

TREATMENT OF DAIRY INDUSTRY WASTEWATER USING TAMARINDOUS INDICA SEED AS AN ADSORBENT

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Abstract Dairy industry generates large amount of white highly turbid liquid waste products which cannot be processed further in the industry and has to be discarded. They contain high organic matter that may be in dissolved or colloidal form and is thus very high in organic matter. The effectiveness of Tamarind kernel powder, a cheap agro-based product, as an adsorbent evaluated to remove COD, TS and turbidity present in a dairy industry wastewater. Experiments were carried out by adding Tamarind kernel powder adsorbent to the dairy industry wastewater at different dosages, different rapid mixing contact time and slow mixing contact time. Maximum removal of COD, total solids and turbidity was obtained at an optimum dosage of 6g/l (turbidity-77.2%, total solids-74.02%, COD-79.02%), and the maximum removal of COD, total solids and turbidity was obtained at an optimum rapid mixing contact time of 15 minutes (turbidity-75.4%, total solids-71.4%, COD- 76.8%), and an optimum slow mixing contact time of 40 minutes (turbidity- 78.9%, total solids- 75.12%, COD -80.4%). The results indicated that the use of tamarind kernel powder, as a coagulant to remove COD, total solids and turbidity present in a dairy industry wastewater seems to be an economical and worthwhile alternative over conventional methods.

Key Words: kernel, Adsorbent, Adsorbate, Physico-chemical process.

1. INTRODUCTION

Dairy industry has revealed an impressive growing in size & number in utmost nations of the world. Dairy industries are measured as one of the maximum contaminating industries, not merely in standings of its wastewater characteristics, but also in terms of the capacity of liquid waste generated. The liquid waste generated from the dairy industries conveys large measurements of organic stocks such as BOD and COD and equally Dissolved solids and Suspended solids. Dairy manufacturing generates extremely unclear liquid left-over products, additional of white which comprises of identically high organic substance that might be in colloidal or else dissolved form, consequently identically high in total solids and Biochemical Oxygen Demand (BOD). The generated wastewater from the dairy industry takes to be treated to decrease the organic masses previously emancipating into the environment (oceans or else rivers).

The dairy industry is one of the major sources of wastewater. The liquid wastes from a dairy industry

originate from the various sections namely, from the receiving station, bottling station, cheese plant, butter plant, casein plant, condensed milk plant, dried milk plant, and ice cream plant. Waste also comes from washing silos and milk processing plants. Effluent from milk processing units discharged into water bodies or simply to the land disturbs the ecological balance and deteriorates the water quality and also promotes eutrophication.

The physiochemical parameter of dairy wastewater has been reduced using adsorption batch studies using low cost agrobased adsorbent. Adsorption is a surface phenomenon. It is the adhesion of effluent particulates from a liquid to the surface of the adsorbent. The process creates a film of the adsorbate on the surface of the adsorbent. Adsorption studies are generally conducted as batch studies and column studies. Activated carbon is the most used adsorbent. Due to its high cost. Researchers let in finding low cost agro-based adsorbents.

1.1 SCOPE OF PRESENT STUDY

Wastewater from the dairy industry contains mainly biodegradable and organic constituents that can distract terrestrial & aquatic environments. Due to the more contamination consignment of dairy industry liquid waste, the milk industries releasing incompletely treated liquid waste cause severe conservational problems. Therefore, it is very chief to convey out a whey handling in order to improvise an economic and simple technique to treat the complete dairy overflow. Additionally, the Indian government has made strict rules and principles for the liquid waste or overflow released to defend the environment. Bio sorption structure of wastewater treatment is less cost & has specifically increase whole the conservative biological wastewater management arrangements. In my research work, I will minimize the cost of treatment plant using tamarindous indica seed as a jar test methods and adsorbent unit size, and adsorbent dosage in deletion of pollutants found in dairy industry wastewater was evaluated.

1.2 OBJECTIVES

The chief objective of this work is towards study the effect of tamarindous indica seed as an adsorbent for treatment of dairy industry wastewater.

The specific objectives are;

- To characterize the dairy wastewater for turbidity, pH, total solids, BOD, COD and oil and grease.
- To prepare adsorbent from tamarind seeds.
- To find the optimum adsorbent dosage.
- To compare between contact timings for rapid mixing & slow mixing contact timings for effective treatment of dairy wastewater.

