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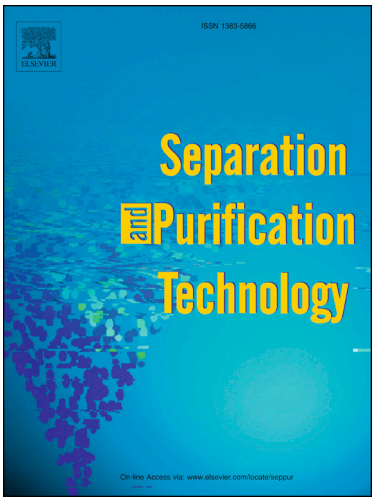

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Numerical study and evaluation of solid-liquid extraction of Montan wax in stirred tanks on different scales

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Abstract

In this paper, mathematical models for the solid-liquid extraction of Montan wax from brown coal are formulated, considering the external mass transfer in liquid phase and the diffusion inside the brown coal particles (effective diffusion) in terms of mass conservation. For parameter identification and evaluation purposes, the Montan wax extraction from brown coal is conducted with small-scale and scaled-up immersion apparatuses. The effective diffusion coefficient D_e for the solute transport of Montan wax from brown coal in toluene is obtained with the proposed correlation $D_e = D_{AB} \cdot \boldsymbol{\varepsilon_p}^{n_\varepsilon}$ ($n_\varepsilon = 2.9$) where ε_p denotes the particle porosity. The effects of the important conditions such as temperature, solvent-solid ratio, the stirring speed and the particle size in terms of extraction rate are investigated by simulation. A sensitivity analysis is performed for the extraction yield with respect of mass transfer coefficient k_f and effective diffusion coefficient D_e.

Keywords: Brown coal extraction; Montan wax; Solid-liquid extraction; Stirred tank; Mathematical model

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