UNIVERSITI TEKNOLOGI MARA

SURFACTANT-MODIFIED PINEAPPLE LEAF FIBRE FOR REMOVAL OF REACTIVE ORANGE 16 AND USED ENGINE OIL

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ABSTRACT

The adsorption process has proven to remove pollutants from the aqueous condition successfully. One of the commonly used adsorbents is commercial activated carbon (CAC). However, the use of CAC has become a challenge due to the source for CAC mainly being from non-renewable materials. This has recently caused considerable interest among the researcher; thus, an alternative material was studied as a CAC replacement. One of the alternatives is using low-cost adsorbents (LCAs) from low-cost materials. Previous studies had shown that LCAs could adsorb pollutants; however, several limitations, such as hydrophobicity and lower adsorption capacity. This study chose pineapple leaf fibre (PALF) as a precursor material. A cationic surfactant, hexadecyltrimethylammonium bromide (CTAB), was chosen as the chemical modifier. Morphology via Scanning Electron Microscopy (SEM) for raw PALF (PALF) and surfactant-modified pineapple leaf fibre (SMPALF) was conducted. Fourier Transform Infrared (FTIR) characterisation for PALF and SMPALF analyses found that -CH's intensity becomes stronger, while -NH and -OH functional group band becomes broadened. This result indicated that CTAB was usefully introduced to the adsorbents. The preliminary experiment found that SMPALF was able to remove Reactive Orange 16 (RO16) in aqueous conditions. The adsorption test was conducted batch adsorption. The adsorption of RO16 onto SMPALF was favourable in acidic conditions, at temperatures 298 K and 150 rpm. The percentage removal of RO16 was found to be increased with the increase of time, and the initial concentration with the highest removal is 96.38%. Kinetics, isotherms, and thermodynamics of adsorbent of RO16 were investigated. The pseudo-second-order kinetic models described the kinetic data well, while the isotherm is well described as the Freundlich isotherm. Thermodynamic studies of RO16 onto SMPALF indicate that it is an exothermic process. A preliminary experiment for removing used engine oil (UEO) found that SMPALF was able to remove UEO in aqueous conditions. The adsorption of UEO onto SMPALF was favourable in the neutral condition, at a temperature of 323 K and 150 rpm. The percentage removal of UEO was found to be increased with the increase of time, and the initial concentration with the highest removal is 73.51%. Kinetics, isotherms, and thermodynamics of adsorbent of UEO were investigated. The pseudo-second-order kinetic models describe the kinetic data well, while the isotherm is well described as the Langmuir isotherm. Thermodynamic studies of UEO onto SMPALF indicate that it is an endothermic process.

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