Model-based Analysis of a Pharmaceutical Fluid Bed Dryer:

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Context

Interaction and evolution of particle size and moisture content of wet granules are investigated in a ConsiGma-25™ semi-continuous fluid bed dryer. Wet granules from twin-screw granulator are placed in dryer and dried in 60°C. Dryer cell loading time: 440 m³ h⁻¹. After a certain time, moisture content converges for all size fractions. The drying rate depends on the relative air humidity and the rate at which the moisture is ventilated from the dryer cell.

Experimental data

Effect of inlet air temperature and flow on particle size distribution. No need for 2D-PBM because no correlation drying time - breakage, breakage and drying occur sequentially. Particle data is insufficient for 2D-PBM, average moisture content for size fraction, no moisture distribution in function of particle size.

Model calibration

Population Balance Model

Single particle drying model

Dryer cell loading time: 60 s

References


Example simulation output

For PBM, a good fit was obtained for volume fraction while calibrating to only two parameters. Porosity plays key role in single particle drying model. Determines amount of weakly and strongly bound liquid in the granule.

Future challenge: relating single particle drying curve to average moisture content profile.

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