

Preservation of Sensitive Biological Products: An Insight into Conventional and Upcoming Drying Techniques

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Abstract : Several drying techniques are used to preserve sensitive substances such as probiotic lactic acid bacteria. With the aim to better understand differences between these processes, this work gives new insights into structural variations resulting from different preservation methods and their impact on product quality and storage stability. Industrially established methods (freeze drying, spray drying) were compared to upcoming vacuum, microwave-freeze, and microwave-vacuum drying. For freeze and microwave-freeze dried samples, survival and activity maintained 100%, whereas vacuum and microwave-vacuum dried cultures achieved 30-40% survival. Spray drying yielded in lowest viability. The results are directly related to temperature and oxygen content during drying. Interestingly, most storage stable products resulted from vacuum and microwave-vacuum drying due to denser product structures as determined by helium pycnometry and SEM images. Further, lower water adsorption velocities were responsible for lower inactivation rates. Concluding, resulting product structures as well as survival rates and storage stability mainly depend on the type of water removal instead of energy input. Microwave energy compared to conductive heating did not lead to significant differences regarding the examined factors. Correlations could be proven for three investigated microbial strains. The presentation will be completed by an overview on the energy efficiency of the presented methods.

Keywords : drying techniques, energy efficiency, lactic acid bacteria, probiotics, survival rates, structure characterization

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