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New Insights into the Pelletization Mechanism by Extrusion/Spheronization

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Pellet manufacturing by extrusion/spheronisation is quite common in the pharmaceutical field because the obtained product is characterized by a high spericity as well as a narrow particle size distribution. After extrusion of the bulk material, the cylindrically shaped extrudates are transferred to the spheronizer, where they are plastically deformed into spherical pellets. The established mechanisms [1, 2] only consider deformation of the initial particles but do not account for mass transfer between the particles as a factor in achieving spherical particles.

This study investigates methods for visualizing and understanding the interparticle interactions and a possible mass transfer during the spheronisation step. Therefore, two common pelletization aids (Microcrystalline cellulose (MCC), kappa – carrageen) were used in combination with lactose as a filler. To visualize the interparticle exchanges of mass during the spheronization process, different colored extrudates were spheronized simultaneously, and the color change of the different particles was monitored.

The data obtained indicated that mass transfer between particles must be considered in addition to plastic deformation in order to capture the spheronization mechanism. A material transfer between pellet particles was observed in all investigations (fig. 1). Moreover, the images show regional distinctions in the amount of mass transfer. There seems to be an equatorial zone with a higher probability for agglomeration than at the former edges of the extrudate.

In conclusion, the commonly espoused pelletization mechanisms need to be extended to account for material transfer between pellet particles, which has not been considered before.

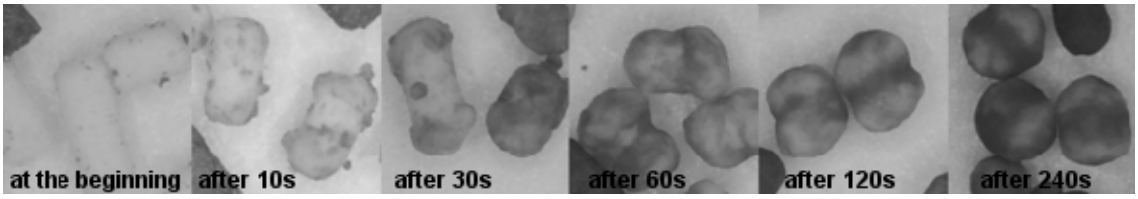

Fig. 1. Images of samples taken during spheronization after different for a pure MCC formulation

[1] Rowe R.C. Spheronization: a novel pill-making pocess?. Pharm Int. 1985; 6: 119–123.

[2] Baert L. Vervaet C. Remon J.P. Extrusion-spheronisation A litrature review. Int J Pharm. 1995; 116: 131–146. doi:10.1016/0378-5173(94)00311-R