

# DEFLUORIDATION OF GROUNDWATER BY USING MODIFIED MORINGA SEEDS POWDER

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**Abstract** - De-fluoridation of ground water is necessary to eliminate the fluoride content in water. The maximum fluoride content was found to be 3.07mg/L, which was recorded from the tube wells of Jajurayanahalli village in Pavagada taluk, Tumkur district [May 2022]. The permissible range of Fluoride in potable water is 0.6-1.2mg/L according to Bureau of Indian Standard. Excess fluoride in potable water causes tooth and bone fluorosis also whole part of the body. Hence, it is necessary to reduce the fluoride content in ground water. There are different techniques for fluoride like precipitation method, exchange method, electro-coagulation method etc. where the adsorption technique was found to be efficient & effective for the fluoride elimination. The efficient adsorbent was found in Moringa Oleifera seeds powder which is having 90-95% percent fluoride elimination potency.

**Key Words:** Moringa Oleifera, Adsorption, Fluoride elimination potency.

## 1. INTRODUCTION

Fluoride content in water is required for all forms of life. Day by day quality of water is decreasing by human activities. Fluorines are generally found in rocks and minerals. Fluoride has dual significance it is advantage, when it is in permissible limit when limit exceeds it causes many problems. Excess fluoride content in water causes skeletal and dental fluorosis. Fluorine is the chemical element having the atomic number 9 and found in a periodic table it is a P block element having a melting point of 53.48K and boiling point 85.03K. The permissible limit of fluoride varies from 0.6-1mg/L according to IS 10500:2012. One of the most successful methods for decreasing fluoride content in drinking water is adsorption.

## 2. MATERIALS AND METHADODOLOGY

- Moringa Oleifera seeds.
- What's man filter paper no 41.
- Nitric Acid.
- Sodium Hydroxide.

### 2.1 Collection of moringa oleifera Seeds

Moringa oleifera seed powders are used in this project were collected from drumstick trees from Tumkur. The seeds shells were removed manually by hands and de-husk the seeds kernels, then washed with distilled water and dried in solar until 7 days. The dried sample powdered in a grinder at home, then sieve the sample to get a particle length of 300µm.



Fig-1: Moringa oleifera with pods



Fig-2: Moringa oleifera seeds without pods

### 2.2 Collection of water samples

For this project water samples are collected from tube-wells of the Pavagada Taluk, Tumkur district, during May 2022. About 5 liters of water are collected and then basic tests like pH, fluoride ion concentration, turbidity, total hardness is examined by Environmental laboratory, (C.I.T. Gubbi)

### 2.3 Preparation of adsorbent

There are mainly classified into two types

Acid Remedy

1N of nitric acid is prepared by dissolving 70ml of concentrated HNO<sub>3</sub> in 930ml of distilled water. Weigh about 50g of 300µm retain moringa oleifera seeds was added to 500 ml of 1N HNO<sub>3</sub>. Stir properly with glass rod until to get

uniform color and mixing. Then it was boiled for 25 minutes, after that the sample was washed using distilled water. Finally the sample dried in an oven at 50°C for 8 hours.

**Alkali Remedy**

0.5 N of NaOH is prepared by dissolving 40g of NaOH tablets in distilled water. weigh about 50g of 300µm retain moringa oleifera seeds was added to 500 ml of 0.5N NaOH. Stir properly with glass rod until to get uniform color and mixing. Then it was boiled for 25 minutes, after that the sample was washed using distilled water. Finally the sample dried in an oven at 50°C for 8 hours.

**2.4 Factors affect the elimination of fluoride-ion concentrations**

There are three major conditions which affects elimination of fluoride are;

- Variation with pH
- Variation with dosage
- Variation with contact time

**2.4.1 Variation with pH**

The removal of fluoride content by Moringa Oleifera seed powder experiment was takes place in a 250 ml conical flask. Take 100 ml of water sample containing initial concentration of fluoride ion is known (2.237mg/L) and different pH used to be from 4, 7 and 9.2 for different samples. Then add acid and alkali remedy adsorbent dose to the sample having size of 300µm with an adsorbent dose of 300mg/L for contact time of 2 hours. Then filtered using Whatman's filter paper no 41 and sample is collected. Then sample was used for fluoride ion estimation using the SM 4500-F- C. Ion- Selective Electrode Method.

