



Fluoride in Groundwater of Tamil Nadu: an overview

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Fluoride is widely dispersed in nature and is estimated to be the 13th most abundant element on our planet. Fluorite and topaz are widespread and contain a high percentage of fluoride. Fluoride concentration in natural waters depends on various factors such as temperature, pH, solubility of fluoride bearing minerals, anion exchange capacity of aquifer materials (OH⁻ or F⁻), and the nature of geological formations drained by water and contact time of water with a particular formation. Fluoride ion in drinking water is known for both beneficial and detrimental effects on health. The World Health Organization and Indian Council of Medical Research described the drinking water quality guideline value for fluoride. In India, approximately 62 million people including 6 million children suffer from fluorosis because of consumption of water with high fluoride concentrations due to its strong electronegativity, fluoride is attracted by positively charged calcium in teeth and bones causing dental fluorosis, teeth mottling, skeletal fluorosis and deformation of bones in children as well as in adults. Excess fluoride affects plants and animals also. The severity of injury is determined by duration of fluoride exposure and concentration. The major sources of fluoride in groundwater are

fluoride bearing rocks such as fluor spar, cryolite, fluorapatite and hydroxyapatite. Fluoride is a common constituent of rocks, soils and waters with rock being the primary reservoir and ultimate source. The presence of fluoride in groundwater is governed by several factors like igneous rocks formation, magmatic processes i.e., and formation of magma, pegmatite, hydrothermal fluids, metamorphic rocks and weathering processes. The permissible limit for fluoride in drinking water is 1.0 mg/l (WHO, 1971) and 1.5 mg/l (Indian standard]. In some parts of India, the fluoride levels are below 0.5 mg/l, while at certain other places, fluoride levels are as high as 30 mg/l have been reported. Presence of fluoride-bearing minerals in the host rock, chemical properties like decomposition, dissociation, and dissolution, and their interaction with water are considered to be the main causes for fluoride in groundwater. Chemical weathering with relatively high alkalinity favors high concentration of fluoride in groundwater. The permissible limits of fluoride in drinking water by various organizations are given in Table I.

Table I. permissible level of fluoride in drinking water by various organizations

S.No	Name of the organization	Permissible limit of fluoride (mg L ⁻¹)
1	World Health Organization (WHO) International Standard for Drinking Water	1.5
2	Bureau of Indian Standard (BIS)	1.0
3	The committee on Public Health Engineering (PHE), Govt. of India	1.0
4	Indian Council of Medical Research (ICMR), Govt. of India	1.0

The problem of excessive fluoride in groundwater in India was first reported in 1937. Tamil Nadu is ranked sixth among states. Here, the distribution of fluoride in groundwater has been found to be above permissible limit in as many as 16 districts. Rajasthan tops the list with 30 districts followed by



Karnataka with 20, Andhra Pradesh and Madhya Pradesh with 19 and Gujarat with 18 districts where fluoride distribution in groundwater is above permissible limit. In Tamil Nadu, the high concentration of fluoride in groundwater is found to be in Dharmapuri and Salem district closely followed by Coimbatore. Recent literature reports that fluorosis is a global problem affecting more than seventy million people in 25 countries.

Fluoride in Tamil Nadu

In Tamil Nadu, the high concentration of fluoride in groundwater is found to be in Dharmapuri and Salem district closely followed by Coimbatore, Madurai, Trichy, Dindukal and Chidambaram district. The districts having low fluoride are Thirunelveli, Pudukottai, North Arcot, and Ramnad districts. The district wise fluoride status in Tamil Nadu is presented in Table II.

Table II. Status of Fluoride in various districts of Tamil Nadu

S.No	Status	Districts
1	Sever	Dharmapuri salem
2	Moderate	Coimbatore Madurai Trichy Dindukal chidambaram
3	Less	Thirunelveli Pudukottai North arcot Ramnad

Besides fluoride, Increased population and industrialization generate enormous quantity of solid and liquid waste and there by deteriorating environmental quality and ecological niche. The discharge of untreated industrial effluents from large number of small industrial units and poorly treated effluents from big industrial units,

also deteriorated the groundwater quality of Tamil Nadu.

Reference

Gautam R., N. Bhardwaj. 2010. Bioaccumulation of fluoride in different plant parts of *Hordeum vulgare* (Barley) var. RD-2683 from irrigation water. Fluoride 43 (1) 57-60.