ABSTRACT

The present study involves application of Monte Carlo technique for analysing complex problems of attrition process and crystal size distribution (CSD) analysis. For the former problem, it focuses on the effects of attrition on the theoretical CSD, modelling of experimental CSD results in a mechanically agitated crystallizer under attrition conditions and finally the effects of volume shape factor dispersion on the CSD resulting from attrition. While for the latter, it includes the simulation of transient CSD under size-dependent growth rate and stochastic dispersion effects for an imperfectly mixed crystallizer. The basic idea behind employing stochastic methods to handle aforesaid problems is that it obviates the need to solve the system equations, which often comprise coupled differential equations. Moreover, these equations often contain variables that render the analysis extremely complex.

In transient CSD analysis, the simulation scheme is attractive due to its simple algorithm, i.e. free from iterative calculations and related convergence problems. The simulated transient CSD can account for size-dependent growth. It could also incorporate improper mixing conditions under all possible dispersion effects. The agreement among the predicted results and available experimental data confirm the validity of the proposed scheme.

In the attrition process, MC offers an alternative to the conventional deterministic approach in solving the Random Breakage model, described by a second order ODE. In addition, a comparison between experimental CSD results under attrition conditions with the simulated CSD indicates good agreement. The MC method was also successfully used together with a physical model for obtaining the fragment size distribution. The distribution provides an account of the volume shape factor dispersion, which previous authors often, assumed to be a constant.