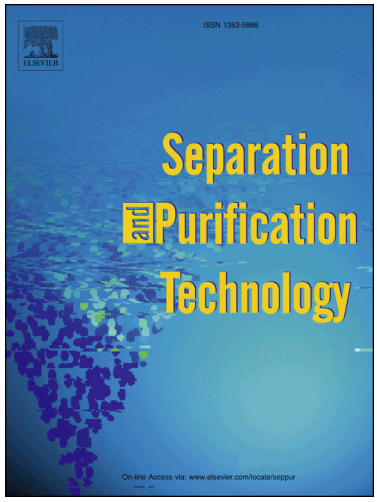

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Analysis of thermal parameter effects on an adsorption bed for purification and bulk separation

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Abstract

Understanding separation behavior in an adsorption bed is crucial for well-designed adsorption processes. Since adsorption phenomena depend on temperature, thermal parameters, such as the internal heat transfer (h_i), isosteric heat of adsorption (Q_{st}) and axial thermal conductivity of the bed (K_w), can affect the adsorption dynamics and performance of the bed. In this study, the effects of these thermal parameters on the adsorption dynamics and breakthrough curves were analyzed with the experimental results using integrated gasification combined cycle gas from the carbon capture process (IGCC gas; H_2 : CO : N_2 : CO_2 : Ar = 88 : 3 : 6 : 2 : 1 mol%) as a purification gas and blast furnace gas (BFG; H_2 : CO : N_2 : CO_2 = 20 : 0.1 : 44.5 : 35.4 mol%) as a bulk separation gas. The results were then compared with the isothermal and adiabatic results. Considering the variation of the internal heat transfer coefficient and isosteric heat of adsorption along with the propagation of gas in the bed, the temperature profiles inside the bed could be predicted better than in the case using constant values. The axial thermal conductivity of the bed significantly affected the temperature profiles as the