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Abstract

When 0.65 mol% toluene was added to SAPO-34 membrane feeds (172-kPa feed pressure), the CO_2 and N_2 permeances decreased by approximately 50%, even though toluene is too large to diffuse into the SAPO-34 pores. Single-component adsorption isotherms for CO_2 and toluene were used to fit a dual-site Langmuir model to estimate external surface coverages. The lower CO_2 permeances qualitatively correlated with the reduced CO_2 surface coverages. Changes in permeances for 10-kPa feed pressures were also measured so that surface coverages could be estimated more accurately using ideal adsorbed solution theory. The estimated decreases in CO_2 coverages on the membrane surface due to competitively-adsorbed toluene reduced the trans-membrane CO_2 driving force and accounted for the observed decreases in permeance.

Keywords

SAPO-34; zeolite membrane; toluene; competitive adsorption