A simple method for the determination of adsorption kinetic parameters using circulating-type shallow bed reactor (CSBR)

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ABSTRACT

This study focuses on a novel technique for determining intraparticle diffusivity ($D_p$) and fluid-film mass transfer coefficient ($k_f$) using a recycling type fixed-bed reactor. The detail analysis technique is established in this study. The $D_p$ and $k_f$ values of phenol on XAD-2000 are $7.26–11.4 \times 10^{-6}$ (cm$^2$ s$^{-1}$) and $0.0035–0.0062 \times 10^{-3}$ (cm s$^{-1}$), respectively. The obtained $D_p$ values are similar to the values obtained in the shallow bed reactor $1.6–2.7 \times 10^{-6}$ (cm$^2$ s$^{-1}$). The method has significant advantages over the conventional shallow bed method in chemical/solution saving with easy operation. This technique is useful to estimate diffusivities of phenolic compounds onto resins, especially when the fluid-film mass transfer resistance cannot be negligible.

Keywords: Phenol; Recycling shallow bed reactor; Adsorption; Intraparticle diffusivity; Fluid film mass transfer coefficient