

Concentration of Fluoride in Groundwater and its Distribution between Coastal and Interior Areas in Tirunelveli District

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This paper deals with the results of analysis of fluoride and other water quality parameters of ground water 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 interior areas.

Key Words: Fluoride, Ground water, Tirunelveli, Coastal, Interior areas.

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 effects in human beings and animals. Fluoride deficiency, on the other hand may have a harmful influence on the growth of teeth¹. Fluorosis is a kind of disease caused by consuming excessive amounts of fluoride *i.e.* above 1 ppm fixed by ICMR. However with identical concentrations of fluoride in water, variations in the incidence of the disease have been noticed. Thus, it is related to other chemical constituents of drinking water which are protective against the development of fluorosis such as magnesium, calcium and total hardness. After eruption of the teeth, the fluoride content of drinking water has no visible effect on the enamel even though the fluoride content of the teeth increases².

For analysis, the samples of water were collected from Chettikulam located in Radhapuram taluk of Tirunelveli district on the Bay of Bengal and were investigated.

EXPERIMENTAL

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 20. The borewells in the areas were about 100 to 550 feet in depth. All the water samples were analysed for various parameters³⁻⁵. Fluoride was analyzed by spectrophotometer. Total alkalinity, total hardness, calcium, magnesium

and chloride were determined by usual titration methods. pH of the water samples was measured by using pH meter. Electrical conductivity of the water samples was measured by using conductivity bridge.

TABLE-1
PHYSICO-CHEMICAL PARAMETERS IN GROUND WATER SAMPLES

Description of source	Fluoride (ppm)	pH	EC mho/cm	Total alkalinity (ppm)	Total hardness (ppm)	Calcium (ppm)	Magnesium (ppm)	Chloride (ppm)
Chettikulam								
Hand pump water inside the campus of Hr. Sec. School	3.8	7.83	1080	235.29	270	190	80	43.66
Public hand pump water on the main road side	4.8	6.70	2448	224.59	330	240	90	305.65
Public hand pump water at southern side of the pool	3.9	6.68	1278	213.90	360	290	70	32.02
Bore water from Jesu Dasan's house	3.9	6.78	936	235.29	300	240	60	52.39
Chettikulam Pudumanai								
Public hand pump water at western side	3.4	8.43	1494	128.34	380	310	70	40.75
Bore water from Thangavel's	3.5	6.79	1026	203.21	330	275	55	34.93
Sivasakthipuram								
Water from public hand pump on the road side	2.9	6.39	1546	256.68	550	410	140	419.18
Water from public hand pump at northern side of the big pool	3.0	7.45	1746	310.16	750	580	170	489.05
Keelkulam								
Hand pump water at southern side of the pool	2.0	8.34	680	213.80	450	330	120	139.73
Bore water from Mr. Thoma's house	2.0	7.38	610	267.25	460	350	110	58.22
Hand pump water near Amman temple	1.6	7.40	3200	96.21	1510	1380	130	1787.35
Hand pump water on the main road side	2.0	8.13	690	310.01	510	460	50	52.398
Hand pump water at eastern side	3.0	7.37	2260	224.49	690	400	290	1082.89
Mathaganeri								
Bore water from Murugesan's house	1.5	7.21	1079	267.25	1860	1500	360	1717.49
Bore water from Jeyabalan's house	1.0	7.47	1423	160.35	3420	1900	1520	2352.08
Bore water from Thangasuyampu's house	1.7	7.56	1280	256.56	3600	2800	800	2084.28
Bore water from Ganesan's house	1.8	7.91	738	181.73	800	550	250	1210.97
Bore water from Durai's house	2.0	8.01	741	160.35	970	720	250	1251.73
Sempikulam								
Bore water from Abdul Kadar's house	1.0	8.04	532	288.63	620	500	120	291.10
Bore water from Haniba's house	0.9	7.84	511	256.56	760	680	80	87.33

RESULTS AND DISCUSSION

The concentration of natural fluoride in ground water is not uniform in these areas⁶. The fluorotic variation is due to many factors such as sources of water, the geological formation of the area, the amount of rainfall and the quantity of water lost by evaporation. The parameters *e.g.*, pH, alkalinity, calcium, magnesium and chloride which are enhancing fluoride toxicity.

Table-1 reports the findings of the concentration of fluoride and other parameters in ground water samples. In the water samples of these areas, pH ranged from 6.39 to 8.43. The electrical conductance ranged between 511 and 2448 mho/cm. Total hardness and chloride were ranged from 270 to 3600 ppm and 32.02 to 2352.08 ppm. The total alkalinity of these samples ranged from 96.21 to 288.63 ppm.

Concentration of fluoride in Chettikulam ranged from 3.8 to 4.8 ppm, Chettikulam Pudumanai ranged from 2.9 to 3.5 ppm, Keelkulam from 1.6 to 3.0 ppm, Mathaganeri from 1.0 to 2.0 ppm and Sempikulam ranged from 0.9 to 1.0 pm. As the distance increases from the coastal areas of Chettikulam towards interior parts upto Sempikulam, 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 Chettikulam to Sempikulam, the percentage of people affected by fluorosis is also decreases. The average values of fluoride in water and percentage of people affected by fluorosis are given in Table-2.

TABLE-2
AVERAGE VALUES OF FLUORIDE (PPM) IN WATER AND
PERCENTAGE OF FLUOROSIS

Name of the village	Fluoride (ppm)	% of people affected by fluorosis
Chettikulam	4.20	38.50
Chettikulam – Pudumanai	3.45	31.00
Sivasakthipuram	2.95	30.75
Keelkulam	2.12	26.70
Mathaganeri	1.60	Trace
Sempikulam	0.95	Nil

Conclusion

The author found that concentration of fluoride in ground water decreases from 4.8 to 0.9 ppm, on the coastal area of Chettikulam upto Sempikulam. The percentage of people affected by fluorosis also decreases from Chettikulam to Sempikulam. In Sempikulam none of the people is affected by fluorosis. Therefore, the concentration of fluoride in water

drawing from deep borewells from the coastal areas to the interior parts influence fluorosis. Hence it is obvious that nature of depthness of borewell is a factor for fluorosis.

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