

# Use of Moringa Oleifera Seeds as Natural Coagulant for Recycling of Domestic Waste Water in Ramanathapuram

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Abstract: The removal of turbidity from domestic water is essential before it can be disinfected for human consumption. In a water treatment works, this clarification stage is normally achieved by the application of chemical coagulants which change the water from a liquid to semi-solid state. This is usually followed by flocculation, the process of gentle and continuous stirring of coagulated water, which encourages the formation of 'Flocs' through the aggregation of the minute particles present in the water. Flocs can be easily removed by settling or filtration. For many communities in developing countries, however, the use of coagulation, flocculation and sedimentation is in appropriate because of the high and low availability of chemical coagulants, such as aluminium potassium sulphate. This technical brief gives an overview of an indigenous, naturally derived coagulant, namely seed material from the multi-purpose tree moringa oleifera which offers an alternative solution to the expensive chemical coagulants.

*Keywords*: Alkalinity, Coagulation, Turbidity, Water treatment.

## 1. Introduction

A coagulant is one of the key components for removing turbidity in a water treatment process. Coagulants are classified into in organic, synthetic organic polymers and natural coagulants, two primary coagulants are iron and aluminium. However, recent studies have shown several drawbacks of using aluminium salts, such as Alzheimer's disease for residual aluminium in treated water and production of large sludge volumes. Recently researchers have shown tremendous interest in commonly used coagulants since long time in treating drinking water and it is also used as disinfect in drinking water treatment. Moringa oleifera (MO), is a tropical plant from the family of moringaceae, a single family of shrubs with 14 know species. MO is native from India but is now found in arid and semi-arid regions of India. They are non-toxic natural organic polymers, a medical plant. It is drought tolerant and has nutritional, medicinal, and water-cleaning attributes the mechanism of suspended solids removal by the coagulation active component has been described. They are finely powdered and used as coagulant in treatment. They produce less sludge compared to aluminium and iron and is good adsorbent for cadmium. It is inexpensive safe and active compounds. The coagulant activity of Moringa oleifera seeds is widely known

and applied in water treatment at household level in rural areas of developing countries.

#### 2. Drinking water treatment and water quality

Water, where ever present in nature, is always contaminated with various types of pollutants. Some of them are harmless, and sometimes even desired in the water where as others need to be removed before the water can be used for drinking purposes. The following chapter describes the main aspects of drinking water treatment.

#### A. Parameters for drinking water quality

When evaluating the quality of drinking water, numerous parameters must be taken in to account. The most important ones are presented and described below.

#### 1) Turbidity

The cloudiness of water is referred to as turbidity and has its origin from particles suspended in the water. These are natural contaminants and most often mineral particles such as clay and silt or organic Flocs. Turbidity is a major problem in drinking water treatment when the water source is surface water but can often be neglected in treatment of ground water. Turbidity is usually measured in nephelometric turbidity units (NTU), and is an optical measurement, where a light beam is transmitted through the water sample, and the amount of scattered and absorbed light is detected. The world health organization allows drinking water with turbidity level below.



The pH of the water will have an impact on the water quality and are closely linked corrosion pH is defined as the negative 10-logarithm of the hydrogen ion activity in the water, and thus indicates the amount of hydrogen ions in the water. Alkalinity is the waters ability to neutralize added hydrogen ions, or buffering capacity.

The main buffering species include carbonates  $(co_3^{2-})$ , and hydrogen carbonates  $(Hco_3^{-})$  in the water. Since corrosion is caused by calcium carbonates, the corrosion process is dependent on the pH of the water.

## 3) Electrical conductivity

Conductivity is a measurement of the water ability to lead electricity and depends on the amount of ions in the water.



Conductivity increases with the content of dissolved salts in the water, and is also dependent on the temperature. It is measured in Siemens.

# 4) Color

The color is tested by filter photometer and the color is measured in haze. Color may be due to the presence of organic matter, metals (iron, manganese) or highly coloured industrial waste, it is desirable that drinking water should be less than 5HZ.

# 5) Taste and odor:

Taste and odor mainly due to organic substances, biological activity, industrial pollution. Taste bunds in the oral cavity specially detect inorganic compounds of metals like magnesium, calcium, sodium, copper, iron, and zinc water should be free from objectionable taste and odor.

Table 1	Table 1								
Pacammandad values	in	drinking							

Recommended values in drinking								
Parameters	Desirable Limits	Permissible Limits						
Color hazen unit	5	25						
Turbidity-NTU	5	10						
pH	6.5-8.5	6.5-8.5						
Hardness( $CaCo_3$ )	0.3	1						

# 3. Materials and methods

# A. Collection of materials

Moringa oleifera seeds were collected in and around Ramanathapuram district.

