

STUDY ON EFFICIENCY OF TAMARIND AND SYZYGIUM CUMINI SEED POWDER AS A NATURAL COAGULANT IN THE TREATMENT OF DAIRY WASTEWATER

G. Hariesh

PG Scholar Department of Civil Engineering, Pandian Saraswathi Yadav Engineering College, Sivagangai, India

Abstract

Water is one of the important substances on earth. Turbidity seems to be the major problem in the waste water treatment. In this study an attempt has been made to determine the efficiency of readily available Tamarind and Syzygiumcumini seeds as natural coagulant to reduce the turbidity in wastewater in the aspect of improving the quality of wastewater, the coagulant was prepared by drying, crushing and grinding the seed to fine powder. Jar test is to be carried out and the test samples are to be evaluated for pH, turbidity, total solids, suspended solids, dissolved solids, BOD and COD. It is therefore, recommended that the usage of this locally available natural coagulant is found to be suitable, cheap and environmental friendly for the treatment of dairy wastewater.

Keywords: *Natural coagulants, Dairy waste water, Turbidity, pH.*

Introduction

Industrialization is the backbone for the development of a country, but on the other hand pollution caused by the industries seems to be severe concern throughout the world, out of all industries food sector consume highest amount of water and is one of the biggest producer of the effluent per unit of the production more than that of the generation and generate large volume of sludge in the biological treatment one of which is dairy industry. In dairy industry large quantity of wastewater is originated due to their different operations, It involves processing of raw milk into products such as consume milk, butter, cheese, yogurt, condensed milk, dried milk and of ice cream are formed by the process involving chilling, pasteurization and homogenization respectively. Many coagulants are widely used for the conventional treatment process based on their chemical characteristics. In order to avoid various health issues and related problems Natural coagulants are used in the treatment of wastewater.

Need of Study

Dairy wastewater contains huge amount of organic constituents so that it needs to be treated before discharging into the environment. The two primary coagulants that have been used are the salts of aluminum and iron. But the usage of this coagulants have led to adverse effect to the environment and human life, The salts of aluminium in water resulted in Alzheimers disease, nervous disorders, cancer etc..This emphasizes the need for natural coagulants to treat waste water, the need for simple reliable and effective method of water treatment led to the application of plant materials, including seed of Tamarind seed and Syzygiumcumini seed.

‘Objectives of Study

1. To identify the turbidity removal efficiency of Tamarind seed (Tamarindusindica) and Syzygiumcumini seeds (Java plum)
2. To determine the optimum dosage of coagulant by varying the dosage of coagulants.
3. To determine the ability of adsorption based on the experimental studies.
4. To determine either Tamarind seed (Tamarindusindica) or Syzygiumcumini seeds (Java plum) which of the one is effective.
5. To compare the treated water with standard dischargeable limits.

Focused Examination

- Physical Examination
- Chemical Examination

Physical Examination

Turbidity

The definition of turbidity is that cloudiness or haziness of fluid caused by suspended solids that are usually invisible to the naked eye. The measurement of turbidity is also important factor to determine the quality of water.

Causes of Turbidity Organisms like phytoplankton can contribute to turbidity in open water Erosion and effluent from highly urbanized zones contribute to the turbidity of water in those areas

Measurement of Turbidity

The most common measurement of turbidity in the United States is the Nephelometric Turbidity units (NTU)

Procedure

The raw water was taken in the test tube and placed in Nephelometric turbidity meter. The reading was observed in the meter and it is noted.

Effect

If turbidity is more than 10, the water gets unfit for the drinking purpose

If turbidity is less than 0, the water appearance is clear.

PH

PH is a measure of the hydrogen ion concentration of a solution. Solutions with a high concentration of hydrogen ions have low pH and solutions with low concentrations of H⁺ ions have high PH.

$$PH = -\log [H^+]$$

PH < 6.5, then water is acidic

PH>8.5, then water is alkalinity

It has no unit

Procedure

The Ph was calibrated with buffer solution of 4.0 and 7.0 and then all the samples were analyzed for the PH.

Effect

If PH is greater than 8.5, digestion disorder will occur

If PH is less than 6.5, mucus membrane gets affected.

Chemical Examination

BOD

It is the amount of dissolved oxygen needed by aerobic biological organisms to break down organic material present in a given water sample at certain temperature over a specific time period.

Procedure: Take the sample, dilute with dilution water. Take the sample in 2 BOD bottles, fill another two bottles with dilution water alone (without nutrient). Immediately find DO of the diluted wastewater sample and dilution water, Incubate the other 2 BOD bottles at 20°C for 5 days. It must be highly stopper to prevent air entering the bottles, finally DO in the bottle is found out at the end of 5 days.

COD

It is the indicative measure of amount of oxygen that can be consumed by the reactions in measured solution. It is commonly expressed in mass of oxygen consumed over volume of the solution which in SI units is milligrams per liter.

