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Original Research Paper

A Study of the Fluoride Contamination in Groundwaters of Masooda Tehsil of Ajmer District, Rajasthan

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ABSTRACT

Fluoride in water is mostly of geological origin. The control of drinking water quality from groundwaters is critical in preventing fluorosis. A physico-chemical analysis of available groundwater drinking resources in 10 villages of Masooda tehsil of Ajmer was carried out. The analytical results revealed considerable variations in chemical composition of water samples. Fluoride concentration varied from 0.5 to 6.7 ppm, causing dental and skeletal fluorosis amongst people.

INTRODUCTION

Groundwater with high levels of fluoride is worldwide in occurrence. Known fluoride belts on land include: one that stretches from Syria through Jordan, Egypt, Libya, Algeria, Sudan and Kenya, and another that stretches from Turkey through Iraq, Iran, Afghanistan, India, northern Thailand and China. There are similar belts in the America and Japan. However, Shortt (1937) was the first to identify the disease as 'fluorosis' in human beings in Nellore district of Andhra Pradesh.

Ingestion of excess fluoride, most commonly in drinking water, can cause fluorosis, which affects the teeth and bones. Moderate amounts of fluoride lead to dental effects, but long-term ingestion of large quantities can lead to potentially severe skeletal problems. Paradoxically, low levels of fluoride intake help to prevent dental caries (WHO 2004).

In Rajasthan, groundwaters contain high concentration of fluoride in 22 districts out of 33 districts. Public Health Engineering Department in Rajasthan revealed on the basis of a habitation survey (PHED 1991-1993) that out of 37,889 villages in the state, 9,741 have more than 1.5 ppm of fluoride in groundwater, and 3,280 villages have more than 3.0 ppm of fluoride. The problem of fluorosis is one of most severe problems affecting the State (Sharma & Choubey 2007). The present communication deals with physico-chemical characteristics of groundwaters collected from 10 villages of Masooda tehsil.

MATERIALS AND METHODS

Sample collection: Groundwater samples were randomly collected in precleaned polythene bottles from 10 villages of Masooda tehsil (Ajmer district) of Rajasthan, viz., Shyamgarh, Khimpura, Pachpedi, Moyana, Surajpura, Bassi, Dholadanta, Baghmaali, Daulatpura and Kanpura.

Water analysis: Analysis of the collected water samples was done for parameters like temperature, pH, turbidity, calcium, magnesium, chloride, total hardness, total dissolved solids, alkalinity, acidity and fluoride as per standard methods of Golterman et al. (1978) and APHA (1998).

RESULTS

The results of the study are presented in Table 1, Fig. 1 and Fig. 2. The concentration of fluoride of the water samples collected from the villages was found to be more than 1.5 ppm in 50% of the villages (5/10), and more than 3 ppm in 40% of the villages (4/10). Alkalinity of the samples was more than the standard limits in all the samples. 70% of villages had high chloride content in drinking water. 40% of villages had high calcium level in groundwaters. Pachpedi had highest concentration of fluoride (6.5 ppm).

DISCUSSION

Physico-chemical parameters of all water samples clearly indicate that the water is unfit for drinking purpose due to high concentration of fluoride, alkalinity and chlorides. pH readings show that the water is slightly alkaline. A higher concentration of chloride in water gives salty taste. Alkalinity and fluoride concentration of samples show a positive correlation of 0.3, and calcium and fluoride content show a negative correlation of 0.3. As 50% of the villages have fluoride concentration more than 1.5 ppm, and 40% more than 3 ppm, there is prevalence of dental and skeletal fluorosis in the area.

To combat fluoride problem in the study area, it is suggested that an awareness programme must be run amongst the rural population about fluorosis problem and its mitigation techniques. Attempts should be made at local population level for rain water harvesting and Nalgonda technique so as to quench the thirst through safe drinking water free from fluoride. Also a nutritional profile including ingestion of *Ocimum* leaves and tamarind (Raja et al. 2001, Khandare et al. 2002) for self mitigation technique should be made aware in the rural population residing in the area. Raw bauxite can also be used for defluoridation to treat water in high fluoride areas (Sajidu et al. 2008).

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Table 1: Pre-monsoon status of drinking water from villages of Masooda tehsil.

