

DEFLUORIDATION OF DRINKING WATER USING LOCALLY AVAILABLE LOW COST ADSORBENTS

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ABSTRACT

A study was conducted to investigate the possibility of removing fluoride from water using low cost adsorbents such as Acacia Catechu, Cuminum cyminum, Coens vettriverodies, Eletaria cardamomum, Phyllanthus embilica, Strychnos potatorum and Tamarindus indica.

INTRODUCTION

In Vallioor Union of Tirunelveli District most of the people are dependent on ground water for drinking. But the ground water is contaminated with dissolved inorganic substances namely fluoride, which makes the water unsafe for drinking. Fluoride is one such constituent found in ground water in Vallioor Union causes dental and skeletal fluorosis. The excess of fluoride in drinking water can be removed by adopting various methods using various adsorbents.

The defluoridating agents may be divided into three basic types depending upon the process of removal of fluoride.

1. Those based on adsorption process.
2. Those based on ion-exchange process.
3. Those based on some kinds of chemical reaction with fluoride.

In the present study the adsorption process has been adopted.

Characteristics of a good adsorbent

1. The adsorbents must be available locally.
2. The cost of the adsorbents must be low.
3. The materials should have powerful removal capacity of fluoride.
4. The materials should not give any other side effects.
5. The method of operation must be easy.
6. The materials should be readily acceptable to the users.

MATERIALS AND METHODS

In the present study the following adsorbents have been selected for defluoridation.

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|-------------------------|------------------------|
| 1. Acacia catechu | 2. Coens vettiverodies |
| 3. Cuminum cyminum | 4. Eletaria cardamomum |
| 5. Phyllanthus embilica | 6. Strychnos potatorum |
| 7. Tamarindus indica | |

All the adsorbents except tamarindus indica were separately weighed. The known weight of adsorbent pieces were mixed with known volume of standard solution of sodium fluoride, boiled, cooled and then filtered. The filtrate was used for fluoride analysis using ion selective electrode.

0.1 gram of tamarind (dry fruit) was dissolved in 100ml of distilled water and 0.05 mg AR sodium chloride was added and mixed thoroughly with a glass rod. Then the solution was filtered through Whatman No.42 filter paper. The filtrate was used to dilute the stock sodium fluoride solution to suitable concentrations such as 6ppm, 7ppm and 8ppm. This mixture was taken in a beaker and heated for boiling. Then the solution was allowed to cool and the concentration of fluouride was noted by using ion selective electrode.

RESULTS AND DISCUSSION

The Table -2 indicates the values of defluoridation. All the adsorbents reduced the fluoride content, but the pH values of resultant water also lowered.

Among these defluoridating agents Eletaria cardomomum showed the best results obtained. Other defluoridating agents also reduced the fluoride

Table - 1
Botanical and English name of the adsorbents.

Sr. No.	Botanical Name	English Name
1.	Acacia catechu	Black catechu
2.	Coens vettiverodies	Cuscus grass
3.	Cuminum cyminum	Cumin seeds
4.	Eletaria cardamomum	Cardamom
5.	Phyllanthus embilica	Indian Cooseberry
6.	Strychnos potatorum	Clearing nut
7.	Tamarindus indica	Tamarind

Table - 2
Low cost adsorbents for defluoridation of drinking water.

Sr. No.	Material Used	Amount of material	Quantity of water (in grams)	Fluoride content (ppm)		Initial pH	pH After treatment	Results of the use of Adsorbents
				Initial (in ml)	After treatment			
1.	Acacia catechu	2	200	6	5.02	8.0	5.97	Fluoride content is reduced and the colour of the resultant water is brown and acidity of the water increases.
		2	200	7	6.30	8.0	5.92	
		2	200	8	6.33	8.0	5.88	
2.	Coens vettiveradies	2	200	6	3.94	7.9	6.95	Fluoride content is reduced and thepH of resultant water is slightly reduced.
		2	200	7	4.37	7.9	6.96	
		2	200	8	4.66	7.9	6.95	
3.	Cuminum cyminum	1	100	6	3.93	7.8	7.2	Fluoride content is reduced and pH of resultant water and pH of water is also slightly changed.
		1	100	7	4.08	7.8	7.2	
		1	100	8	5.02	7.8	7.2	
4.	Eletaria cardamomum	1	100	6	2.93	7.8	7.34	Fluoride content to reduced and the pH of resultant water is not much changed.
		1	100	7	3.86	7.8	7.28	
		1	100	8	5.36	7.8	7.11	
5.	Phyllanthus embillica	2	200	6	2.09	7.8	6.54	Fluoride content is much reduced and the colour of the resultant water is pale brown & acidity of the water increases.
		2	200	7	2.98	7.8	6.59	
		2	200	8	3.91	7.8	6.57	
6.	Strychnos potatorum	1	100	6	4.62	7.9	6.98	Fluoride content is slightly reduced and the colour of the resultant water is not changed and pH of the solution is slightly lowered.
		1	100	7	5.74	7.9	6.91	
		1	100	8	6.62	7.9	6.87	
7.	Tamarindus indica	1	1000	6	3.14	7.8	4.53	Fluoride content is slightly reduced but tamarindus indica cannot be directly used because acidity of the water increased.
		1	1000	7	3.30	7.8	4.63	
		1	1000	8	2.66	7.8	4.81	

concentrations but pH value was also highly lowered (ie) water became acidic.

The investigation revealed the fact that the people should be provided drinking water containing fluoride in permissible range (1 ppm) in addition to the diet with sufficient dose of calcium, vitamin C, vitamin E and antioxidants.

CONCLUSION

Drinking water is an important basic need. Hence people should consume protected water containing fluoride within the prescribed limits. If not, they will be affected by dental and skeletal fluorosis.

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