



Research Project Brief

Spray-Drying of Pastes for Process Intensification

The International Fine Particle Research Institute (IFPRI) wishes to fund a research project on spraying of highly concentrated materials (pastes) as a means of improving process sustainability. Spray-drying of liquid products is a key technology that is widely used in many industries. Its environmental impact could be reduced through process intensification by increasing the concentration of the feed liquid to be dried, thereby reduce energy consumption and process footprint. This would require the ability to atomize highly viscous liquids (especially pastes) and achieve short drying times to produce a suitably dry product that does not stick to process surfaces without changing functionality of the dried product.

Key objectives of this project are:

- Identify and validate one or more atomization technologies that will enable spraying highly viscous liquids (up to 100 Pa.s) or dispersions with high solids fraction (pastes) and generate droplets smaller than 100 micron [see references below]
- Develop methods to measure drying kinetics of highly viscous liquid or paste droplets in controlled temperature and humidity conditions.
- Evaluate the impact of the composition and morphology of the atomized droplets on the drying kinetics and develop drying models for highly concentrated feeds.

The scope of this project is limited to viscous aqueous solutions and high solids fraction suspensions, with no limitation on the solute or dispersed particles. IFPRI members can provide recommendations for experimental systems and perhaps provide materials for study.

Some relevant papers on atomization approaches are:

1. Stähle, P., et al. (2017). "Comparison of an Effervescent Nozzle and a Proposed Air-Core-Liquid-Ring (ACLR) Nozzle for Atomization of Viscous Food Liquids at Low Air Consumption." *Journal of Food Process Engineering* 40(1)
2. García, J. A., et al. (2016). "Experimental characterization of the viscous liquid sprays generated by a Venturi-vortex atomizer." *Chemical Engineering and Processing - Process Intensification* 105: 117-124
3. Czisch, C. and U. Fritsching (2008). "Atomizer design for viscous-melt atomization." *Materials Science & Engineering A* 477(1-2): 21-25