

Application of Biological Coagulation in Sedimentation Process

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Abstract: This study discusses real life problem faced by the conventional treatment plants in order to devise a biochemical coagulation process using biological coagulants conducted in laboratory-based experiments. Biochemical coagulation process can be defined as the biochemical destabilization of particles in water to bring about their aggregation during perikinetic and orthokinetic flocculation. Water treatment plants face with the sludge disposal problems, due to chemical coagulants that is iron and aluminum salts. In practice, the sludge from these unit processes are not safely disposed in water or land. Because of chemical sludge contains tiny colloidal solid particles and chemical compounds, there is a need for the present study towards sustainable development. If the sludge is disposed into natural streams and low-lying wetland areas, it may lead to land, air and water pollution. In the present experimental investigation, study of organic coagulants like Nirmali seeds (clearing nut), Jackfruit seed powder, and Conocarpus leaves solution, has been attempted. The biological coagulants are commonly plant based substances that are experimented in the present biochemical coagulation process in jar test apparatus experimental rig for results of turbidity. The comparison of these three natural coagulants are determined by the optimum coagulant dosage requirements for analysis and evaluation of turbidity. It is concluded that present biological coagulants are sustainable coagulation dose requirements to meet global water quality index of excellent standards. The sludge from these biological coagulants may be disposed by the aerobic and anaerobic composting techniques. Otherwise these organic sludges can be dumped in natural streams and lands. Abundantly, the biological coagulants are safe and environment friendly that can be used for water treatment plants.

Index Terms: Biochemical coagulation, Conocarpus leaves solution, Jackfruit seeds powder and Nirmali seeds.

INTRODUCTION

Water is the important thing in the entire life of all natural and human activities. Now a days available of Clean drinking water will be very scarcity. Due to the surface water is polluted by various human activities such as conveying wastewater, discharging industrial effluents and dumping solid waste into natural streams [1]. Even ground water also polluted by the percolating of leachate from the waste dumping site [2]. This polluted water should be conveyed to the treatment. In the treatment processes load will be increased. Coagulants play a important role in the treatment of water and wastewater. Many coagulants used are conventional treatment process that includes chemical coagulants such as Aluminum sulfate, sodium aluminate, and ferric chloride and After treatment process the sludge from these units causes several health hazards [3]. Aluminum is the harmful factor for viral infections or toxins

in the blood, study of various reports on impact of aluminum on human health [4]. Therefore, it is need to that replacement of these chemical coagulants with an of alternative natural coagulants [5]. Natural coagulants (biological coagulants) are originated from the plants. They are less cost products, environmentally friendly behavior, and safe for the human health [6]. Some of the plant-based coagulants like moringa oleifera, common beans, tamarind seeds. These coagulants are rich source of polysaccharide substances. Natural polyelectrolyte of plant origin has been used for many centuries in developing countries for purification of turbid water. For house hold purposes water treated by the materials are used in the form of powder or paste.

RESEARH SIGNIFICANCE

This study discusses about controlling the disposal of chemical sludge into land or natural streams. In water or wastewater treatment plants inorganic coagulants used in the unit processes. In order to mitigate that the chemical sludge, using of various biological coagulants like conocarapus leaves solution, Jackfruit powder and nirmali seeds are tested. A comparison was made with the chemical coagulants in terms of efficiency. These studies are helpful for small scale water treatments plants.

MATERIALS AND METHODS

Preparing of Conocarpus Leaves Solution

The Conocarpus leaves solution was prepared by collecting from Conocarpus trees and washed with water. These leaves were dried in sunlight. The Dry leaves are made into fine powder by using a kitchen mixer (Figure 1). This fine powder was sieved with 100 μ sieve and finally the powder was mixed with the 50 ml of distilled water by the help of magnetic stirrer to get homogeneous liquid. This liquid is filtered through the filter paper. The filtrate was stored in an airtight container. The coagulant solution is prepared fresh daily before the experiment.



Figure 1: Conocarpus Leaves made into powder

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Jackfruit Seeds Powder Preparation

Jackfruit were collected from the market and the seeds were separated. The seeds were dried with normal sunlight about 3-4 days. Then the seeds were grained into a fine powder with the help of kitchen blender. The powder was sieved using 100µ sieve and it was stored in an airtight container to prevent the entry of moisture. The fine powder was used as coagulant.