2. MATERIALS AND METHODOLOGY

Tamarindous indica seed kernel is used as an adsorbent for elimination of contaminants from liquid waste generated from dairy manufacturing. Firstly, the tamarindous indica seeds were collected and it is scrubbed by the tap liquid and then it is wash away with deionized water to eliminate dirt substances from their external surface. Afterwards, the seeds were followed by desiccating in an oven at 100°C meant for 24 hours. The oven dried out seeds are milled and pounded by a mixer. The ground tamarind seed be there sieved over a 300µ to get homogenous geometrical size for use.



Fig-1: Tamarindous Indica Seed and Powdered Tamarindous Indica Seed

2.1 ACTIVATION OF ADSORBENT

The tamarind seed sieved through 300µ is treated by concentrated sulphuric acid to make active the adsorbent, the activated adsorbent is kept dry for 24 hours. After 24 hours, the adsorbent is wash away with distilled water for removing the acid elements. At that point the adsorbent is treated with Sodium bicarbonate for neutralizing the pH value. After pH test, the adsorbent is kept in oven at 100°C for 24 hours to eliminate additional moistness content. Over again the adsorbent is wash away with deionized water to fully dry out the acid components.



Fig -2: Activated Tamarind Kernel Adsorbent

2.2 COLLECTION AND ANALYSIS OF SAMPLE

For the present study, wastewater samples existed collected from the SHIMUL in Shimoga with the help of air tight sterilized bottles. The wastewater samples were transported to the laboratory and then they were stored for evaluating different physico-chemical parameters. The main focus of the current study is to reduce the Total solids, Turbidity & COD concentrations in a dairy wastewater using tamarindous indica seed powder as a coagulant. The dairy industry yields 2.5 lakh liters of milk every single day and the generation of wastewater is around 5 lakh liters. It is initiate that the one liter of milk production achieves around two liters of wastewater.

Table 1: Physio-chemical characteristics of dairy wastewater

Physico-Chemical Factors	Characteristics
Turbidity	1026 NTU
Colour	PALE WHITE
Total solids	462 mg/l
pH	6.57
BOD	850 mg/l
COD	1408 mg/l
Temperature	27°C
Oil and Grease	200 mg/l

3. RESULTS & DISCUSSION

3.1 ESTIMATION OF OPTIMUM ADSORBENT DOSAGE

The optimal dosage of adsorbent is obtained by using batch examinations of adsorbent concentrations differing (2G/L, 4G/L, 6G/L, 8G/L, 10G/L, 12G/L) with a contact time for rapid mixing of 6 minutes and contact time for slow mixing of 15 minutes. From the fig 3, it may be noticed that up to 6g/l of tamarindous indica seed powder dosage, concentration of Total solids, COD and Turbidity in a dairy wastewater reduced, above which they attained steady state condition. The percentage removal in concentrations of Total solids, Turbidity and COD for a tamarind seed powder dosage of 6g/l was 74.02%, 77.2% and 79.2% respectively. Hence, an optimum dosage for which the best removal of Total solids, Turbidity and COD exists is found to be 6g/l. Later, the contact time for rapid mixing and contact time for slow mixing will be conducted for the optimal adsorbent dosage of 6g/l.

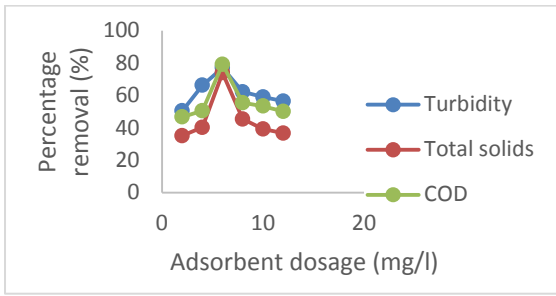


FIG-3: Estimation of Optimum Adsorbent Dosage

Fig 3 displays the effect of tamarindous indica kernel powder as a coagulant dosage on turbidity, total solids and COD variations in dairy wastewater with a rapid mixing timings of 6 minutes and slow mixing timings of 15 minutes. Here the dosage of 2G/L, 4G/L, 6G/L, 8G/L, 10G/L, 12G/L of activated adsorbent added to the six beakers simultaneously. In that time adsorption process takes place. Firstly, the rapid mixing was carried out, later the speed of paddles reduced and thus the slow mixing was done. During this time, the floc will settle or pollutants settles at the bottom. Then the supernatant water is collected from each beakers and find out the optimum adsorbent dosage.

