APPLICATION OF SAW DUST AS BIOSORBENT FOR TREATMENT OF DAIRY EFFLUENT

Dr. Simmi Goel

Asstt. Professor, Department of Biotechnology, Mata Gujri College, Fatehgarh Sahib (Punjab)

Abstract

In the present research work, batch adsorption studies using saw dust after determination of the initial parameters of the dairy wastewater was done. The COD value was found to be 2500 mg/l. The effect of contact time, amount of saw dust on %COD removal, hardness, chlorides and TDS removal was observed through batch adsorption studies. Maximum % removal in COD, TDS, Hardness and Chlorides was 67.5%, 75%, 69% and 68% respectively using an adsorbent dosage of 3 g/L and contact time of 5 hours.

Key words: saw dust, dairy effluent, COD load, adsorbent, hardness, biosorption

Introduction

Dairy effluent has high organic loads as milk is its basic constituent with high levels of chemical oxygen demand, biological oxygen demand, oil and grease and nitrogen and phosphorous content (Braio and Granhem, 2007). Because of its high organic content with high BOD, dairy waste water dumped directly to the environment is causing serious contamination problems. Water used in all processes in the dairy industry containing high concentration of organic load contributing largely towards their high values of biological oxygen demand (BOD), chemical oxygen demand (COD), high concentration of suspended solids and oil grease, liquid effluents, large quantities of casein, lactose, and fats in addition to inorganic salts (Singh *et al*., 2014; Murali *et al*., 2013). The volume of the wastewater produced depends largely on the quantity of milk processed and type of product manufactured. It is slightly alkaline in nature and becomes acidic quite rapidly, because of the fermentation of milk sugar to lactic acid. The COD of dairy wastewater is mainly due to milk, cream or whey (Pathak *et al*., 2016).

Methodology:

Pre-treatment of saw dust

Saw dust was collected from the local saw mills. Saw dust was oven dried at 100^0 C for 24 hours. The dried samples were pulverized using 250µ sieve. The use of saw dust as an adsorbent of organic pollutant from dairy wastewater was tested experimentally after sulphuric acid treatment. The dairy effluent is brought into contact with saw dust individually for a known time during which the solids in the effluent get absorbed by the adsorbent, there by leaving the effluent relatively pure.

Analysis of wastewater

Dairy wastewater samples were collected from local milk plant. Samples were collected in plastic bottles which were first rinsed with distilled water in the laboratory and

then rinsed with effluent at the sampling site. The effluent was anlaysed for various physico-chemical parameters as per standard methods (APHA, 2005).

Batch adsorption:

Batch adsorption studies were conducted using the pretreated saw dust. The known volume of wastewater was taken in a conical flask and amount of biosorbent varied between 1-4gm/l, samples were agitated on shaker to reach equilibrium. The contact time of biosorbent was varied between 1-6hours.Suspensions were then filtered through whatmann filter paper. The filtrates were analysed for COD, TDS, hardness and chlorides removal. From which optimum contact time and amount of adsorbent was determined.

Results and Discussion

The results of initial characterization of dairy effluent are presented in Table 1. Results showed that all the parameters analysed are having values above the permissible limits of discharge. So there is a need to develop some technology for treatment of effluent before its safe disposal.

Table 1: Initial parameters of dairy effluent

Parameters	Observations
Colour	Whitish
pH	7.5–8.0
Biological oxygen demand(BOD)	1300mg/l
Chemical oxygen demand (COD)	2500mg/l
Total dissolved solids	955mg/l
Total solids	1745mg/l
Total suspended solids	790mg/l
Hardness	987mg/l
Chlorides	215mg/l

Effect of contact time on removal of COD

The effect of contact time on %removal of COD with an adsorbent dosage of 2g was studied and the results are shown in Fig. 1. Saw dust showed maximum reduction of COD upto 64.2% at the incubation time of 5 hours. On increasing contact time further, COD removal remains constant.

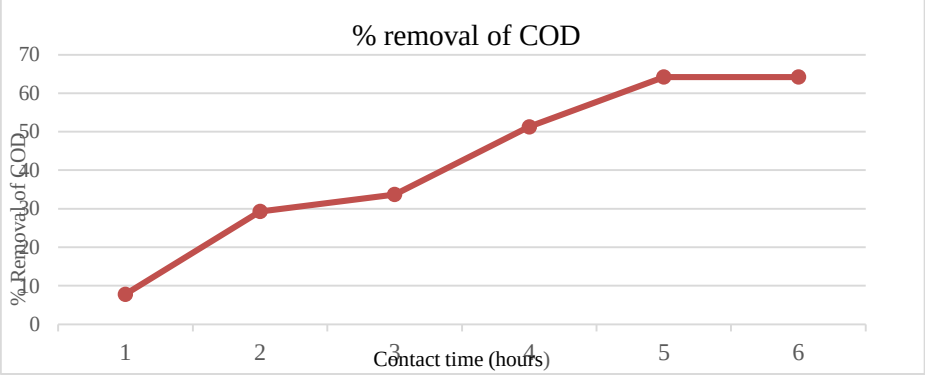

Fig. 1: Effect of contact time on %removal of COD

Effect of amount of saw dust on COD removal

The effect of adsorbent dosage on % removal of COD was studied at an optimized contact time of 5 hours (Fig.2). It was observed that % removal of COD increased with increase in the amount of biosorbent. The change can be attributed to the fact that at higher doses of biosorbent results in higher removal. Further increase in amount of saw dust has no profound effect on % removal of COD.