NirmaliSeeds

Nirmali seeds were collected and dried at 100°C for 24 hours in hot air oven. Seeds were directly used as coagulant. The application of nirmali seeds as coagulant can be done either in the form of seeds powder or water extract or seeds. Nirmali Seed acts as a natural coagulant material with polyelectrolyte. This polyelectrolyte is responsible for coagulation property of Nirmali seeds.

Preparation of Synthetic Turbidity Water

A 10 grams of clay was taken from the passing of 75µ sieve and is mixed with the one liter of water at 500 rpm for 30 minutes with the help of magnetic stirrer (Figure 2). After stirring, the solution was allowed to settle for 24 hours which will result in a homogeneous turbid liquid. This 1 liter of turbid liquid was made up to 10 liters by using ta water.



Figure 2: Preparing the synthetic turbidity water using magnetic stirrer.

Jar Test

A jar test apparatus was used in the optimum coagulant dosage of organic coagulant sample of synthetic turbid water by using coagulants like as nirmli seeds, conocaparus leaves solution, and jackfruit seeds powder as biological coagulant. The dosage of coagulant of each jar 1ml,2ml...6ml/lit are added in to the six beakers. The jar test was operated initially at 80 rpm for 2 minutes then at 40 rpm for 30 minutes. The solutions were allowed to settle. Turbidity was measured initially and at the end of the running Jar test using the turbid meter. All tests were achieved at an temperature of 27°C - 28°C and turbid ranges should be done less than 120) NTU.

RESULTS AND DISCUSSIONS

Turbidity of synthetic water sample should be taken into six beakers and add a dosage of 1ml, 2ml up to 6 ml after the experiment, the degree of transparency should be checked by Jackson turbidity meter and find out removal efficiency of turbidity of each beaker. Conocarpus leaves solution used as a coagulant the best result is observed with an efficiency of

82.53 with a dosage of biological coagulant 6ml /lit with initial turbidity of 112 NTU (Table 1, Figure 3).

Table 1: Coagulant dosage verses removal efficiency of turbidity

Dosage of Coagulant	Removal Efficiency of Turbidity (%)		
	Conocaparus leaves	Nirmali Seed	Jackfruit Seeds
1	12.85	13.44	10.38
2	24.75	26.58	18.88
3	43.54	41.26	33.45
4	55.11	54.8	50.58
5	71.94	67.2	60.12
6	82.53	83.74	66.41

Nirmli seeds are used as a coagulant the best result is observed with an efficiency of 83.74with an dosage of biological coagulant 6mg /lit with initial turbidity of 119 NTU.

Jack fruit seeds powder are used as a coagulant the best result is observed with an efficiency of 66.41with an dosage of biological coagulant 6mg /lit with initial turbidity of 104 NTU.

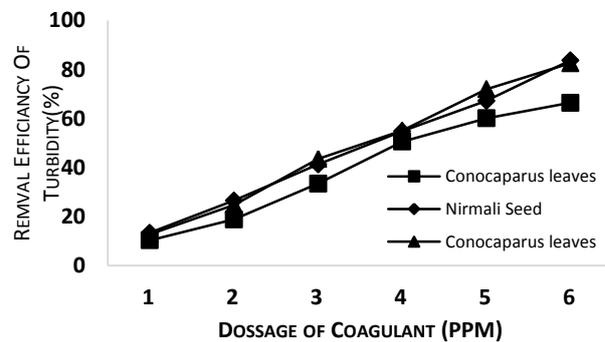


Figure 3: Turbidity removal efficiency of conocaparus leaves solution coagulant.

The above natural coagulants are used to removal of turbidity from sample turbidity water. The entire experimental work used synthetic water because this water contains particles size less than 75µ then the initial turbidity ranges from 100 to 120 NTU. Compare the efficiency of these biological coagulants we observed that clearing nut and conocarpus leaves solution is gives best results then compare with jackfruit seed powder coagulant.

CONCLUSION

The present study revealed that the removal efficiency of turbidity from the synthetic water by using of conocaparus leaves solution, clearing nuts and jackfruit seeds powder coagulants. These coagulants are used in water and wastewater treatments, the sludge from these unit process should dumped into low lying areas or dumping into near natural streams. It is organic content easily bio gradable otherwise these sludges should be both aerobic and anaerobic composting technique the biological coagulants are safe and environment friendly that can be used for water treatment plants.



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