

Powder Morphology Development during Spray Drying

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Spray drying is widely applied in food industry to convert liquid formulations into powder to facilitate transport and extend their shelf-life. Spray dried powders have superior quality due to their excellent reconstitution behaviour and the relative mild drying process which preserves product quality. One of the key factors in determining product quality is the morphology of the primary powder particle, which influences reconstitution behavior and flowability. However, the complex phenomenon of morphology development, especially as function of material composition and drying conditions, has not been topic of in-depth scientific study. Better understanding of morphology development is expected not only to contribute to improved powder quality, but also to improved efficiency of spray drying operations. Specifically, lack of control on particle formation and stickiness behavior increases risk of fouling in spray drying towers, which leads to extended downtime and loss of material. The main objective of our research was thus to create mechanistic understanding of morphology development of drying droplets, which was divided in two main research questions: 1) How are skin formation and subsequent morphology development affected by the drying conditions or product formulation? 2) Can the rheological properties of components at high concentration explain the morphology development during drying? To answer these research questions multiple methods were employed. Single droplet drying was used to observe morphology development and rheology revealed the behaviour of concentrated systems explaining skin formation. Finally, pilot-scale experiments were done to translate findings of this research to larger-scale spray drying