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COLOUR REMOVAL OF TEXTILE INDUSTRY EFFLUENT USING WASTE PEA PODS AS ADSORBENT

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Abstract - *Dyes are a major component in textile industries and this colour pollutes the water bodies if let out without decolourization. Adsorption with natural adsorbents is a viable and ecofriendly method to remove colour from textile effluent. This research is carried out to investigate the effectiveness of eco-friendly, cost effective adsorbent from waste pea pods to decolourize textile dye effluent. This research revealed that pea pods could be used to remove textile dye colour and the removal efficiency was 48.54 % at a dilution factor of 30.*

Key Words: **Effluent; Decolourize; Adsorption; Adsorbent**

1. INTRODUCTION

The textile industry is one of the major polluting industries. In textile industry, dyes are used in almost every stage of wet processing like desizing, scouring, bleaching and dyeing and these processes leave behind a lot of coloured effluent which are the major causes of water pollution. Discharging a small quantity of dye into water bodies can affect aquatic life and food webs due to the carcinogenic and mutagenic effects of synthetic dyes (Sharma *et al.,* 2005[1]; Tahir *et al.,* 2008[2]; Vinoth *et al.,* 2010[3]; Abbas *et al.,* 2011[4]; Karthik *et al*, 2012[5]). A majority of the used dyes are azo dyes which are bright in colour due to the presence of one or several azo (–N=N–) groups associated with substituted aromatic structures (Vinoth *et al.,* 2010[3]). Also these dyes are difficult to degrade due to their complex aromatic structures and tend to persist in the environment (Tahir *et al.,* 2008[2]; Vinoth *et al.,* 2010[3]). Colour is a pertinent problem in all kinds of textile effluents and different methods have been used by researchers to decolourize textile effluents before discharging into water bodies. Notable methods include physical (precipitation, coagulation, ion exchange, membrane separation, adsorption); chemical (irradiation, electrofloatation, electrodialysis, ion oxidation) methods (Voudrias *et al.,* 2002[6]; Tahir *et al.,* 2008[2]; Abbas *et al.,* 2011[4]; Fathi *et al.,* 2011[7]) and biological (biosorption with dead bacteria, fungi, yeasts) techniques (Joshi *et al*., 2004[8]). Among all techniques, adsorption is an efficient, effective and best equilibrium process for the removal of colour from the wastewater (Sharma *et al.,* 2005[1]; Karthik *et al*, 2012[5]). Adsorption techniques employing solid sorbents are widely used to remove colour and activated carbon is the most popular for the removal of pollutants from wastewater. However owing to costs, activated carbon has been replaced by natural adsorbents like chitin, chitosan, sawdust, rice husk, fruit and vegetable peels (Joshi *et al*., 2004[8]), Banana trunk fibres (Rosemal *et al.,* 2010[9]), Yam leaf fibres (Vinoth *et al.,* 2010[3]), Hazelnut seeds (Fathi *et al.,* 2011[7]), Cassave peel waste (Adowei *et al.,* 2012[10]). This research is aimed at studying the feasibility of waste pea pods as adsorbent in decolourizing industrial effluent.

2. MATERIALS AND METHODOLOGY

2.1 Preparation of Adsorbent

Waste pea pods collected from home were washed with distilled water and allowed to dry under the sun till these became crisp and easy to be crushed. The pea pods were then powdered in mixer. These were then passed through a 0.246 mm sieve to obtain uniform particle size of adsorbents. The pea pod adsorbents were stored in air tight containers.

2.2 Preparation of Adsorbate

The effluent dye wastewater was collected from a small scale silk thread dyeing unit from a village near Bengaluru. The effluent was collected and stored in clean air tight bottle.

