HIGH FLUORIDE IN GROUNDWATER CRIPPLES LIFE IN PARTS OF INDIA

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ABSTRACT

Water is essential natural resource for sustaining life and environment which we have always thought to he available in abundance and free gift of nature. However, chemical composition of surface or subsurface, geothermal or non - thermal, is one of the prime factors on which the suitability of the water for domestic, industrial or agriculture purpose depends. Groundwater forms a major source of drinking water in urban as well as in rural areas. More than 90% of the rural population uses groundwater for domestic purposes. However, around 300 million people still live in absolute poverty in both urban and rural areas, and often lack access to clean drinking water and basic sanitation; nearly half the population is illiterate, not at all aware of the water borne diseases affecting their health. Seventy percent of infectious diseases in rural India are water borne and nearly fifty percent due to diarrhea. Major problems are being faced by the country due to the presence of excess fluoride, arsenic and nitrate in groundwater in certain parts of country. Fluoride problems are wide spread in nine States covering almost the entire country. Nearly 66 million people face the risk of which an estimated 6 million are children.

Key Words : Groundwater, Fluoride, Fluorosis, Mottled teeth, Defluorination

INTRODUCTION

Though there has been tremendous progress in rural water supply infrastructure after setting up of the Rajiva Gandhi National Drinking Water Mission in 1986, the goal to provide safe drinking water to all is still to be achieved. India's population has recently crossed the one billion. Ever-increasing population and the increased need for agriculture and industries has resulted in water scarcity. The country thus faces a series of threats to the management of water resources (2). This leads the rural population and even urban also to depend upon water from local tanks and tube wells and the consumption of untreated water for all purposes (1). In view to look into the aspects of water quality and related health problems, the water quality data from nine following States (a) Jammu and Kashmir (J&K), (b) Himachal Pradesh, (c) Rajsthan, (d) Haryana, (e) Bihar, (f) West Bengal, (g) Chattisgarh, (h) Orissa and, (i) Maharashtra, covering almost the entire nation has been collected and analyzed.

RESULTS

The surface, subsurface and thermal water sample analysis indicate the fluoride concentration ranging from < 0.2 to 18 ppm in the States of Jammu & Kashmir, <0.2 to 6.5 ppm in Himachal Pradesh, > 1.5 ppm in Rajsthan, 0.2 to 0.6 in Haryana, 0.35 to 15 ppm in Bihar, on an average 12 ppm in West Bengal, 15 to 20 ppm in Chattisgarh, 8.2 to 13.2 ppm in Orissa and 0.7 to 6.0 in Maharashtra, indicating that except in Haryana, the concentration of fluoride is very high up to 20 ppm. The results of chemical analysis of water are summarized in Table 1.

Table 1 Average fluoride concentration detected in water from different parts of India.

	1	2	3	4	5	6	7	8	9
Area State	Ladakh (J&K)	Manikaran (Him. Prad.)	Bhilwara (Raj.)	Sohna (Haryana)	Tantoli (Bihar)	Tattapani (Chattisgarh)	Bakreshwar (W. Bengal)	Khudra (Orissa)	Unkesher (Mahar.)
Sample Nos.	20	12	15	10	30	25	60	50	65
Surface			> 1.50		0.35 to 4.00			8.20 to 13.20	2.70 to 6.00
Subsurface	<0.2 to 18.00	<0.2 to 6.50		0.20 to 0.60			0.60 to 15.00		
Thermal						15.00 to 20.00			

