# A REVIEW ON EFFECT OF MORINGA OLEIFERA SEEDS EXTRACT IN WATER PURIFICATION

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## ABSTRACT

A single family of plants and trees known as *Moringa oleifera* is cultivated over the whole tropical belt. One of the 14 recognised species, it is a member of the Moringaceae family. The tree is categorised as a multifunctional tree for life. It has gained popularity in recent years as a superb native source of highly digestible protein, calcium, iron, vitamin C, and carotenoids suitable for consumption in many of the world's poorest countries where malnutrition is a serious issue. The seeds may be consumed raw, roasted, ground, brewed in tea, or added to curries. It has been used for cosmetic purposes, dietary additives, therapeutic purposes, and water purification. A polyelectrolyte has been discovered as one of the active elements in M. oleifera seed. Its use as a coagulant, co-coagulant, or coagulant assistance has been the subject of research in many parts of the globe. It has been determined that softening water with M. oleifera may have additional benefits since it is paired with very little loss of alkalinity, which is required to provide the necessary buffering capacity to achieve desired treatment goals. Moreover, several studies have shown that *Moringa oleifera* seeds contain an active antimicrobial activity. This paper summarises the several uses of M. oleifera seed extract in water treatment and highlights areas that need further research.

***Key words:*** Moringa oleifera, seeds, water purification, disinfection.

## INTRODUCTION

All living things—including humans—need potable water. Water covers 71% of Earth. This is only 2 ppm (0.0002%) in rivers worldwide. River water contains faeces, urine, washing water, laundry waste, etc. Sewage water describes it. River pollution may cause typhoid, amoebiasis, and diarrhoea. Water should be purified before consumption to ensure community health and well-being.

Before delivering treated water to clients, coagulation-flocculation, sedimentation, filtration, and chlorine disinfection are utilised. Water filtration systems today use RO water purifiers. This method is expensive for regular customers. Moringa oleifera seeds, a naturally occurring polyelectrolyte, can clear murky river and sewage waters. M. oleifera is one of 14 Moringaceae tree species. Alum, a chemical coagulant used in conventional procedures, increases Alzheimer's risk (aluminium sulphate). M. oleifera seeds are herbal and cheaper than chemical treatments. This study compared the coagulant potentials of commercial alum and Moringa oleifera powder made from mature, dried seeds.

## CIRCUMSTANCE OF MORINGA OLEIFERA

Moringa oleifera, usually known as Moringa or just Moringa, is the most frequently cultivated type of the Moringa plant, asserts Wikiepedia (2009). (2009). The tree itself is very thin, with drooping limbs, and reaches a height of around 10 m. To ensure that the pods and leaves are still within reach, it is normally pruned down yearly to a height of one metre or less and left to re-grow. Moringaceae is a single genus family with 14 known species, according to Wikipedia (2009). (2009). The most popular and frequently utilised of these is Moringa oleifera Lam (syn. Moringa pterygosperma Gaertn). (syn. Moringa pterygosperma Gaertn.). Moringa oleifera (M. oleifera), originated from the sub-Himalayan areas of north-western India, is today a native of many countries in Africa, Arabia, South East Asia, the Pacific and Caribbean Islands, and South America. M. oleifera is also called to as "Zogale" in Northern Nigeria, which is a reflection of the tree's significance around the globe. Other popular names for the tree include "horse-radish" (owing to the taste of a condiment derived from the roots) and "drumstick" (because to the form of the pods) (due to the shape of the pods).

According to Rajangam (2001), India is the world's greatest producer of moringa, producing 1.1 to 1.3 million tonnes of tender fruits yearly from an area of 380 km2. Andhra Pradesh, the biggest state by both size and production (156.65 km2), is followed by Tamil Nadu (74.08 km2) and Karnataka (102.8 km2) (102.8 km2). It includes an area of 46.13 km2 in various states. Insofar as it comprises genotypes from many geographic locations, as well as introductions from Sri Lanka, Tamil Nadu is the pioneering state.

- **Description of M. oleifera**

Moringa's tuberous taproot makes plant drought-resistant, according to NRC (2006). The umbrella-shaped tree has a graceful, airy crown. Fine inherent divisions give leaves a fluffy appearance. Leaves cluster at branchlet tops. Depending on climate, the foliage looks like leucaena or calliandra from afar.

