ABSTRACT

Water pollution is a major environmental problem faced by modern society that leads to ecological disequilibrium and different health hazards. Due to rapid industrialization, contamination of aquatic ecosystem by water soluble dyes has created a major global concern. In recent years, removal of highly coloured dyes in effluents produced by textile industries has attracted much attention and the disposal of dye wastewater with proper treatment is a big challenge. Hence this research attempts a comparative study of removal of textile dyes using activated carbon and polymer coated saw dust composites of *Euphorbia Tirucalli* L wood.

There is an urgent requirement for development of innovative but low cost processes of dye absorption/removal. Adsorption of dyes is one of the most promising technologies involved in the removal of dyes from wastewater. The adsorbents commonly recommended for the removal of dyes range from industrial wastes to agricultural waste products, biomaterials and activated carbon. A great attention has recently been directed to remove dyes from aqueous solutions using polymer coated saw dust composites as an adsorbent.

*Euphorbia Tirucalli* L wood, an economical waste material is used as a precursor for the preparation of adsorbents like activated carbon and polymer coated saw dust composites. For the purpose of this research, five
varieties of activated carbon were prepared by various physical and chemical activation processes.

Polymer coated saw dust composites were prepared by polymerizing monomers on the surface of saw dust. Polymer coated saw dust composites are materials formed by matrix (polymer) phase and a reinforcement of natural wood fibre derived from *Euphorbia Tirucalli L* wood.

Physico-chemical characteristics of activated carbon samples and polymer coated saw dust composites were studied as per the standard testing methods. From the five varieties of activated carbon, the carbon prepared by H$_3$PO$_4$ impregnation process (ET3) found to be superior for adsorption experiments. ET3 and polymer coated saw dust composites PAC and PPC were selected as suitable adsorbents for adsorption experiments.

The dyes selected for the batch mode adsorption studies were Acid Orange 10, Reactive Red, Direct Blue and Basic Violet 3. Batch mode adsorption studies were carried out for four dyes using three different adsorbents and adsorption capacities were compared. The maximum dye uptake at the initial concentration of 100 mg/L of dye was observed by polypyrrole coated saw dust composites (PPC) for anionic dyes and by ET3 (activated carbon) for cationic dyes.

The amount of Acid Orange 10 removed by ET3, PAC and PPC were 171.72 mg/g, 171.72 mg/g and 173.74 mg/g respectively, Reactive Red by ET3, PAC and PPC were 146.67 mg/g, 152 mg/g and 157.33 mg/g and
Direct Blue by ET3, PAC and PPC were 104.62 mg/g, 126.15 mg/g and 129.23 mg/g respectively.

The kinetic studies revealed that pseudo-second order kinetics described the adsorption of all the selected dyes with very high correlation coefficient. Adsorption of all four dyes by ET3 was well explained by intraparticle diffusion model and polymer coated saw dust composites were explained by ion-exchange adsorption process.

The maximum monolayer adsorption capacities determined by Langmuir isotherm model were comparable with the reported values. Thermodynamic parameters $\Delta G^o$, $\Delta H^o$, $\Delta S^o$ and $E_a$ were calculated and they showed spontaneous and endothermic nature of adsorption process. The adsorption of all dyes by polymer coated saw dust composites involved weak Vander Walls force of attraction between adsorbed dye molecules and adsorbent. The desorption studies indicated that reuse of adsorbents may not be economical.

All the three adsorbents were tested for the removal of dyes from effluents of dyeing industries. Most of the samples (6 out of 8) were