

## Moringa Oleifera Seed Extract As A Natural Coagulant For Water Purification

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Many places in the world lack potable (drinkable) water. The World Health Organization has estimated that up to 80% of all disease and sickness in the world is caused by inadequate sanitation, polluted water or unavailability of water. . Uncontaminated water is rarely obtainable in rural areas and incidentally, the prevalence of infectious disease amongst rural dwellers. It is now well established that 90% of the rural diseases may be attributed to the polluted water. the rural population is thriving on the contaminated water supply due to prohibitive cost and low availability of chemical coagulants and disinfectants and the heavy investment in setting-up the conventional water treatment plants at village level is not only a theoretical exercise but practically impossible for several reasons. Such projections have prompted interest in using traditional methods for treating the water Using natural materials to clarify water is a technique that has been practiced for centuries Nirmali seed powder, and , seeds of the *Moringa* have been found to be one of the most effective.

This may be more environment friendly easy to handle by our rural people and comparatively less toxic than the use of chlorine (Kenneth, 1986). To explore the conditions under which the natural coagulant aids as these additives are called in literature, the following short term study is selected for study. The difference is to use the powder, **not as an aid but as coagulant itself**. This is in view of the illiteracy, economics and environmental conditions of the rural women folk.

The ultimate goal of this work was to carry out an in vitro evaluation of *Moringa oleifera* in water and waste water purification.



Figure: 1 *Moringa oleifera* tree

*Moringa oleifera*: It is sometimes known as **Drumstick** because of the shape of the pods



**Figure: 2** Pods of *Moringa oleifera*

It is a fast growing tree bearing ever green foliage with leaflets 1-2 cm in diameter; the flowers are white or cream colored. The fruits (pods) are initially light green, firm. Fully mature dried seeds are round/ triangular shaped, the kernel being surrounded by a lightly wooded shell with three papery wings.



**Figure: 2** Leaf of *Moringa oleifera*



**Figure: 3** Flower of *Moringa oleifera*



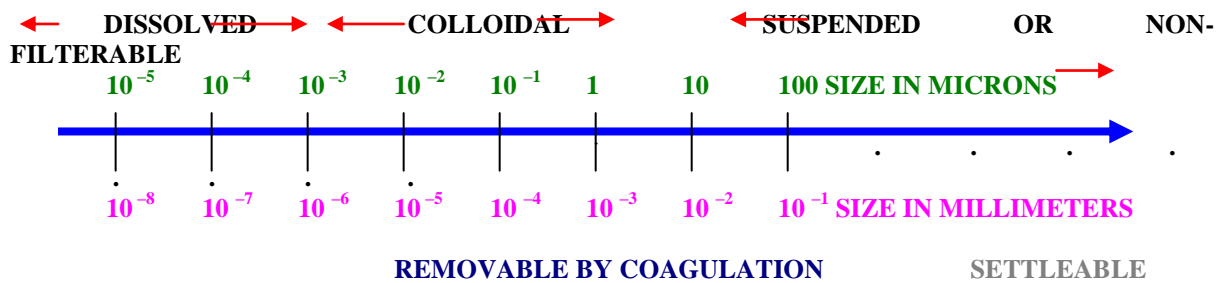
**Figure: 4** Dry seed of *Moringa oleifera*



Figure 5: Moringa seeds and pods

Turbidity is caused by particles and bacteria in water, and depending on size some settle down while some remain suspended.

**CLASSIFICATION OF PARTICLES**



The surface charge on colloidal particles is the major contributor to their long term stability. Particles which might otherwise settle or coalesce are mutually repel by their like charge.

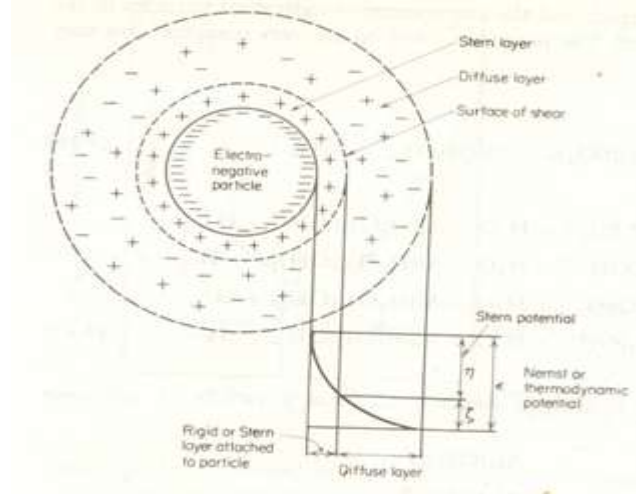


Figure 9-19 Guoy-Stern colloidal model.

It will be interesting if the aid acts as coagulant also.