The tree blooms with 10–30 cm panicles of creamy white, honey-scented flowers. Flower pollination "requires a large number of insect visitations," and carpenter bees are the most frequent visitors (Plate 1). Flowering and fruiting can occur twice a year in many areas. Slim, light green, tender fruits become dark green and firm. Genotype-dependent, they may reach 120 cm. Some are curly, but most are straight. Some are triangular and round, but most are rectangular. Dried seeds have three papery wings and a light wooded shell..

- **Related Species**

The National Research Council reports that among the 14 Moringa species, only M. oleifera has received money for study and development (2006). Science doesn't grasp the rest. NRC (2006) also noted that these extra species may have unique properties that make them excellent food components, flocculants, antibiotics, oils, or lumber.

**Active Ingredients in M. oleifera Seeds**

Ndabigengesere et al. found 36.7% proteins, 34.6% lipids, and 5% carbs in shelled Moringa oleifera (1995). Unshelled Moringa oleifera has 5.5 g carbs, 21.1 g fats, and 27.1 g protein. M. oliefera seeds contain a polyelectrolyte, as shown by Folkard et al. in 1989. Jahn (1988) reported that the basic polypeptides in moringa flocculants range from 6,000 to 16,000 daltons. Six polypeptides with glutamic acid, proline, methionine, and arginine were found. According to Ndabigengesere et al. (1995; 1998), the active components in an aqueous Moringa extract include dimeric cationic proteins with molecular weights of roughly 13,000 daltons and iso-electric points of 10–11. Bina (1991) identified cationic polymers as the active component.

- **Applications of Moringa oleifera in Water Treatment**

Cleaning muddy surface rivers using botanical organic compounds is not new. Others believe Exodus (15:23–27) is the first mention of Moringa purifying water: The people chastised Moses for asking, "What shall we drink?" He cried out to the Lord, who revealed a tree that made the waters tasty. (NRC, 2006)

M. Oleifera seeds purified domestic water in rural Sudan (NRC, 2006). Powdered moringa seeds are popular in West Asia for flocculating pollutants and purifying drinking water (Berger et al. 1984; Gassenchmidt et al. 1995; Olesen, 1987), but they may also be eaten whole, roasted, powdered, steeped for tea, or used to curries (Gassenchmidt, et al 1995). This tree has been touted as a great local source of highly digestible protein, calcium, iron, vitamin C, and carotenoids for many "poor" countries with malnutrition. Moringa oleifera seed extract has been extensively studied for water filtration (Eilert, 1978; Fahey, et al 2001, 2002; Jahn, 1986, 1988; Kaser, et al 1990; Okuda, et al 1999; Okuda et al 2001a, b; and Muyibi, et al 2003). The following parts summarise this endeavour.

- **Processing of Moringa Oleifera**

Making Moringa oleifera seed powder is the first step in treating water with it. This sometimes involves physically removing the seed coat and wings, crushing the seeds into a fine powder using a household blender, and sifting. Muyibi et al. 1995a,b utilised ground powder without filtration. A 210 m sieve was used by researchers afterwards (Okuda et al 1999; Okuda, et al 2001a, b; Ali, 2010; Bichi, et al 2012a,b, c). Active substance extraction follows. Past researchers mixed water and filtered it through cotton cloth (Muyibi, et al 1995a, b). Additional investigation blends using a stirrer and filters with Whatman filter paper (Muyibi, et al, 2003). Ali employed six methods: standard salt extraction (M2), standard aqueous extraction (M1), oil removal followed by aqueous and salt extraction (M3), M4, M5, and M6 (2010). (M6). The optimal action was determined utilising the recovered bio-active components. Ali (2010) found that oil removal from water coagulation worked best, followed by salt extraction and microfiltration.

Bichi et al. found that oil removal and aqueous extraction disinfected water best (2012a). The extraction solvents may change the species' extractive components and antibacterial activity, according to Zaika (1988). Gan et al. (2011) compared 50% acetone to methanol, ethanol, ethyl-acetate, and hexane for polyphenolic component extraction from P. speciosa pod powders. Oluseyi and Francisca found that Buchholzia Corcea (Lovely Kola) inhibited E. coli with 21 mm for hexane extraction and 30 mm for methanolic extraction (2009).

