

Modeling of sorption kinetics: misapplications overlooked and rectifications

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Sorption kinetics and equilibrium uptake are two important aspects in sorption separations, and they are also important membrane separations based on solution-diffusion. In almost all sorption studies reported in the literature, when fitting the integrated sorption model to the kinetics data based on batch sorption experiments, the sorption uptake at equilibrium (Q_e) is often treated as a constant which should be obtained beforehand from equilibrium sorption experiment or in many cases Q_e is considered as a model parameter to be determined by data fitting. A closer look at this reveals that there is an oversight with such a treatment, which results in an erroneous overestimation of the rate constant. To resolve the issue, a rectification of the model fitting was proposed by accounting for the concentration dependence of Q_e in the model equation based on the fact that Q_e in the model equation represents the sorption capacity at that instant as sorption proceeded with time. The rectified approach was validated with experimental data for various sorption systems.