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Potassium Acetate - Coconut Shell Activated Carbon for Adsorption of Benzene and Toluene: Equilibrium and Kinetic Studies

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Abstract : Considerable concerns have been raised over the presence of volatile organic compounds (VOCs) in water. In this study, coconut shell based activated carbon was produced through chemical activation with potassium acetate (PAAC) for adsorption of benzene and toluene. The porous carbons were characterized using Fourier transform infrared spectroscopy (FTIR), thermogravimetric analysis (TGA), scanning electron microscopy (SEM), proximate analysis, and ultimate analysis and nitrogen adsorption tests. Adsorption of benzene and toluene on the porous carbons were conducted at varying concentrations (50-250 mg/l). The high BET surface area of 622 m2/g and highly heteroporous adsorbent prepared gave good removal efficiencies of 79 and 82% for benzene and toluene respectively, with 32% yield. Equilibrium data were fitted to Langmuir, Freundlich and Temkin isotherms with all the models having R2 > 0.94. The equilibrium data were best represented by the Langmuir isotherm, with maximum adsorption capacity of 192 mg/g and 227 mg/g for benzene and toluene respectively. The Webber and Chakkravorti equilibrium parameter (RL) values are between 0 and 1 confirming the favourability of the Langmuir model. The adsorption kinetics was found to follow the pseudo-second-order kinetic model. The PAAC produced can be used effectively to salvage environmental pollution problems posed by VOCs through a sustainable process.

Keywords : adsorption, equilibrium and kinetics studies, potassium acetate, water treatment
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