# OPPORTUNITIES TO REDUCE SUSPENDED SOLIDS IN WASTE WATER BY USING NATURAL COAGULANT USED IN EDUCATIONAL AND ADMINISTRATIVE INSTITUTIONS

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**ABSTRACT**

*Natural coagulant is a naturally occurred; plants based coagulant that can be used in coagulation-flocculation process of wastewater treatment for reducing turbidity. The objectives of this study were to treat the waste water created in our collage campus using natural coagulants as an alternative to the current commercial synthetic coagulant such as aluminium sulphate and to optimize the coagulation process. Based on the experimental results, it was concluded that natural coagulants which have been obtained from watermelon seeds, banana peels, oranges peels, drumstick seeds, lady figure seeds and many one equivalent coagulation comparing to commercial alum. The turbidity removal efficiency for Dolichas lablab, Azadirachta Indica, Moringa Oleifera, respectively were 37.45%, 63.01%, 31.47% against 75.01% obtained from alum.*

**KEYWORDS: -** *Natural coagulant, collage campus ,Environment protection, synthetic coagulant*

## 1.0 Introduction

In wastewater treatment, coagulation has been practiced since earliest times and the main objective is to remove colloidal impurities and also removing turbidity from the water. Coagulant is a chemical used that is added to the water to withdraw the forces that stabilizes the colloidal particles and causing the particles to suspend in the water.

