Abstract

The application of adsorption in terms of separation of process gases i.e. purification of biogas or natural gas, is economically desirable because of the higher material and energy efficiency compared to cryogenic distillation or absorption respectively.

Due to their modular assembly, metal-organic frameworks (MOFs) are providing the ability of tailoring specific adsorbents for a desired separation task. With regard to this the imidazolate frameworks Potsdam (IFP), which represent a subclass of zeolitic imidazolate frameworks (ZIF), are a very promising species as they show remarkable hydrothermal stability, which is a prerequisite for their industrial application.

In order to design adsorption processes and predict the breakthrough curves of CH₄/CO₂-mixtures onto the presented adsorbents a model based on experimental equilibrium data (see Fig. 1) of the pure gas components is established.

The simulated breakthrough (see Fig. 2) curves are validated by lab scale experiments and are about to be extended to ternary systems by investigating the influence of water vapor onto the separation efficiency.

Fig. 1: Equilibrium Data of CH₄ and CO₂ on IFP-1 at different temperatures fitted with a modified Langmuir-Model (---)
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Fig. 2: Simulated breakthrough of CO₂ and CH₄ on fixed beds of IFP-1, -4, -5 at T = 30 °C and p = 7 bar