

DEFLUORIDATION OF GROUNDWATER BY MODIFIED MORINGA SEEDS

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Introduction:

- Fluorosis water is a very essential element for all forms of life and is indispensable to the maintenance of life on earth. Pure mineral water is the basic requirement of every human being. Water quality degrades by either natural or manmade sources.
- Indian standard specification for fluoride in drinking water is 0.6 – 1.0 ppm
- Among the water contaminants, fluoride is such a contaminant that has dual significance within permissible limits it is beneficial and it can cause many problems when its limit exceed. Fluoride is a compound form of fluorine (F) its concentration in water is depending on the sources of water.

Objectives:

- To identify a sustainable, low cost, locally available, simple, reliable, acceptable, eco-friendly, household level point of use water treatment technology most suitable for rural population of developing countries.
- To find a process that allowed efficient removal of fluoride from aqueous systems.

Methodology:

Materials used

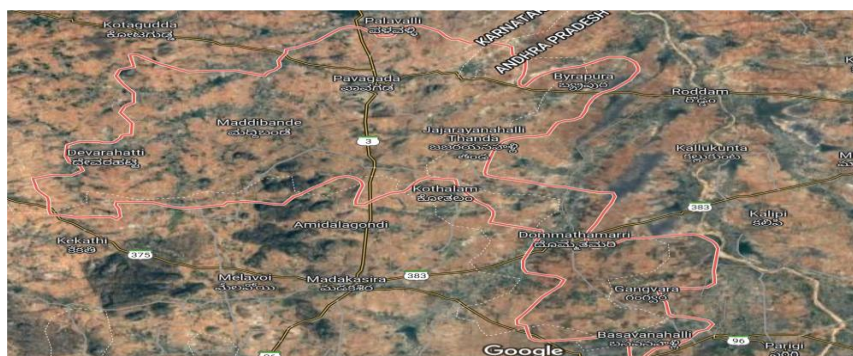
- Moringa oleifera seed powder.
- 1 N Nitric acid (HNO₃).
- 0.5 N Sodium hydroxide (NaOH).
- Whatman's filter paper no-41

Collection of Adsorbent:

- Moringa oleifera seeds used in this experiment were collected from local trees from Tumakuru.
- Pod shells were removed manually and de-husked seeds kernels, then washed properly with distilled water to rid of dust and dried in solar until 6 days.
- The dried sample changed into micronized in a grinder at home to powder, then sieve to get a particle length of 300µm, then used as adsorbent.

Collection of water samples:

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



Village name –Jajurayanahalli

Preparation of adsorbent:

- 50g of the powder was added to 500 ml of 1N HNO₃ (465ml of sample +35ml conc HNO₃) for acid remedy and 50g powder was added to 0.5N NaOH (20g of tablets in 500ml sample) for alkali remedy.
- The mixture was boiled about 25 minutes, after that the sample of powder was washed using distilled water finally again dried in an oven at 55 degrees Celsius for 7 hours.

Variation of PH on fluoride elimination:

- The elimination of fluoride experiment by Moringa Oleifera seed powder was performed in a 250 ml conical flask the use of 100 ml of groundwater sample containing different pH and initial concentration of fluoride ion (2.237mg/L).
- The PH used to be from 4,7,9.2 for both acid modified Moringa oleifera seeds powder and for alkali modified Moringa oleifera seeds powder.
- Then add adsorbent having 300µm size, with an adsorbent dose of 300mg/L and a 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.

Variation of contact time on fluoride elimination:

- 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 300 μ m size, with an adsorbent dose of 300mg/L and a contact time of 1hours to 2hours 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.

Variation of adsorbent dosage on fluoride elimination:

- 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 300 μ m size, with an adsorbent dose of 300 mg/L ,400mg/L and 500 mg/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.

Experimental Results:

Impact of PH on fluoride elimination

Sl. No.	pH	Acid Modified Moringa oleifera powder			pH	Acid Modified Moringa oleifera powder		
		Initial conc of fluoride ion	final conc of fluoride ion	% elimination potency		Initial conc of fluoride ion	final conc of fluoride ion	% elimination potency
1	4	2.237mg/L	0.171mg/L	92.35	4	2.237mg/L	0.180mg/L	91.95
2	7	2.237mg/L	0.194mg/L	91.61	7	2.237mg/L	0.186mg/L	91.68
3	9.2	2.237mg/L	0.214mg/L	90.43	9.2	2.237mg/L	0.190mg/L	91.50

Impact of contact time on fluoride elimination

Sl. No.	Contact time	Acid Modified Moringa oleifera powder			Contact time	Acid Modified Moringa oleifera powder		
		Initial conc of fluoride ion	final conc of fluoride ion	% elimination potency		Initial conc of fluoride ion	final conc of fluoride ion	% elimination potency
1	60min	2.237mg/L	0.186mg/L	91.68	60min	2.237mg/L	0.185mg/L	91.72
2	120min	2.237mg/L	0.183mg/L	91.81	120min	2.237mg/L	0.184mg/L	91.77

Impact of adsorbent dosage on fluoride elimination

Sl. No.	Adsorbent dosage	Acid Modified Moringa oleifera powder			Adsorbent dosage	Acid Modified Moringa oleifera powder		
		Initial conc of fluoride ion	final conc of fluoride ion	% elimination potency		Initial conc of fluoride ion	final conc of fluoride ion	% elimination potency
1	300mg/L	2.237mg/L	0.181mg/L	91.90	300mg/L	2.237mg/L	0.174mg/L	91.72
2	400mg/L	2.237mg/L	0.183mg/L	91.81	400mg/L	2.237mg/L	0.187mg/L	91.77
3	500mg/L	2.237mg/L	0.182mg/L	91.86	500mg/L	2.237mg/L	0.183mg/L	91.81

Conclusion:

Moringa oleifera is an environmentally-friendly natural coagulant most suitable for the treatment of water containing undesirable fluoride concentrations. Based on the experimental test results, the following conclusion can be drawn.

- The best adsorption condition was reached using Moringa oleifera adsorbent dose of **300mg/L** with PH of **4**, with the Contact time of **2hours** 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 **2hours 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.
- It is an eco-friendly technology that is economically more advantageous than other treatment alternatives.

Scope of future works:

- Diversity of different adsorbents.
- Different particle size can be used as adsorbent.
- The combination of adsorbents like Tamarind seed powder and moringa oleifera seeds powder.
- high-potency fluoride in water sample can be eliminate from ninety to ninety-five percent.