Surface water samples were collected from three different Lakes, which were carried in plastic water bottles of 1L each. The samples were collected in duplicate from the study area during Feb – Aug. The samples collected from the areas- Pragathi Nagar Lake, Kukatpally Lake, and Medchal Lake.

<u>S.No</u>	<u>Location</u>	<u>Source of contamination</u>
1	<u>Pragathi Nagar</u>	Contaminated through municipal <u>Sewage and industrial sewage.</u>
2	<u>Kukatpally</u>	Major contamination through <u>Industrial sewage and animal Dead bodies.</u>
3	<u>Medchal</u>	Agricultural <u>run off.</u>

**Table 1: Source of contamination at the site**

#### 4.0.2 Seed collection:

*Moringa oleifera* pods were brought from Horticulture Nursery Training Centre, Garimellapadu, Khammam district.

#### 4.0.3 Preparation of synthetic sample:

Natural clay from agricultural fields of gowdavally was used to prepare

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turbidity by soaking the clay overnight in tap water and then blending it for 10 min. the suspension was washed through a micron sieve. This suspension was used as a synthetic turbid water sample.



**Figure 5: Fine Powder of *Moringa* Seeds**

#### 4.0.4. Equipment:

Turbidity was measured with a turbidity meter [ELICO CL 52 D Nephelo Meter]. A clean mortar and pestle was used to pulverize the *Moringa oleifera* seeds.



#### **4.1 Method**

##### **4.1.1 *Moringa oleifera* seed suspension preparation:**

Seeds are separated from dried *Moringa oleifera* pods. The seeds cover was shelled and are pulverized to a fine powder by using a mortar and pestle. Add small amount of water to powder to form a paste and was mixed in 250ml of distilled water. This was mixed for one min by using a glass rod in order to

Stabilize the suspension. This stock suspension was prepared freshly when ever needed (Jahn 1986). The suspension was filtered to have uniform size of particles through the muslin cloth into the raw water to be treated

##### **4.1.2 Coagulation Jar test:**

1litre beakers were filled with 750ml (500 ml water sample + 250 ml seed suspension) of water samples was then placed under the flocculator. The paddle was lowered into the beaker and the apparatus was switched on at the desired stirring speed 100rpm. After 1min the paddle speed was reduced to the speed needed for the flocculation. After 5min the paddles were stopped and taken out of the beakers. The water was left to settle for different settling times (30min, 1hr, and 1<sup>1/2</sup>hr). The water from the upper surface of the beakers was separated without disturbing the lower surface.

##### **4.1.2.1 Calibration of dosage:**

The dosage of *Moringa oleifera* seed used was about 0.12gm throughout the experiment.

##### **4.1.2.2 Mixed speed and time:**

During the entire experiment, the stirring speed and time was kept constant at 100rpm for 1min for the rapid mixing and 40rpm for 5min for the slow mixing.

##### **4.1.2.3 Settling time:**

Different settling time periods (30min, 1hr, and 1<sup>1/2</sup>hr) have been tested during the experiment in order to find out the coagulation activity of the coagulant

Immediately after treating with *Moringa* seeds, the samples were tested for turbidity and microbial tests.

#### **4.2 Turbidity test:**

##### **Reagents:**

Solution I: 1gm of Hydrazine sulfate was dissolved in 100ml of distilled water.

Solution II: 10gm of Hexa Methylene Tetra Amine was dissolved in 10ml of distilled water.

Stock turbidity solution: 5ml of solution I and 5ml of solution II were mixed kept for 24 hrs and then diluted to 100ml. This solution has turbidity of 400NTU.

##### **Procedure:**

The standard solution of 10, 20, 30, and 40 NTU was prepared from the stock 400NTU solution. Absorbance for the standard solutions was measured at 420nm. The NTU for the samples were measured from the standard graph (APHA, 1983).

##### **4.3 Culture test:**

Surface water samples from three different places were collected in the bottles of 1L each.

One ml of the samples each was serially diluted with saline solution three fold; i.e. up to 10<sup>-3</sup> and one ml of each diluents of 10<sup>-1</sup> and 10<sup>-3</sup> were plated aseptically on to Nutrient agar for Total Aerobic Mesophilic bacteria and MacConkey agar for Total Coli form and Eosin Methylene Blue agar for *Escherichia Coli* counts.

The whole setups were incubated at 37<sup>0</sup>c for 24 hrs and the colonies were counted and calculated according to the formula

$$\text{Bacterial Density (cfu/ml)} = \frac{\text{No. of colonies formed}}{\text{Sample plated}} \times \frac{1}{\text{D.F}}$$

Where: cfu/ml = colony forming units per ml,

D.F = Dilution Factor.

All these tests were followed before and after the treatment of samples with seed powder.

