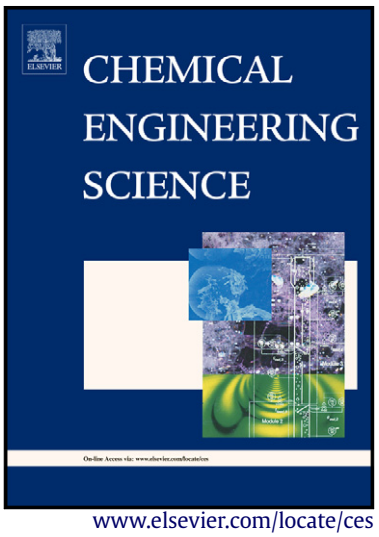

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Kinetic identification and experimental validation of continuous plug flow crystallisation

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Keywords: continuous antisolvent crystallisation, plug flow crystalliser, population balance model, growth rate dispersion

Abstract

This paper investigates the suitability of a number of potential crystallisation models to best describe the experimentally observed behaviour of the antisolvent crystallisation of benzoic acid from aqueous ethanol solution using water as an antisolvent, in a continuous plug flow crystalliser. The system is modelled using a population balance model incorporating nucleation and growth kinetics. Three separate population balance models have been assessed using a variety of growth models (size-independent growth, growth rate dispersion through random fluctuation growth, and constant crystal growth). The prediction from the growth rate dispersion model with constant crystal growth kinetics shows good agreement with the experimental results. In this model, growth rate is described by a normal power law of the absolute supersaturation and the value of growth exponent was estimated as 1.09. The value of the exponent in the expression that describes the relationship between the coefficient of variation of the growth activity distribution and supersaturation is estimated to be 0.09 and as a result this would indicate that there is a weak dependence on supersaturation. The same model was then validated at different residence times and the results demonstrate good agreement between the simulated and experimental results. Estimated parameters were then