



Effect of Shelled and Unshelled Moringa Seed on Fecal Coliform Reduction in Water Treatment

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Abstract

This research presents the effect of shelled and unshelled Moringa seed on fecal coliform in water treatment. Bacteriological analysis was conducted on a natural occurring water to examine the effect of the shelled and unshelled Moringa seed on fecal coliform reduction. The treatment variables, shelled and unshelled Moringa seeds were used under the same temperature and environmental conditions. Raw water samples were collected and subjected to post-treatment analysis. The treatment variable was used at a treatment level of 50ml and 75ml Moringa seed aqueous solution which was produced at 40g/l. The presence and reduction of fecal coliform was analyzed. The shelled Moringa seed aqueous solution produced an average of 76% fecal coliform reduction level as against the unshelled Moringa seed aqueous solution with 73.5% fecal coliform reduction level. The result showed that the lowest coliform level was 1811cfu/ml and 1899cfu/ml after treatment with the shelled and unshelled 50ml Moringa Oleifera seed sample respectively while at 75ml treatment level, the result also showed 1860cfu/ml and 1977cfu/ml respectively for the shelled and unshelled Moringa seed sample. The analysis showed clearly that the unshelled Moringa will serve as a better fecal coliform reduction agent.

1. Introduction

Water is indispensable for life and the presence of disease causing microbes in water is unhealthy and even life-threatening. The quality of water has a lot to do with the usage and acceptability of the natural resource for whatever purpose. Whatever the case, for water to be acceptable as safe enough for direct human consumption and good enough for domestic uses, the water quality must be ascertained and the portability of the water verified. Water is portable when its physio-chemical and bacteriological characteristics meet certain prescribed standards [1,2,3,4]. Water treatment being a means of water quality improvement, remains a visible tool for making polluted water portable. In treatment, the sources and level of pollution tends to determine the extent of treatment and type of treatment facility to be adopted. There are physical treatment methods and chemical treatment processes depending on what is to be treated in any source water. Treatment for physical quality management includes: clarification and discoloration among other things. Chemical treatment methods include coagulation and disinfection.

Fecal coliform bacteria exist in the intestines of warm-blooded animals and humans, and are found in bodily waste, animal droppings, and naturally in soil. The presence of fecal coliform in water may indicate recent contamination of natural occurring water by human sewage or animal droppings which could contain other bacteria, viruses, or disease causing organisms. This is why coliform

bacteria are considered “indicator organisms”; their presence warns of the potential presence of disease causing organisms and should alert the person responsible for the water to take precautionary action [5]. However, recent researchers have identified the seeds of *Moringa Oleifera* as very useful in water treatment [6,7]. Studies [8] have indicated a number of serious drawbacks linked to the use of aluminium salts such as Alzheimer’s disease associated with high aluminium residuals in treated water, excessive sludge production during water treatment and considerable changes in water chemistry due to reactions with the OH⁻ and alkalinity of water. *Moringa Oleifera* seeds have been found to contain water soluble substances, proteins, with high coagulation and antibacterial efficiency in water treatment [9,10,11]. Different researches have also shown and confirmed *Moringa Oleifera* seed extracts as very good alternatives for alum as coagulants in drinking water clarification, Turbidity removal and Total coliform reduction. This natural coagulant can be prepared as shelled seed of *Moringa* reported by some researchers [12,13,14] or unshelled seeds of the *Moringa* [15,16,17,18,19,20]. However, the efficiencies of shelled and unshelled *Moringa Oleifera* seeds in water treatment have been established [21]. Therefore, the paper is focused on the effect of shelled and unshelled *Moringa Oleifera* seeds on fecal coliform reduction in water treatment.

1.2 Processing of *Moringa* (Review)

The first stage in the application of *Moringa Oleifera* seeds extract in water treatment is the production of *Moringa Oleifera* seeds powder and normally involves manually removing the seed coat and wings, grinding the seeds in to fine powder using a domestic blender, and sieving. The second stage comprises extracting the active ingredients. Earlier researchers used mixing in water and filtering through Mosley cloth and mixing with a stirrer and filtering with Whitman filter paper [7]. Six different methods for *Moringa* seed extraction have been used: normal aqueous extraction (M1), normal salt extraction (M2), oil removal followed by aqueous extraction (M3), oil removal followed by salt extraction (M4), oil removal followed by aqueous extraction and micro-filtration or cross flow filtration (M5), and oil removal followed by salt extraction and micro-filtration or cross flow filtration (M6). [22]. However, there has been research on *Moringa Oleifera* seeds by manually removing the dry seeds from the dry fruit. It was manually grinded with the winged cover and thus, proceeded with the extraction [14].