### **Results**

**Physical nature and Microbial load of Lake Water samples before treatment with Moringa seeds.**

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Type of waste	Physical	TAMB counts	Coli form	E.coli counts
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Water sample	appearance		counts Cfu/ml	Cfu/ml
Dirty water Stagnant from Medchal Hyderabad	very dirty and highly turbid with a lot of Suspended Matter	TMTC	TMTC	TMTC
Polluted stream At Pragathi Nagar,	foul smell appearing greenish	TMTC	TMTC	TMTC
Low turbid, Polluted stream From Kukatpally, Hyderabad.	rotten foul smell, appearing Greenish	TMTC	90,000	TMTC
Synthetic Sample (clay From Medchal Agricultural Forms)	dirty, cloudy and highly turbid appearing light brownish	TMTC	50,000	TMTC

**KEY: CFU----- Colony forming unit per ml,  
TMTC ---- Too many to count,  
TAMB ----- Total Aerobic Mesophilic Bacteria.**

**Table: 3** Coagulative and Disinfective effect of *Moringa oleifera* seeds on Lake Water samples after 30 min of settling time.

Type of waste Water sample	Physical appearance	TAMB counts	Coli form counts Cfu/ml	E.coli counts Cfu/ml
Dirty water Stagnant from Medchal, hyd	a slight change in appearance	TMTC	TMTC	TMTC
Polluted stream At Pragathi Nagar, Hyd.	no change	TMTC	TMTC	TMTC
Low turbid, Polluted stream From Kukatpally, Hyderabad.	no change	TMTC	20,000	TMTC
Synthetic Sample (clay From Medchal Agricultural Forms)	a slight change	30,000	10,000	TMTC

**KEY: CFU----- Colony forming unit per ml,  
TMTC ---- Too many to count,  
TAMB ----- Total Aerobic Mesophilic Bacteria.**

**Table: 4** Coagulative and Disinfective effect of *Moringa oleifera* seeds on Lake Water samples after 1 hr of settling time.

Type of waste Water sample	Physical appearance	TAMB counts	Coli form counts Cfu/ml	E.coli counts Cfu/ml
Dirty water Stagnant from Medchal, hyd	clear supernatant	15,000	8,000	2,000
Polluted stream At Pragathi Nagar, Hyd.	clear supernatant	20,000	1,000	3,000
Low turbid, Polluted stream From Kukatpally, Hyderabad.	clear supernatant	15,000	7,000	5,000
Synthetic Sample (clay From Medchal Agricultural Form	clear supernatant	20,000	5,000	5,000

**KEY: CFU ----- Colony forming unit per ml,  
 TMTC-----Too many to count,  
 TAMB-----Total Aerobic Mesophilic Bacteria.**

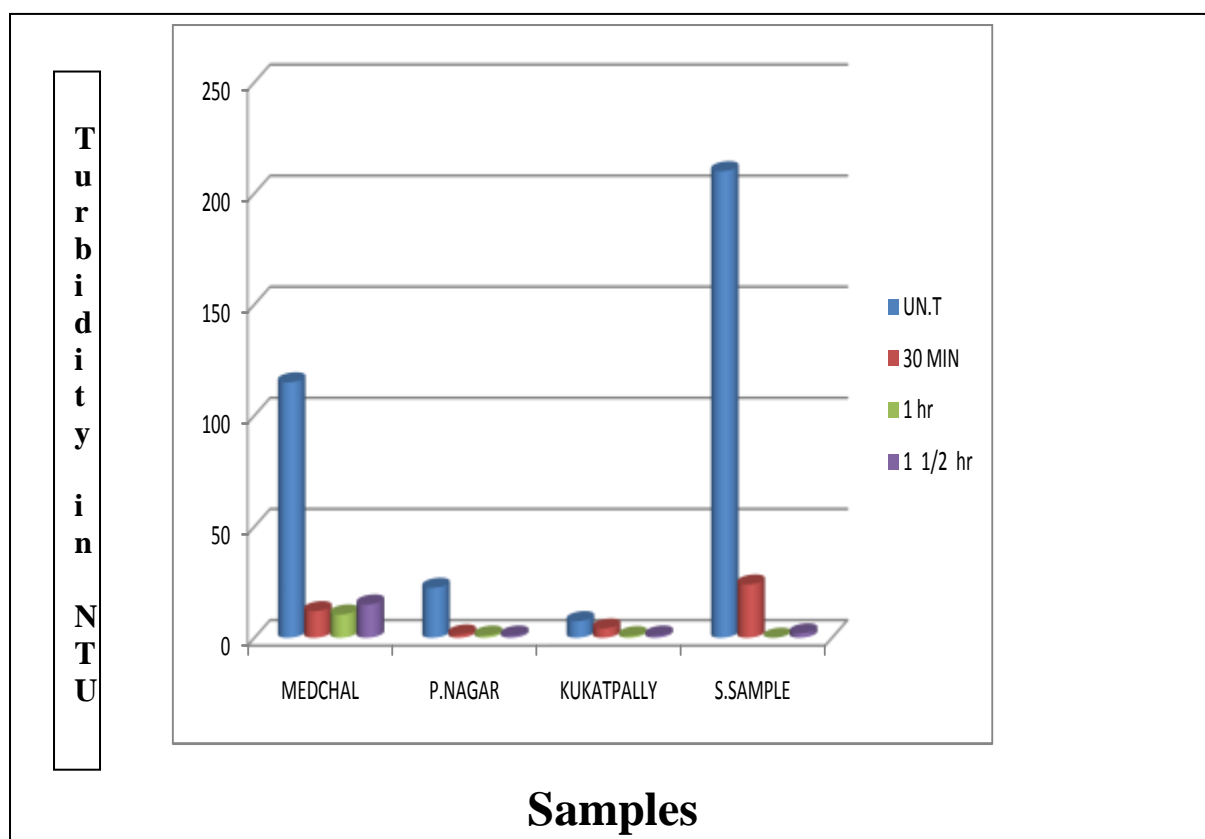
**Table: 5** Coagulative and Disinfective effect of *Moringa oleifera* seeds on Lake Water samples after 1 ½ hr of settling time.