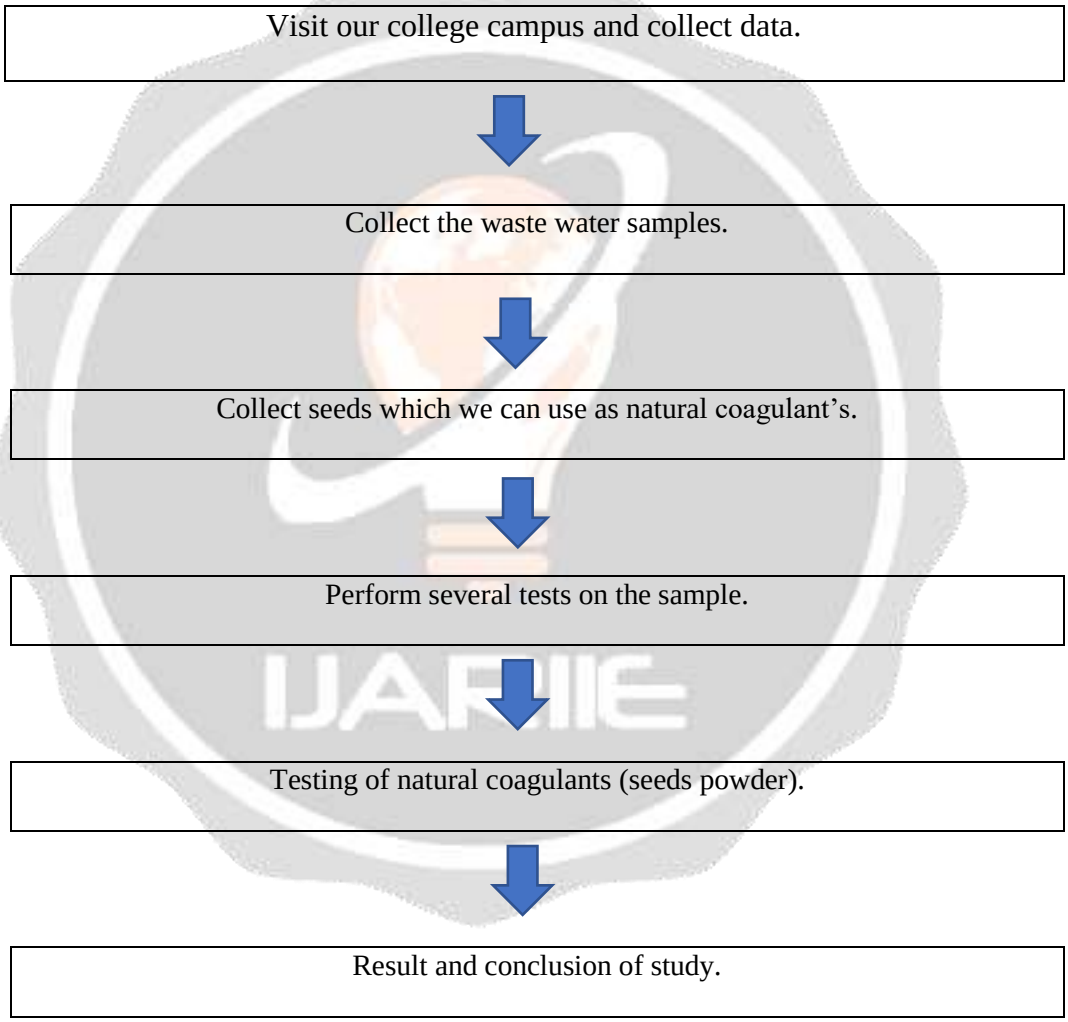
Once the coagulant is introduced in the water, the individual colloids must aggregate and grow bigger so that the impurities can be settled down at the bottom of the beaker and separated from the water suspension. Aluminum sulphate and iron coagulants are commonly used in most industries. However, when aluminum sulphate is used as a coagulant in waste water treatment, it can cause several bad effect on human health such as intestinal constipation, loss of memory, convulsions, abdominal colic's, loss of energy and learning difficulties. Hence nowadays, there has been great attention in the improvement and implementation of natural coagulants in wastewater treatment. These natural coagulants can be formed or extracted from animal, microorganisms and also plant. Natural coagulants used for our study are Dolichos lablab, Azedarach Indica, Moringa Oleifera, which are locally available from vegetables and flowers. We can reduce the load on waste water treatment plant, Hence time and cost will be reduced to treat water. For that purpose at institutional level we have to make small treatment unit having primary and secondary tank to store and treat waste water by using natural coagulant. the methodology used is described below.

