

## A Leap in Process Efficiency

### Expert Advice: Continuous Solids Dosing

**Continuous manufacturing of oral solid dosage (OSD) forms provides significant efficiency and quality benefits – but it can also pose substantial process-development challenges.**

**Dr. Ralf Weinekötter, an expert on continuous dosing and mixing, provides insights on the capabilities and limitations of such systems.**

#### How does a tablet manufacturer benefit from a continuous approach?

A tablet press can be considered a continuous system already. However, the tablet mixture has historically been prepared in a batch mode. Making the entire pro-

cess continuous provides significant efficiency gains and contributes to better product quality.

#### What is the role of dosing and mixing in this process?

The continuous dosing-mixing module is an essential element of continuous OSD production. It typically consists of gravimetric feeders for APIs and excipients, as well as a mixing module that feeds directly into the tablet press, granulator or extruder. Such a system requires much less floor space and substantially reduces development and validation time because scale-up is no longer needed. Current systems can process between 50 grams and 250 kilograms per hour.

#### What needs to be considered when switching to a continuous process?

Product quality is substantially determined by the accuracy and consistency of upstream gravimetric dosing processes. Any error will result in a deviation from target quality.



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Dr. Weinekötter studied Chemical Engineering at University Karlsruhe, Germany and ENSIC Nancy, France. He was awarded his Ph.D. at the ETH-Zürich, Switzerland on the topic of "Continuous mixing of fine solids." Weinekötter is a respected author of articles, papers and books, including *Mixing of Solids*, published by Springer Verlag, Germany.

Additionally, mix homogeneity is influenced by mixing chamber and paddle design, rotational frequency (shear rate) and residence time distribution. Continuous processes have a reduced segregation risk compared to batch mixers because the product is directly fed into the next process without the use of intermediate bins with a high segregation risk.

Material properties can also pose challenges. Cohesive materials, for example, require extensive engineering to ensure accurate dosing and mixing.

#### Why is weighing technology a critical part of continuous dosing systems?

Dosing of micro-components, such as APIs, requires a level of accuracy that only can be achieved with gravimetric dosing feeders. Other technologies for powder dosing, such as flow meters, are significantly less accurate.

#### What are important specifications for weighing sensors in these systems?

Precise feeding requires advanced weighing, optimal design of the screw feeder and a sophisticated controller that analyzes weighing-sensor data and selects the optimal settings to ensure a constant feed rate.

The weighing sensor must combine high accuracy with a large capacity. The capacity is essential because the sensor has to carry the screw feeder with the feed hopper, which contains the dosing material. Not many weighing technology companies, apart from METTLER TOLEDO, can provide sensors that master this challenge of high capacity with pristine accuracy. In addition, the weighing sensor must provide a high measurement update rate and fast transmission of weighing data to the controller. This is necessary to accurately control the screw feeder and ensure constant material throughput.

#### Are continuous processes the future of pharma preparation?

Continuous processes provide significant benefits in terms of efficiency, quality and process safety. We have reached a point where suitable systems are available to help companies transition to the continuous method, and we believe the coming years will generate many more exciting developments.

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### Key Benefits:

#### Continuous Solids Processing

- **Better quality:** Easy integration with downstream processes, such as tablet compression, reduces segregation risk.
- **Improved efficiency:** Continuous manufacturing is an automated process with integrated sophisticated online measuring devices and control technologies to ensure accurate formulations.
- **Faster time to market:** Scale-up from lab to pilot to production is no longer necessary. Extending the operating time of the pilot module to reach normal production output is sufficient.
- **Less space:** A continuous dosing-mixing-module's footprint is just 2 x 2 x 2 meters.

► [www.mt.com/ind-continuous-dosing](http://www.mt.com/ind-continuous-dosing)



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