2. Methodology

The *Moringa Oleifera* seeds were sourced from a *Moringa Oleifera* tree. The seeds were obtained fresh from its tree. Some of the seeds (shelled), grayish black in colour were split open to obtain the white seeds (unshelled). These are the two *Moringa* seeds used in the study. The raw water samples were fetched from a highly turbid water. Figure 1&2 shows the *Moringa Oleifera* seed samples.



Figure 1: Shelled *Moringa Oleifera* seed



Figure 2: Unshelled *Moringa Oleifera* seed

The seeds were obtained and allowed to sun-dry under ambient temperature for a period of 10 days. This was done for both the shelled seeds and the unshelled seeds. The dried seeds were ground into fine powder using a manual kitchen grinder. The seeds were ground twice in order to obtain a homogenized seed powder and was sieved using a Standard Test Sieve (ASTM) 460 of 1.1mm. Aqueous solution of the Moringa seed was prepared by dissolving 40g of the ground seed in 1liter of distilled water respectively, thereby making a concentration of 40g/l. The seed powder was weighed using an electronic weighing balance (Search Tech). The Moringa Oleifera seed solutions were stirred for 25minutes using a magnetic stirrer (Search Tech) and was filtered with Chi-filter cloth and whitman filter papers (110mm diameter). The treatment variables, shelled and unshelled moringa seeds were used under the same temperature and environmental conditions. The raw water sample was collected and analyzed for treatment and were poured into 1000ml beakers up to 500ml. 50ml and 75ml of the aqueous solutions were dosed into the beakers respectively. The mixtures were vigorously shaken and allowed to stand. 25mls of the treated water were collected for the analysis at every four-hour interval after it was treated with the variables. The activity lasted for 72hours.

3. Results and Discussion

The results of the analysis of the treated water with shelled and unshelled Moringa with respect to the total fecal coliform reduction are presented in Figures 3 & 4. The results indicated that the fecal coliform levels were lesser when treated with the shelled Moringa as against the unshelled Moringa. However, this was the same case for the 50ml and 75ml treatment level.

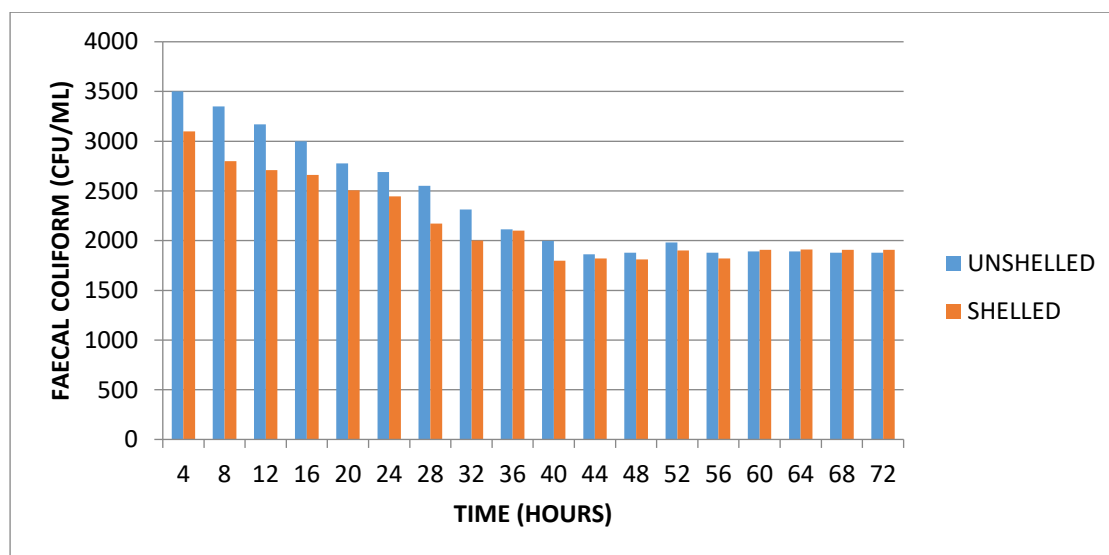


Figure 3: Graph Showing Faecal Coliform Reduction at 50ml Treatment Level.