**1.1Objective of study:**

1. To promote the educational administrative institute to take participation in processing waste water which is generated in campus.
2. To participate in Swatch bharat mission.
3. To reduce the load on waste water treatment plant.
4. To make environment free from pollution.
5. To use natural material as coagulant minimize the cost

## 2.0Methodology

### ❖ Flowchart




**a) VISIT TO THE COLLAGE CAMPUS**

Firstly, we visit the college campus to collect date. Like source of water, daily use of water, quantity of waste water per day, discharge place of waste water.

**b) COLLECT THE WATER SAMPLES: -**

- After visiting the campus and collecting the data, then we have to collect waste water samples like canteen waste, hostel wash basin, tap water, water from washing cloths etc.

- Collect the water samples and pack it tightly in container through which there is no any path to circulation of any type of gases etc.

Fig :-Canteen waste water

Fig :-Bathroom waste water

Fig :- Cloths wash waste water

**c) COLLECT NATURAL COAGULANTS (SEEDS)**

- Collection of natural coagulants for its coagulation purpose, like drumstick seeds, banana peels, ladyfigure seeds etc.
- Then put all natural coagulants in the ray of sun to make it filly water free.
- After that make powder of all samples.
- And then put the powder form samples in a special container and then tightly pack it.

Fig :- Orange peels powder

Fig :-Beens seeds powder

Fig :- Banana peels powder

Fig :- Watermelon seeds powder

Fig :- Drum stick seeds powder

Fig :- Neem adzidch indica powder

❖ **PERFORM SEVERAL TESTS**

**Test performed on water samples.**

- P.H testing.
- Turbidity testing
- Odour test
- Temperature testing

**Test performed on natural coagulants**

- Odour testing
- P.H testing
- Temperature testing
- Jar testing of each sample

**d) TESTING OF NATURAL COAGULANT**

The first processing phase is widely and essentials for conjugal application for utilization. In this step plant is being cut, sliced, chop and peel for drying purpose by manual or mechanical pulverization to avoid undesired parts. Conventional method involves aeration and following pulp of plant parts into particles are then used by local area due to lack of such equipment. In the second processing phase, organic and/or alcoholic solvents extraction is used to remove the active agents. However, water salt solution (NaCl) extraction also used. The previous research pointed out that by using NaCl solution extraction with lower dosages as 7.4 times higher to eliminate kaolinite turbidity. The author also endorsed improved the substance in proteins whereas substance increases protein anion and ability of solution. Third process phase involves dialysis, lyophilization, ion-exchange and precipitation to treat water as viable refining methods for Moringa oleiferastepped for treatment of higher volume of turbid water. Such methods are not much actively used over other PBCs; therefore, it shows opportunity for researcher to explore this area.

- **JAR TEST**

Jar testing is a pilot-scale test of the treatment chemicals used in a particular water plant.It simulates the coagulation/flocculation process in a water treatment plant and helps operators determine if they are using the right amount of treatment chemicals, and, thus, improves the plant's performance.

Jar test is performed by "**JAR TEST APERATUS**"

**what is jar test aperatus?**
Jar Test Apparatus, commonly known as flocculators or flocculation testers, are used primarily in the water treatment and testing industry. Jar Test Apparatus allows efficient and economical flocculation, jar Test Flocculator are used for a uniform stirring of samples in a water testing laboratory.

Fig: Jar test aperatus

**Procedure of jar test:-**

1. Fill each of the jar test beakers with 1,000 mL of raw water using a 1,000 mL graduated cylinder.
2. Before starting, note the raw water's temperature, pH, turbidity, and alkalinity.
3. After that, make a stock solution by combining 10.0 grammes of coagulants such as alum, with 1,000 mL of distilled water. When added to 1,000 mL of test water, this stock solution will make each 1.0 mL equal 10 mg/L (ppm).
4. Dose each beaker with increasing amounts of the prepared stock solution of alum.
5. Switch on the stirrers after dosing each beaker. This step of the procedure should correspond to the plant's actual conditions as much as possible. In other words, if the plant follows chemical addition

with a static mixer, then 30 minutes in a flocculator, followed by 1.5 hours of settling time before the filters, then the test should follow suit.

6. To mimic a static mixer, run the stirrers at a high RPM for one minute.
7. After that, adjust the stirrers' speed to the flocculator's parameters and let them run for 30 minutes.
8. Over the course of the 30 minutes, keep an eye on the floc creation. Turn off the stirrers and let the mixture settle once the 30 minutes have passed. Within an hour, the majority of the settling will be finished.
9. Now examine the beakers to see which jar produced the greatest results. If there were no obvious results, then for the following six jars, raise the dosage using the table above. A low feeding will result in a cloudy-looking sample in the beaker.

**Factors to consider while conducting jar test**

1) The coagulant ingredient is introduced to the water sample beakers using a flocculator. The contaminants are trapped as the chemical coagulant begins to precipitate, generating flocs that will settle to the bottom of the beaker.
2) The sample is continuously churned so that it is possible to see how floc forms, develops, and settles just as it would in a real water treatment facility.
3) The operator then conducts a series of experiments, to examine the results of various dosages of flocculation agents at various pH levels, in order to identify the proper floc size.

**The following analytic scenarios frequently involve the use of a flocculator:**

- 1000 ml tall, 105 mm glass beakers (jars).
- Coagulant and 600 cc of wastewater samples
- Paddle height: centred above the sample
- Stirring at 120 rpm for 120 seconds
- Moderate speed flocculation: 30 rpm, 25 minutes

## 3.0Results and conclusion

- **Optimum dosage**

The optimum dosage of coagulants are determined by varying the dosage of coagulants are 0.025gm, 0.05gm,0.1gm,0.2gm,0.3gm,0.4gm,0.5gm/500ml at original pH of dairy wastewater (pH =7.41).