**2.4.2 Variation with dosage**

250 ml conical flask the use of 100 ml of groundwater sample containing natural pH and initial concentration of fluoride ion is known (2.237mg/L). Then add adsorbent having 300µm size, with an adsorbent dose of 300mg/L, 400mg/L and 500mg/L with a contact time of 2 and half hours for both acid remedy and alkali remedy. Then filtered using Whatman's filter paper no 41 and sample is collected. Then sample was used for fluoride ion estimation using the SM 4500-F- C. Ion- Selective Electrode Method

**2.4.3 Variation with contact time**

250 ml conical flask the use of 100 ml of groundwater sample containing natural pH and initial concentration of fluoride ion is known (2.237mg/L). Then add adsorbent having 300µm size, with an adsorbent dose of 300mg/L and a contact time of 1hour to2.5hours for both acid remedy and

alkali remedy. Then filtered using Whatman's filter paper no 41 and sample is collected. Then sample was used for fluoride ion estimation using the SM 4500-F- C. Ion- Selective Electrode Method.

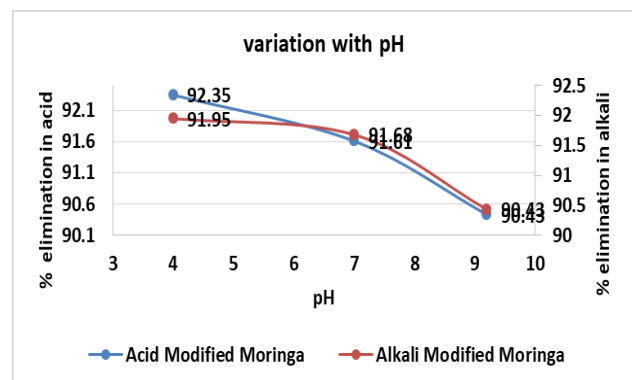
**3. RESULTS AND THEIR GRAPHS**

**Table -1:** Variation with pH by Acid Modified

Sl. No.	pH	Acid modified sample		
		Initial Conc. of F <sup>+</sup>	Final Conc. of F <sup>+</sup>	% of F <sup>+</sup> removed
1	4	2.237	0.171	92.35
2	7	2.237	0.194	91.61
3	9.2	2.237	0.214	90.43

**Table -2:** Variation with pH by Alkali Modified

Sl. No	pH	Alkali modified sample		
		Initial Conc. of F <sup>+</sup>	Final Conc. of F <sup>+</sup>	% of F <sup>+</sup> removed
1	4	2.237	0.180	91.95
2	7	2.237	0.186	91.68
3	9.2	2.237	0.190	91.50



**Chart -1:** Variation with pH

Above graph depicts the percentage elimination of fluoride ions of water treated with acid modified moringa seeds and alkali modified moringa seeds. The elimination is observed to be increasing with varying pH of 4, 7 and 9.2 respectively. This is due to the composition of moringa seeds.

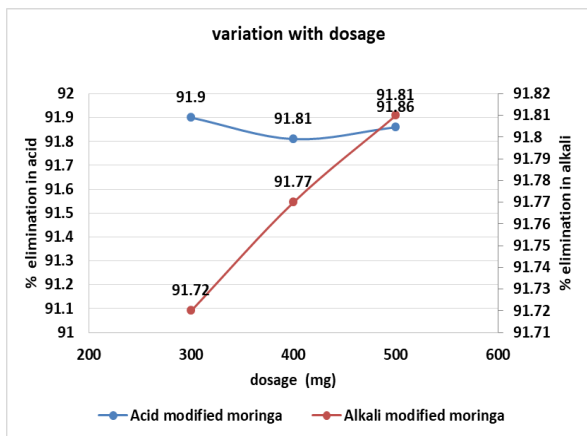
Moringa seeds are considered to be positively charged whereas the contaminants are treated as negatively charged. As the raw water is treated with moringa seeds the opposite charges neutralize thereby reducing the fluoride content.

