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Towards a Rigorous Analysis for a Supercritical Particulate Process

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Abstract : Crystallization with supercritical fluids (SCFs), as a developed technology to produce particles of micron and sub-micron size with narrow size distribution, has found appreciable importance as an environmentally friendly technology. Particle synthesis using SCFs can be achieved employing a number of special processes involving solvent and antisolvent mechanisms. In this study, the compressed antisolvent (PCA) process is utilized as a model to analyze the theoretical complexity of crystallization with supercritical fluids. The population balance approach has proven to be an effectual technique to simulate and predict the particle size and size distribution. The nucleation and growth mechanisms of the particles formation in the PCA process is investigated using the population balance equation, which describes the evolution of the particle through coalescence and breakup levels with time. The employed mathematical population balance model contains a set of the partial differential equation with algebraic constraints, which demands a rigorous numerical approach. The combined Collocation and Galerkin finite element method are proposed as a high-resolution technique to solve the dynamics of the PCA process.

Keywords : particle formation, particle size and size distribution, PCA, supercritical carbon dioxide
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