

CO₂ adsorption on modified carbon coated monolith: effect of surface modification by using alkaline solutions

ABSTRACT

A monolithic column was used to study the feasibility of modified carbon-coated monolith for recovery of CO₂ from gaseous mixtures (He/CO₂) in a variety of operating conditions. Carbon-coated monolith was prepared by dip-coating method and modified by two alkaline solutions, i.e. NH₃ and KOH. The surface properties of the carbon-coated monolith were altered by functional groups via KOH and NH₃ treatments. The comparative study of CO₂ uptake by two different adsorbents, i.e. unmodified and modified carbon-coated monolith, demonstrated that the applied modification process had improved CO₂ adsorption. The presence of nitrogen- and oxygen-containing functional groups on the surface of the carbon led to an improved level of microporosity on the synthesized carbon-coated monolith. The physical parameters such as higher surface area, lower pore diameter, and larger micropore volume of modified monoliths indicated direct influence on the adsorbed amount of CO₂. In the present study, the Deactivation Model is applied to analyze the breakthrough curves. The adsorption capacity increased with an increase in pressure and concentration, while a reduction of CO₂ adsorption capacity was occurred with increase in temperature. Ammonia (NH₃) and potassium hydroxide (KOH)-modified carbon-coated monolith showed an increase of approximately 12 and 27% in CO₂ adsorption, respectively, as compared to unmodified carbon-coated monolith.

Keyword: CO₂ adsorption; Carbon-coated monolith; Alkaline treatment; NH₃; KOH