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Published 2005



Moringa seeds with outer seed coat.

In addition to food, shelter and clothing, water is one of our basic human needs, and lack of potable water is a major cause of death and disease in our world. The purpose of this document is to provide information on household water treatment using seeds of the Moringa oleifera tree.

Using natural materials to clarify water is a technique that has been practiced for centuries and of all the materials that have been used, seeds of moringa have been found to be one of the most effective.

Studies have been conducted since the early 1970's to test the effectiveness of moringa seeds for treating water. These studies have confirmed that the seeds are highly effective in removing suspended particles from water with medium to high levels of turbidity (moringa seeds are less effective at treating water with low levels of turbidity).

Theory

Moringa oleifera seeds treat water on two levels, acting both as a coagulant and an antimicrobial agent. It is generally accepted that moringa works as a coagulant due to positively charged, water-soluble proteins, which bind with negatively charged particles (silt, clay, bacteria, toxins, etc) allowing the resulting “flocs” to settle to the bottom or be removed by filtration.

The antimicrobial aspects of moringa continue to be researched. Findings support recombinant proteins both removing microorganisms by coagulation as well as acting directly as growth inhibitors of the microorganisms. While there is ongoing research being conducted on the nature and characteristics of these components, it is accepted that treatments with moringa solutions will remove 90%–99.9% of the impurities in water.

Water Treatment

Solutions of moringa seeds for water treatment may be prepared from seed kernels or from the solid residue remaining after oil extraction (presscake). Moringa seeds, seed kernels or dried presscake can be stored for long

periods but moringa solutions for treating water should be prepared fresh each time. In general, 1 seed kernel will treat 1 liter (1.056 qt) of water.

Dosage Rates:

Low turbidity	NTU* <50	1 seed per 4 liters (4.225 qt) water
Medium turbidity	NTU 50–150	1 seed per 2 liters (2.112 qt) water
High turbidity	NTU 150–250	1 seed per 1 liter (1.056 qt) water
Extreme turbidity	NTU >250	2 seeds per 1 liter (1.056 qt) water

*NTU: Nephelometric Turbidity Unit

Steps for Household Water Treatment

1. Collect mature *Moringa oleifera* seed pods and remove seeds from pods.
2. Remove seed coat to obtain clean seed kernels; discard discolored seeds.
3. Determine quantity of kernels needed based on amount and turbidity of water; in general 1 seed kernel will treat 1 liter (1.056 qt) of water.
4. Crush appropriate number of seed kernels (using grinder, mortar & pestle, etc) to obtain a fine powder and sift the powder through a screen or small mesh.
5. Mix seed powder with a small amount of clean water to form a paste.
6. Mix the paste and 250 ml (1 cup) of clean water into a bottle and shake for 1 minute to activate the coagulant properties and form a solution.
7. Filter this solution through a muslin cloth or fine mesh screen (to remove insoluble materials) and into the water to be treated.
8. Stir treated water rapidly for at least 1 minute then slowly (15–20 rotations per minute) for 5–10 minutes.
9. Let the treated water sit without disturbing for at least 1–2 hours.
10. When the particles and contaminants have settled to the bottom, the clean water can be carefully poured off.
11. This clean water can then be filtered or sterilized to make it completely safe for drinking.
 - a. Sand Water filters: www.cawst.org/en/resources/biosand-filter
 - b. Solar Sterilization: http://www.sodis.ch/index_EN
 - c. Chlorination: 1–2 drops per liter (1.056 qt)
 - d. Boiling: minimum of 5 minutes



Contaminated water before and after moringa treatment. Photo by Beth Doerr.

Dangers

- **Secondary infection.** The process of shaking and stirring must be followed closely to activate the coagulant properties; if the flocculation process takes too long, there is a risk of secondary bacteria growth during flocculation.
- **Recontamination.** The process of settling is important. The sediment at the bottom contains the impurities so care must be taken to use only the clear water off the top and not allow the sediment to recontaminate the cleared water.
- **Additional contaminants.** Moringa treatment does not remove 100% of water pathogens. It is acceptable for drinking only where people are currently drinking untreated, contaminated water.

Additional Notes

- Seeds of *Moringa stenopetala* have been found to be more effective than *Moringa oleifera* for purifying water.
- Some studies have found that the levels of the active components in moringa seeds were lower in the rainy season suggesting that seeds for water purification should be collected during the dry season.
- For water with medium turbidity levels, 2 trees could supply sufficient seeds for water treatment for a family of five.

Relevant Websites

<http://www.jalmandir.com/>

<http://www.lboro.ac.uk/well/resources/technical-briefs/technical-briefs.htm>

<http://www.le.ac.uk/engineering/staff/Sutherland/moringa/moringa.htm>

http://www.who.int/household_water/en/

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