INFLUENCE OF OPERATING PARAMETERS OF A SPRAY TOWER ON SPRAY POLYMERIZATION PRODUCT PROPERTIES

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Spray drying is a process mainly used in the pharmaceutical, chemical and in the food industry to produce particles with definite properties for various applications [1]. The spray polymerization is a technical development of spray drying. Spray polymerization is a fusion of polymerization and spray drying. Due to the phenomenon of the wet-bulb temperature of a droplet, the polymerization enthalpy is removed by evaporation of the dispersion medium. Thus, the droplet temperature can be assumed as isothermal. After shell formation the droplet temperature drastically increases and the ongoing polymerization leads to the final particle. Due to the process intensification the spray polymerization is interesting for industrial use. The constant and controllable particle morphology plays an important role for industrial applications. Just like the product morphology during spray drying [2], properties and morphology in the spray polymerization can be controlled by operating parameters such as gas flow rate, gas stream composition and temperature. These parameters affect the spray characteristics and, in particular, the later product properties, like stickiness, porosity, surface texture or morphology, flowability, storage stability. E.g. Krueger investigated the product morphology during co-current flow of the tower reactor [3]. Results for countercurrent operation are not published yet. This study shows that the process temperature has an influence on both, particle size distribution and inner as well as upper surface morphology in a countercurrent operation mode of the spray reactor. Further, we are able to show a dependence of the morphology on the gas flow rate, gas composition and countercurrent flow rate. The above mentioned process parameters are also analyzed regarding their influence on product characteristics such as molecular weight, residual monomer content and residual moisture. Figure 1 shows the technical drawing of the tower reactor used in this study and an example of a powdery product.

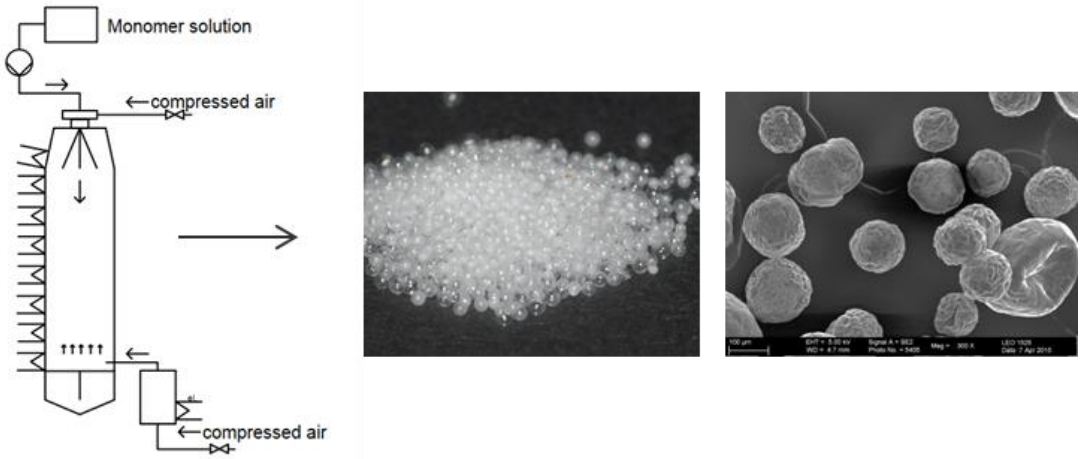

Figure 1 - Technical drawing of the tower reactor (left) and the dry powdery polymer product (middle) and a SEM picture of the polymerized particles (right).

Literature:
[1] Masters, K., 1991, “Spray Drying Handbook”.
[2] W. Rähse, O. Dicoi, Produktdesign disperser Stoffe: Industrielle Sprühtrocknung, Chemie Ingenieur Technik 2009, 81, No. 6.
[3] M. Krüger, Sprühpolymerisation: Aufbau und Untersuchung von Modellverfahren zur kontinuierlichen Gleichstrom-Sprühpolymerisation, Fortschritt der Polymerisationstechnik XII, Wissenschaft & Technik Verlag, 2003.