

# Wastewater Treatment using Natural Coagulants

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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 assess the possibility of 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 *Dolichas lablab*, *Azadirachta Indica*, *Moringa Oleifera*, *Hibiscus Rosa Sinensis* have showed an merely equalant coagulation comparing to commercial alum. The turbidity removal efficiency for *Dolichas lablab*, *Azadirachta Indica*, *Moringa Oleifera*, *Hibiscus Rosa Sinensis* respectively were 37.45%, 63.01%, 31.47%, 12.95% against 75.01% obtained from alum.

**Keywords** — Jar Test, Coagulation, Flocculation, Natural Coagulants, Turbidity. NTU.

## I. INTRODUCTION

In wastewater treatment, coagulation has been practiced since earliest times and the main objective is to remove colloidal impurities hence 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. Aluminium and iron coagulants are commonly used in most industries. However, when aluminium is used as a coagulant in waste water treatment, it can caused 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 *Dolichas lablab*, *Azadirachta Indica*, *Moringa Oleifera*,

*Hibiscus Rosa Sinensis* which are locally available from vegetables and flowers.

## II. METHODOLOGY

### A. Materials:

Wastewater was obtained from Nachiyaar Paper Mills, Sivakasi as raw wastewater before entering into the nearby screening cum sedimentation tank. Coagulants were prepared from seeds and flowers of various plants by drying and powdering them and finally sieving them in 600 micron IS Sieves.

### B. Method:

Jar Test was carried out to evaluate the initial and final turbidity values (in NTU) before and after the coagulation process using natural coagulation. We have conducted 3 tests to take the average turbidity value for every coagulant dosage.

## III. RESULTS AND DISCUSSIONS

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

**Table 1: Wastewater Vs Alum**

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

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

**Table 2: Wastewater Vs Dolichas Lablab**

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

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

**Table 3: Wastewater Vs Azadirachta Indica**

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	-	-

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

**Table 4: Wastewater Vs Moringa Oleifera**

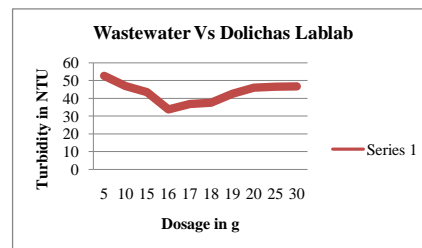
Initial Turbidity of wastewater = 44.8 NTU			
Dosage	Turbidity	Dosage	Turbidity
1 g	39.2 NTU	2 g	37.1 NTU
3 g	30.7 NTU	4 g	35.1 NTU
5 g	36.8 NTU	6 g	38.2 NTU

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

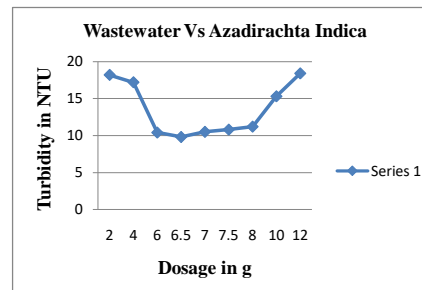
**Table 4: Wastewater Vs Moringa Oleifera**

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

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**

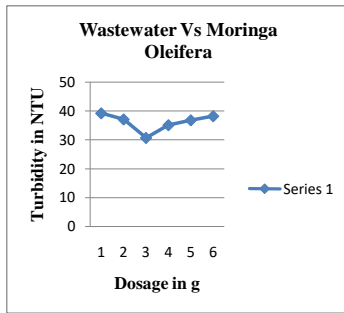


Fig 3: Moringa Oleifera as Coagulant

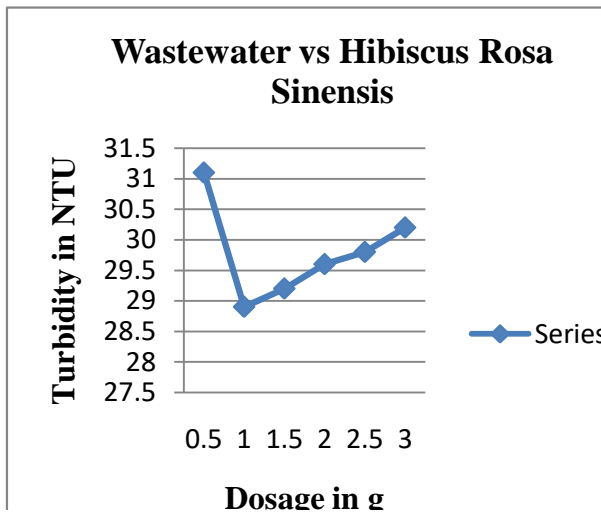


Fig 4: Hibiscus Rosa Sinensis as Coagulant

#### IV. CONCLUSIONS

- From the experimental results, we have concluded that among the chosen natural coagulants, Azadirachta Indica showed a better coagulation and turbidity removal for given paper mill wastewater.
- 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.
- Since, we have collected the wastewater from a smaller paper mill; we suggest that, by using Azadirachta Indica as a coagulant instead of commercial alum, for sedimentation process, we can restrict the treatment expenses in a significant scale.

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