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Effects of Different Seed Dynamics on Crystal Size Distribution for Seeded Batch Crystallization Process

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Abstract

The effects of different seed crystal such as lognormal and bimodal on crystal product distribution are presented for optimizing crystal size distribution (CSD) in the case of seeded batch cooling crystallization process. The different seed crystal recipes are introduced as variable parameter for CSD control of seeded batch crystallization process via simulation in Matlab software. Cubic cooling profile is adapted as the temperature profile for potash alum crystallization system due to its ability to control secondary nucleation. Four seed recipes which are lognormal with different standard deviation of 0.37 and 0.31, and bimodal recipes with different mean at 80/250 μm and 80/190 μm, are used as input for seeded batch crystallization process. Based on these input variables, the final CSD of all seed recipes are further evaluated against experimental data of cubic cooling profile for comparison. Lognormal seed recipe with standard deviation of 0.31 (narrow distribution), labelled as L_2 produces the best seed recipe for seeded batch potash alum crystallization process because it has the largest size of crystals at mean crystal size of 500 μm grown from 90 μm of seed crystals. However, considerable fine crystals are also obtained at mean crystal size of 35 μm, thus trade-off between large size of crystals and fine crystals are needed to be considered. Additionally, the resulted CSD of simulated bimodal seed recipes emphasize that good quality of final crystal products is highly dependent on the good quality of seed crystals. In conclusion, this work highlights the effects of different seed quality in terms of distribution and shape (lognormal or bimodal) on crystal size distribution as one of the important quality specifications in crystallization process and demonstrates narrow distribution of seed crystals as recommendation on the best seed quality for producing desired CSD.

Keywords: Seed crystal; Cubic profile; Crystal size distribution; Crystallization; Potash alum.