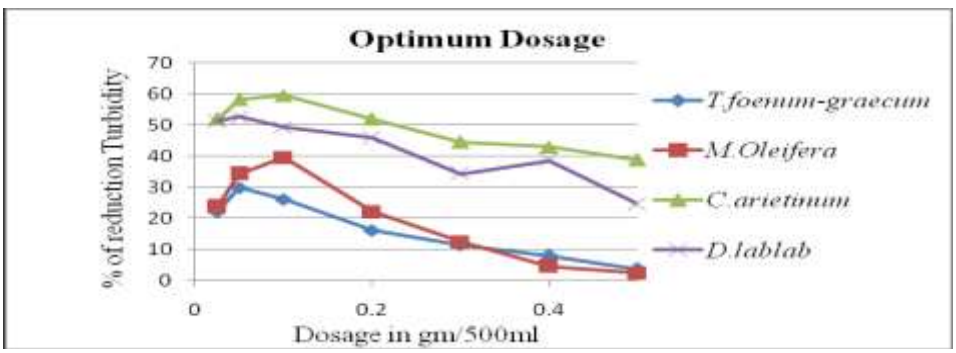



Chart:1 optimum dosage of coagulant

The optimum dosage of T. foenum-graecum, M. oleifera, C. arietinum and D. Lablab are 0.05gm, 0.1gm, 0.1gm and 0.05gm respectively.

❖ **Optimum pH**

Optimum pH is pH at which the maximum reduction of turbidity takes place. Optimum pH can be determined by varying the pH value as 6, 7.41, 8, 9, 10, 11. The below chat-2 shows optimum ph.

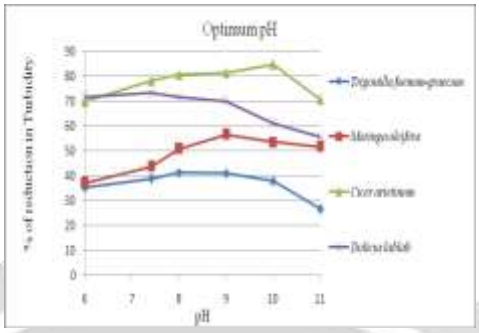



Chart:2 optimum ph. of natural coagulant

The optimum pH for the *T. foenum-graecum, M.oleifera, C.arietinum and D. Lablab* are 8, 9, 10 and 7.41 respectively

**The coagulant dosage and respective turbidity values obtained are tabulated as follows:**

| *Initial Turbidity of wastewater = 28.8 NTU* | | | |
|---|---|---|---|
| **Dosage** | **Turbidity** | **Dosage** | **Turbidity** |
| 0.5 g | 14.8 NTU | 1g | 26.5 NTU |
| 1.5 g | 27.1 NTU | 2 g | 27.8 NTU |
| 2.5 g | 31 NTU | 3 g | 32.2 NTU |
| 0.5 g | 14.8 NTU | 0.6 g | 13.5 NTU |
| 0.7 g | 12.9 NTU | 0.8 g | 11.7 NTU |
| 0.9 g | 23.6 NTU | 1 g | 26.5 NTU |

**TABLE 1: Wastewater Vs Alum**

While using the conventional alum (AlumniumSulfate) as coagulant, the optimum dosage was 0.8 g, which gave 75.01% turbidity removal efficiency.

| *Initial Turbidity of wastewater = 54.2 NTU* | | | |
|---|---|---|---|
| **Dosage** | **Turbidity** | **Dosage** | **Turbidity** |
| 5 g | 52.8 NTU | 10 g | 47.1 NTU |
| 15 g | 43.7 NTU | 20 g | 46.2 NTU |
| 25 g | 46.6 NTU | 30 g | 46.9 NTU |
| 15 g | 43.7 NTU | 16 g | 33.9 NTU |
| 17 g | 37 NTU | 18 g | 37.6 NTU |
| 19 g | 42. NTU | 20 g | 46.2 NTU |

