

Analysis of Some Ground Water Samples with Special Reference to Fluoride in Dudu Tehsil of Jaipur District, Rajasthan, India

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Abstract: *The Dudu tehsil lies in south west region of Jaipur district and covers an area of 1,870.64 sq. km. Twenty five ground water samples were collected (five from each village) from five villages of the tehsil between January to June, 2014. These samples were analyzed for fluoride content. Fluoride value in the samples ranged between 0.19 to 3.70 mg/l. Other parameters like EC, pH, Total Dissolved Solids, Total alkalinity, Total hardness, Nitrate and Chloride were also studied. Some of these parameters were higher than the permissible limit which makes water unfit for human consumption.*

Keywords: Fluoride content, Jaipur district, Dudu tehsil, Five villages, Ground water samples

1. Introduction

Fluoride is a commonly occurring toxic mineral in ecosystem. It occurs in traces in many waters but higher concentrations are observed in groundwater (Indermitte et. al., 2009). The presence of high fluoride in ground water is mainly due to a number of reasons: Weathering of fluoride bearing minerals, Volcanic process, Use of chemical fertilizers, Salt deposits of marine origin, Industrial effluent and Mine water discharge (Agarwal and Vaish, 1999).

Fluoride content from 0.6-1.2 mg/l in drinking water is desirable in prevention of dental cavities. But, when present in excessive amount in drinking water and then long term consumption of this water (mainly ground water since this contains more fluoride than surface water), food habits (tobacco, tea, fish, medicine, various vegetables, ragi, bajra etc) and inhalation of air containing high fluoride content (fluoride level in atmosphere rises during the industrial and Volcanic activity) lead to Fluorosis viz: Dental Fluorosis, Skeletal. Fluorosis, this is because fluoride has chemical affinity with calcium therefore it reacts with calcium containing body parts e.g. teeth and bones. Children under the age of 12 year are more prone to fluorosis (Jain et.al, 1999, Mandini et. al, 2010). Fluoride toxicity also affects the soft tissue and enzyme system however the effects on teeth and bones are easily visible.

Endemic fluorosis is prevalent in India since 1937. At present, it has been estimated that fluorosis is present in 17 states of India, indicating that endemic fluorosis is one of the most alarming public health problem of the country, especially in Rajasthan, Madhya Pradesh, Andhra Pradesh, Tamil Nadu, Gujarat and Uttar Pradesh (Arif et. al., 2013). In Rajasthan prevalence percentage for dental fluorosis is 39.2-72.1% and for skeletal fluorosis 12-27.6 %, which can be seen in all age groups (Arlappan et.al., 2013).

2. Study Area

The Jaipur district has been divided into 13 administrative blocks namely Amer, Virat nagar, Bassi, Chaksu, Dudu, Govindgarh, Jamwa Ramgarh, Jhotwara, Kotputli, Phagi, Sambher, Sanganer and Shahpura.

Dudu block (tehsil) is located in between 26°25' and 26°57' N latitude and 74 55' and 75 30' E longitude. It lies in south west region of Jaipur district and covers an area of 1,870.64 sq. km. The area is semi-arid and the annual mean rainfall is 490 mm.

A region known as Gadota is present on National Highway-8 which lies 48 Km from Jaipur city and 17 Km from Dudu. Five villages near Gadota region, named: Chandpura, Kapadiawas, Gadoti, Nasnoda, Sheoshingpura Basadi were selected for the study.

2.1 Experimental

Samples were collected from hand pumps in 1litre rinsed polyethylene bottles and brought to the laboratory. Collection and analysis was done between January to June 2014. Distilled water and Analar grade chemicals were used for analysis.

Fluoride concentration was determined with the help of selective ion meter 9 (Toledo MA 235 pH/ion Analyzer) standard procedure for determining the fluoride followed (APHA, 2012). Total ionic strength adjustment Buffer (TISAB) was used to maintain a suitable ionic strength and also to avoid complex formation. Other Physico-chemical parameters were analysed following the standard methods (APHA, 2012) using precise instruments.

3. Results and Observations

All the samples collected from five villages were analysed for fluoride concentration and other parameters of ground water quality. The results are given in Table 1.

The fluoride concentration ranged from 0.19 mg/L to 3.70 mg/L that is Kapadiawas and Sheoshingpura basadi, respectively. Based on the available data prevalence of high fluoride was observed in Gadoti, Sheoshingpura basadi, Nasnoda. The maximum permissible limits for fluoride level is 1 mg/L recommended by WHO, 2004. High fluoride concentration in the study areas is responsible for causing fluorosis among the residing population (fig. 1).



Figure 1: Photographs of some people residing in the study areas showing Dental and Skeletal fluorosis

Table 1: Details of the analysis of the studied samples

S.no.	1	2	3	4	5
Location	Gadoti	Chandpura	Sheoshingpura Basadi	Kapadiawas	Nasnoda
EC $\mu\text{S}/\text{cm}$ at 25° C	13100 \pm 4.5	8700 \pm 3.2	6000 \pm 0.8	1490 \pm 2.4	8600 \pm 2.6
pH	7.7 \pm 0.06	7.4 \pm 0.04	8.1 \pm 0.01	8.0 \pm 0.01	7.9 \pm 0.03
TDS	7657 \pm 3.1	5574 \pm 0.7	2755 \pm 2.5	988 \pm 2.1	6556 \pm 4.0
Chloride	3969 \pm 3.6	2157 \pm 4.5	1550 \pm 1.71	337 \pm 4.0	2589 \pm 3.8
CO ₃	0	0	0	0	0
HCO ₃ ⁻	1159 \pm 1.64	634 \pm 1.44	1012 \pm 1.34	293.4 \pm 3.9	793.2 \pm 2.3
Fluoride	3.5 \pm 0.01	0.67 \pm 0.02	3.7 \pm 0.01	0.19 \pm 0.07	2.4 \pm 0.01
Total Hardness	256 \pm 4.0	287 \pm 1.2	99 \pm 1.8	114 \pm 6.5	199 \pm 1.96
Nitrate	50 \pm 1.3	36 \pm 2.4	75 \pm 2.6	15 \pm 1.7	68 \pm 1.4

Mean \pm S.D.

