Contribution ID: **59** Type: **Oral Presentation**

Use of advanced imaging techniques as a valuable tool to analyze the freeze-drying process in more detail in situ

Tuesday, 31 May 2022 14:35 (15 minutes)

Lyophilization or freeze-drying is commonly applied to stabilize (bio-)pharmaceutical substances and high value foods for long-term storage. The freeze-drying cycle typically consists of three stages: i: freezing ii: primary drying and iii: secondary drying [1]. The freezing step is the most crucial one because the performance of the overall process vastly depends on the freezing step. Since the freezing parameters fixes the morphological structure of the dried material, they directly influence the pore size distribution and the connectivity of the porous matrix. Hence, it affects the heat and mass transfer trough the dried cake, which effects the drying rates of both, the primary and secondary drying stages [1,2].
While the influence of pore size on the freeze-drying process is already known, surprisingly other structural parameters like pore orientation or shape is still not sufficiently investigated. Next to the microstructure, process design as well as critical properties of the formulation are important. Drying above critical parameters can lead to changes in microstructure and thus, directly influence the overall drying process and product quality [3].
In this study we will present the influence of the pore structure on the overall drying kinetics and how the pore structure will change during drying. This investigation is carried out in a lyomicroscope. Furthermore, for the first time our self-developed freeze-drying stage [3,4] inside a 4D µ-CT (DynaTOM, TESCAN) to observe structural changes in 3D with a high temporal resolution in-situ is used. Here, maltodextrin and sucrose solutions with different solid concentrations (c = 0.05 w/w, c = 0.2 w/w and c = 0.3 w/w) were used as model substances. In order to estimate the structural changes during the drying process, an in-house image processing code is applied to analyze microstructural parameters like pore size, orientation and shape. The change in the morphological structure at the different drying stages is discussed. The experimental data will further be transformed into irregular pore networks and used for further modelling of drying. The results will lead to guidelines for a faster freeze-drying process with high product quality.

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References

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Time Block Preference

Time Block B (14:00-17:00 CET)

Participation

In person

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