

Scourge of High Fluoride in Ground Waters of Arid Rajasthan and Strategy of Its Mitigation.

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The occurrence of high fluoride concentration in ground water has now become one of the most important health related geoenvironmental issues in many countries of the world. Our country is also confronting the same problem where the high fluoride concentration in ground water resources and the resultant disease “**Fluorosis**” is evenly distributed in nearly 150 districts of 15 states. It has been observed that about 25 million people in 8700 village in india are using ground water having fluoride content more than 1.5 mg/l. In Rajasthan, ground waters of the western and some southern part of the state are enriched with high fluoride concentration. The arid areas of the state are prone to both dental and skeletal fluorosis. As per P.h.e. Deptt. out of 37,889 villages and 45,311 habitations. 9741 villages and 6819 habitations, ground waters are enriched with excess fluoride content. The extent of severity was observed in Nagaur, Pali, Barmer, Jalore and Sikar district. It has also been observed that besides water other factors viz. nutritional deficiencies, high ambient temperature, high alkalinity and low calcium content and vitamin C are also responsible for endemic fluorosis. In recent years there has been a tremendous increase in the sale of sachets of Pan masala, Gutka, mouthwash and mouth rings in north India in general and Rajasthan in particular, these are also rich sources of fluoride. Therefore, for the welfare of mankind such items must be banned. Since it is a socio-economic disease, therefore, it is imperative to mitigate the problem by adopting suitable scientific measures to protect the consumers.

Introduction :

Schrott (1937) was the first and foremost scientist in our country who reported first time fluorosis disease in Andhra Pradesh. In Rajasthan the first case of skeletal fluorosis was reported from jobner near Jaipur city by Kalsiwal and Soloman (1959). Later, during 1964 in the villages of Nagaur and Bhilwara district, high fluoride contents in drinking water were observed. Mathur (1976) reported the prevalence of fluorosis in Ajmer district. Thereafter many scientists did extensive studies pertaining to the prevailing problem.

In recent years, the problem of fluoride in Rajasthan has reached an alarming proportion. This is due to both the indiscriminate exploitation of water sources and the total lack of awareness of the importance of water quality for human consumption.

The problem of fluoride has social implications as well. According to a press report, there are some villages in the arid Rajasthan where no marriages have taken place in the last several years, as people from other villages are not ready to give their daughters to the grooms of this village. In some cases wives have deserted their husbands, left the village and remarried elsewhere, as they could not cope with the problematic water. Since the losses caused by fluorosis both in human beings and livestock are irreparable but only preventive. Therefore, it is exigence to know the fluoride content in drinking water i.e. ground water and food stuffs. In arid Rajasthan particularly in Nagaur, Barmer and Pali districts the extent of problem is severe. Therefore, in the present communication, an attempt have been made by the authors to aware the people regarding this prevailing problem.

Experimental :

During the course of investigation 620 water samples were collected from different blocks of aforesaid districts having different hydrogeological formations during hydrogeological survey. These representative water samples were analysed physico-chemically using standard methods (Apha, 1985) and precise instruments.

Results and Discussion :

The districtwise distribution of potability parameters in their minimum and maximum range are shown in Table-1

Table-1 : Districtwise distribution of various potability parameters (mg/l)

Parameter	Nagaur	Pali	Barmer
T.D.S.	25,440 (338)*	16,000 (168)	15,000 (215)
Nitrate	4,750 (5)	1,020 (5)	1,900 (5)
Fluoride	34 (0)	19 (0)	18 (0)
Hardness	9,890 (40)	2,945 (10)	5,990 (14)

* Minimum values are given in parenthesis

The percentage frequencies of ground waters with different range of various health affecting constituents are tabulated in Table-2. A perusal of chemical analysis data reveals that great variations in the chemical quality of ground waters of arid areas occur in all the potability parameters. From Table-2 it is quite clear that the extent of problem of salinity is much more aggravated in the areas of Barmer and Nagaur districts. whereas, generally the ground water of Pali is moderately saline. It is obvious that exceedingly high concentration of fluoride are present in the study areas but the extent of severity of the problem is much higher in Nagaur and Barmer, districts. Highest fluoride value of 34 mg/l was observed in ground water of Nagaur district. Locally fluorosis affected areas are called as “**Banka Patti**”.

The fluoride enriched ground waters are invariably observed in all the major hydrogeological formations viz. alluvium, crystallines and sedimentaries. Generally the high fluoride content in water is associated with high alkalinity to calcium ratio, low calcium to fluoride and magnesium to fluoride ratios. It has also been observed that many fresh waters in the arid region have fluoride level above 1.5 mg/l despite low T.D.S. Some high fluoride bearing waters had high Residual Sodium Carbonate values (Ozha, 2001).