The results also reveal that all the fluoride containing water samples were slightly inclined towards the alkaline side, with pH varying from 7.4 to 8.1 which is within the permissible limit i.e., 6.9 to 9.2 as per WHO (2004). The alkalinity is mainly due to the bicarbonate ions which is clear from the absence of carbonate alkalinity. It varies from 293.4 mg/L (Kapadiawas) to 1159 mg/L (Gadoti) exceeding the permissible limits in all the samples.

Electrical conductivity (EC) measures the electrical current, which is proportional to the minerals present in water. Variation in EC was recorded in all samples. EC values ranged from 1490 $\mu\text{S}/\text{cm}$ (Kapadiawas) to 13100 $\mu\text{S}/\text{cm}$ (Gadoti). The high EC values may be due to the rock soils and the presence of higher TDS in the study areas. (Rao et al., 2004)

The chloride content also varied in the range of 337 mg/L to 3969 mg/L, The content in all the water samples was higher than permissible limit except Kapadiawas (337 mg/L). High chloride content in drinking water gives a salty taste. Association of salinity, with high fluoride waters is a general concept. The primary source of fluoride in groundwater being weathering of rocks, dissolution of fluoride with other

salts and hence extra build of salinity in high fluoride waters could be a natural phenomenon (Gupta, 1999). However, total hardness (99 mg/lit to 287 mg/lit) of all the studied samples was within the permissible limits.

Nitrate content of Gadoti, Sheoshingpura basadi, Nasnoda was higher mainly due to the agricultural fields where the nitrogenous fertilizers make their entry into ground waters due to leaching. The poor sanitation level is also another important source contributing high amount of nitrate in ground water (Chaudhary et.al. 2007, Kataria, 2012)

4. Conclusion

It has been concluded from the analysis that the fluoride level in all villages is either below or higher than the permissible limit, which makes it unsuitable for drinking or other household purposes.

References

- [1] APHA. 2012. Standard methods for the examination of water and wastewater. (22 Ed.), Washington, DC: American Public Health Association.

- [2] Arif, M., Hussain I.I.J., Hussain, I. and Kumar, S. 2013. An Investigation of Fluoride Distribution in Ladnu Block of Nagaur District. *Central Rajasthan World Applied Sciences Journal*. 26 (12): 1610-1616.
- [3] Arlappan, N., Aatifoureshi, I. and Srinivas, R. 2013. Fluorosis in India: an overview. *International Journal of Research Development and Health*. 1(2): 97-102.
- [4] Agarwal, V. and Vaish, A. K. 1999. Geochemical considerations of fluoride contamination in ground water resources of Rajasthan. Proceedings of National seminar of Environment and Health. 99: 8-10.
- [5] Chaudhary, P., Dagaonkar, A. and Praveen, S. 2007. Physico-chemical analysis of ground waters for Evaluation of Drinking water quality at Dhar Town, Madhya Pradesh. *Nature Environment and Pollution Technology*. 6(1): 109-112.
- [6] Gupta, S. C. 1999. Fluoride distribution in groundwater of western Rajasthan. *Journal of Indian Water Works Association*. 1: 57-61.
- [7] Indermitte, E., Saava, A. and Karro, E. 2009. Exposure to High Fluoride Drinking Water and risk of Dental Fluorosis in Estonia. *Int. J. Environ. Res. Public Health*. 6: 710-721.
- [8] Jain, C. K., Ali, I. and Sharma, M. K. 1999. Fluoride contamination in ground water-Indian Scenario. *Indian Journal Environmental Protection*. 19(4): 260-266.
- [9] Kataria, A. 2012. Fluoride and Nitrate level in groundwaters of some villages of Dudu tehsil, Jaipur district. *International Journal of Physical and Social Sciences*. 2(7): 280-285.
- [10] Nemade, P. D., Nayak, D. and Hussian, U. M. 2003. Fluoride concentration in groundwater and its effects-an Indian Scenario. *Environmental Pollution Control Journal*. 7(1): 39-46.
- [11] Mandini, Z., Curcic, M., Antonijevic, B., Carevic, M., Mandic, J., Djukic-Cosic D. and Lekic, C. P. 2010. Fluoride in drinking water and dental fluorosis. *Science of the Total Environment*. 408: 3507-3512.
- [12] Rao, K. S., Prasad, N. V. V. S., Babu, C. R., Kishore, M., Ravi, M. and Vani, K. N. K. 2004. Physico-chemical analysis of water samples of A. Konduru Mandal, Krishana District. *Indian Journal of Environmental Protection*, 24(9): 695- 704.
- [13] WHO. 2004. Guidelines for drinking-water quality. 3rd Ed.; World Health Organization: Geneva, Switzerland.
- [14] Yadav, J. P. and Lata, S. 2004. Fluoride levels in Drinking water sources in rural areas of block Jhajjar, district Jhajjar, Haryana. *Journal of Indian Water Works*. 2: 131-136.