3.2 OPTIMUM CONTACT TIME FOR RAPID MIXING

Fig 4 displays the result of contact time for rapid mixing on Total Solids, Turbidity and COD fluctuation in dairy wastewater respectively with an optimum dose of 6g/l. At this point the revolving steel paddles of the jar test equipment were revolved at a more rapid rate (120rpm) in contact with the dairy industry effluent for the dose of 6g/l for contact time differing from (3minutes, 6minutes, 9minutes, 12minutes, 15minutes, 18minutes). From fig 4, it may be noticed that up to 15 min contact time for rapid mixing, the concentrations of Total Solids, Turbidity and COD reduced, above which they reached a steady state condition. The maximum percentage removal in concentrations of Total solids, Turbidity and COD was 71.4%, 75.4% and 76.8% respectively for rapid mixing contact time of 15 min.

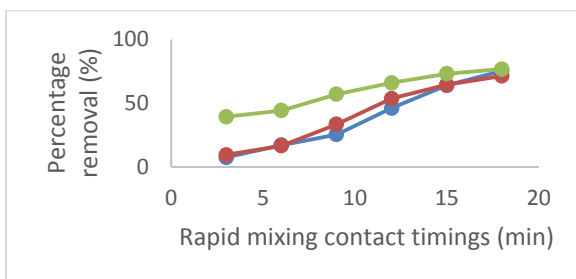


Fig-4: Effect of Tamarind Kernel Adsorbent on Rapid Mixing Contact Timings

3.3 OPTIMUM CONTACT TIME FOR SLOW MIXING

Fig 5 displays the effect of contact time for slow mixing on COD, Total solids and Turbidity fluctuation in dairy

effluent respectively by an optimum dose of 6g/l. Here the rotating steel paddles of the jar test equipment were revolved at a slower rate (15rpm) in contact with dairy effluent for the dosage of 6g/l for contact timings differing from (5minutes, 10minutes, 15minutes, 20minutes, 25minutes, 30minutes, 35minutes, 40minutes, 45minutes). From fig 5, it can be noticed that up to 30min contact time for slow mixing, concentration of COD, Total solids, and Turbidity reduced and above which they achieved steady state condition. The maximum percentage removal in concentration of Total solids, Turbidity and COD for 30 min slow mixing contact time was 75.12%, 78.9% and 80.4% respectively.

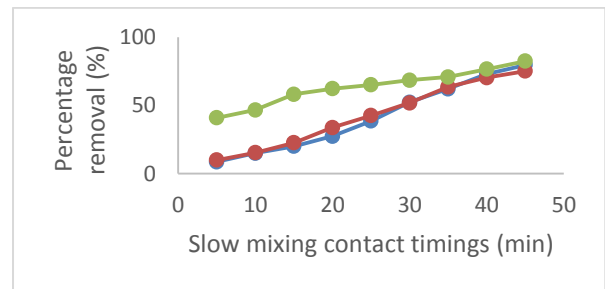


Fig-5: Effect of Tamarind Kernel Adsorbent on Slow Mixing Contact Timings

3.4 DISCUSSIONS

From the above results we are concluded that the optimum contact time for rapid mixing of 15 minutes has larger deduction of impurities. The safe state status is concluded in among 15 minutes to 18 minutes. The optimal contact time for slow mixing of 40 minutes has larger removal of contaminants and the safe state situation is attained in between 40 minutes to 45 minutes. The maximum deduction of COD, turbidity and total solids was achieved at an optimum contact time for rapid mixing of 15 minutes (total solids-71.4%, turbidity-75.4%, COD-76.8%) and an optimum contact time for slow mixing of 40 minutes (Total solids-75.13%, turbidity-78.9%, COD-80.4%).

4. CONCLUSIONS

The current work analyzes a new access of development in the field of wastewater purification through less labor, minimum energy input and low investment, also proves to be effective and biodegradable compared to chemicals and synthetic adsorbents. In the present study, the experimentations have been governed to catch out the appropriateness of tamarindous indica seed kernel adsorbent for eliminating COD, turbidity and total solids present in dairy industry effluent. The capability of tamarindous indica seed kernel as adsorbent for removing the wastewater characteristics such as turbidity, COD and total solids in a dairy industry wastewater with different contact timings for rapid mixing, different contact timings for slow mixing and different dosages were supervised. The outcomes reveal that maximum proportion achieved at an optimum dosage

of 6g/l, an optimum contact time for slow mixing of 40 minutes and a contact time for rapid mixing of 15 minutes. The experimental analysis was established and the conclusion of the verification tests also reveals that the maximum removal of other characteristics in a dairy wastewater appeared at the same optimum dosage 6g/l.



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