Multibed pressure swing adsorption modeling for CO/N_2 mixture gas separation

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C1 chemistry is on the rise due to its importance as chemical feedstock. Especially, carbon monoxide is used to make liquid fuel by adding hydrogen. Thus, recovering carbon monoxide from industrial gases is useful in terms of the economy and the environment. It also can be energy saving compared to the case when the industrial gases are used as low-energy heat source.
Multi-bed pressure swing adsorption process was designed to recover carbon monoxide from CO/N2 mixture gas. Adsorption equilibrium and kinetics of zeolite were measured beforehand. And the adsorption isotherms and diffusional time constants were predicted by the dual-site Langmuir model and non-isothermal diffusion model. Breakthrough curve study was also conducted experimentally and theoretically to confirm the validity of simulation parameters. Multi-bed PSA processes were simulated by a dynamic model containing mass, energy, and momentum balance and the performance was evaluated in terms of purity and recovery of carbon monoxide. Cyclic configurations and operating parameters were evaluated in case study.