- **Use of Moringa oleifera as Coagulant**

Coagulation is the most common method for removing water pollution. These components, which are largely tiny organisms and clay minerals, range in size from large enough to settle quickly to small enough to stay suspended for years. Hydrate shells or a double electric field surrounding colloidal and microscopic water contaminants provide them anticoagulant stability. Impurities may resist coagulation due to magnetic fields, freezing, electrolytes in water, heating, or freezing. Coagulation solves this issue. (Nikoladze, 1989).

Polyelectrolytes are M. oleifera seeds' active component (Folkard et al 1989). Co-coagulation, coagulant assistance, and coagulation research have been done worldwide. Jahn (1986), Jahn (1988), Folkard et al (1989), Sani (1990), Bina (1991), Ndabigengesere et al (1995), Muyibi and Okuofu (1995), Muyibi and Evison (1996), and Buthalezi, et al. (1997) have recorded most of these attempts (2009).

- **Moringa oleifera as a Primary Coagulant**

Folkerd et al. (1989), Muyibi and Okuofu (1995), and Kaser et al. (1995) all suggested using M. oleifera seed extracts as major coagulants (1990). Madsen et al. (1987) studied Nile River water in Sudan and found that the turbidity dropped from 2000 FTU to 1-2 FTU for Blue Nile water, 50 FTU to 10 FTU for White Nile water, and 300 FTU to 10 FTU for irrigation canal water within an hour.

M. Stenopetola alum-flocculating murky water. M. oleifera and M. Stenopetola cleared highly dirty waterways as well as alum. Nevertheless, low turbidity waters limited seed development, depending on the source.

Sani (1990) found a 92.99% reduction in turbidity after two hours for beginning turbidities of 205-986NTU and M. oleifera concentrations of 40 to 400 mgll. Muyibi and Okuofu (1995), based in Kano, Nigeria, examined three water samples from Challawa water works, Thomas reservoir, and Rimin Gado water. Challawa water had 26.5% to 45% turbidity reduction, Thomas reservoir water 32.5% to 83.3%, and Rimin Gado reservoir water 27.8% to 49.1%. Turbidity reduction for Thomas reservoir water was 83% at 90 NTU and 63% at 60 NTU. The result: Turbidity decrease usually increases with raw water sample turbidity. These findings supported Kaser, Folkard, and Jahn et al (1990).

In 1996, Muyibi and Evison tested water from the Challawa, Dambatta, and Rimin Gada reservoirs in Kano. The Challawa and Dambatta water works had 36-98.2% and 14.3-99.4% turbidity reduction rates at dosages of 100-450mg/l and 100-250mg/l, respectively. M. Oleifera 250mg/1 worked best for both samples. M. oleifera doses ranged from 100 to 450 mg/l, and Rimin Gado reservoir water samples reduced turbidity by 17.1 to 95.7%. Nevertheless, the water samples' rich natural colour and humic substances likely precluded turbidity reduction. M. Oleifera, a polyelectrolyte (Weber, 1972), would not be a good primary coagulant in low-turbidity water, according to Muyibi and Okuofu (1995). Muyibi and Evison continue this (1995a).

The jar test is used in most M. oleifera coagulation studies. Muyibi and Evison (1995) examined the physical effects of quick and slow mixing rates and durations on murky water coagulation with M. oleifera, among other things. At initial turbidity of 50 NTU, the quick mix velocity gradient and duration were 432/s and 1 min, respectively, using the single factor optimisation and optimal dose (low turbidity). The ideal quick mix velocity gradient and duration were 443/s and 4 min for starting turbidity of 225-750 NTU (moderate to high). All residual turbidity was < 10 NTU. Hence, for low turbidity water, the slow mix velocity gradient and duration were 149.9/5 and 20 min, and for medium and high turbidity water, 208.3/5 and 25 min.

- **M. oleifera as a Coagulant Aid**

M. oleifera seed extract may be used as a secondary coagulant with alum (Jahn, 1982). This decision is under study. Muyibi and Okuofu (1995) recommended 40 mg/l alum for a trial without M. oleifera. M. oleifera works better as a coagulant aid at 10 mg/l than 20 mg/l. M. oleifera was best applied 50 seconds after gently mixing. Thick floes settled faster than with alum alone. Residual turbidity was far lower than alum alone.

