Adsorption characteristics of lithium ions on coconut-based activated carbons modified with acids

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\textbf{Abstract}

The adsorption characteristics of lithium ions on virgin and modified activated carbons with three different acids (acetic acid, sulfuric acid, and nitric acid) were studied. Although the surface modification by acids decreased pore surface area and volume, the increased acidity and oxygen-containing functional groups on the surface improved the equilibrium adsorption capacity of activated carbons. Especially, the modification by nitric acid increased the adsorption capacity of lithium ions by 45.5\% compared with virgin activated carbons, despite the loss of Brunauer-Emmett-Teller specific area and total pore volume by 34\% and 39\%, respectively. Langmuir isotherm model provided the best fit to the adsorption isotherm data of virgin (AC) and modified activated carbons with nitric acid (NAC) and the calculated maximum adsorption capacities were 2.48 and 5.64 mg/g for AC and NAC, respectively. The adsorption energies calculated based on D–R equation for AC and NAC were 7.90 and 10.91 kJ/mol, respectively, suggesting that lithium ion adsorption on AC and NAC are characterized by ion exchange. Meanwhile, the adsorption kinetics obeyed the pseudo-second-order rate model more reliably than the pseudo-first-order rate model.

\textbf{Keywords:} Activated carbon; Adsorption; Lithium ion; Surface modification; Acetic acid; Sulfuric acid; Nitric acid

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