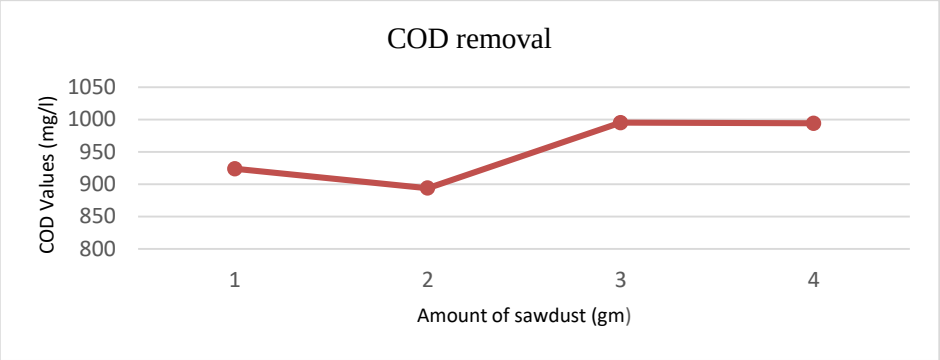

Fig. 2: Effect of amount of sawdust on COD reduction

Effect on TDS, Hardness and chlorides reduction

The dairy wastewater was treated with an optimized amount of saw dust by varying contact time, the maximum % removal in TDS, Hardness and Chlorides was found to be 75%, 69% and 68% respectively.

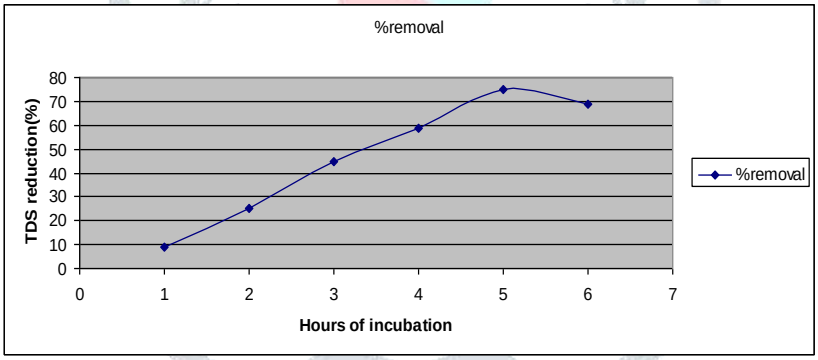

Fig 3: Percentage reduction of TDS

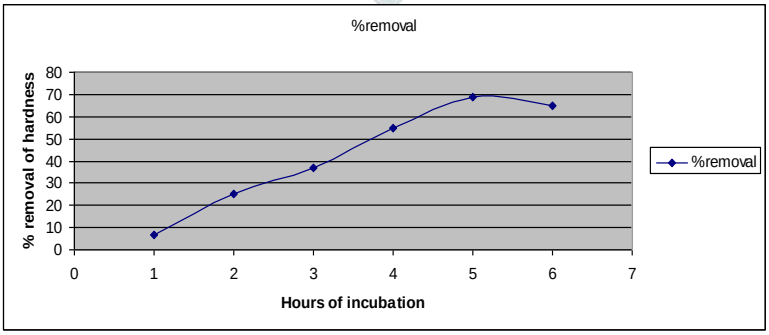

Fig. 4: Percentage reduction of hardness

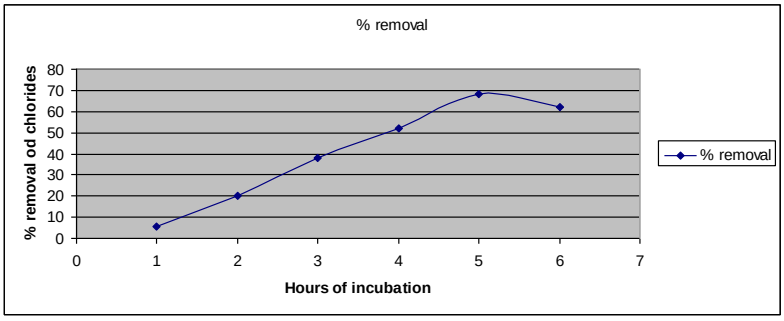

Fig. 5: Percentage reduction of chlorides

From Fig.3, Fig.4 and Fig. 5 it was observed that % removal of TDS, hardness and chlorides increases with increase in the contact time. The maximum removal was at 5 hours of contact time beyond which all the three parameters start decreasing.

Conclusion

The present study shows that saw dust can be effectively used as adsorbent for treatment of dairy wastewater as it could bring about a removal up to 92.5% which could be achieved using an adsorbent dosage of 5 g/L, pH of 2, and temperature of 30∘ C. Moreover it is a cost-effective process since it is cheaply available raw material. From the present study it clear that utilization of easily available saw dust have effectively removed the COD, hardness, TDS and chloride content of dairy wastewater and this is a better solution for achieving cleaner production technology.

References

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