- **Use of Moringa oleifera in water Softening**

Softening removes hardness-causing ions. Calcium and magnesium ions are the major sources of hardness, although iron, manganese, strontium, and aluminium may also contribute. Hardness causes soap usage and scale buildup in pipes, boilers, and hot water pumps. Hardness exceeding 150 mg/l is unattractive, but public water supplies shouldn't exceed 300 to 500 mg/l (Corbitt, 1990). Local researchers are looking for cheaper softening chemicals. M. oleifera seed extract may soften (Muyibi and Evison, 1995a; Muyibi and Evison, 1996; Muyibi and Okuofu, 1996).

Barth et al. (1982) found that M. oleifera coagulation and softening lowered water hardness from 80 to 300 mg/l CaCO3 to 50–70%. Sani (1990) utilised water samples from the Watari, Challawa, Yarimawa, and Kofar Kabuga wells to reduce the total hardness of river Watari water from 54 mg/l to 25 mg/l CaC03 using 40-200 mg/l M. oleifera. Challawa water reduced CaC03 from 95 to 30 mg/l from 50 to 250 mg/l M. oleifera. In comparison, the Kabuga well water sample hardness rose from 21 mg/l to 20 mg/l at 150 mg/I before levelling out at 15 mg/l CaC03 at 250 mg/l M. oleifera dose. The hardness of Yarimawa well water reduced from 11.2 mg/l at 100 mg/l M. oleifera to 09.8 mg/l at 400 mg/l.

In 1995, Muyibi and Okuofu found that M. oleifera dose decreased residual hardness in water samples from 17 hand-dug wells in Kano, Nigeria. Water samples with calcium and magnesium hardness needed higher dosages to achieve the same initial hardness. M. oleifera has calcium hardness exclusively. Muyibi and Evison (1995a) found that M. oeifera dosages decreased hardness in water samples from four English sources with varied hardnesses. The next Muyibi and Evison investigation supported this (1996). This study also found that the quantity of seed extract and water hardness affected how much M. oleifera was required to soften water samples with hardness values from 50 to 600 mg/l CaC03. Muyibi and Okuofu (1995) also reported a linear Langmuir absorption isotherm for softening with M. oleifera. The next Muyibi and Evison investigation supported this (1996).

M. oleifera softens water with low alkalinity loss, providing enough buffering capacity to meet treatment goals, according to Muyibi and Okuofu (1996), Muyibi and Evison (1995a), and Muyibi. This may benefit (1996).

- **Cleaning water using Moringa oleifera**

Pathogens pose the greatest threat to water supply. Chemically disinfecting an area eliminates harmful germs. Halogens, phenols, alcohols, heavy metals, dyes, soaps and detergents, ammonia compounds, hydrogen peroxide, and different alkalis and acids are disinfectants (Metcalf and Eddy, 1991). Chlorine is the most often used oxidizer. Nevertheless, chlorine degrades and loses concentration throughout delivery (Devarakonda, et al, 2010). DBPs may be mutagenic and carcinogenic (Goveas, et al, 2010). Disinfectants and their byproducts may also increase cancer, cardiovascular disease, and birth defects. Although though risks are minimal, Arbuckle, Bove, and Woo (2002) found that these disorders may be linked.

Due to these problems and chlorine's expensive cost, particularly in underdeveloped nations where it must be imported, cheaper, ecologically friendlier alternatives are needed. Fisch et al. (2004), Thilza et al. (2010), Bukar et al. (2010), and Eilert et al. (1981) found antibacterial properties in Moringa oleifera seeds.

## CONCLUSION

According to the findings, M. oleifera seed powder is more efficient as a coagulant than the chemical alum. In addition, it does very well across the board when put through a battery of tests at high doses (pH, absorbance, TDS, hardness, TSS, chlorides, conductivity, turbidity, MPN, and dissolved oxygen, to name a few). Water filtration systems might make use of Moringa oleifera seeds since they are cheap, readily available, and safe for the environment.

Seeds from the Moringa oleifera tree have several potential uses in water purification, including those of coagulant, flocculant, hard water softener, disinfectant, and heavy metal removal. As a high and stable production from Moringa is expected, it makes sense to advocate for its greater usage, particularly in rural water systems, where water demand is lower.

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