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Continuous Pelletization – Effect of Process Parameters

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The Leistritz Micro Pelletizer (LMP) is a tool to cut extrudates from a twin-screw extruder to a defined shape and size. The purpose of this study was to evaluate the influence of the parameters to the granular properties in a wet granulation process. 3³ experimental design was applied.

A formulation consisting of 40% microcrystalline cellulose (MCC M101, Pharmatrans Sanaq, Switzerland) and 60% lactose (Granulac 200, Meggle, Germany) was used. A preblend was transferred to the gravimetric powder feeder of the twin-screw extruder (18GL-40D, Leistritz, Germany). The extrusion took place at a constant powder feed rate of 25g/min and different liquid feed rates. Deionized water was used as granulation liquid. The Pelletizer (Leistritz Micro Pelletizer, Leistritz, Germany) cut the extrudates when emerging from the orifices of the die-head, using variable cutting blade speed. Image analysis was conducted by using the Camsizer (Retsch Technology, Germany).

The study dealt with the effect of 3 different process parameters – screw speed, liquid feed rate and cutting blade speed – on the pellet shape and size. These parameters were varied systematically in a 3³ full factorial design. In addition, 3 experiments were performed at the center point in order to approximate the reproducibility.

The regression model was simplified by a backward regression. The pellet size and the pellet shape were characterized by equivalent diameter and aspect ratio, respectively. The most spherical pellets were obtained by using a liquid feed rate of 0.95kg/h and a cutting blade speed of 2500rpm. In the variance analysis, the cutting blade speed and the screw speed were insignificant, whereas the liquid feed rate had an effect to the pellet shape and size.

One of 3 investigated process parameters affected the pellet properties. Neither the screw speed nor the cutting blade speed showed an influence on the pellet shape and size. The liquid feed rate was crucial in the used experimental setup. The continuous granulation process using the Leistritz Micro Pelletizer (LMP) in combination with the twin-screw Extruder (Leistritz 18GL-40D) was robust and reliable.