Short Communication

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Fluoride Concentration in Groundwater of Khapa Town, Saoner Tehsil, Nagpur District – A Case Study

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Fluoride is known to contaminate groundwater in many countries notably India, Sri Lanka, China, rift valley countries in East Africa, Turkey, and parts of South Africa. Sporadic occurrence of high fluoride content in ground water has been reported in 19 states and union territories across the country (CGWB 2010; Pol 2012). The fluoride occurrences in top aquifer system are endemic in many parts of Andhra Pradesh, Tamil Nadu, Karnataka, Gujarat, Rajasthan, Punjab, Haryana, Bihar and Kerala (Agarwal *et al.* 1996; Latha *et al.* 1999 and Gopalakrishnan *et al.* 2012). The toxicity of fluoride is generally influenced by high ambient temperature, alkalinity, calcium and magnesium contents in drinking water (BIS 1991). High level of fluoride poses serious health hazards to humans and irreversible damage to plants. The present study was carried out to assess the fluoride concentration of ground water in the selected villages around Khapa town of Nagpur district.

Khapa town (20.92°N, 78.95°E) is situated 25 km from Saoner tehsil and 63 km away from Nagpur and covers an area of 349.22 hectares. Khapa town is located on the banks of river Kanhan, a right-bank tributary of the Wainganga River. People residing in Khapa and the surrounding villages depend mainly on borewell for domestic and agricultural purposes. There was a lack of As the information about fluoride concentration in groundwater of villages in and around Khapa is virtually lacking and hence the present intervention was carried out.

Water samples from 24 borewells were collected from selected villages of Khapa town in a pre-cleaned plastic polythene bottle. The pH of the water was measured immediately using a Systonic Digital pH meter (S-903). Standard methods were used to determine chloride, fluoride and water hardness. Groundwater was mildly alkaline (pH 7.1 - 8.0), moderately hard without any suspended matter (Table 1). Roy *et al.* (2012) reported a pH of 7.3 to 8.2 in the well water of Nari area, Nagpur district. Chloride ranged from 35.60 to 230.73 mg L^{-1}, and it was within the permissible limit of drinking water. The water samples had lower total hardness than the permissible limit of drinking water (200 mg L^{-1}) (WHO 2011). Sample B-3, MH-1, PS-3, T-1 and Khapa-2 had higher total hardness than the permissible limit, which could be due to their proximity to limestone and dolomite reserves.

The fluoride concentration showed a negative correlation with the pH ($r = -0.027$) but had a positive correlation with total hardness ($r = -0.569$), calcium ($r = -0.497$), magnesium ($r = -0.291$) and chloride ($r = -0.561$) (Table 2). The results conform to the findings of Venkatachalam *et al.* (1998).

It is concluded that the fluoride of all the groundwater samples was within the permissible limits prescribed by the WHO (WHO 2011).

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Table 1. Fluoride content and Physico-chemical properties and fluoride concentration in water

Sample ID*	pH	Total hardness (mg kg^{-1})	Calcium (mg L^{-1})	Magnesium (mg L^{-1})	Chloride (mg L^{-1})	Fluoride (mg L^{-1})
B-1	7.6	163.42	78.17	59.73	80.34	0.3
B-2	8.0	169.47	83.89	60.13	80.96	0.5
B-3	7.7	226.93	107.82	63.18	51.83	0.4
DH-1	7.3	163.82	96.48	46.18	68.19	0.3
G-1	7.3	122.03	63.82	44.16	41.53	0.2
G-2	7.3	133.14	66.42	38.26	44.15	0.3
K-1	7.6	105.73	58.63	38.44	37.85	0.4
KHAPA-1	7.2	128.16	68.11	35.13	59.47	0.4
MH-1	7.6	246.65	116.35	42.67	140.14	0.5
MH-2	7.4	194.67	96.38	62.67	108.75	0.4
MH-3	7.4	164.67	84.49	67.30	96.67	0.4
MH-4	7.7	104.04	58.90	47.34	47.08	0.2
MH-5	7.3	124.14	66.71	41.06	60.44	0.3
PH-1	7.4	109.70	59.43	33.76	40.82	0.2
PH-2	7.5	148.52	79.51	53.44	60.38	0.3
PH-3	7.5	136.42	72.54	52.51	71.14	0.2
PS-1	7.7	196.40	95.43	58.11	90.43	0.4
PS-2	7.6	165.06	76.52	59.26	56.07	0.3
PS-3	7.2	308.64	157.67	97.34	230.73	0.3
PS-4	7.9	127.08	58.67	39.25	35.60	0.2
RD-1	7.3	107.04	58.34	44.57	36.48	0.2
T-1	7.1	236.40	109.46	63.22	211.58	0.6
KHAPA-2	7.2	243.18	86.16	68.22	152.34	0.4

*Bichwa (B-1, B-2, B-3), Dahegaon (DH-1), Gumgaon (G-1, G-2), Khairi (K-1), Mahadula (MH-1, MH-2, MH-3, MH-4, MH-5), Pandhari (PH-1, PH-2, PH-3), Patansawangi (PS-1, PS-2, PS-3, PS-4), Raiwadi (RD-1),Tighai (T-1), Khapa (KHAPA-1, KHAPA-2).

Table 2. Correlation of fluoride with Physico-chemical properties of water.

Parameter	pH	Total Hardness	Chloride	Calcium	Magnesium
Fluoride Concentration	-0.0273	0.5692	0.5617	0.4975	0.2917

References

Agarwal, V., Vaish, A.K. and Vaish, P. (1997). Groundwater Quality: Focus on Fluoride and Fluorosis in Rajasthan. *Current Science* **73**, 743-746.

BIS-Bureau of Indian Standards. (1991). Indian Standard Drinking water-specifications. New Delhi, India.

CGWB-Central Ground water Board Ministry of Water Resources. (2010). Groundwater Quality in Shallow Aquifers of India. Faridabad: Central Ground Water Board Ministry of Water Resources, Government of India.

Gopalakrishnan, S.B., Viswanathan, G. and Ilango, S. S. (2012). Prevalence of fluorosis and identification of fluoride endemic areas in Manur block of Tirunelveli district, Tamil Nadu, South India. *Applied Water Science* **2**, 235–243.

Latha, S. S., Ambika, S. R. and Prasad, S. J. (1999). Fluoride contamination status of groundwater in Karnataka. *Current Science* **76**, 730-734.

Pol, P.D., Sangannavr, M.C. and Yadawe, M.S. (2012). Fluoride contamination status of groundwater in Mudhol Taluka, Karnataka, India: Correlation of fluoride with other physico-chemical parameters. *Rasayan Journal of Chemistry* **5**, 186-193.

Roy, R. P., Jagdish Prasad, Rashmi Gupta (2012). Assessment of well-water quality for drinking purpose, a case study in Nari area, Nagpur District, Maharashtra, India. *Journal of Environmental Science & Engineering* **54**, 420-423.

Venkatachalam, M. R., Jebanesan, A. (1998). Correlation among water quality for groundwater in Chindambram town. *Indian Journal of Environmental Protection* **18**, 734-738.

WHO-World Health Organization. (2011). Guidelines for Drinking-water Quality.