WA_091

OPTIMIZATION OF RICE HUSK-DERIVED ACTIVATED CARBON FOR EFFICIENT METHYLENE BLUE ADSORPTION: KINETICS AND EQUILIBRIUM STUDIES

K.A.D.D. Sakunthala[1, 2*], P.L.R.A. Perera[1, 2], W.P.R.T. Perera[1,2,3], J.A. Liyanage[1,2] and W.A.P.J. Premaratne[1,2]

[1]*CKDu Information and Research Centre, University of Kelaniya, Kelaniya, Sri Lanka*

[2]*Department of Chemistry, University of Kelaniya, Kelaniya, Sri Lanka*

[3]*Department of Indigenous Medical Resources, Gampaha Wickramarachchi University of Indigenous Medicine, Yakkala, Sri Lanka*

**dilshanisakunthala1997@gmail.com*

Synthetic dyes are indispensable in various industries, yet their toxicity necessitates efficient wastewater treatment. Activated carbon (AC) plays a crucial role in this regard. This study aimed to optimize AC from rice husk through method optimization and to investigate its methylene blue (MB) adsorption potential. Method optimization for AC synthesis involved varying parameters: HCl concentrations (5, 15, 30% v/v), soaking times (12, 24, 48 h), activation temperatures (400, 600, 800 °C), and activation times (60, 120, 180 min). Then, yield was calculated for each sample. AC samples prepared were introduced into MB solution and agitated for 60 min. Post-centrifugation, dye concentration in the supernatant was measured at 15 min intervals using a UV-Vis spectrophotometer at 664 nm, enabling the determination of MB removal percentages. The optimal method involved treating rice husk with HCl (5% v/v) for 24 h, followed by washing with DI water, drying, and pyrolysis at 400 °C for 2 h. This AC variant exhibited the highest MB removal. The surface morphology and the elemental composition of this AC variant was examined by scanning electron microscopy and energy dispersive spectroscopy and Fourier transform infrared spectroscopy. In batch adsorption, the effects of experimental parameters, such as initial MB concentration, adsorbent dose, pH and shaking time, on MB adsorption to AC were evaluated at room temperature. Results indicated the highest MB removal percentage with AC (0.05 g), concentration of MB (5 mg L^{-1}), pH (7), and shaking time (60 min). Further, the equilibrium adsorption data were analyzed by the Langmuir and the Freundlich isotherm models. Among the two isotherms, the Langmuir isotherm (R^2 = 0.9981) is better fitted with data having a maximum adsorption capacity (Q_{max}) of 20.88 mg g^{-1}. Adsorption kinetics analysis suggests that the pseudo-second order model best fits the data, indicating a chemical sorption mechanism governing the adsorption process. Based on the results, it can be concluded that AC is an efficient and cost-effective adsorbent for dye removal from industrial wastewater.

Keywords: Activated carbon, methylene blue, rice husk, wastewater