**TABLE 2: Wastewater Vs Dolichas Lablab**

While using the Dolichos lablab as coagulant, the optimum dosage was 16 g, which gave 37.45% turbidity removal efficiency.

| *Initial Turbidity of wastewater = 26.5 NTU* | | | |
|---|---|---|---|
| **Dosage** | **Turbidity** | **Dosage** | **Turbidity** |
| 2 g | 18.2 NTU | 4 g | 17.2 NTU |
| 6 g | 10.4 NTU | 8 g | 11.2 NTU |
| 10 g | 15.3 NTU | 12 g | 18.4 NTU |
| 6 g | 10.4 NTU | 6.5 g | 9.8 NTU |
| 7 g | 10.5 NTU | 7.5 g | 10.8 NTU |
| 8 g | 11.2 NTU | - | - |

**TABLE 3: Wastewater Vs Azadirachta Indica**

While using the Azadirachta Indica as coagulant, the optimum dosage was 6.5 g, which gave 63.01% turbidity removal efficiency.

| *Initial Turbidity of wastewater = 44.8 NTU* | | | |
|---|---|---|---|
| **Dosage** | **Turbidity** | **Dosage** | **Turbidity** |
| 1 g | 39.2 NTU | 2 g | 37.1 NTU |
| 3 g | 30.7 NTU | 4 g | 35.1 NTU |
| 5 g | 36.8 NTU | 6 g | 38.2 NTU |

**TABLE 4: Wastewater Vs Moringa Oleifera**

While using the Moringa Oleifera as coagulant, the optimum dosage was 3 g, which gave 31.47% turbidity removal efficiency.

| *Initial Turbidity of wastewater = 33.2 NTU* | | | |
|---|---|---|---|
| **Dosage** | **Turbidity** | **Dosage** | **Turbidity** |
| 0.5 g | 31.1 NTU | 1 g | 28.9 NTU |
| 1.5 g | 29.2 NTU | 2 g | 29.6 NTU |
| 2.5 g | 29.8 NTU | 3 g | 30.2 NTU |

**TABLE 4: Wastewater Vs Moringa Oleifera**

While using the Moringa Oleifera as coagulant, the optimum dosage was 1 g, which gave 12.95% turbidity removal efficiency.

