Batch equilibrium and kinetic studies of naphthalene and pyrene adsorption onto coconut shell as low-cost adsorbent

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\textbf{ABSTRACT}

This study investigated the use of coconut shell as a non-conventional and low-cost adsorbent for the removal of naphthalene and pyrene from synthetic waste water. Coconut shells were used to adsorb naphthalene and pyrene at varying initial naphthalene and pyrene concentrations, adsorbent dosage, particle size and agitation time. The results of the batch equilibrium adsorption studies revealed that adsorption capacity decreased with increase in particle size and increased with increase in adsorbent dosage. The equilibrium adsorption data were analysed by two-parameter models of Langmuir and Freundlich and three-parameter models of Redlich-Peterson, Sips and Toth isotherms. The results showed that the equilibrium adsorption data for naphthalene and pyrene sorbent systems fitted well with all the tested adsorption isotherm models which can adequately describe the adsorption behaviour of naphthalene and pyrene onto coconut shell. The adsorption kinetic data obtained at 100 mg/l initial naphthalene and pyrene concentrations were analysed using Lagergren pseudo-first order, Elovich and intraparticle diffusion rate equations. The rate equations fitting showed that the adsorption kinetic data generally fit the three rate equations tested from which the rate constants and diffusion rate constants were estimated. However, the Lagergren pseudo first-order rate equation gave the best fit and, thus the process followed the first-order rate kinetics. Therefore, coconut shells being an agricultural waste product have the potential to be used as a low-cost adsorbent for the removal of organic pollutant from waste water.

\textbf{Keywords:} Adsorbent; Adsorption; Adsorption isotherms; Adsorption kinetics; Coconut shell

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