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Treatment of Dairy Wastewater Using Tamarind Kernel Adsorbent

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ABSTRACT
The effectiveness of Tamarind kernel powder, a cheap agro-based product, as an adsorbent evaluated to remove COD,TS, turbidity and sulphate 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, turbidity and sulphate was obtained at an optimum dosage of 4g/l (turbidity-57%, total solids-77.14%,COD-68.18%, sulphates-71.42%) and the maximum removal of COD, total solids, turbidity and sulphate was obtained at an optimum rapid mixing contact time of 15 minutes (turbidity-73%, total solids-76.19%, COD- 79.5%, sulphates-85.71%) and an optimum slow mixing contact time of 40 minutes (turbidity- 78.8%, total solids- 80.95%, COD -92.05%, sulphates – 88.57%).

Key words
kernel, Adsorbent, Adsorbate, Physico-chemical process.

1. INTRODUCTION
Industrialisation is backbone for development of country. The pollution caused by industrial sector is a serious concern in throughout the world. All industrial activities, the food sector have one of the highest consumptions of water and are one of the biggest producers of effluent. The dairy industry is an example of this sector. Dairy industry is one of the major food industries in India, and India ranks first among the maximum major milk producing nation.

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 agro-based 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.

2. PURPOSE AND SCOPE OF PRESENT STUDY
Many Industries use activated carbon as adsorbent agent for removal of pollutants which is much costlier has forced to a new and cheap agro based adsorbent. The Regeneration of activated carbon is also tedious hence it forced to a new research. Mainly it is to reduce the organic load of waste water and to reduce surface and ground water pollutant and its effects on environment and human health.

3. MATERIALS AND METHODOLOGY
The tamarind kernel powder is used as adsorbent for removal of pollutants from dairy industry wastewater. Initially tamarind kernel seeds were collected and it is washed with tap water and then it is washed with distilled water to remove particulate material from their surface.

After that, they are dried in an oven at 100°C for 24 hr. The dried materials are Tamped and powdered using a mixer. The powdered kernels were sieved through 300 microns to get uniform geometrical size for use.

The sieved material is treated with sulphuric acid to activate the adsorbent, and it is washed with distilled water to remove the acid constituents. Then the washed adsorbent is kept in muffle furnace to remove excess moisture content and again it is washed with distilled water to completely vanish the acidic constituents. The material is dried to get the tamarind kernel powdered adsorbent as shown in fig.1.

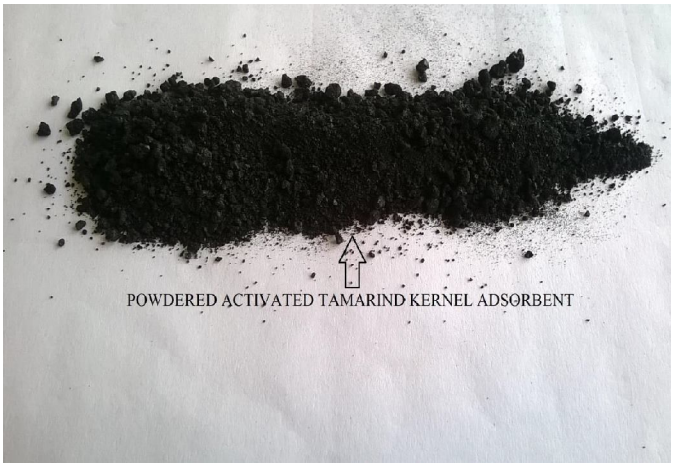

Figure 1. Tamarind Kernel Powder Adsorbent

4. COLLECTION AND ANALYSIS OF DAIRY WASTEWATER SAMPLE

The Dairy wastewater is collected from Aavin dairy industry in Pachapalayam, Coimbatore, India. The wastewater generation at different level of production of milk products was observed. The Industry produces 2.5 lakh liters of milk every day and the wastewater generation is about 5 lakh liters. It is found that the one liter of milk production generates about two liters of wastewater. The following physic chemical analysis was done in the laboratory and the results were tabulated in Table1.

Table 1. Physio-chemical characteristics of dairy wastewater

Physico-chemical parameters	Characteristics
COLOUR	PALE WHITE
TURBIDITY	200 NTU
TOTAL SOLIDS	210 mg/l
pH	7.8
BOD	85 mg/l
COD	1408 mg/l
SULPHATES	384 mg/l
TEMPERATURE	27C

5. ESTIMATION OF OPTIMUM ADSORBENT DOSAGE

The optimum adsorbent dosage is done using batch tests of adsorbent concentrations varying (2g/l, 4g/l, 6g/l, and 8g/l) with a rapid mixing contact time of 6minutes.and a slow mixing contact time of 15minutes. The physio-chemical characteristic was then estimated. Based on the experimental inference the optimum adsorbent dosage was estimated to be 4g/l is shown in fig.2. The maximum percentage removal of pollutants were obtained at 4g/l. Rapid mixing contact time and slow mixing contact time will be done for the optimum adsorbent dosage of 4g/l.

