Problems

Characterizing an ammonium sulfate crystallization. A continuous crystallization vessel containing 100 liters of ammonium sulfate slurry is fed with 50 liter per hr of supersaturated solution. The withdrawal rate of product slurry is also 50 liters per hr. A nucleation rate B of 7.18×10^7 nuclei /liter hr, and a growth rate G of 0.056 mm/hr are expected. Determine the following:

(a) The dominant crystal size,
(b) The number of crystal equal to or smaller than this size,
(c) The fraction of crystals in this range, and
(d) The product slurry concentration.

In these calculations, assume cubic crystals with a density of $1.769 g/cm^3$.

10 kg of adipic acid is slurried in 13.1 kg of water and heated to. 90°C to solubilize the acid. The solution is then filtered to remove insoluble impurities. During the heating and filtration, 10% of the water is evaporated. The clarified solution is cooled to 35°C and filtered. The solubility at 35°C is 0.05 kg acid per kg water. Determine the weight of crystals recovered in this operation.

A mixture of stigmasterol and sitosterol weighing 2040 kg is divided into two fractions by crystallization. The original mixture contains 86.3% stigmasterol. The recovered crystals are 96.6% stigmasterol and weigh 1137 kg. The solids in the liquor contain 74.6% stigmasterol, found by evaporation to dryness. Calculate β

As part of a fundamental study of crystallization, you have mounted a single crystal of this antibiotic in a clean, supersaturated solution which flows past the crystal at an adjustable rate. By examining it microscopically, you find that the crystal grows at a rate almost independent of crystal size. At 10% supersaturation, this rate is 0.02 cm/hr at a flow of 5.0 cm/sec and is 0.04 cm/hr when the flow is six times larger. From mass transfer correlations, you expect that the mass transfer coefficient varies with the square root of the fiuid velocity. Estimate k and κ from these observations.