

CHITOSAN/OIL PALM TRUNK POWDER MODIFIED IN 1-BUTYL-3-METHYLIMIDAZOLIUM ACETATE FOR THE ADSORPTION OF MALACHITE GREEN

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ABSTRACT

More than 8000 chemicals, including hazardous dyes affecting human health and aquatic ecosystems, are discharged into the environment by industries such as textile manufacturing. This research seeks to evaluate the efficacy of chitosan/OPT adsorbent (CSOPT) modified with imidazolium-based ionic liquid and acetic acid in eliminating the harmful malachite green (MG) dye through batch adsorption experiments. The CSOPT adsorbent was characterized using Scanning Electron Microscope with Energy Dispersive X-Ray (SEM/EDX) and Fourier Transform Infrared (FTIR) spectrophotometer. Key parameters, such as initial pH (3-8) and adsorbent dosage (0.02-0.10g), initial concentration (5, 10, 15 mg/L) and contact time (3-60 minutes) were investigated to determine the optimal conditions for maximal malachite green adsorption. The adsorption process adhered to the pseudo-second order kinetic model with a high regression correlation ($R^2 = 1.000$) and a low chi-squared value ($\chi^2 = 0.05$). The adsorption isotherm of MG on the CSOPT surface exhibited a multilayer stepwise pattern, denoted as type VI isotherms. CSOPT shows a high adsorption capacity of 1000 mg/g at pH 8 and room temperature (equivalent to 20 to 25°C). The desorption of MG using 0.01 HCl was only 5.7%, indicating the presence of electrostatic attraction, as well as other interactions like H-bonding and π - π interaction. These results suggest that the CSOPT adsorbent offers a practical and alternative solution for extracting MG from water.