2.3 Batch Studies

Aliquots of the dyes were prepared with varying dilution factor from 30 to 150. A constant volume of 50 mL was taken in 150 mL conical flasks and 0.5g of adsorbent was weighed and added to each of the conical flasks. The solutions were agitated at a constant room temperature and speed of 240 wrist action per minute using Secor India Griffin Flask Shaker for 60 minutes. The adsorbate was filtered out using ordinary filter paper from each of the conical flasks in order to get a clear solution. Optical Density was measured at 530 nm as the peak was observed at this wavelength using Systronics Spectrophotometer (Model-106).The percentage removal of adsorbate adsorbed on the adsorbent is given as

$$\%Dye\,\mathrm{Re}moval = \frac{(C_0 - C_f)}{C_0} X100 - - - - - - - - (1)$$

Where C_0 = Initial concentration of dye (mL)
C_f = Final concentration of dye (mL)

3. RESULTS AND DISCUSSIONS

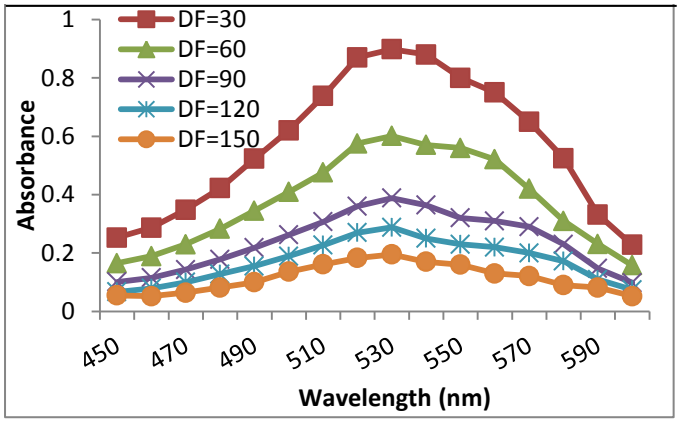

Chart -1: Absorbance of Industrial Dye Effluent at Different Dilution Factors

From Fig.1, it was observed that up to wavelength of 530 nm, the absorbance of effluent increased with wavelength, beyond which, the absorbance decreased. The point at which the absorbance decreased is called point of deflection and the wavelength corresponding to the point before deflection is called maximum wave length. The observed maximum wavelength from Fig.1 is 530 nm. The same peak was observed for all the dilutions of the effluent in this research. The inference of maximum peak for unknown samples was inspired from Durairaj *et al.*, 2012[11].

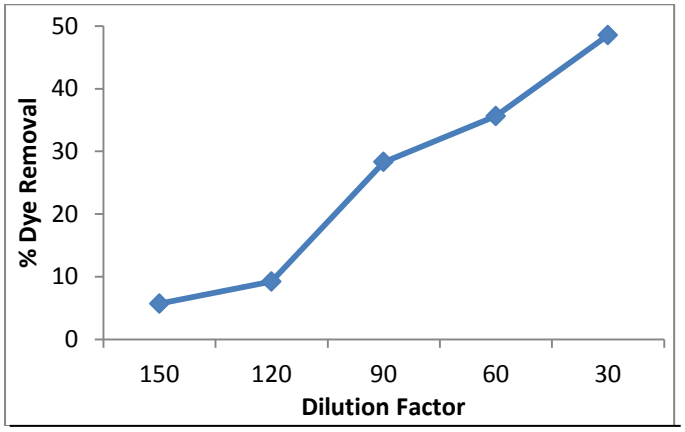

Chart 2 - Efficiency of Colour Removal of Industrial Dye Effluent at Different Dilution Factors

From Figure 2, increasing trend was seen for percentage dye removal of effluent dye. With decrease in dilution factor from 150 to 30, the percentage dye removal was found to increase from 5.70% to 48.54%. This was because the adsorbed dye molecules tend to increase adsorption of other molecules and the higher initial concentration provided larger driving force for adsorption and this was similar to the work done by Abdul Karim *et al.,* 2015[12].

4. CONCLUSIONS

This research demonstrated the effectiveness of waste pea pods as a good adsorbent in removing the colour of textile dye effluent. From this research it was seen that the percentage dye removal was found to increase from 5.70% to 48.54% with decrease in dilution factor from 150 to 30. It means that at higher dye concentration with dilution factor of 30, the pea pods adsorbent could remove 48.54 % colour. Thus pea pods can be used to remove the colour of dyes from textile industry effluent.

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