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High surface area mesoporous activated carbon developed from coconut leaf by chemical activation with H_3PO_4 for adsorption of methylene blue

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ABSTRACT

In this paper, coconut (*Cocos nucifera* L.) leaves, an agricultural waste, were used as precursors to prepare activated carbon by using H_3PO_4-activation method. Physical properties of the prepared activated carbon (PAC) were undertaken using Brunauer–Emmett–Teller (BET), scanning electron microscopy, Fourier transform infrared, elemental analyzer (CHN) and point of zero charge method. Batch mode experiments were conducted to study the influence of the initial pH (3–11), initial dye concentration (30–400 mg/L), contact time (1–300 min) and temperature (303–323 K) on the adsorption of the methylene blue (MB). The kinetic adsorption is well described by the pseudo-second-order model, and the Langmuir model describes the adsorption behavior at equilibrium. The adsorption capacities (q_{max}) of PAC obtained are 357.14, 370.37 and 370.37 mg/g at temperature of 303, 313 and 323 K, respectively. PAC has a mesopore content of 93% with an average pore size of 73.94 Å. The BET surface area and total pore volume corresponded to 981.79 m^2/g and 1.371 cm^3/g, respectively. Various thermodynamic parameters such as standard enthalpy ($\Delta H°$), standard entropy ($\Delta S°$) and standard free energy ($\Delta G°$) showed that the adsorption of MB onto PAC was favorable and endothermic in nature.

Keywords: Activated carbon; Adsorption; Coconut leaves; Biomass; Methylene blue; Phosphoric acid

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