

Concentration of Fluoride in Groundwater and its Distribution

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Abstract: The paper deals with the result of analysis of fluoride and other water quality parameters of groundwater and its distribution in view of distance from coastal areas towards interior areas. The findings reveal the fact the concentration of fluoride comes from the coastal area towards the central area. The concentration of natural fluoride in ground water is not uniform in these areas. The fluoride variation is due to many factors such as source of water, the ecological formation of the area, the amount of the rain fall the quantity of water lost by evaporation, other parameters such as pH, alkalinity, calcium, magnesium and chloride which are enhancing fluoride toxicity.

KEY WORDS: fluoride, groundwater, coastal areas, central areas, Narmada district.

I. INTRODUCTION

Fluoride is an essential element for human and animal health particularly for prevention of dental **caries**. But high fluoride content in drinking water gives rise to harmful effect in human beings and animals. Fluoride deficiency, on the other hand may have a harmful influence on the growth of teeth. Fluorosis is a kind of disease caused by consuming excessive amounts of fluoride i.e. , above 1 ppm **fixed disease** have been noticed. For analysis, the samples of water were collected from different places located in Narmada district in Gujarat and were investigated. Thus, it is related to other chemical constitution of drinking water which is protective against the development of Fluorosis such as magnesium, calcium and total hardness. After eruption of the teeth, the fluoride content of the drinking water has not visible effect on the enamel even though the fluoride Content of the teeth increase.

II. MATERIALS AND METHODS

Samples of drinking water from all the available sources of the selected areas were collected in polythene bottles. The total number of water samples collected from all these areas put together was **16**. The bore wells in the areas were about **100 – 600** feet in depth. All the samples were analyzed for various parameters. Fluoride was analyzed by Spectrophotometer and **ion meter**. Total alkalinity, total hardness, calcium, magnesium and fluoride were determined by usual titration methods. pH of the water sample was measured by using pH meter. Electrical conductivity of the sample was measured by using Conductivity Bridge.

III. RESULTS AND DISCUSSION

The concentration of natural fluoride in ground water is not uniform in these areas. The fluoride variation is due to many factors such as sources of water, the geological formation of the area, the amount of rain fall and the quantity of water lost by evaporation. The parameter such as pH, alkalinity, calcium, magnesium and chloride are enhancing fluoride toxicity.

Table-1 reports the finding of the concentration of fluoride and other parameters in ground water samples. In the water sample of these areas, PH ranged from 6.39 to 8.34. The electrical conductance ranged between 680 to 2448 mho/cm. Total hardness and chloride was ranged from 270 to 3600 ppm and 40 to 2352.08 ppm. And Total alkalinity of these samples from 127.34 to 328.30 ppm.

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Concentration of fluoride in Jaria ranged from 4.2 to 4.5 ppm, Gurudeswer ranged from 2.3 to 2.10 ppm, Pantalavdi ranged from 2.10 to 3.0 ppm, Zarvani from 1.9 to 2.80 ppm, Chatwad from 1.0 to 1.60 ppm, and Dhannacha from 0.90 to 1.5 ppm, Rajpipla from 1.0 to 1.5 ppm, As the distance increases from the coastal areas of Jaria towards interior parts up to Rajpipla, the values of fluoride concentration decreases, this is due to the leaching of fluoride from the rock soil to the ground water. While fluoride toxicity decreases from Jaria to Rajpipla, the percentage of people affected by fluorosis is also decreasing. The average values of fluoride in water and percentage of people affected by fluorosis are given in table-2

