

# Efficiency of Jackfruit Seed Powder as a Natural Coagulant

Aneesu Rahman<sup>1</sup>, Aswathy Ramesh<sup>1</sup>, Ranjitha O R<sup>1</sup>, Suranya T<sup>1</sup>, Jency Nadayil<sup>2</sup>

<sup>1</sup>Student, Department of Civil Engineering, Mar Athanasius College of Engineering, Kothamangalam

<sup>2</sup>Asst.Prof, Department of Civil Engineering, Mar Athanasius College of Engineering, Kothamangalam

\*\*\*

**Abstract** - Natural coagulant is a natural based coagulant that can be used in coagulation process of waste water treatment for reducing turbidity. The study aimed to evaluate the efficiency of *Artocarpus Heterophyllus* (Jackfruit seed) powder as a coagulant in dairy waste water and kitchen waste water samples collected. Jar Test was conducted and the treated samples were evaluated for pH, turbidity and COD. The result showed 82% reduction in turbidity at an optimum dosage of 1600 mg/l for dairy waste water and 88.4% reduction in kitchen waste water at an optimum dosage of 600 mg/l. The reduction in COD was obtained as 57% for dairy waste water and 53% for canteen waste water. Jackfruit seeds could be used as an effective natural coagulant since it is eco-friendly and of low cost when compared with chemical coagulant.

**Key Words:** Jackfruit seed (*Artocarpus Heterophyllus*), Turbidity, pH, COD, Dairy waste, Kitchen waste

## 1. INTRODUCTION

Water is an elixir for human life. However man seems to have forgotten its importance for the growing need for wealth. Due to rapid industrialisation and population explosion the amount of waste disposed to water bodies have increased at an alarming rate thereby diminishing the quality of water. This has led to various water treatment techniques for the improvement of water quality. The two most commonly used primary coagulants are salts of aluminium and iron. But its use has led to adverse effect to the environment and human life. The salts of aluminium in water is reported to cause Alzheimers disease, nervous disorders, cancer etc...This emphasises the need to search for natural coagulants for simple, reliable and effective treatment of waste water.

Jackfruit is an important naturalised plant of Southeast Asia which is rich with starch sources. Due to its eco-friendly nature and cost effectiveness jackfruit seed powder can be used as an alternative to chemical coagulants. Water treatment becomes more cheap and can be implemented in different countries.

Coagulation flocculation process is one of the earliest process involved in the treatment of waste water. Its main objective is to remove the colloidal impurities and hence results in the reduction of turbidity from water samples.

The research conducted by Anu Sundaresan and Anu N in 2016 emphasised on the feasibility of natural coagulants such as common beans (*Phaseolus vulgaris*) and jackfruit

seeds (*Artocarpus heterophyllus*) for the treatment of waste water. Coagulated in jar test apparatus with dosage 0.2,0.4,0.6,0.8,1.0 gm/500 ml of dairy waste water sample agitated at 125 rpm for 30 minute and samples allowed to settle for 30 minute. Characterisation of treated effluent was conducted and compared and was found to attain 99% removal efficiency.

A study was conducted by Robert Natumanya and James OKUT-OKUMU in 2015 on the treatment of community drinking water in Uganda with Javaplum, Jackfruit and Moringa seed powder using Jar Test and obtained turbidity removal efficiency of 97.7% for Moring Oleifera, 95.8% for *Artocarpus Heterophyllus* and 94.1% for *Syzgium Cumini*. The seed extracts were also found effective as water disinfectants.

## 2. OBJECTIVE

The main objective of this project is to identify the turbidity removal efficiency of jackfruit seed (*Artocarpus Heterophyllus*) powder in dairy and kitchen waste water samples collected.

## 3. MATERIALS AND METHODS

Dairy waste was collected from Jeeva Milks, Pareekanny.. The samples were collected in sterilised bottles and were preserved in the refrigerator during storage. Also kitchen waste water was collected from the canteen outlet of Mar Athanasius College of Engineering, Kothamangalam. Sufficient care was taken to obtain a sample that was true representative of existing condition and to handle it in such a way that it do not deteriorate or become contaminated before it reached the laboratory. Initial characterisation of waste water samples were carried out and parameters like pH, turbidity, COD, hardness, total acidity and total alkalinity were determined.

