Effects of the operating condition on the crystal size distribution and productivity of potassium chloride by numerical simulation

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Crystallization is an old yet efficient separation technique that are commonly used in pharmaceutical industry. High productivity and narrow crystal size distribution (CSD) are two of the most desired characteristics in a majority of crystallisation processes. Another concern is the need for rapid process development and scalable design, making tubular crystallizer a potential candidate for continuous manufacturing and crystallization. Effects of operating conditions, such as seeded inlet flow, flow residence time, and wall temperature, on the CSD within plug flow crystallizer were studied employing ANSYS Fluent 18.

Residence times were varied via varying fluid flow velocities while maintaining the pipe length at 1m. Results showed that the residence time affected the shape of CSD and the extent of the hot zone residing near the flow centre, where crystal nucleation and growth ceased. Longer residence time gave longer cooling time and smaller hot zone, resulting in higher productivity yet broader CSD.

With lower wall temperature, the induced higher supersaturation led to higher productivity; however, high volume fraction of hot zone still existed.