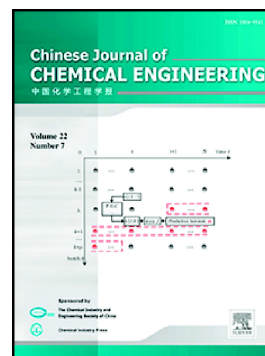


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Separation Science and Engineering

Synthesis of Activated Carbon from Spent Tea Leaves for Aspirin

Removal

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Abstract

Adsorption capacity of activated carbon prepared from spent tea leaves (STL-AC) for the removal of aspirin from aqueous solution was investigated in this study. Preliminary studies have shown that treatment with phosphoric acid (H_3PO_4) increased removal efficiency of STL-AC. Characterizations on STL-AC revealed excellent textural properties ($1200\text{ m}^2\cdot\text{g}^{-1}$, 51% mesoporosity), as well as distinctive surface chemistry ($1.08\text{ mmol}\cdot\text{g}^{-1}$ and $0.54\text{ mmol}\cdot\text{g}^{-1}$ for acidic and basic oxygenated groups, $pH_{pzc}=2.02$). Maximum removal efficiency of aspirin observed was 94.28% after 60 minutes when the initial concentration was $100\text{ mg}\cdot\text{L}^{-1}$, 0.5 g of adsorbent used, pH 3 and at a temperature of $30\text{ }^\circ\text{C}$. The adsorption data were well fitted to Freundlich isotherm model and obeyed pseudo-second order kinetics model. The adsorption of aspirin onto STL-AC was exothermic in nature ($\Delta H^\ominus = -13.808\text{ kJ}\cdot\text{mol}^{-1}$) and had a negative entropy change, ΔS^\ominus ($-41.444\text{ J}\cdot\text{mol}^{-1}$). A negative Gibbs free energy, ΔG^\ominus was obtained indicating feasibility and spontaneity of the adsorption process. The adsorption capacity of AC-STL ($178.57\text{ mg}\cdot\text{g}^{-1}$) is considerably high compared to most adsorbents synthesized from various sources, due to the well-defined textural properties coupled with surface chemistry of STL-AC which favours aspirin adsorption. The results demonstrate the potential of STL-AC as aspirin adsorbent. **Keywords:** activated carbon; spent tea leaves; aspirin; adsorption; kinetics; isotherm

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