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DECOLOURIZATION OF CRYSTAL VIOLET SYNTHETIC DYE FROM AQUEOUS SOLUTION BY WOODY BIOCHAR

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Colour removal from textile effluents prior to their disposal is an emerging concern due to its adverse effects on the environment and public health. Biochar can be used effectively as a biosorbent for removal of dye contaminants. This study investigated the adsorption of a basic dye, Crystal Violet (CV), from aqueous solutions on to biochar derived from *Gliricidia sepium* pyrolysed at 700 °C (GBC700). Pyrolysis was done under a heating rate of 7 °C min^{-1}. The adsorption process was investigated through batch experiments by varying pH, adsorbent dose, initial dye concentration, and contact time. The sorbent dosage, initial dye concentration and contact time were set as 0.5 - 6.0 g L^{-1}, 5 - 200 mg L^{-1} and 5 min - 24 hr, respectively. The effect of pH was determined through edge experiments at pH 3 to 9. The equilibrium data was analyzed using the Langmuir, Freundlich and Hill isotherm models. Pseudo first order, Pseudo second order and Elovich kinetic models were used to investigate the kinetic data.

Results indicated that the optimal adsorbent dose was obtained at 2 g L^{-1} and the optimum contact time was 12 hr. The adsorbed amount was increased from 5.5 mg g^{-1} at pH 3 to 8.0 mg g^{-1} at pH 9 while the equilibrium was reached at pH 7. Since higher pH conditions lead to increasing the negative charge density of GBC700 and the electrostatic attraction to the dye cations can be enhanced. Crystal Violet removal efficiency was 99% at 20 mg L^{-1}. According to the Langmuir model, maximum adsorption capacity was observed at 30.4 mg g^{-1} at 30 °C. The experimental data fitted well with the Freundlich isotherm model (r^2 = 0.9788) and Pseudo second order kinetic model (r^2 = 0.9703) which suggests the importance of multilayer adsorption to heterogeneous sites in biochars.

The adsorption process is highly pH dependent. Crystal Violet molecule may interact with the GBC700 through the mechanism of π-π electron donor-acceptor interactions between the π-electron rich graphene surface of biochar and π-electron deficient CV dye molecule. The use of Gliricidia biochar pyrolysed at 700 °C could be a sustainable solution to remove CV in aqueous media while compromising the waste problem by using Gliricidia byproduct.