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Low-Cost Eco-Friendly Dairy Wastewater Treatment Using Natural Coagulant-Jackfruit Seed Powder

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Abstract : The dairy industry is one of the major source of food processing. These industries produce a huge amount of wastewater. Such wastewater is to be treated by using naturally and easily available coagulants and tests are to check the different water characteristics of waste water before and after coagulation process. Natural coagulant is a natural based coagulant that can be used in coagulation process of waste water treatment. The study aimed to evaluate the efficiency of Artocarpus Heterophyllus (Jackfruit seed) powder as a coagulant in dairy waste water samples collected. Jar Test was conducted and the treated samples were evaluated for pH, turbidity and COD. Coagulated in jar apparatus with dosage 0.2, 0.4, 0.6, 0.8, 1.0 g/ 800ml of dairy wastewater sample agitated at 125 rpm for 30 minutes and after the samples were allowed to settle for 30 minutes.

***IndexTerms* - Jackfruit seed (Artocarpus Heterophyllus), Turbidity, pH, COD, Dairy waste.**

I. 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 industrialization and population explosion the amount of waste disposed to water bodies has 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 Alzheimer's disease, nervous disorders, cancer etc…This emphasizes the need to search for natural coagulants for simple, reliable and effective treatment of waste water. The WHO states that "The management of water resources will become increasingly important in the future, and we should also look at alternative water sources, such as the reuse of waste water". Andone such idea for reuse of waste water is treatment of Dairy Wastewater by adsorption concept using Natural Adsorbent like jackfruit seeds.
The dairy industry consumes considerable amount of water for its production processes, generating large volumes of effluents with high load pollution, which if not properly disposed or treated, can cause serious problems of environmental contamination. The waste water treatment means the removal of the contaminants from any form of wastewater, includes physical, chemical and biological processes so that water can be reused.

The dairy industry is one of the most polluting of industries, not only in terms of the volume of effluent generated, but also in terms of its characteristics as well. It generates about 0.2–10 liters of effluent per liter of processed milk with anaverage generation of about 2.5 liters of wastewater per liter of the milk processed. The dairy waste effluent is complexin nature and characterized by high dissolved solids, high suspended solids, high BOD,COD, phosphorus, nitrogen, oil and grease etc.., Such untreated wastewater pollutes land and river system so proper treatment of dairy wastewater is necessary before disposal into environment.

II. OBJECTIVES OF THE STUDY:

- To check the feasibility of the use of Jackfruit seeds as Adsorbent for dairy waste water
- To determine reduction efficiency of adsorbent over various parameters such as pH. Alkalinity, Turbidity, BOD, COD.
- To determine the effective dosage of the natural coagulant-Jackfruit Seed Powder

III. MATERIALS AND PROPERTIES:

3.1 Waste Water Considered

Wastewater considered for the present study of dairy waste water effluents is collected from YH Dairy Farm Chitradurga.

Table 1: Raw water characteristics Dairy Wastewater

Sl. No	Parameters	Untreated	Treated
1.	pH	9.75	7.5
2.	Turbidity	148NTU	68NTU
3.	Alkalinity	344mg/l	209mg/l
4.	COD	1280mg/l	400.5mg/l
5.	BOD	739.5mg/l	328.5mg/l

3.2. Jackfruit Seed Powder Preparation

Jackfruit seeds were cleaned with water and sundried for 2 days. Then the seeds were grained to fine powder in grinding mills. The powder was sieved using 0.425 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 will be used as a coagulant for analysis.

Fig 1: Jackfruit seed powder

3.3 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 were determined.

Fig 2: Jar Test Apparatus and the filtered samples

IV RESULTS AND DISCUSSION:

4.1 Jack Fruit Seeds as a Coagulant

Table 2 Results of Experimentation

Dosage (g)	pH	Turbidity (NTU)	Alkalinity mg/l	BOD mg/l	COD mg/l
0.4	8.67	106	235	468.5	590
0.6	8.1	73	221.5	410.5	480
0.8	7.5	68	209	328.5	400.5
1.0	7.7	69	221	380	441.5

FIG: GRAPHS

For dosage of 0.8g jackfruit powder, the construction of pH 9.75 and was neutral after treatment with a percentage reduction of 76.92%, in turbidity initially it was 148NTU and finally reduced to 68NTU with percentage reduction of 54.05%, in Alkalinity initially it was 344mg/l and finally reduced to 209mg/l with the percentage reduction of 39.24%, in BOD initially it was 739.5mg/l and finally reduced to 328.5mg/l with the percentage reduction 55.57%, in COD initially it was 1280mg/l and finally obtained result was 400.5mg/l with the percentage reduction of 68.71%.

VI. CONCLUSIONS

1. Jack Fruit seed powder is inexpensive and easily available in large quantities raw material and hence may be usedfor the treatment of dairy wastewater as a low cost adsorbent for the removal of dairy wastewater pollutants.
2. It is found that dosage and contact time plays a major role in achieving better efficiencies since both are inter related with regard to characteristics of the adsorbent used.
3.In this study we analyzed the removal efficiency of jackfruit seed powder at an optimal dosage of 0.8g/l. Turbidity was reduced

by 54.05% and pH was reduced to 7.6 and Alkalinity was reduced by 39.24% and reduction in COD and BOD were 68.71% and 55.57%

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