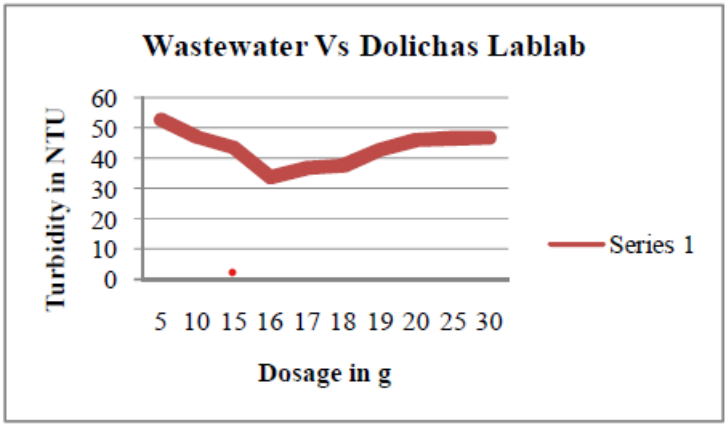



**Fig 1: Dolichas Lablab as Coagulant**

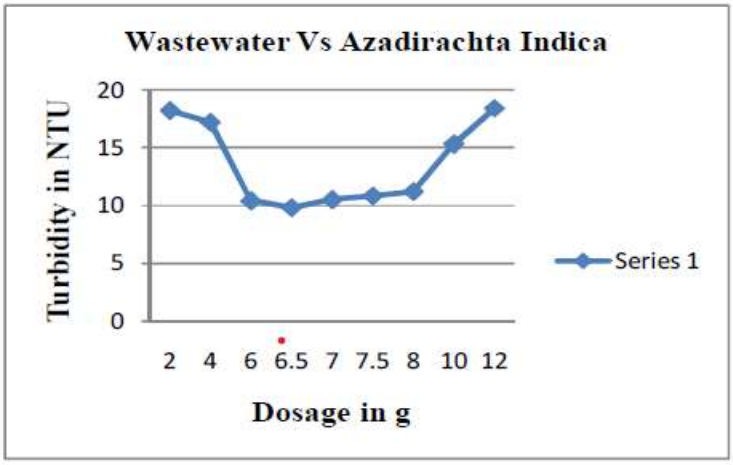



**Fig 2: Azadirachta Indica as Coagulant**

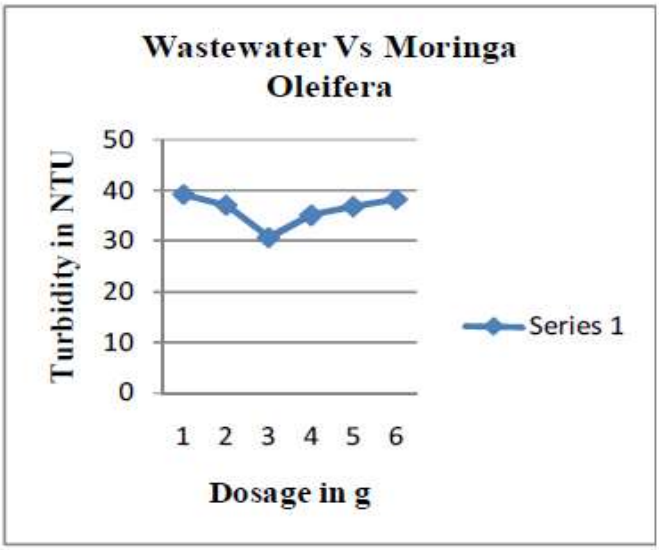



**Fig 3: Moringa Oleifera as Coagulant**

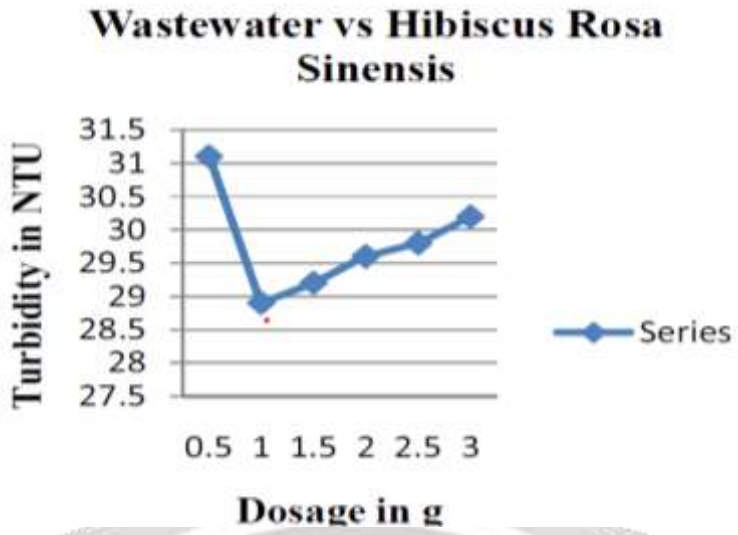



**Fig 4: Hibiscus Rosa Sinensis as Coagulant**

## 4.0CONCLUSIONS

i. From the experimental results, we have concluded that among the choosen natural coagulants, Azadirachta Indica showed a better coagulation and turbidity removal for given paper mill wastewater.

ii. Effect of pH, temperature can also be experimentally found out with the extension of current study, which may further improve the turbidity removal efficiency of the natural coagulants.

iii. Since, we have collected the wastewater from college campus ,canteen waste ; we suggest that, by using Azadirachta Indica as a coagulan instead of commercial alum, for sedimentation process, we can restrict the treatment expenses in a significant scale.

## 5.0References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