A generalized Langmuirian approach in adsorption kinetic modeling

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ABSTRACT

Liquid-phase adsorption kinetic models used in the literature include a limited number of equations, the most frequently used being those of the pseudo first-and pseudo-second order. The applicability of these two equations is discussed by researchers, which can be deduced from the Langmuir kinetic equation under specific experimental conditions. This conclusion is confirmed in this work for the pseudo-first-order model. The assumptions under which the equation is valid, i.e. single-site adsorption, are determined, whereas the pseudo-second-order-kinetic equation is deduced from the Langmuir dual-site adsorption model and the respective equation. A calculation procedure based on those models is proposed for the kinetic modeling of adsorption. The main characteristic is that the modeling procedure makes use of the Langmuir theory of adsorption and the corresponding equilibrium and kinetic equations. The only restriction is that the adsorption mechanism of the adsorbent–adsorbate system under consideration must follow the Langmuir theoretical model.

Keywords: Adsorption modeling; Kinetic equations; Langmuir model