Success Story
COMET

FFG

research center pharmaceutical engineering

RCPE
Research Center Pharmaceutical Engineering
Programme: COMET – Competence Centers for Excellent Technologies
Programme Line: K1-Zentren
COMET individual project, duration and type of project:
03/2009 – 02/2011, multi-firm

Simulation of Mixing and Solution Processes in Pharmaceutical Production

Mixing and dissolving of solids (powder) in liquids are common mixing tasks in the pharmaceutical industry. Many of the required systems are tested and optimized via a simple trial and error method. Advanced simulation methods developed at RCPE improve process understanding of mixing systems and make possible efficient development and optimization of new mixing systems on the computer.

RCPE further develops 3D simulation methods

In order to optimize mixing and solution processes, the effects that occur during the mixing process must be recognized and understood. In practice, the required measurement parameters (speed, concentration, etc.) in a real steel tank can often be determined with great effort and for some variables (e.g., shear force) not at all.

With the help of 3D simulation methods (CFD) developed at RCPE, this lack of information for real mixing systems can largely be compensated. System features, such as the flow rate, concentration and shear force, can be determined by simulating each geometrical location in the tank and at every time point. This way, the overall system can be better understood and the interplay of the effects can be recognized. In this context, solving solid materials (powder) in a liquid solution is another challenge.

This process can also be modeled and optimized using the developed methods. The simulation method is ultimately used to select the various tank geometries and mixer types for different products with different physicochemical properties.

Optimizing mixing and solving processes

bmwfw Bundesministerium für Wissenschaft, Forschung und Wirtschaft
bmvit Bundesministerium für Verkehr, Innovation und Technologie

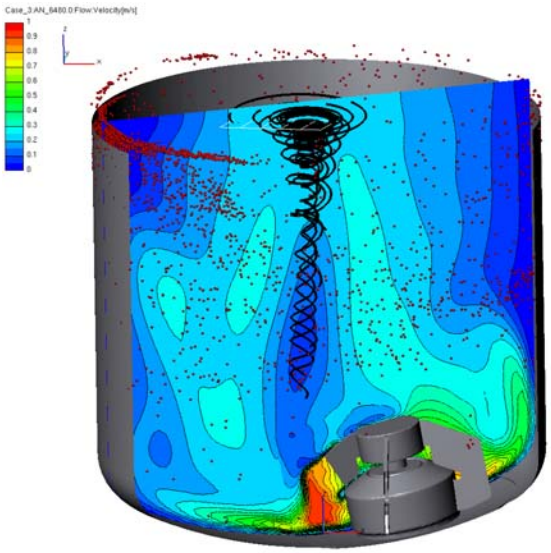

Fig. 1: Velocity distribution and powder flow in a tank with a bottom stirrer © RCPE

In addition, process variables, such as the mixing speed and the required stirring and mixing time, are examined and optimized. The goal is to develop a computer-aided optimization method for mixing and dissolution processes in the pharmaceutical industry. The optimization goal is to produce a homogeneous product in the most economical and energy-efficient way.

Impact and effects

- achieving an understanding of the production process for selected pharmaceutical products
- developing a mathematical model for the solution of solids (powder) in liquids to be able to compute industrial-scale mixing and dissolution processes
- developing a CFD simulation method to optimize typical mixing systems
- applying the simulation method to selected products

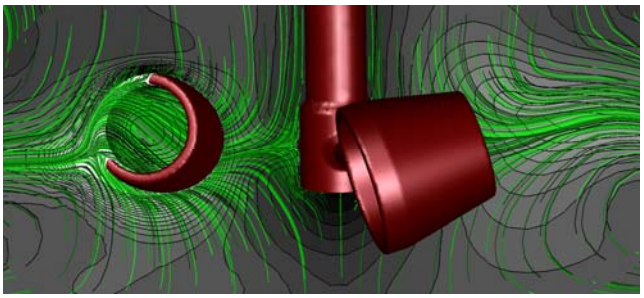

Fig. 2: Flow lines in a ViscoJet mixer © RCPE

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Graz Centre for Electron Microscopy	Austria
Institute of Fluid Mechanics and Heat Transfer Graz University of Technology	Austria