



IFPRI Project Abstract

Selection of Flow Aids: Model-based Prediction of Flow Properties Enhancements

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Project Start Date: 01 September 2021

Abstract Date: 9 May 2025

Project Objective:

Develop and validate mechanistic models that predictively guide flow-aid processibility, including expected property improvements across various processes (batch vs. continuous), coating parameters (selection of flow aid type, amount, and processing intensity), device options (low vs. high shear), and resulting property improvements. Additionally, create practical tools to guide flow and processibility by translating powder mechanics principles into enhancements in processibility.

Approach:

Develop and test mechanistic models to quantify and predict the quality of flow aid coatings and their effect on cohesion reduction, considering the type of mixing device, its parameters, and intensity, while experimentally validating the results.

Recent Results:

Three different mixing devices, a V-blender, a comil, and the labRAM, representing three different levels of intensities, were tested on three exemplary fine powders and two exemplary flow aids to assess the extent of enhancements in flowability and bulk density. As expected, the higher the intensity, the better the enhancements. Lower intensity devices led to significant flow aid aggregation, which was mechanistically analyzed. The previous contact model was extended to account for the loss in the extent of cohesion reduction due to flow aid aggregation as a function of the number of particles, porosity, and size of the aggregates, assuming the aggregates are fractal. This predictive framework is intended to help explain the differing performances of different devices. Another modeling enhancement was to account for the host particle size distribution and identify the best particle size metric to be used. Comil device scalability was investigated in a collaborative work, and its performance was evaluated at the pilot scale. The impact of coating quality on downstream feedability, tablet weight variability, and tableting was evaluated, and it was found that dry coating significantly enhanced those properties.

Next Steps:

The plan for the coming year is to expand the investigation beyond silica to explore metal oxide-based flow aids and validate a wider range of flow aids as cohesion-reducing agents. Additionally, all models and tools are to be integrated into a user-friendly simulation package to guide the industry practitioner about the flow aid processibility