**Table -1:** Characteristics of dairy waste water

PARAMETERS	VALUE
pH	8.2
Turbidity	260 NTU
COD	696 mg/l
Hardness	100 mg/l
Total Alkalinity	920 mg/l
Total Acidity	80 mg/l

**Table -2:** Characteristics of kitchen waste water

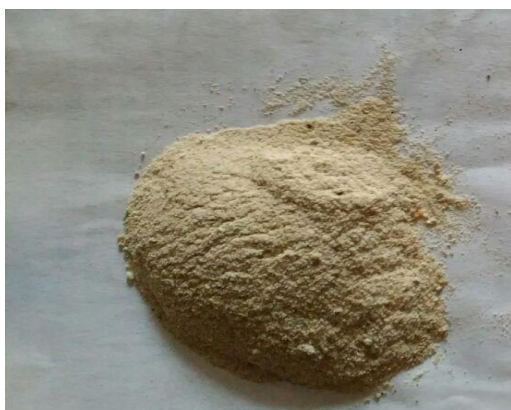
PARAMETERS	VALUE
pH	7.8
Turbidity	192 NTU
COD	1067.2 mg/l
Hardness	80 mg/l
Total Alkalinity	200 mg/l
Total Acidity	160 mg/l



**Fig -2:** Jar Test Apparatus and the filtered sample

### 3.1. Jackfruit Seed Powder Preparation

Jackfruit seeds (*Artocarpus Heterophyllus*) were collected from households and was boiled and sundried for 48 hours. Then the seeds were grained to fine powder in grinding mills. The powder was sieved using 0.45 mm mesh and was stored in an airtight container to prevent the entry of moisture into it and to avoid loss of its activity. The fine powder was used as coagulant for analysis.



**Fig -1:** Jackfruit seed powder

### 3.2. Jar Test Apparatus

Coagulation and flocculation are the most common method used for the removal of turbidity, colour, suspended matters, microorganisms and other odour producing substances. It involves the addition of coagulants that brings together the small destabilised particles to form large flocs so that they settle under the force of gravity and can be easily separated from the water. Jar test apparatus was selected for coagulation – sedimentation. Jackfruit seed powder was fed to the respective samples in varying dosages. Initially rapid mixing was carried out for 2 minutes at 100 rpm followed by slow mixing for 25 minutes at 20 rpm. The sample after coagulation was allowed to settle for 30 minutes. The supernatant obtained was filtered and its characteristics (pH, turbidity and COD) were determined.

## 4. RESULTS AND DISCUSSIONS

Optimum coagulant dosage was determined by varying the dosage of coagulant as 0.4, 0.8, 1.20, 1.60, 2.00 g/l for dairy waste water and 0.2, 0.4, 0.6, 0.8, 1.00 g/l for kitchen waste water. The turbidity of the sample was measured by using Nephelometric Turbidity meter and pH using pH meter.

**Table -3: Variation of turbidity and pH with varying coagulant dosage for dairy waste water**

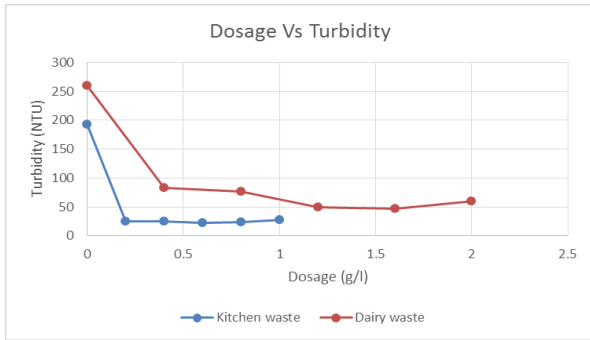
DOSAGE (g/l)	TURBIDITY (NTU)	pH
0.00	260	8.2
0.40	83	7.8
0.80	77	8.02
1.20	50	7.89
1.60	47	7.80
2.00	60	7.72

Upon treating with jackfruit seed powder, optimum coagulant dosage was obtained at 1600 mg/l for dairy waste water. Turbidity reduction was 82% and optimum pH range can be found to be between 7.7-7.9.