**Table -3:** Variation with Dosage by Acid Modified.

Sl. No.	Adsorbent dosage	Acid modified sample		
		Initial Conc. of F <sup>+</sup>	Final Conc. of F <sup>+</sup>	% of F <sup>+</sup> removed
1	300	2.237	0.181	91.90
2	400	2.237	0.183	91.81
3	500	2.237	0.182	91.86

**Table -4:** Variation with Dosage by Alkali Modified.

Sl. No.	Adsorbent dosage	Alkali modified sample		
		Initial Conc. of F <sup>+</sup>	Final Conc. of F <sup>+</sup>	% of F <sup>+</sup> removed
1	300	2.237	0.174	91.72
2	400	2.237	0.187	91.77
3	500	2.237	0.183	91.81



**Chart -2:** Variation with dosage

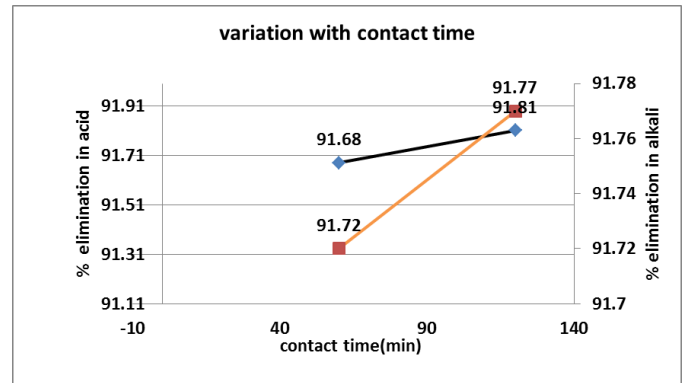
Above graph depicts the percentage elimination of fluoride ions of water treated with acid modified moringa seeds and alkali modified moringa seeds. The elimination is observed to be with varying of sample dosage. The moringa seeds reduce the turbidity in water as moringa seeds behaves like a coagulant.

**Table -5:** Variation with Contact time by Acid Modified.

Sl. No.	Contact time	Acid modified sample		
		Initial Conc. of F <sup>+</sup>	Final Conc. of F <sup>+</sup>	% of F <sup>+</sup> removed
1	60	2.237	0.186	91.68
2	120	2.237	0.183	91.81

**Table -6:** Variation with Contact time by Alkali Modified.

Sl. No.	Contact time	Alkali modified sample		
		Initial Conc. of F <sup>+</sup>	Final Conc. of F <sup>+</sup>	% of F <sup>+</sup> removed
1	60	2.237	0.185	91.72
2	120	2.237	0.184	91.77



**Chart -3:** Variation with Contact time

Above graph depicts the percentage elimination of fluoride ions of water treated with acid modified moringa seeds and alkali modified moringa seeds. The elimination is observed to be increasing with adsorbent dose with increase in detention period.

#### 4. CONCLUSIONS

Moringa oleifera is an eco-friendly natural coagulant that can be adopted for the water treatment containing excess amount of fluoride concentrations. Experimental investigations results show the minimum dosage of Moringa oleifera adsorbent dose of 300 mg/L with pH of 4 and natural pH with the Contact time of 2 hours in the water. However, the contact time can be reduced for the drinking water purpose. This results in maintaining presence of fluoride within permissible limits as per IS standards. The best adsorption condition was reached using Moringa oleifera adsorbent dose of 300 mg/L with pH of 4, with the Contact time of 2 hours in the water, achieving this way 92.35% of fluoride reduction in the sample water. The optimal removal of fluoride ions of contact time of 2 hours at 300mg/L of acid remedy with natural pH of sample of water having elimination potential of 91.81%. In variation with the adsorbent dosage the maximum removal of fluoride ions is 91.90% achieved at 300mg/L of acid remedy at natural pH of water.

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