

A modified shrinking core model for leaching of aluminum from sludge solid waste of drinking water treatment

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Abstrak

The kinetics of aluminum leaching from sludge solid waste (SSW) using hydrochloric acid at different leaching temperatures (30-90°C) was studied. A mathematical model was developed based on a shrinking core model by assuming first-order kinetics mechanisms for leaching and an equilibrium linear at the solid-liquid interface. The proposed model is suited to fit experimental data with three fitting parameters and to simulate the leaching of aluminum from SSW, which was validated with the mass transfer coefficient (k_c , cm/s), diffusion coefficient (D_e , cm²/s), and reaction rate constants (k , cm/s). The evaluated k_c , D_e , and k are expected to follow an increasing trend with increasing temperature. The correlation coefficient $r = 0.9795$, the root mean square error $r = 0.399$, the mean relative deviation modulus $r = 6.415\%$, and the value of activation energy is 13.27 kJmol⁻¹. The proposed model could describe the kinetics of aluminum leaching from the SSW DWT in accordance with test parameters and relevant statistical criteria. Valuable information on the results of this work can be given for the purposes of the simulation, optimization, scaling-up, and design of the leaching process.