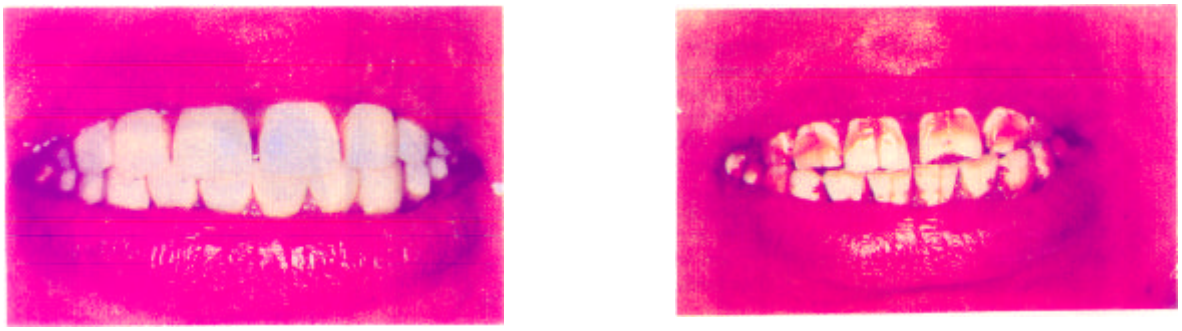
DISCUSSIONS

Probable source of high fluoride in Indian waters seems to be that during weathering and circulation of water in rocks and soils, fluorine is leached out and dissolved in ground water. Tile fluoride content of ground water varies greatly depending on the type of rocks from which they originate. Among the various minerals responsible for high concentration of fluoride, the Flour - apatite 3Ca-3 (PO-4)-2, CaF-2 and Fluorite, CaF-2 are important. However, the most important being the Fluorite, CaF-2 and the leaching of fluoride from the metamorphic rocks hornblende gneiss of Proterozoic age (3).

Ill affects of high fluoride content in water are manifested in the form of 'Endemic fluorosis' which is an acute public health problem in India. Around 25 million people of 150 Districts are affected by this disease (Survey report – Rajiva Gandhi National Drinking Water Mission, 1993). Medical advice recommends the drinking water should not contain more than 1.5 ppm of fluoride (5). Concentration of fluoride below 1.5 ppm are helpful in prevention of tooth decay, and such level of fluoride also assists in the development of perfect bone structure in human and animals. However, doses of fluoride above 1.5 ppm increases the severity of tooth mottling and induces the prevalence of osteoporosis and collapsed vertebrae (4). The disease resulting from excessive consumption of fluoride. Fluorosis has no treatment and is considered to be deadly disease. High fluoride content in water even causes change in shape and colour of the fruits and vegetation.

Unlike bacteriological pollution, the effect of the excess chemical constituents (that may be present in the groundwater, like fluoride) on human health is chronic in nature and manifest after consuming the water over a long period of time. Long term ingestion of drinking water having fluoride beyond a limit of 1.5 ppm lead to dental and skeletal fluorosis as well as non skeletal manifestations. The left hand side picture in Figure 1 shows a person with normal teeth whereas the right one suffering from dental fluorosis from Orissa State having brownish Yellow mottled teeth, a common feature in high fluoride States.

It is unfortunate that millions of people in India and neighboring States have no access to safe drinking water and they are compelled to consume the untreated water easily accessible to them without knowing the ill affects of such consumption.



NORMAL TEETH

DENTAL FLUOROSIS
MOTTLED TEETH

Figure 1 Normal and Mottled teeth

RECOMMENDATIONS

High fluorine consumption leads to the fluorosis of the bones which is generally found in Asian region but it is more acute in India. Hence, possibilities of reducing the high fluorine content of groundwater by defluorination process / dilution with the surface water is one very simple technique but addition of Ca++- ions to solution in contact with fluorite when experimented in distilled water caused appreciable decrease in fluoride concentration which appears to be more suitable solution to high fluoride problem in an otherwise water scarce India. In areas of high concentration. easily available local raw materials, such as clay, serpentine and marble can he used to reduce the fluoride content if geological and geochemical investigations be carried out prior to the implementation of water supply schemes.

Caution

A much elevated concentration of fluoride, ranging from more than 1.5 ppm to 20 ppm in surface, subsurface and thermal waters in nine States in India, is beyond the permissible limit fixed by the WHO for human beings, the consumption of which is bound to yield the deadly Fluorosis disease. It may also cause harm to the ecosystem and vegetation, if used for irrigation.

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