Table - 1 : Physico-chemical Parameters in Groundwater Samples

Sr	Description of source	Fluoride (ppm)	pH	EC (mho/cm)	Total Alkalinity (ppm)	Total hardness (ppm)	Calcium (ppm)	Magnesium (ppm)	Chloride (ppm)
1	Rajpipla Town Bore water from swami narayan temple	1.0	7.47	1423	160.35	3420	1900	1520	2352.08
2.	Hand pump water inside the campus of G.S.L High school	1.5	7.21	1079	267.25	1860	1500	360	1717.49
3.	Jaria Hand pump near housh of Lakshmanbhai Laljibhai Bhil, navivashavt	4.20	8.01	741	160.35	970	720	250	1251.73
4.	Hand pump near panchayat office	4.60	8.34	680	213.80	450	330	120	139.73
5.	Bore water from thakor faliya	4.10	7.91	738	158.40	897	725	247	1257
6.	Hand pump near primary school	4.0	7.45	1746	310.16	750	580	170	489.05
7.	Garudeshwar(Navapara) Hand pump near housh of ashokbhai H.bhil /patel faliya	2.35	7.40	1699	309.16	749	585	179	522.05
8.	Hand pump near primary school campus	2.10	8.34	1491	127.34	378	309	70	40.75
9.	Bore water from gram panchayat of navapara	2.9	6.39	1546	256.68	550	410	140	419.18
10	Zarvani Well water near housh of ramanbhai shantilal vasava	4.9	6.70	2448	328	330	240	90	305.65
11	Bore water on the	4.7	6.83	2312	224.59	314	223	85	295

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	main road side								
12	Ratudiya (Tilakvada taluka) Hand pump near housh of Bipinbhai bariya	2.80	6.78	936	235.29	300	240	60	52.39
13	Near primary school	1.90	7.91	738	181.73	800	550	250	1210.97
14	Chatwad(sagbar a taluka) Hand pump near primary shcool	1.60	7.85	1196	238	3012	2600	796	1994.28
15	Bore water near temple	1	7.47	1423	160.35	3420	1900	1520	2352.08
16	Dhamnacha Bore water from grampanchayat	1.5	7.21	1079	267.25	1860	1500	360	1717.49

Table – 2 : Average Values of Fluoride (ppm) in Water and Percentage of Fluoride

Name of the place	Fluoride(ppm)	% of people affected by fluorosis
Jaria	4.20	38.50
Navapara (Garudeshvar)	2.20	30.00
Zarvani	2.99	29.75
Ratudiya	2.80	26.70
Chatwad	1.00	20.00
Dhamnacha	1.50	Trace
Rajpipla	1.00	Nil

IV.CONCLUSION

The authors found that concentration of fluoride in ground water decreases from 4.20 to 1 ppm on the coastal area of the Jaria upto rajpipla. The percentage of people affected by fluorosis also decreases from Ghodham to Rajpipla. In rajpipla none of the people is affected by fluorosis. Therefore, fluoride in water drawing from deep borewells from the coastal area to the interior parts influence fluorosis. Hence it is obvious that nature of depthness of borewells is a factor for fluorosis.

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REFERENCES

- Standard methods for the examination of water and waste water, American public health association and water pollution control federation AFPH.Edu.16, 156, 1985.
- WHO, Fluoride and human health, 59, 1970.
- [www.fluoride alert.org/growth](http://www.fluoride.alert.org/growth),
- R.Y.Trivedy and P.K Goel, Chemical and Biological Method for Water Pollution studies, Environmental Publications, 215, 1984.
- A.I. Vogel, A text book of quantitative inorganic analysis, Edu 4, 326, 1978.
- National research council fluorides, National Academy of Science, 1971.

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(An ISO 3297: 2007 Certified Organization)

Vol. 3, Issue 3, March 2014

7. S.K. Maiti. Hand book of methods in environmental studies, ABD publishers, 2004.
8. N.S Bhujangaiah and P.Vasudeva Nayak, *Indian J.Chem* , **22**, 42, 2005.
9. N.Kochhar. and V.Dadmal, *Surv.Ind.SP.Publ*, **83**, 293, 2004.
10. ISI, Indian standard institute, drinking water specification, 1991.
11. ICMR, Indian council of Medical Research, Manual of Standards of Quality for Drinking water Supplies, 74,
1975.
12. A.K. Susheela, A Treatise on Fluorosis, Delhi, 53(2001).
13. R.Y. Eagners, Toxic properties of inorganic fluorine compounds, Elsevier publishing company Ltd., 4, 1969.
14. D.Santhi, *Asian Journal of Chemistry*, 19(2), 1269(2006).
15. H.Limanowska, M. Kobylanska and B. George, *Fluoride*, **5**, 15, 1982.
16. *Chemical and engineering news*, Jun 3, 1974.
17. K.V. Rao. A.K. Khandekar and D. Vaidyanadhan, *Indian J. Exper. Bio*, 11, 68, 1975.