DEFLUORIDATION OF DRINKING WATER USING
LOCALLY AVAILABLE LOW COST ADSORBENTS

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Key words : Defluoridation, Drinking water, Ion selective electrode.

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.
DEFLUORIDATION OF DRINKING WATER USING

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.

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 fluoridate 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 cardamomum showed the best results obtained. Other defluoridating agents also reduced the fluoride content, but tamarindus indica was not among them because acidity of the water increased.

Table - 1

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

Table - 2

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Material Used</th>
<th>Amount of material (in grams)</th>
<th>Quantity of water (in ml)</th>
<th>Initial Fluoride content (ppm)</th>
<th>Initial pH</th>
<th>Treatment</th>
<th>Final Fluoride content</th>
<th>Final pH</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Acacia catechu</td>
<td>100</td>
<td>600</td>
<td>6</td>
<td>7.9</td>
<td>Boiling</td>
<td>2.9</td>
<td>7.3</td>
</tr>
<tr>
<td>2</td>
<td>Coens vettiverodies</td>
<td>200</td>
<td>600</td>
<td>6</td>
<td>7.9</td>
<td>Boiling</td>
<td>2.9</td>
<td>7.3</td>
</tr>
<tr>
<td>3</td>
<td>Cuminum cyminum</td>
<td>100</td>
<td>600</td>
<td>6</td>
<td>7.9</td>
<td>Boiling</td>
<td>2.9</td>
<td>7.3</td>
</tr>
<tr>
<td>4</td>
<td>Eletaria cardamomum</td>
<td>100</td>
<td>600</td>
<td>6</td>
<td>7.9</td>
<td>Boiling</td>
<td>2.9</td>
<td>7.3</td>
</tr>
<tr>
<td>5</td>
<td>Phyllanthus embilica</td>
<td>100</td>
<td>600</td>
<td>6</td>
<td>7.9</td>
<td>Boiling</td>
<td>2.9</td>
<td>7.3</td>
</tr>
<tr>
<td>6</td>
<td>Strychnos potatorum</td>
<td>100</td>
<td>600</td>
<td>6</td>
<td>7.9</td>
<td>Boiling</td>
<td>2.9</td>
<td>7.3</td>
</tr>
<tr>
<td>7</td>
<td>Tamarindus indica</td>
<td>1000</td>
<td>600</td>
<td>6</td>
<td>7.9</td>
<td>Boiling</td>
<td>2.9</td>
<td>7.3</td>
</tr>
</tbody>
</table>
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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REFERENCES

Sym. on Fluorosis, Hyderabad. 285.
Kulkarni, D.N., and Nawlakha, W.G. 1974. Ind J. Enl Hlth.16 : 15
Vaidhya Rethna Murugesu Mudaliyar, K.S. 1998. Former Head Master Sidha Medicine Theological Indian Medical College, Chennai, Tamil Nadu Sidha Medical Board.