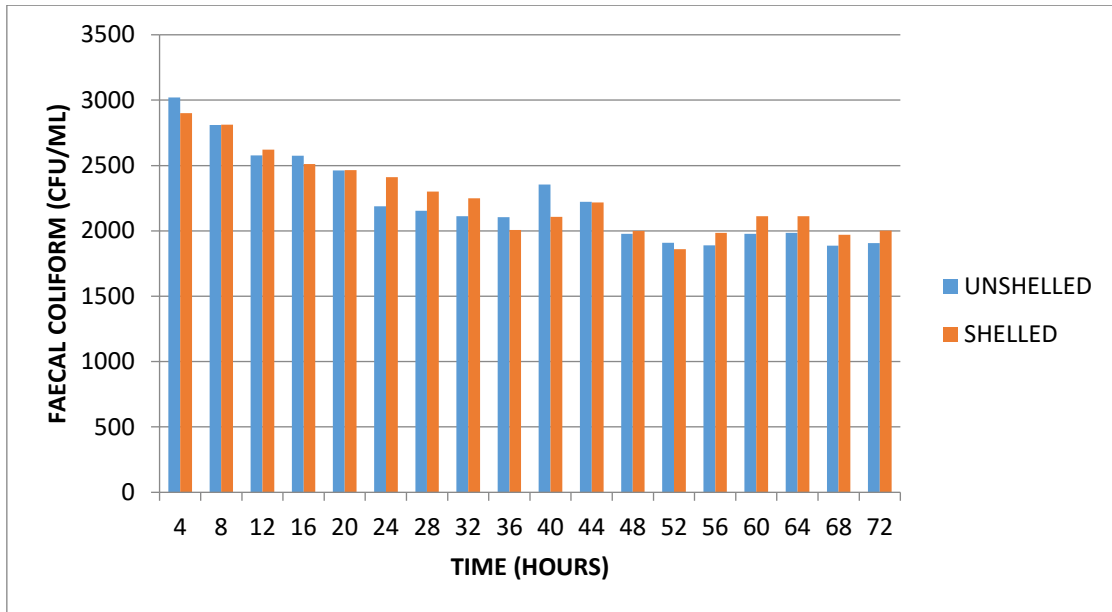


Figure 4: Graph Showing Faecal Coliform Reduction at 75ml Treatment Level

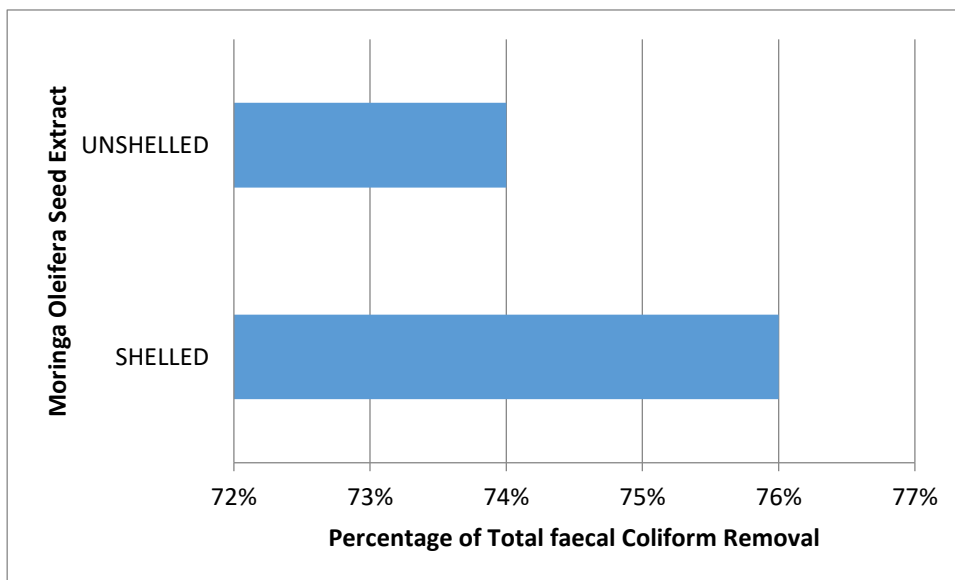


Figure5: Graph Showing Faecal Coliform Reduction Level of Shelled and Unshelled Moringa at 50ml Treatment Level

