 dihydroxy -3, 6-napthalene disulfonate (SPAND) reagents. The fluoride concentration in the ground water of these villages varied from 0.73 to 3.02 mg/L, causing dental fluorosis among people especially children of these villages. Overall water quality was found unsatisfactory for drinking purposes without any prior treatment except few villages. Most people in these study areas suffer from dental fluorosis and skeletal fluorosis such as mottling of teeth, deformation of ligament, bending of spinal column and ageing problem.

INTRODUCTION

Fluorides have, lately, become a matter of great health concern due to 'Fluorosis' problem reported from various parts of the World. It is, however, ironical as fluorides have great therapeutic value in removing dental carries. If the concentration of fluoride in water is less than 0.5 mg/L, the incidence of dental carries is likely to be high. However, with higher concentration of fluoride, it causes a crippling disease called 'Fluorosis'. The natural fluoride content in drinking water depends on the source, climatic and geological factors. The fluoride concentration of seawater is usually constant around 1-3 mg/L. The concentration is usually below 1 mg/L in unpolluted surface waters. Water bodies contaminated by industrial effluents may have

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higher fluoride content. The safe limit of fluoride for drinking water supply is 1.5 mg/L. A careful observation of the results reveals that, the distribution of fluoride level in ground water sources in all the regions in the study area is not uniform. The results also indicate that many water samples contain fluoride content above the maximum permissible limit. At first in 1937, the excessive fluoride in groundwater reported in India in the state of Andhra Pradesh. Approximately 62 million people including 6 million children suffer from fluorosis because of consumption of water with high fluoride concentrations1. Many states in India have been identified as widespread for fluorosis and Chhattisgarh is one of them. The amount of fluoride occurring naturally in groundwater is governed by climate, composition of the host rock and hydrogeology (Gupta *et al.* 2006). The major sources of fluoride in groundwater are due to fluoride bearing rocks such as fluorspar, cryolite, fluorapatite andhydroxylapatite. The fluoride content is a function of many factors such as availability and solubility of fluoride minerals, velocity of flowing water, temperature, pH,concentration of calcium and bicarbonate ions in water, etc 3. In Indian continent, the higher concentration of fluoride in groundwater is associated with igneous and metamorphic rocks. A survey has shown that yet no studies have been undertaken in the rural areas of Bilaspur in Chhattisgarh with regard to fluoride and fluorosis problem . So objective of this study was to investigate the quality of water with special references to fluoride.

MATERIALS AND METHODS

Chhattisgarh state came into existence on 1st Nov. 2000. Bilaspur is important and fast growing district of Chhattisgarh. It is the judicial capital and the second biggest city of Chhattisgarh state. Bilaspur is located at 25 °.5' latitude and 82° .25' longitude (Chandrakar and Tripathi, 2000). The main sources of drinking water are hand pumps and bore wells.

A total of ten ground water samples were collected from bore wells of different sampling sites of Rural areas of Bilaspur district .The ground water samples were collected during the post monsoon session in month of October 2010 to January 2011.The ground water samples were collected in systematically using clear acid washed polythene bottles of one liter.

Fluoride testing in water quality analysis should be given importance because fluoride is known to cause a variety of health problems like dental fluorosis, skeletal fluorosis and non-skeletal manifestations when the level is beyond 1.5 ppm. The analysis for fluoride in ground water samples was carried procedure of (APHA, 1998). SPADNS Reagents method, Alizarin visual method and Ion Selective Electrode method are available for testing of fluoride in ground water .But in our laboratory Fluoride concentration was determined SPANDS method. In this method fluoride concentration was determined spectro-photometrically by using acid Zirconyl and Sodium -2 para sulfophenyl azo -1, 8 dihydroxy -3, 6-napthalene disulfonate (SPAND) reagents 6.

RESULTS AND DISCUSSIONS

All the ground water samples collected in the Sample stations were clear without any visible color, Odor and turbidity. The fluoride concentration in ground water varied greatly in different sampling sites of study areas .The results of fluoride concentration in ground water is presented in Table 1.

The variation of fluoride concentration in ground water samples showed a define trends with respect to sampling sites of rural areas of Bilaspur. Fluoride concentration varied from 0.28 to 2.10mg/L in ground water samples, with lowest value 0.28 mg/L (S-2) and highest value 2.10 mg/L (S-8). 41.66% of samples showed fluoride concentration below 0.5 mg/ L and 16.66% samples showed fluoride concentration in between 0.5 to 1.5 mg/L.(Table 2). It is evident from the research analysis data. Almost all bore wells, which are exclusively used for drinking and cooking purpose, were found to be high in fluoride concentration.

4 (a) Sources of Fluoride

Fluoride exists naturally in water sources. The origin of fluoride in groundwater is through weathering of alkali, igneous and sedimentary rocks. The common fluoride bearing minerals are a. Fluorspar (CaF2) b. Cryolite (Na3AlF6)c. Fluor-apatite (Ca3 (PO4) 2Ca(F.Cl)2). Fluoride may also be introduced to the environment due to burning of coal and during manufacturing process of aluminum, steel, bricks. In the phosphate fertilizers used in the agricultural activities, fluoride is an impurity which results in high fluoride concentration in the soils.

4(b) Effect of fluoride on human health

Fluoride is the most exclusive bone seeking anion

Table 1. Fluoride concentration in sampling sites of Rural areas of Bilaspur, C.G., India)

S .No.	Name of Sampling Site	Code of Sampling site	Fluoride (mg/L)
1	Koni	S-01	0.37
2	Sendari	S-02	0.28
3	Sakari	S-03	1.37
4	Sambalpur	S-04	0.46
5	Sirgitti	S-05	1.12
6	Tarbahar	S-06	1.75
7	Lokhandi	S-07	1.98
8	Nirtu	S-08	2.10
9	Mangala	S-09	1.68
10	Parsada	S-10	0.57
	Minimum		0.28
	Maximum		2.10
	Average		1.29

Table 2. Concentration of Fluoride in drinking water

Parameter	Fluoride concentration (mg/L)	Effect on human health	Representing Samples
Fluoride	<0.5	Dental caries	S1, S2,,S4,
	0.5-1.5	Prevents tooth decay	S3, S5,S10
	1.5-4.0	Mottling and pitting of teeth (Dental Fluorosis)	S6,S7,S8,S9,
	>4.0	Pain in neck bones and back(Skeletal Fluorosis) and Crippling Fluoros	NA

owing to its affinity for calcium phosphate, up to 99% of the body burden of fluoride is found in bone. Presence of fluoride in drinking water is both beneficial and detrimental to the consumer. Low levels of fluoride in drinking water results in incorporation of fluoride in to teeth during the formative years of children, which makes the teeth resistant to decay and development of dental caries. However, mottling of teeth may occur when the concentration increases more than 1.5 mg/L. Long term intake of water containing excessive concentration in the range of 4 to 10 mg/L causes skeletal fluorosis, in which the bone structure is affected causing bone deformation and crippling (Table 2). Fluorosis, which was considered to be a problem related to teeth, only, has now, turned up to be a serious health hazard. It seriously affects bones and problems like joint pain, muscular pains etc.

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