

PRELIMINARY STUDIES ON DIFFERENT CHEMICALS FOR DEFLUORIDATION

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ABSTRACT

This paper deals with a comparative study on the fluoride removal capacity of readily and cheaply available five kinds of materials-calcium phosphate, magnesium phosphate, aluminum phosphate, calcium carbonate and magnesium carbonate. Among those materials aluminum phosphate is the most efficient defluoridating agent.

INTRODUCTION

The presence of fluoride in ground water is mainly a natural phenomenon, influenced fundamentally by local regional geological setting and hydrogeological conditions. The Ministry of Health, Govt. of India prescribed 1.0ppm as the permissive concentration of fluoride in drinking water. Ten panchayats of Vallioor union in Tirunelveli District were affected by fluorosis. The amount of fluoride present in drinking water in these areas ranged from 1.2ppm to 6.0ppm.

The fluoride removal methods can be divided into three broad categories namely adsorption, ion-exchange process and precipitation. In the present study precipitation method had been adopted for the removal of fluoride. Precipitation methods involves the addition of chemicals while the fluorides precipitate or co-precipitate. The chemicals employed in this method are calcium phosphate, magnesium phosphate, aluminum phosphate, calcium carbonate and magnesium carbonate.

Water containing excess of fluoride ion have been conventionally treated by the addition of calcium salts to form an insoluble precipitate. The

precipitation process has also been studied by combining magnesium and aluminum salts to facilitate fluoride removal. Because of the high electro negativity of fluoride ion, it has very high affinity to multivalent metal elements.

EXPERIMENTAL STUDIES

At the outset a standard solution of sodium fluoride was prepared and 0.221 g of AR sodium fluoride was dissolved in double distilled water to make the volume one litre. 100ml of this solution was taken and diluted to one litre by adding double distilled water. This stock solution contained 10ppm of fluoride. A series of standard sodium fluoride solutions were prepared with suitable concentration by dilution of the stock solution with double distilled water.

Known volume of standard sodium fluoride solution was mixed with known weight of salts. The reaction mixture was boiled and allowed to stand for 24 hours. The solution was filtered through Whatman No. 42 filter paper. The filtrate was used for the analysis of fluoride and pH. The fluoride was analysed by using spectrophotometer. The experiment was repeated for changing the amount of above said salts.

RESULTS AND DISCUSSION

The experimental values are shown in the table 1. By the treatment of the magnesium phosphate, it reduced the fluoride value from 5ppm to 2ppm and pH of the resulting the change of water from 7.30 to 8.17 within the permissible limit of pH.

Under the treatment of calcium phosphate, the fluoride value came down from 5ppm to 2.6ppm and pH of resulting the change of solution from 7.30 to 5.50 the solution became acidic. By the treatment of calcium and magnesium carbonate, the fluoride came down effectively but the solution became more alkaline.

Under the treatment of aluminum phosphate, the fluoride was brought down to the permissible limit 1.5ppm according to World Health Organisation, but resulting solution became more acidic.

CONCLUSION

All the defluoridating agents used for this analysis very effectively removed the fluoride. Among these defluoridating aluminum phosphate is more efficient due to the tripositive metal ion of aluminum. The investigation is used for academic purpose only.

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Table 1. Preliminary studies on different chemical for defluoridation

Sl. No.	Material used	Amount of material is gm	Volume of standard NaF solution in mL	Concentration of Fluoride (ppm)		pH		Remarks
				Initial	After treatment	Initial	After treatment	
1.	Magnesium phosphate	0.1	100	5	4.0	7.30	7.93	Resulting water became alkaline but in the permissible
		0.2	100	5	3.4	7.30	8.17	
		0.3	100	5	3.0	7.30	8.21	
		0.4	100	5	2.4	7.30	8.26	
		0.5	100	5	2.0	7.30	8.17	
2.	Calcium phosphate	0.10	100	5	4.1	7.30	5.83	Resulting water became acidic
		0.15	100	5	3.9	7.30	5.79	
		0.20	100	5	3.5	7.30	5.67	
		0.25	100	5	3.2	7.30	5.66	
		0.30	100	5	2.6	7.30	5.50	
3.	Aluminum phosphate	0.10	100	5	3.9	7.23	5.69	Acidic
		0.15	100	5	3.4	7.23	5.59	
		0.20	100	5	2.9	7.23	5.20	
		0.25	100	5	2.0	7.23	4.76	
		0.30	100	5	1.5	7.23	4.49	
4.	Calcium carbonate	0.10	100	5	4.5	6.94	8.50	Alkaline above the permissible limit.
		0.15	100	5	4.2	6.94	8.56	
		0.20	100	5	4.0	6.94	8.67	
		0.25	100	5	3.9	6.94	8.69	
		0.30	100	5	3.9	6.94	8.84	
5.	Magnesium carbonate	0.10	100	5	4.2	6.94	9.56	Alkaline above the permissible limit.
		0.15	100	5	3.6	6.94	9.64	
		0.20	100	5	3.0	6.94	9.65	
		0.25	100	5	2.8	6.94	9.63	
		0.30	100	5	2.8	6.94	9.63	

this investigation.

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