# Comparative Evaluation of *Moringa oleifera* Seed Forms for Low-Cost Water Treatment

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## Introduction

According to the BCM Water and Sanitation Department, about 2.1% of the population in East London, South Africa, still do not have access to potable water. This is still concerning as everyone deserves clean drinking water; therefore, research will continue to find a suitable filter using natural substances such as *Moringa oleifera seeds (MOS)* to reduce the percentage not receiving clean water.

Moringa is a tropical tree belonging to the family of *Moringaceae*. This plant grows quickly in low altitudes in the whole tropical belt, including arid zones. *Moringa oleifera* is a natural coagulant containing a cationic protein that neutralises particles in turbid water. Studies show MOS reduces turbidity, colour, and chemical oxygen demand by up to 99%. Shelled Moringa seeds are more effective than unshelled ones. MOS works best in high turbidity water and is biodegradable and low-cost.

## Problem, Aim & Hypothesis

**Problem:** Rural communities lack affordable and effective water treatment methods.

**Aim:** To find the most effective form of moringa seed that will reduce impurities in untreated water to acceptable levels for drinking.

**Hypothesis:** The powder form of moringa seed will reduce impurities in untreated water to acceptable levels for drinking.

## Method

**Tested three forms of MOS:** whole, crushed, and powdered.

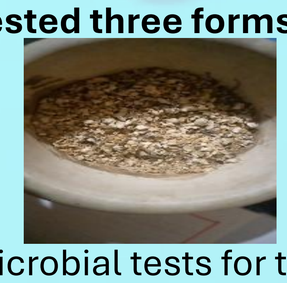

**Figure 1**: Crushed MOS

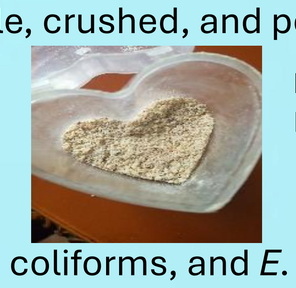

**Figure 2**: Powdered MOS

Microbial tests for total microbes, coliforms, and *E. coli* were conducted on untreated and MOS-treated water samples at the BCM Water Services laboratory. Shelled, crushed, and powdered MOS seeds were added to separate bottles, gently mixed, and sampled at intervals of 10 minutes, 30 minutes, 1 hour, and 2 hours while observing changes in colour, turbidity, and particle settling. Laboratory results were received after three days and recorded for analysis.

Turbidity test was done to determine the optimum dosage of powdered MOS, 5 g, 10 g, 15 g, and 20 g of MOS were each added to 1 L of water. The samples were mixed in a jar test apparatus at 200 Hz for 3 minutes, then at 45 Hz for 12 minutes. After mixing, the water was filtered through filter paper, and the turbidity of each sample was measured using a turbidimeter to evaluate the effectiveness of each dosage.

**Figure 3:** Test jars before spinning

**Figure 4:** Test jars after spinning

**Figure 5**: Filtration

## Results

**Table 1:** Shows the total coliform and E.coli colony-forming units per millilitre in the different MOS forms

| | Total coliforms (cfu/100ml | E. coli (cfu/1 ml) |
|---|---|---|
| Water | >2420 | 613 |
| Crushed form | >2420 | 276 |
| Whole unshelled seed | >2420 | 240 |
| Powder form | >2420 | 43 |
| Specifications SANS 241 | <= 10 | Not detected |

The table clearly shows that all forms of Moringa seeds reduced E. coli, but the powdered form achieved the greatest reduction (from 613 to 43 cfu/ml). However, total coliform levels remained high

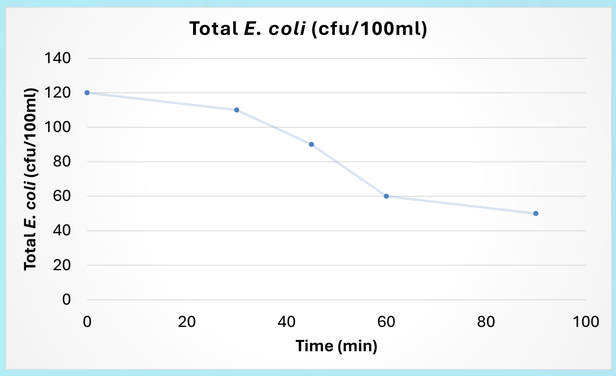


**Figure 6:** A graph showing the *E.coli* counts per 100ml of water

Shows a rapid drop in *E. coli* colony-forming units per millilitre after adding powder MOS extract, indicating that the extract was particularly effective against this specific indicator of faecal contamination

Shows a gradual decrease in total coliform counts over time, indicating that powder MOS extract slowly inhibited general bacterial growth.

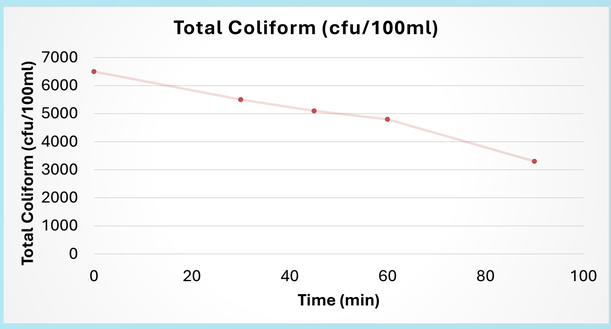


**Figure 7:** A graph showing the total coliform counts per 100ml of water

## Discussion

The powdered form of MOS proved to be the most effective in reducing *E. coli* and turbidity due to its larger surface area, which enhances coagulation and flocculation. Results showed that both time and dosage significantly affected water clarity, with the best outcome at 5 g/L and longer settling periods. While *E. coli* levels dropped significantly, the total coliform counts did not show a comparable decrease. This inconsistency was likely due to contamination introduced during handling, as gloves were not worn and the seeds were not sterilised before testing.

The findings suggest that sterilisation using 70% ethanol and improved aseptic procedures would yield more reliable results. Moreover, the study confirmed that MOS works best in water with high turbidity levels, as its coagulating proteins attach to suspended particles more efficiently in such conditions.

## Limitations and Recommendations

Limitations:

- Gloves not worn, possible contamination.
- Water still needs disinfection post-filtration.

Recommendations:

- Develop a household filtration system.
- Conduct multiple trials under lab conditions.

## Conclusion

The powdered Moringa oleifera seed proved to be a powerful natural purifier, reducing E. coli and turbidity to near-safe levels. Its affordability, availability, and eco-friendly nature make it a promising solution for clean water access in rural communities.

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