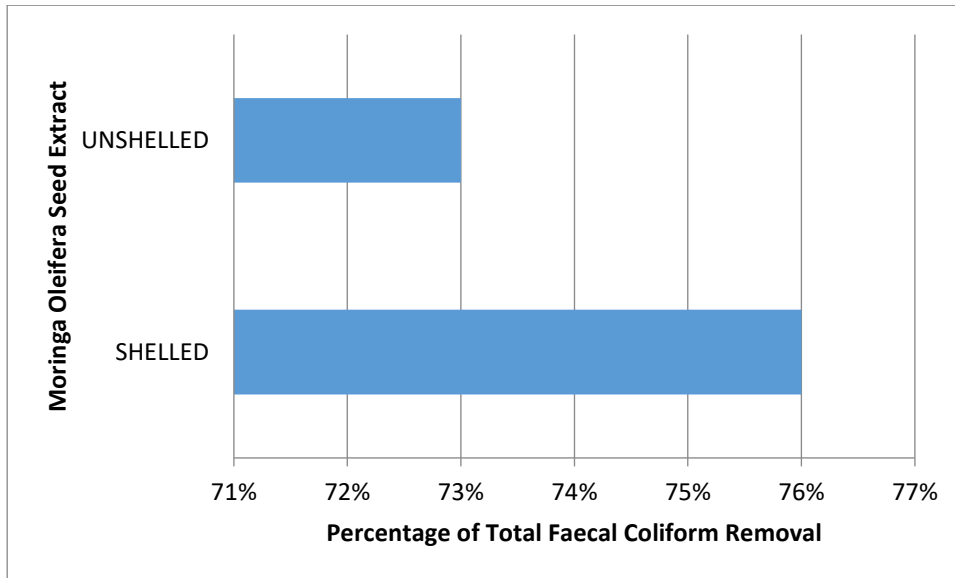


Figure6: Graph Showing Faecal Coliform Reduction Level of Shelled and Unshelled Moringa at 75ml Treatment Level

As shown in Figure 5&6 the shelled Moringa recorded 76% faecal coliform reduction level against the unshelled Moringa at 73 % . This has shown that the shelled Moringa has an edge in the removal of coliform in the treatment process.

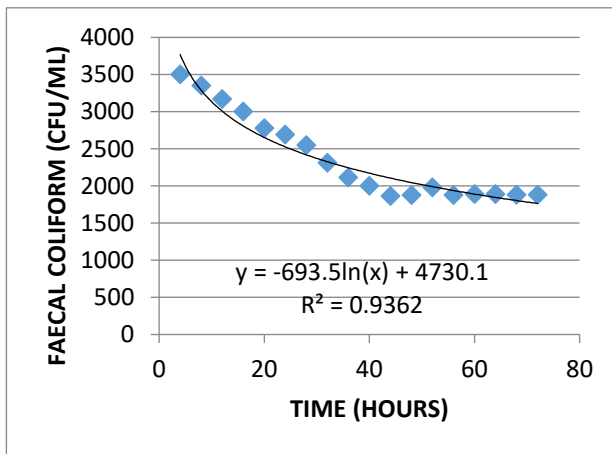


Figure 7: Estimated relationship between faecal coliform level and time with 50ml unshelled Moringa sample as treatment agent

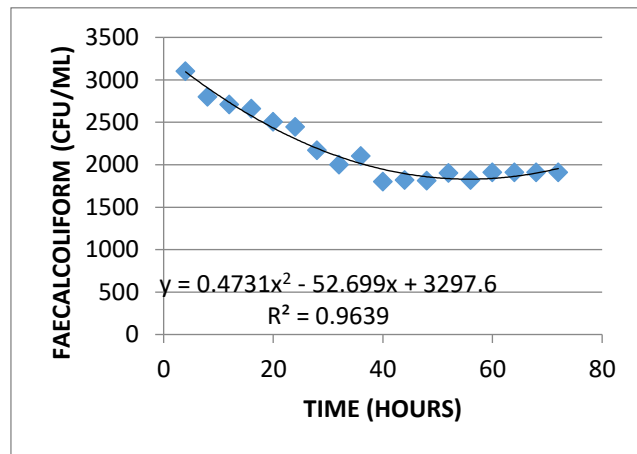


Fig 8: Estimated relationship between faecal coliform level and time with 50ml shelled Moringa sample as treatment agent

