Name:	Ir. Séverine Mortier
Phone:	+32 9264 6196
Fax:	+32 9264 6220
E-mail:	severine.mortier@ugent.be
WWW:	http://biomath.ugent.be/
Supervisor:	Prof. I. Nopens/Prof. T. De Beer (FFW)
Context:	PhD research
Start:	August 2010
End:	July 2014

Modelling of drying processes in Pharmaceutical continuous operation

Objectives

- Understand the drying behaviour of pharmaceutical granules.
- Develop a Population Balance Model (PBM) for the drying of a population of granules.
- Develop a Computational Fluid Dynamics (CFD) Model to simulate the flow of granules in a fluidised bed dryer.
- Study the effect of granule density on the fluidization pattern of granules in a fluid bed dryer using CFD.
- Incorporate PBM in CFD to simulate the fluid bed dryer
- Validate all models using experimental data.

Background

- The production of pharmaceutical tablets consists of several steps: mixing, granulation, drying, tabletting. In this study the focus lies on continuous processing of pharmaceutical tablets, and more specifically the drying of wet granules. This is innovative compared to the currently used batch-wise production in industry.
- CFD is a mathematical tool to simulate the flow pattern of different phases. Here, particles are fluidized in a gas flow.

- PBM allows investigating the distribution of certain granules' properties during drying. Here, granular moisture content will decrease as drying proceeds. The latter can be different for every granule.

- **Methodology**
  - The modelling of the process will be performed in several steps.
  - First, one single particle is modelled in a constant environment. The moisture content is calculated using different gas temperatures, gas velocities... This model will be validated using experimental data.
  - Second, the PBM model envisaged includes a growth term in its internal property (i.e. moisture content) that will be derived from the drying model developed earlier.
  - Third, a CFD model will be set up for the particle-gas flow in the fluid bed dryer. This model will be simulated for different densities of the particles to investigate the system behaviour.
  - Upon validation of the stand-alone PBM and CFD models, both will be integrated allowing prediction of the drying behaviour of granules during fluidization for different system specs.
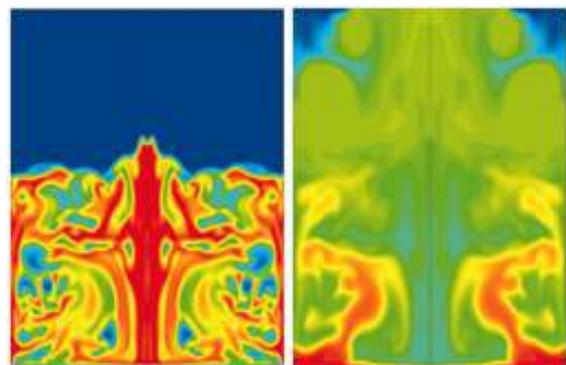

Figure 1: Fluid bed dryer for the continuous drying of pharmaceutical granules

Figure 2: Fluidized bed behaviour with CFD