

Using compaction simulation to support tablet technology transfer and scale-up

Material-sparing simulation studies helped establish robust processing parameters during scale-up of a tablet manufacturing process.

Development challenge

Technology transfer between manufacturing sites can introduce variability that affects tablet quality and performance. Differences in compression parameters, lubrication levels, and blending conditions can lead to changes in tabletability during scale-up.

During development of a 40 mg tablet formulation of fexuprazan, the sponsor needed to transfer manufacturing between sites while maintaining consistent product performance. There was concern that over-lubrication during blending or changes in compression parameters could reduce tablet strength or introduce lamination risks during commercial-scale manufacturing.

Using compaction simulation to understand material behavior

To evaluate these risks without consuming large quantities of material, OSD Predict™ compaction simulation tools were used to replicate manufacturing conditions in a controlled environment.

Studies were conducted using a Gerteis MINI-PACTOR® roller compactor and a Fette 1200i rotary tablet press to simulate both dry granulation and high-speed tableting processes. The analysis included characterization of bulk and flow properties of intra-granular blends and their impact on tabletability.

Heckel analysis and strain-rate sensitivity measurements were used to understand material deformation behavior. Additional experiments evaluated the impact of lubrication levels and mixing times on tablet mechanical strength.

Defining robust processing parameters

The simulation studies identified the optimal processing window for the formulation. Heckel analysis indicated a yield pressure of 78.5 MPa and strain-rate sensitivity of 15.9%, suggesting a balanced deformation behavior between ductile and brittle characteristics.

Roller compaction simulations identified a target solid fraction range of 0.6–0.7 using roll forces between 3 and 4 kN/cm.

Tabletability data generated from simulated compression profiles were then used to establish appropriate operating parameters for the final manufacturing process

Development outcome

Compaction simulation allowed the team to investigate the causes of tabletability loss during dry granulation and confirm the potential impact of over-lubrication during scale-up.

The results established a defined processing window for roller compaction and tableting, enabling the team to de-risk technology transfer, conserve material, and support efficient scale-up.

At a glance

Program focus

Process development and technology transfer for a 40 mg tablet formulation of fexuprazan.

Methods used

Material characterization, Heckel analysis, strain-rate sensitivity analysis, and compaction simulation using Gerteis MINI-PACTOR® roller compactor and Fette 1200i rotary tablet press.

Manufacturing parameters evaluated

Roll force, solid fraction during dry granulation, lubrication levels, and blending time.

Key technical finding

Material behavior indicated balanced ductile/brittle deformation ($P_y \approx 78.5$ MPa; $SRS \approx 15.9\%$), allowing identification of an optimal solid-fraction range of 0.6–0.7 during roller compaction.

Development impact

Simulation studies identified optimal processing parameters, enabling efficient technology transfer while minimizing material consumption and development risk.

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