COLOUR REMOVAL FROM TEXTILE EFFLUENT USING AGRICULTURAL WASTE AS ADSORBENTS

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DECLARATION

I certify that this thesis does not incorporate without acknowledgement any material previously submitted for a degree or diploma in any university and to the best of my knowledge and belief it does not contain any material previously published, written or orally communicated by another person except, where due reference is made in the text.

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ABBREVIATIONS

CD	Coir Dust
RH	Rice Husk
SD	Saw Dust
TW	Tea Waste
GAC	Granular Activated Carbon
PAC	Powdered Activated Carbon
CB	Cibacron Blue FR
LB	Lenazan Blue CF
COD	Chemical Oxygen Demand
LUB	Length of the Unused Bed
BDST	Bed Depth Service Time
CEA	Central Environmental Authority

ABSTRACT

The adsorption process is considered as one of the effective methods for colour removal from wastewater. In this study a number of low cost adsorbents were investigated in search of an alternative to commercial Granular Activated Carbon (GAC) which is an expensive material. Utilization of Coir dust, Rice husk, Saw Dust and Tea Waste has been investigated for its ability to adsorb dyes from aqueous solutions. The results showed high removals over 80% of Cibacron Blue dye by all four chemically treated adsorbents. The ground and sieved adsorbents were activated chemically by impregnating with an activation agent. The use of hydrochloric acid and zinc chloride were studied as chemical activation agents in this work. A hundred percent colour removal efficiency was observed for the system of HCl treated Coir Dust-Cibacron Blue and Coir Dust was identified as the best substitute for GAC.

The batch experiments showed that the adsorption of dyes increased with the increase in contact time and adsorbent dose. Maximum decolourisation of all the dyes was observed at acidic pH. It was observed that contact time up to 4 hrs was required for the every adsorbent-dye system used in this study to attain equilibrium. The adsorption isotherm studies were performed on a laboratory scale setup with two different synthetic dye solutions made up of two different commercial grade dyes namely, Cibacron Blue and Lenazan Blue. The adsorption capacity for coir dust from this study was found to be 65 mg/g. This was as effective as GAC while others were less effective than GAC. The Langmuir & Freundlich adsorption models were applied to describe the equilibrium isotherms and both these models agreed very well with the experimental data obtained in this work. The kinetics of the process was also evaluated by the pseudo first order and second order kinetic models. The results gathered from these experiments agreed very well with the first order kinetic model.

Typical S shape breakthrough curves were obtained from packed bed adsorption experiments and 92-100% removal of the adsorbate was observed. The column experiments showed that decrease in initial concentration of dye solution, adsorbent particle size, flow rate and increase in bed depth produced higher breakthrough time with better bed performance. The Bed Depth Service Time (BDST) analysis carried out for the dye indicated a linear relationship between bed depth and service time.

An 83% of colour removal and 72% of Chemical Oxygen Demand (COD) removal efficiencies were achieved using HCl treated Coir Dust for the textile wastewater samples containing a mixture of various dyes collected from and industrial establishment.