S. No.	Villages	Parameters (Physical and Chemical)										
		Temp.	pH	Turbidity	Acidity	Alkalinity	F^-	Ca^{2+}	Mg^{2+}	TDS	Cl^-	TH
1	Shyamgarh	31	7.2	1.0	10	840	0.5	224.5	177.2	1990	167.5	232
2	Khimpura	31	7.2	0.9	10	1200	1.2	102.6	83.0	2000	553.8	108
3	Pachpedi	29	7.5	0.5	10	900	6.7	28.06	65.2	1470	332.3	72
4	Moyana	30	7.1	2.0	10	660	0.7	202.8	158.5	1520	335.1	208
5	Surajpura	30	7.2	0.4	10	720	1.1	169.1	138.7	1160	349.3	180
6	Bassi	29	7.4	0.5	10	900	3.6	42.48	69.6	910	90.9	80
7	Dholadanta	31	7.5	0.7	10	720	1.3	72.95	62.2	1660	482.8	80
8	Baghmaali	31	7.6	2.0	10	800	4	39.28	70.4	850	99.4	80
9	Daulatpura	30	7.0	0.5	10	760	2.3	58.52	45.7	2130	724.2	60
10	Kanpura	29	7.2	1.0	10	1000	5.1	34.46	31.6	2760	653.2	40

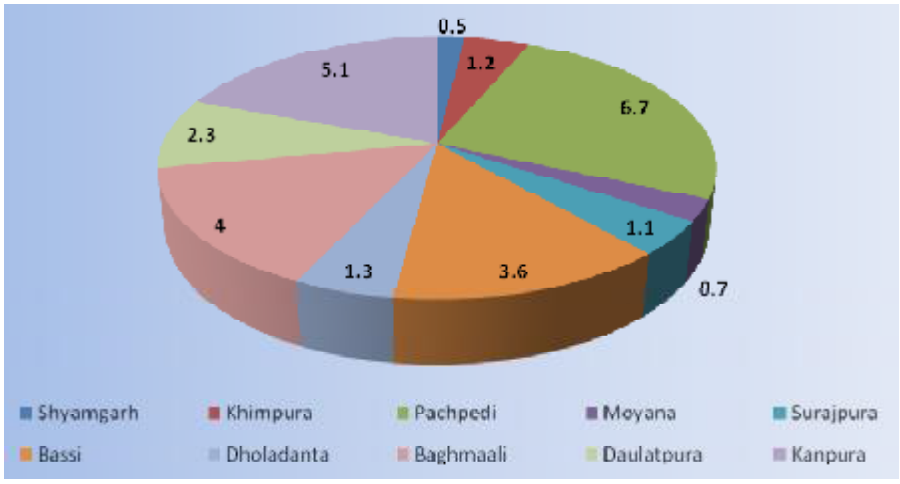

Fig. 1: Fluoride content in groundwater of Masooda tehsil.

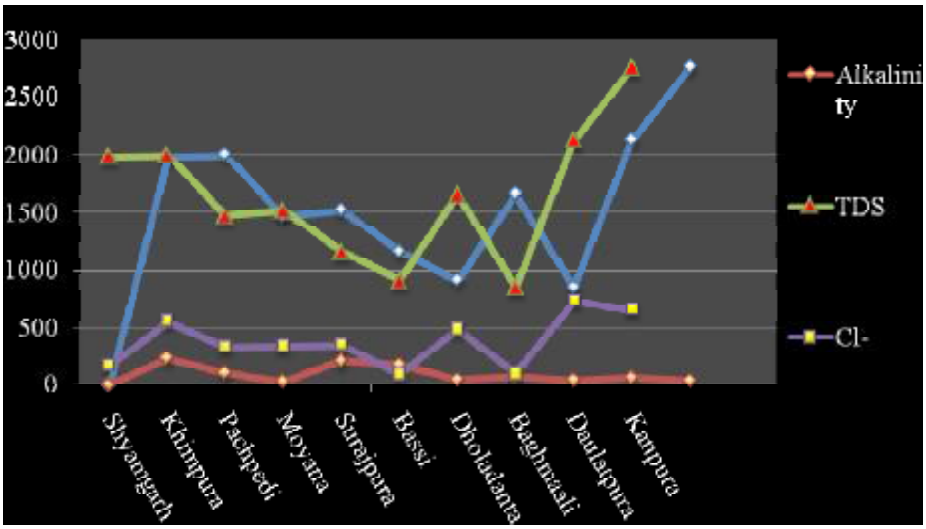

Fig. 2: TDS, chloride and calcium levels of drinking water from Masooda tehsil.

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