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## WATER, SANITATION, ENVIRONMENT and DEVELOPMENT

### Occurrence of high fluoride in Gujarat



J M Barot and C R Samajpati

#### General

The State of Gujarat in India occupies an area of 195,984 sq km in the western part of the country and is situated between 20°6' North and 20°4' North latitudes and 68°10' East and 74°28' East longitudes. It has a population of 41,174,060 as per 1991 census. It has got semi arid climate with high frequency of droughts. The rainfall is between 300 mm to 2000 mm 83% of the area is having rocky strata having poor groundwater potential. It has got longest coastal line (1600 km) and large desert area (2000 sq km).

#### Drinking water supply

The management of drinking water supply in rural areas of the State is done through a Statutory Board of the State Government, viz, Gujarat Water Supply and Sewerage Board, whereas that of urban towns is managed by local bodies themselves. The main source of supply of water is groundwater varying in depth from 25 to 300 meters. Overall quality of groundwater is considered to be moderately good; however problems of salinity, nitrate and fluoride are encountered due to the complex geohydrological conditions. The quality of water supplied to the community is assessed through standards framed by the Bureau of Indian Standards under IS:10500-1991, which are mostly in line with International Standards of WHO.

#### Fluoride in water

Fluoride in water comes mainly from the rocks containing minerals of Fluorspar (calcium fluoride), Fluorapatite (calcium phosphate) and Cryolite (sodium aluminofluoride). In surface waters, the concentration of fluoride usually remains low or sometimes inadequate. Excessive amounts of fluoride in water causes health hazards. The solubility of fluoride increases as the temperature goes up. Also the total intake of fluoride in the body increases due to the body increases due to greater consumption of water in the hot climate. Hence health hazards of excessive fluoride are noticed mostly in tropical countries. Contrary to this, in the countries of cold climate fluoride is added to water (fluoridation) to maintain optimum level.

#### Health hazards

As per the Indian Standards of drinking water, permissible limits of fluoride are a minimum of 1.0mg/L and maximum

of 1.5mg/L. Some amount is considered essential to prevent dental decay whereas excess amount is responsible for causing fluorosis, a disease of bones and teeth. Fluoride is also known to induce ageing. It affects young and old alike. In dental fluorosis which is prevalent in children, discoloration due to excess fluoride will be visible to the naked eye. In the late stage the teeth may become black and will be pitted or perforated and may even get chipped off. Fluoride has got a high affinity for calcium. So in the body, it gets accumulated in bones and ligaments. Deposition of fluoride in bones reduces the cavities thereby making joint movement difficult and painful. It causes pressure on nerves which leads to paralysis. Non skeletal fluorosis causes gastro-intestinal, allergic or urinary tract manifestations. It is unfortunate that there is no medical cure for this disease and it is irreversible. It affects cattle also if they drink high fluoride water.

#### Extent in Gujarat

Some pockets in the State were found to contain excessive fluoride in drinking water, causing health hazards. The Government of Gujarat appointed a committee of experts in 1983, to investigate the problem and suggest remedial measures. The committee identified pockets having excessive fluoride in drinking water and suggested short and long term remedial measures. A detailed survey and regular monitoring of water sources in the State has been subsequently introduced and remedial measures initiated. During the detailed survey and investigation work, it was found that the districts of Amreli, Mehsana, Banaskantha and Kheda are having excessive effect, whereas Bhavnagar, Ahmedabad, Sabarkantha, Panchmahal, Vadodara and Gandhinagar districts are moderately affected by this problem. The concentration of fluoride in ground water was found between 2.0 mg/L and 13.20 mg/L.

#### Clinical evidences

Research work carried out in association with the Gujarat University postgraduate department at Ahmedabad has shown that urine and blood samples of fluoride afflicted people have enhanced values of fluoride. The enhanced Na and K levels in the urine of fluorotic population indicated electrolyte imbalance and altered kidney functions. Serum sialic acid was also found reduced in cases from endemic villages. Thus the studies have revealed altered liver and kidney function in fluorosis afflicted individuals with high urine and serum fluoride but low sialic acid levels.

## Food analysis

Research work carried out in association with the Biochemistry Department of M.S. University, Baroda, has established that grain and spices samples analysed from fluorotic areas in Amreli district have shown increased amount of fluoride. Thus the total intake of fluoride is enhanced which needs to be checked through avoidance of such stuff.

## Preventive measures

Fluorosis, although it is untreatable, can be easily prevented. Major preventive measures include the following:

- a) avoiding use of high fluoride containing water;
- b) use of alternative water with less fluoride;
- c) removal of fluoride by chemical defluoridation;
- d) intake of Vitamin C in large amount;
- e) use of calcium rich items;
- f) avoiding other items containing high fluoride such as food, drugs and toothpaste; and
- g) to take medical advice in case of complaint of pain or any other symptoms.

Gujarat has initiated efforts in this direction through training in health education and mass awareness campaigns. Help of voluntary agencies and medical associations is also sought to educate people about the preventive measures. The training institute of Gujarat Water Supply Board, which is a nodal agency for National Fluorosis Control Programme is playing a very active role in propagating actions. Many awareness and training programmes have been conducted by this institute under the special drive of Fluorosis Control Sub-Mission of Rajiv Gandhi National Drinking Water Mission of the Government of India.

## Control measures

The control measures adopted in Gujarat are of two types. One is short term or interim measures and the second is long-term or permanent measure. The short term measures includes chemical treatment for removal of fluoride from water which is known as defluoridation. A research institute in India, National Environmental Engineering Research Institute (NEERI), Nagpur, has invented a process known as the 'NALGONDA' technique by which the fluoride from the water is easily removed by chemical precipitation with the help of filter alum (aluminium sulphate). This method of defluoridation could be adopted on a house to house basis as well as at a public source on community basis. Gujarat has adopted both these approaches which have been found successful. The Government of India in its national programme through Rajiv Gandhi National Drinking Water Mission has also provided financial and technical support to popularize and

implement the defluoridation schemes in many States including Gujarat. A number of defluoridation plants based on these techniques are in operation in Gujarat. The technique involved is simple in operation and can be accommodated in conventional rural water supply schemes. Support and help was received from voluntary agencies, which proved very useful and encouraging.

The long term measures include water supply schemes based on a safe water source (having less fluoride) from a distance place. In this case the water is brought through a pipeline from a safe source and distributed to the affected villages in clusters or in large number. Such schemes are implemented under Group Water Supply Schemes. Some of the schemes are supported by bilateral agencies like the Netherlands Government. A large scheme covering some 550 villages affected by fluoride is posed to World Bank for financial assistance. Thus all efforts have been made to combat the scourge of fluorosis.

## Conclusion

Fluorosis is a challenging problem in the management of drinking water supply which needs careful planning. Gujarat is one of the leading States in the country which has taken steps in combating this problem. It has taken preventive and corrective measures through awareness/training and defluoridation/alternative supply. Both of these have proved effective.

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