Type of waste Water sample	Physical appearance	TAMB counts	Coli form counts Cfu/ml	E.coli counts Cfu/ml
Dirty water Stagnant from Medchal, hyd	clear supernatant, slight increase In turbidity	TMTC	9,000	TMTC
Polluted stream At Pragathi Nagar, Hyd.	clear supernatant, Slight increase In turbidity	TMTC	6,000	TMTC
Low turbid, Polluted stream From Kukatpally, Hyderabad.	clear supernatant, slight increase In turbidity	TMTC	9,000	60,000
Synthetic Sample (clay From Medchal Agricultural Form	clear supernatant, slight increase in turbidity	TMTC	8,000	6,000



**KEY: CFU ----- Colony forming unit per ml,  
 TMTC-----Too many to count,  
 TAMB-----Total Aerobic Mesophilic Bacteria.**

**Figure: 6** Turbidity of Lake Water samples before and after treatment with *Moringa oleifera* at Different settling times.



**KEY: UN.T ----- Untreated sample**

**P. Nagar ----- Pragathi Nagar**

**S. Sample ----- Synthetic sample**



**Figure: 7** Before and after treatment of Lake Water sample with *Moringa oleifera*.

### Conclusions

The result of the physical nature and microbial content of Lake Water samples from Hyderabad city (Medchal, Pragathi nagar, Kukatpally and synthetic sample) before treatment with *Moringa Oleifera* seeds are presented in table 1. The Total Aerobic Mesophilic bacterial counts, *Escherichia coli* counts as well as coli form counts were generally high, which were numerous to count. The visual observation of Lake Water from Kukatpally and Pragathi Nagar was noted to be highly turbid with terrible odor.

Table 2 shows the result of the coagulative and disincentive effect of *Moringa oleifera* seeds on Lake Water after 30 min of settling time. The microbial count in pragathi nagar and medchal sample was too many to count as the original sample. Where as the Kukatpally showed some reduction in the coli form and Total Aerobic Mesophilic count.

Table 3 shows the drastic reduction of about 90% in the microbial count which includes the Total Aerobic Mesophilic bacteria; Coli form and *Escherichia coli*. Table 4 shows increase in the bacterial count may be due to occurring of disassociation.

The graph of Turbidity indicates a great reduction of about 99% of treatment with *Moringa oleifera* seeds.

We can absorb a extreme change at 30 min of settling time and further reduction at 1 hr of settling time and showed a slight increment at 1 ½ hr of settling time.

The best results of water treatment was seen in 1 hr settling time due to the occurrence of polyelectrolytic mechanism i.e., the seeds of *Moringa oleifera* contain significant quantity of low molecular weight (water soluble proteins), which carry positive charge. When the seeds are crushed and added to raw water, the proteins produce positive charges acting like magnets and attracts the predominantly negatively charged particles such as clay, silk, bacteria and other toxic particles in water.

Where as the 30 min and 1<sup>1/2</sup> hr settling time showed lesser reduction of bacterial load which may be caused with the lower time (30 min) as it was probably below optimal time interval than was found for 1 hr. (Jahn, 1986). The disassociation of proteins might occur at the 1 ½ hr settling times which resulted in the increment of the microbial count and turbidity.

#### 5.1 Advantages:

- ✓ *Moringa oleifera* seeds are nontoxic and effective coagulants useful for removing turbidity and bacteria from water.
- ✓ The cost of seed treatment is very low, in most cases negligible.
- ✓ Cheap and easy method for rural peoples.
- ✓ The processing doesn't affect the pH of the water.
- ✓ There are no toxic byproducts associated with use the of *Moringa* seeds as a coagulant.

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