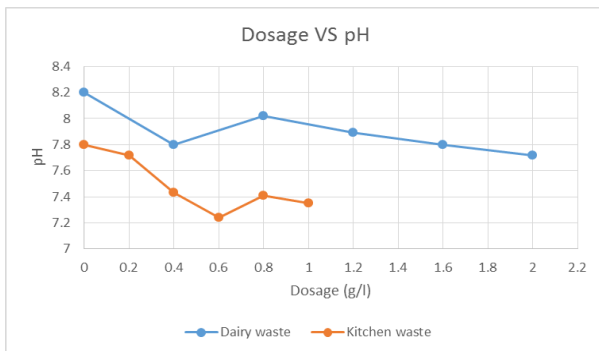
**Table -4: Variation of turbidity and pH with varying coagulant dosage for kitchen waste water**

DOSAGE (g/l)	TURBIDITY (NTU)	pH
0.00	192	7.8
0.20	25.5	7.72
0.40	24.7	7.43
0.60	22.2	7.24
0.80	23.8	7.41
1.00	27.8	7.35

Jackfruit seed powder was fed in varying dosages as shown and optimum coagulant dosage was found to be 600 mg/l with an overall reduction in turbidity 88.43%. Optimum pH range is found to be 7.2-7.4.



**Chart -1:** Variation of turbidity with varying dosages of jackfruit seed powder



**Chart -2:** Variation of pH with varying dosage of jackfruit seed powder

Supernatant obtained from the sample corresponding to optimum coagulant dosage was collected and COD of the treated sample is determined.

For dairy waste water COD of the collected supernatant was found to be 300 mg/l and thus 57% in reduction in COD was obtained.

COD of treated kitchen waste water was found to be 500 mg/l and a reduction of 53% was achieved.

**Table -5: Characteristics of dairy waste water and kitchen waste water at optimum coagulant dosage**

PARAMETERS	DAIRY WASTE WATER	KITCHEN WASTE WATER
pH	7.80	7.24
TURBIDITY (NTU)	47	22.2
COD (mg/l)	300	600

## 5. CONCLUSION

In this study we mainly analysed the turbidity removal efficiency of jackfruit seed powder. Turbidity reduction of 82% at an optimal dosage of 1600 mg/l and 88% for an optimal dosage of 600 mg/l is obtained for dairy waste and kitchen waste water respectively. Also COD was reduced by

57% and 53% for dairy waste and kitchen waste respectively at the optimum coagulant dosage.

## ACKNOWLEDGEMENT

I express my sincere gratitude and thanks to Dr. Soosan George T, our Principal and Dr. Binoy Alias M, Head of the Department for providing the platform to conduct our project and for all the encouragement and support.

I express my sincere gratefulness to Assistant Prof. Jency Nadayil, for her sincere guidance throughout the project. I express my sincere gratitude to all the faculties of the Department of Civil Engineering for their help and encouragement.

## REFERENCES

- [1] Anu Sundaresan and Anu N, "Feasibility of Natural Coagulant for the Treatment of Dairy Wastewater", International Journal of Scientific and Engineering Research, Vol. 7, Issue 4, April 2016, ISSN 2229-5518, pp. 245-249.
- [2] Mohd Suffian Yusoff, Noor Aina Mohamad Zuki and Mohd Faiz Muaz Ahmad Zamri, "Effectiveness of Jackfruit Seed Starch as Coagulant Aid in Landfill Leachate Treatment Process", International Journal of GEOMATE, Vol. 11, Issue 26, Oct. 2016, ISSN: 2186-2982, pp. 2684-2687.
- [3] Robert NATUMANYA and James OKOT-OKUMU, "Evaluating coagulant activity of locally available Syzgium cumini, Artocarpus heterophyllus and Moringa oleifera for treatment of community drinking water, Uganda", Int. J. Biol. Chem. Sci., Vol. 9(6), Dec. 2015, ISSN 1997-342X(Online), pp. 2535-2547.
- [4] Sonal Choubey, S.K.Rajput and K.N.Bapat, "Comparison of Efficiency of some Natural Coagulants-Bioremediation", IJETAE, Vol. 2, Issue 10, Oct. 2012, ISSN 2250-2459, pp. 429-434.