

300f Wet Granule Breakage in High Shear Mixer Granulation

James D. Litster, Rachel Smith, and Neil Page

Granule product attributes are controlled by the balance of granulation rate processes during the granulation process, namely (1) nucleation and wetting, (2) growth and consolidation, and (3) breakage. Wet granule breakage can be an important process for liquid distribution early in the granulation, and to control the maximum size of the product granules, especially for high shear mixer granulation. Despite this, wet granule breakage is relatively poorly understood with some basic questions still open eg. do granules break predominately in shear or by impact? What mechanical properties of the granules dictate the probability of breakage?

In this paper, wet granule breakage is studied in a breakage only granulator. The granulator is a laboratory scale, vertical shaft high shear mixer. The powder bed consists of a cohesive powder formed by coating coarse sand with silicone oil. The flow patterns of the cohesive sand bed have been well characterised. A small number of well characterised granules are placed in the granulator and the proportion of granules that break is measured. Twenty formulations are used with combinations of different size glass and lactose powders (10 microns to 90 microns) with water or silicone binders ranging in viscosity from 0.001 to 30 Pa.s to give granules with a wide range of mechanical behaviours.

The effect of granule mechanical properties (yield stress, plastic or brittle behaviour), impellor speed and impellor type on breakage probability are reported. Hypotheses on the mode of granule breakage are compared critically with the breakage data and implications for the development of a wet granule breakage regime map are discussed.