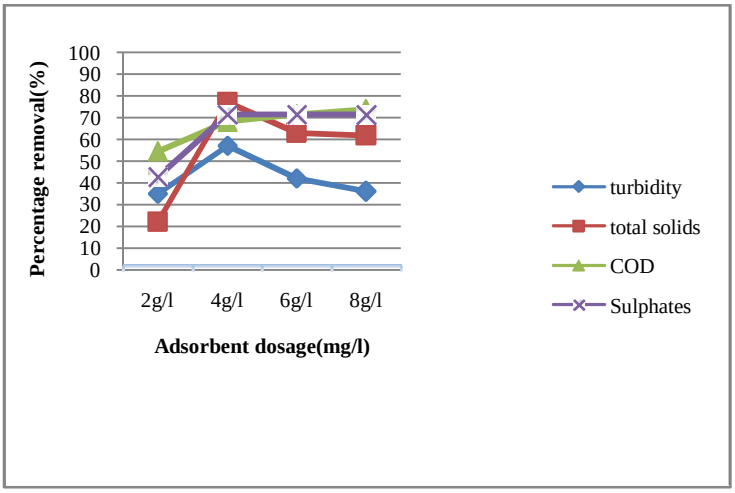

Figure 2. Analysis of optimum adsorbent dosage

6. OPTIMUM RAPID MIXING CONTACT TIME

The Rotating Paddles of the jar test apparatus were rotated at a faster rate (120rpm) in contact with dairy wastewater for the optimum dosage of 4g/l for contact timings varying from (3min, 6min, 9min, 12min, 15min and 18min) and the physio-chemical characteristics was estimated. The results were plotted in fig.3

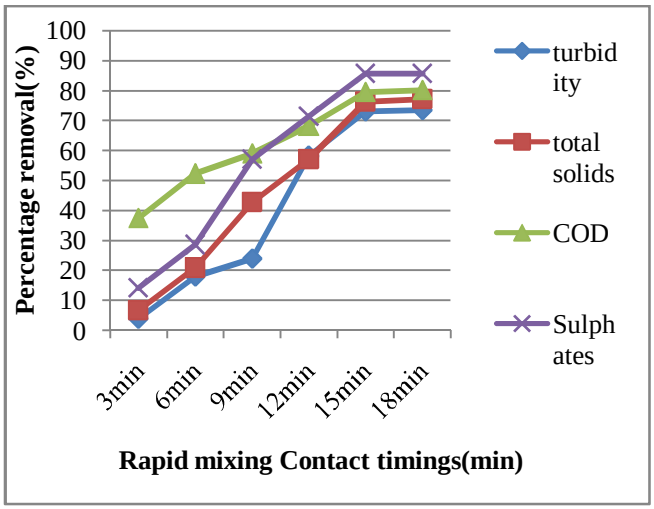

Figure 3. Effect of Adsorbent on Rapid Mixing Contact Timings

7. OPTIMUM SLOW MIXING CONTACT TIME

The Rotating Paddles of the jar test apparatus were rotated at a slower rate (12 rpm) in contact with dairy wastewater for the optimum dosage of 4g/l for contact timings varying from (5min, 10min, 15min, 20min, 30min, 40min and 45min) and the

physiochemical characteristics was estimated. The results were shown in fig.4.

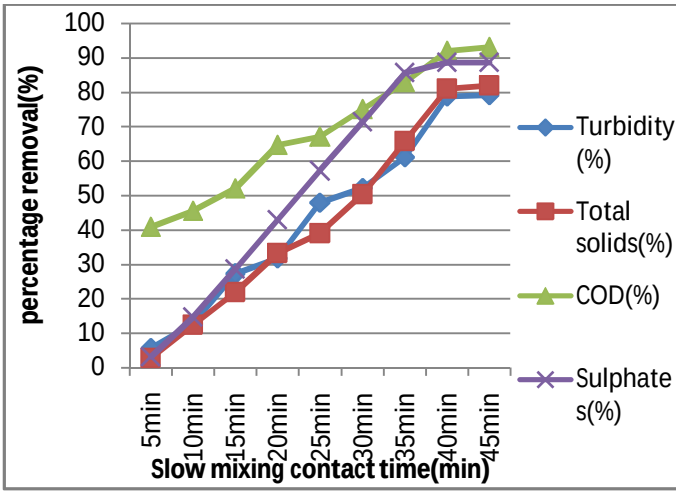

Figure 4 .Effect of Adsorbent on Slow mixing contact time

8. RESULT AND DISCUSSIONS

It was found that the optimum rapid mixing contact time of 15minutes has greater removal of pollutants. The steady state condition is achieved in between 15 to 18 minutes. The optimum slow mixing contact time of 40 minutes has greater removal of pollutants and the steady state condition is achieved between 40 to 45mins. the maximum removal of COD, total solids, turbidity and sulphate was obtained at an optimum rapid mixing contact time of 15 minutes (turbidity-73%, total solids-76.19%, COD-79.5%, sulphates-85.71%) and an optimum slow mixing contact time of 40 minutes (turbidity- 78.8%, total solids- 80.95%, COD -92.05%, sulphates – 88.57%).

9. CONCLUSION

In the present study, experiments have been conducted to find out the suitability of *Tamarind kernel* powder adsorbent for removing COD, total solids, Turbidity and sulphate in dairy industry waste water. The ability of *Tamarind kernel* powder as a adsorbent for removing COD, total solids, turbidity and sulphate in a dairy industry wastewater with different dosages, different rapid mixing contact time and different slow mixing contact time were monitored. The results showed that maximum percentage obtained at an optimum dosage of 4g/l, an optimum rapid mixing contact time of 15minutes, and an optimum slow mixing contact time of 40 minutes.

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