Heat effect of adsorption kinetics of CO_2, CO, N_2 and CH_4 on zeolite LiX pellet and activated carbon granule

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The adsorption kinetics of carbon dioxide, carbon monoxide, nitrogen and methane on zeolite LiX pellet and activated carbon were studied at 293, 308, 323 K and pressure up to 100 kPa. The experiments were carried out by a high pressure volumetric system. Non-isothermal and isothermal kinetic model were applied for the experimental uptake curves in order to compare heat effect on the adsorption kinetics of differenct adsorbate/adsorbent systems. The adsorption kinetics were affected by heat generation, heat transfer and also slope of the adsorption isotherm. At a given pressure and temperature, the order of effective diffusion time constants obtained from non-isothermal kinetics model was $CO_2 << CO << N_2 < CH_4$ for zeolite LiX and $CO_2 << CH_4 \leq N_2 < CO$ for activated carbon. The diffusion mechanism of zeolite LiX was examined by measuring the adsorption rates with different pellet sizes. The contribution of micropore diffusion to the effective diffusion time constants in CO_2, CO and CH_4/zeolite LiX systems was much higher than that of macropore diffusion. The accurate prediction of dynamic behavior could contribute to optimizing the simulation of various separation process such as PSA, PVSA and etc..