- 1) Domestic water
- Water sample collected from houses.
- B. Preparation of moringa seeds powder:

The MO dry were obtained from Ramanathapuram district high quality pods, those which were new and not infected with disease, were selected. Seeds were opened and from the kernels were removed manually. The kernels were crushed and ground to medium fine powder in grinder. The powder was sieved using 90µm mesh and the powder was stored in a container in refrigerator to avoid loss of its activity. The fine powder was used as coagulants for analysis.

## C. Preparation of coagulant solution coagulant 1:

Potash alum: The 1g of potash alum powder was weighted machine. The solution is prepared by mixing 1g of the potash alum into 11 distilled water.

Coagulant 2: moringha oleifera: The 1g of above prepared Moringa Oleifera seed powder was weighted in the weighting machine. The solution is prepared by mixing Moringa oleifera seed powder into 1L distilled waters.

# 1) Description of process

Moringa oleifera wings and coat from seeds were removed. Fine powder was prepared by using mortar and pestle. The coagulant solution is prepared by mixing 1g of the above prepared powder into 11 distilled water. This solution was stirred and directly used as coagulant. Water samples were collected from domestic who is present in ramanathapuram district. Treatment to water was given by directly using coagulant solution. The water quality parameters were checked before and after treatment. Doses of coagulant i.e. 2, 4,6,8,10,12 an 20mg/1 were selected for treatments which are low cost water treatment technologies areas. The coagulant was mixed with turbid water sample and kept on the flocculated for 30 min at 110-120rpm. The settling time was 1-2 hours (depending on the water turbidity). After sedimentation, supernatant of treated water was used for test. The water quality parameters were checked for physicochemical and parameters as per standard methods before and after the treatment. The efficiency dose of MO seed powder was determined.

## D. Steps for household water treatment

- 1. Collect nature moringa oleifera seed pods and remove seeds from pods
- 2. Shell seeds (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 1g seed kernel will treat 1 liter (1.056qt) of water.
- 4. Crush appropriate number of seed kernels (using grinder, mortar pestle, etc.) to obtained a fine powder and sift the powder through a screen or small mesh.
- 5. Mix seed powder with small amount of clean water to from a paste.
- 6. Mix the paste and 250ml (1cup) 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 rotation per minute) and into the water to be treated.
- 9. When the particles and contaminants have settled to the bottom, the clean water can be carefully poured off. This clean water can then be filtered or sterilized to make it completely safe for drinking.
  - Sand water filters a)
  - b) Solar sterilization
  - Chlorination: 1-2 drops per liter (1.056qt) c)
  - Boiling: minimum of 5minute d)

		Alum as a Coagulant								
PARAMETER	RAW WATE R	TESTE WATER							STANDARD LIMITS	
			ALU	JM ADD	OPTIMUM DOSAGE					
		2 ML	4 ML	6 ML	8 ML	10 ML	20 ML			
Turbidity (NTU)	36	5	4	2	2	1	1		5-10	
РН	7.32	6.51	6.6	6.3	6.6	6.7	6.6	2ML	6.5-8.5	
Electrical connectivity MS	3.2	3.1	3.1	3.1	3.1	3.1	3.1		5-5.5	

Table 2
Alum as a Coagulant



Table 3 Moringa Oleifera as a coagulant

PARAMETER	RAW VATER		TESTE WATER								
			ALUM ADDED(ML) OPTIMUM DOSAGE								
		2 ML	4 ML	6 ML	8 ML	10 ML	20 ML				
Turbidity (NTU)	36	5.2	3	3	2	2	1		5-10		
РН	7.32	8.43	8.43	8.4	8.3	7.7	7.54	2ML	6.5-8.5		
Electrical connectivity MS	3.2	1	0.9	0.9	0.9	0.9	0.7		5-5.5		

Table 4 Moringa Oleifera + Alum as Coagulant

PARAMETER	RAW WATER	TH	STANDARD LIMITS						
			ALI	JM ADD	OPTIMU M DOSAGE				
		2 ML	4 ML	6 ML	8 ML	10 ML	20 ML		
Turbidity (NTU)	36	6.2	4.2	2	2	2	1		5-10
РН	7.32	8.16	8.28	8.3	8.08	8.12	8.00	2ML	6.5-8.5
Electrical connectivity MS	3.2	0.7	0.7	0.7	0.7	0.5	0.5		5-5.5

# 4. Conclusion

Mo shows good coagulating properties, and has many advantages compared to aluminium potassium sulphate; it does not affect the pH, alkalinity or conductivity of the water and it can be produced at low cost Mo is a method that can be considered as a good, sustainable and cheap solution for smaller water works, if the supply of Mo seeds can be guaranteed Mo provides a good, cheap and sustainable alternative to aluminium potassium sulphate which should be considered as a coagulant in smaller water works.

## References

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