

Adsorption Kinetics of Congo Red Dye Using an Açaí Seed Biochar and Chitosan Biocomposite (AÇAÍ@QUI)

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Abstract— The discharge of textile effluents containing persistent dyes, such as Congo Red (CR), causes severe damage to aquatic ecosystems. Aiming for a sustainable and relatively low-cost alternative, the adsorption kinetics of CR was evaluated using an açaí seed biochar and chitosan biocomposite (AÇAÍ@QUI) at temperatures of 25, 35, 45, and 55 °C. The non-linear Avrami model provided the best fit to the experimental data, suggesting that dye retention occurs through multiple mechanisms and fractional orders. Intraparticle diffusion confirmed the simultaneous action of resistance in the external boundary layer and transport within the internal pores. The equilibrium adsorption capacity remained stable with increasing temperature, making the ambient condition of 25 °C the most advantageous by eliminating the need for heating. The AÇAÍ@QUI biocomposite emerges as a novel material of high environmental performance with strong potential for application in the removal of dyes from effluents.

Keywords— Agro-industrial Wastes, Avrami, Biopolymer, Congo Red.

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