Procedure

The COD tubes with the stoppers are taken (one for the blank and other for the sample). Adding 2.5ml of the sample in other tube. Add about 1.5ml of potassium dichromate reagents digestion solution to each of two COD tubes. Add 3.5ml of sulphuric acid reagents catalyst solution to each of the tubes switching on the COD digester and fix the temperature at 150°C and further it is heated to about 20 minutes. The digester automatically gets switched off. Then the COD tubes are placed in the COD analyzer "spectroquant-picco". Finally the COD of the samples are measured in mg/l.

Total Solids

Total solid is a measurement that includes the combination of total dissolved solids and total suspended solids. It is measurement that is often used in the water treatment industry. Higher total solids indicate that higher level of solid material in water sample. Depending on the criteria, a higher level of total solids cause the sample to be considered contaminated.

Procedure

Wash and wipe the china dish and dry it in a hot oven for dryness. Measure the initial weight of the dishes using electronic balance. Take 20ml of the filtered sample in the china dish and evaporate in the water bath at 103°C to 105°C. Cool the container to dryness in desiccators and weigh the dishes again. Note the increase in weight. The amount of total solids present in the sample is calculated as

$$\text{Total solids} = (\text{mg of residue} / \text{volume of sample taken}) * 1000$$

Total Dissolved Solids

A total dissolved solid is a measure of the combined content of all inorganic and organic substances present in a liquid in molecular, ionized or micro-granular suspended form.

Procedure

Wash and wipe the china dish and dry it in a hot oven for dryness. Measure the initial weight of the dishes using electronic balance. Take 20ml of the filtered sample in the china dish and evaporate in the water bath at 103°C to 105°C. Cool the container to dryness in desiccators and weigh the dishes again. Note the increase in weight. The amount of total solids present in the sample is calculated as

$$\text{Total dissolved solids} = (\text{mg of residue} / \text{volume of sample taken}) * 1000$$

Total Suspended Solids

The total suspended solids are difference between the total solids and of the total dissolved solids.

$$\text{Total suspended solids} = \text{Total solids} - \text{Dissolved solids}$$

Inference from Literature Review

1. Literature survey reveals that *Phaseolus vulgaris* (common beans) seed have been achieved turbidity removal of 99% in dairy waste water.
2. In this study Tamarind seed and *Syzygiumcumini* seed has been used to treat dairy wastewater, where as tamarind seed has been already used in the treatment of dairy wastewater and achieved turbidity removal efficiency of nearly 78%.
3. So far, cumin seeds are used in adsorption of fluoride from industrial wastewater and removal of chlorine from aqueous solutions etc., in this study an attempt has made by using cumin seed for the turbidity removal efficiency in dairy waste water.

Materials and Methods

Dairy Wastewater

The sample of dairy wastewater has been collected from SNP dairy from ayyankottai Madurai. The samples were collected in the sterilized bottles and preserved in the college laboratory during storage, sufficient care was taken to the sample that was true representative of the existing condition and is further handled with much care so that it does not decorate or get contaminated before it reaches the laboratory. Initial characterization of the wastewater sample and the various parameters such as Turbidity, pH, COD, BOD TS TDS and TSS were analyzed.



Figure 1 Wastewater Sample Collected from SNP Dairy

Natural Coagulants

The natural coagulant is one of the best alternatives to that of the chemical coagulants. The mechanism of which involve reaction of seed powder of natural coagulant with that of the raw water.

Tamarind Seed

The tamarind seed which is disregarded as agricultural waste has proven to be the effect agent to make the turbid wastewater clear. The present practice is to use aluminium salt to treat such water. It has been found that alum increases toxic metals ions in the treated water and could cause disease like Alzheimer's. The tamarind is collected from the market which is locally available.



Figure 2 Tamarind Seed

Syzygium Cumini Seed

The syzygium cumini seeds also known as jambu or jamun seeds are greatly demanded by various manufacturers for making herbal products, the syzygiumcumini seeds are greatly used across the world for making health related problems and is effective in the treatment of turbid wastewater. These types of syzygiumcumini seeds are also collected from the market as it is readily available.



Figure 3 Syzygiumcumini Seed

Jar Test Experiment

Coagulation and flocculation proves to be efficient in water and wastewater treatment plants. The purpose of coagulation or flocculation is to remove the turbidity, color, suspended matter, microorganisms and of the odour producing substances. Coagulation of which involves addition of chemicals to destabilize the suspended particles, colloidal molecules, and macromolecules. Jar test apparatus was selected to be used for coagulation-sedimentation studies, It was carried out as batch test, consists of six beakers together with six-spindle steel paddles, before operating the sample was mixed thoroughly using the jar test, the sample is then mixed homogenously and it is measured for turbidity for the representation of initial concentration. Coagulants of varying concentration are added in the beakers. The whole of procedure in the jar test was conducted with the different rotating speed.



Figure 4 Jar Test Apparatus

Conclusion

- Literature collection
- Collection of Natural coagulants
- Collection of waste water sample
- Project report preparation and submission

Work to be done in phase 2

Wastewater sample collection

- Preparation of seed powder
- Experimental analysis
- Analysis of tests
- Documentation

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