Effect of treatments on activated carbon in adsorption equilibria and kinetics of CO_2, CH_4, CO, N_2, and H_2

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Hydrogen is getting much attention as one of eco-friendly energy sources because it doesn't emit carbon dioxide. However, the purification of hydrogen mixture is essential and adsorption has been an effective way to produce high-purity hydrogen. Effective adsorbents with respect to adsorption and desorption is a key factor for efficient H_2 production. In designing the adsorptive separation process, the equilibrium and kinetic data of components in mixture gas on adsorbents are required.

In this study, a commercial activated carbon was treated in two kinds of methods. The adsorption equilibria and kinetics of representative hydrogen mixture components (CO_2, CH_4, CO, N_2, and H_2) were measured at 293 K, 308 K, and 323 K in the range of low pressure to 0.1 MPa. The isotherms were fitted by the temperature-dependent Sips model, and the non-isothermal kinetic model was applied to fit the uptake curves. Based on the changes induced by the treatments, the results were analyzed with the changes in textural and physiochemical properties. From the obtained data, the direction for the development of adsorbent can be guided and their application way for H_2 PSA processes can be found.