

**Particle formation in drying processes – from single particles to full scale**

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Powders are ubiquitous in the formulation industries, both as ingredients and final products. The characteristics and performance of a powder is designed by the formulation and the manufacturing process, and hence a detailed understanding about the interplay between components and processing is needed to design powders with desired properties. This presentation will provide an overview of particle formation in different powder production processes: spray-drying and spray-freeze-drying. Similar formulations are often used, although the particle structure and properties can be very different. The focus here is on formulations for proteins and food-type emulsions. Through working with formulation and process different particle structures can be obtained.

The mechanisms in particle formation occur on the nano- to microscale in spray-drying, while the production process may be operated on lab- to full scale. In order to design and simulate spray-drying processes, single particle drying is used as a tool to generate necessary data for modelling. A single droplet drying apparatus called the DRYING KINETICS ANALYZER™ (DKA) was developed by GEA. The apparatus is based on the principle of ultrasonic levitation where a single droplet is suspended in an acoustic field. While drying freely under well-defined conditions, the droplet is monitored with a video camera and a large number of measurements are made. Using the apparatus it is possible to quickly dry single particles of different formulations and evaluate the effects of a formulation change drying process and the final particle structure. Based on this the possibilities and limitations of using this apparatus for formulation development and spray drying process design is presented.