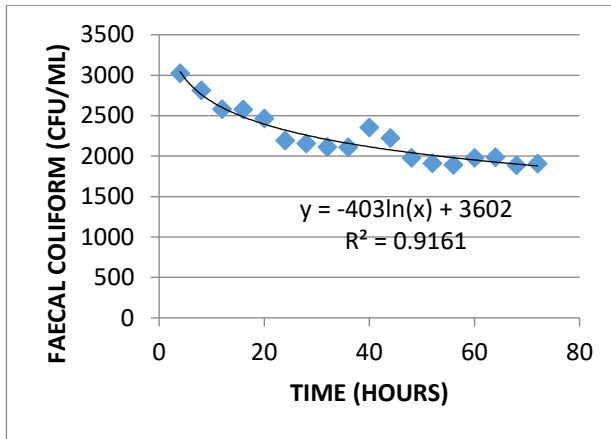


Figure 9: Estimated relationship between fecal coliform level and time with 75ml unshelled Moringa sample as treatment agent

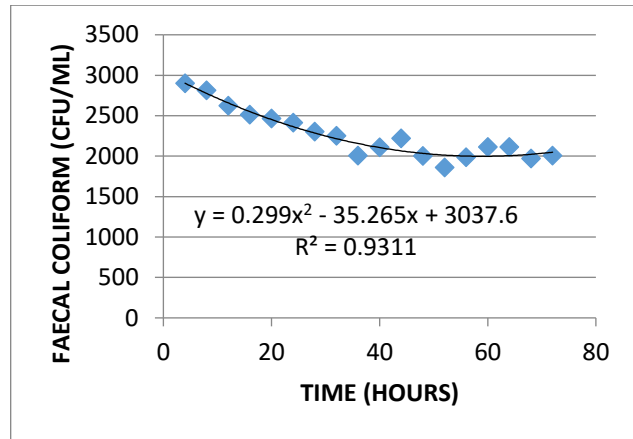


Figure 10: Estimated relationship between fecal coliform level and time with 75ml shelled Moringa sample as treatment agent

The treatment variables have proved to possess potentials for water purification and antimicrobial properties on water samples and can therefore be applied at domestic level in rural areas for water treatment. According to [2], water treatment with *Moringa Oleifera* revealed a substantial reduction of all pathogenic microorganisms present in raw water and could be used in water treatment in rural areas since populations do not have distribution network of drinking water.

It is therefore necessary that inhabitants of rural communities where conventional water treatment technologies are completely absent and borehole facilities are lacking or are far from their homes to treat water from streams, rivers, lakes and springs with shelled and unshelled *Moringa Oleifera* seeds with preference to shelled *Moringa* for effective total fecal coliform reduction before consumption. This would reduce and prevent contacting water-borne diseases as it has proved to have a good anti bacteria activity.

From Figure 7, it will be observed that the fecal coliform level after water treatment with 50 ml unshelled *Moringa* seed sample follows a logarithmic function with R^2 value of 0.936. The minimum and best value of turbidity occurred at the 44th hour after the treatment had started.

From Figure 8 the fecal coliform present in the treated water with 50ml shelled *Moringa* seed follows polynomial function with the R^2 values of 0.963. The minimum fecal coliform level occurred between 48th

From Figure 9, it can be seen that the relationship that exist between total fecal coliform and time for 75ml unshelled *Moringa* seed treatment, follows a logarithmic function with R^2 values of 0.916. while the relationship that exist between total fecal coliform and time for shelled *Moringa* seed treatment in Figure 10 follows a polynomial function with R^2 value of 0.931. Design experiment on Figures 7 to Figure 10 was performed to obtain stratified sample time.

4. Conclusion

After the study on the effect of shelled and unshelled *Moringa* seed on fecal coliform reduction in water treatment, the following conclusions were drawn:

- a) The analysis has shown that the shelled *Moringa* has an edge over the unshelled *Moringa* in fecal coliform reduction in water treatment process.
- b) The *Moringa* seed is edible, non-toxic, and locally available and is a simple, cost-effective and a safe water purification agent. It is therefore necessary that inhabitants of rural communities where conventional water treatment technologies are completely absent and borehole facilities are lacking or are far from their homes to treat water from streams, rivers,

lakes and springs with shelled Moringa Oleifera seeds for effective total fecal coliform removal before use for domestic purposes.

- c) From the water treatment analysis, shelled Moringa recorded an average of 76% fecal coliform reduction level against the unshelled Moringa at 73.5%.
- d) The study has revealed the effect of shelled and unshelled Moringa seed sample on fecal coliform.
- e) The study has developed models that can predict the reduction of fecal coliform which is a water quality parameter for shelled and unshelled Moringa seed. This is to aid in studying the fecal coliform reduction movement and behavior over time(hours).

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