The fluoride rich minerals present in the rocks and soils when come in contact with water of high alkalinity will release fluoride into ground water by a process of hydrolysis replacing hydroxylion. The degree of weathering and leachable fluoride in a terrain is more important in deciding the fluoride bearing minerals in the bulk rocks.

Table-2 : Percentage distribution of ground waters in different fluoride range.

District	Area Sq.km	0-1.0	1.01-1.5	1.6-5.0	5.01-10	>10
Barmer	28,387	17.72	35.56	34.01	10.00	2.70
Nagaur	17,718	21.01	25.23	30.00	19.07	4.68
Pali	12,387	36.12	33.04	20.51	9.21	1.12

Fluoride in edible items :

Fluoride not only enters through water but also with many edible items viz. Pan, Supari, toothpastes, mouth wash, mouthrinse, Tobacco, Pan masala, Gutka etc. Fluoride content in rock salt is also very high. Certain spices also contain adequate fluoride.

Study of Singh *et al.*, (1993) reveals that chewing Tobacco, Gutka, Pan masala etc. causes extra burden of fluoride to the body. Intake of 2-4 sachets of Pan masalas per person yield between 0.34 to 1.12 mg, fluoride for absorption. Studies carried out in our country also indicates the occurrence of mouth cavity cancer and other serious ailments owing to excessive chewing of such edible items.

Effect of Fluoride On Human And Livestocks Health :

It has been well established that when the concentration of fluoride exceeds 1.5 mg/l, it gives a mottled brown stain colouration to the chalky white teeth, the disease is known as dental Fluorosis. In later stages the teeth become black, gets pitted and eventually get chipped off.

In Nagaur district results of epidemiological survey carried out in the district reveals that 16,411 people are afflicted with dental fluorosis. It has also been observed that males are more prone to dental fluorosis as compared to females.

Prolonged ingestion of fluoride causes chronic effect in bones leading to skeletal fluorosis. As a result of such disease stiffness of joints, backbone and calcification of ligaments takes place. Results of epidemiological studies⁶ indicates that in Didwana and jayal block of Nagaur district, Kalyanpura village of Rani block of Pali district, Raniwara, Sayla block of Jalore district and Barmer areas, maximum cases of skeletal fluorosis have been seen (Singh *et al.*, 1993).

As regards fluoride adverse effect on the health of livestock amongst the domestic animals, buffaloes showed higher prevalence of fluorosis as compared to cattles. But the absence of fluorosis in sheeps and goats may be due to the resistance of animal species. In general the skeletal fluorosis is directly affecting the economy of villagers causing health problems of human beings and their domestic animals, which are also basic income sources for them.

Strategy of mitigation :

As stated earlier that the excess fluoride concentration in our body has socio-economic implication as well. The disease fluorosis is non curable but preventable. Following are some of the mitigating measures, be adopted for abatement of the problem.

1. Popularisation of simple, economically viable method of domestic defluoridation using poly aluminium chloride and Nalgonda techniques.
2. Blending of high fluoride with low fluoride water in endemic areas.
3. Construction of wells/tubewells in low fluoride area for drinking water supply.
4. Urging rural people specially the lactating mothers to use fluoride safe water.

5. Adequate use of vitamin C in diets.
6. Periodic nutritional and epidemiological surveys be carried out in endemic areas.
7. Promulgation of Aquifer Protection Policy (App) to avoid over exploitation of ground water to alleviate ingress of fluoride.
8. Enforcement of Minus for phosphatic fertiliser industries more precisely and strictly.
9. Prohibition on use of fluoride rich tooth-pastes, mouth wash and other luxury items.
10. Ban on Pan masala, gutka and other tobacco chewing preparations.
11. High intake of calcium leads to precipitation of fluoride as calcium fluoride and this in turn reduces the conc. ionic fluoride which is responsible for Fluorosis.
12. Dental fluorosis can be vanquished by capping, bleaching or by laminated veneering of teeth. This practice may prove better in matrimonial matters.
13. Public awareness and health education are most important measures to be widely adopted. This can be done by using audio-visual aids, seminars, conferences, symposium and training.
14. Non-Government Organisations (N.g.o.'s) must be encouraged in such programme for public welfare.
15. Collective studies must be undertaken by scientists, nutritionist, engineers and paramedical experts in the fluoritic areas.
16. Detail serology and sampling of village/block.

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