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S. Ambros, A.H. Vollmer, N.N. Youssef, U. Kulozik

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Structural basis of the impact of microwave drying on survival and shelf life of *Lactobacillus paracasei*

S. Ambros[1]*, A. H. Vollmer[2], N. N. Youssef[2], U. Kulozik[1]

[1] Chair of Food and Bioprocess Engineering, Technical University of Munich, reising, Germany

[2] Department of Nutrition, Dietetics, and Food Sciences, Utah State University, Logan, UT, USA

*Corresponding author: sabine.ambros@tum.de, Tel. +498161-713536, Fax +498161-714384

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Abstract:

The impact of microwave application during drying on survival, shelf life and microstructure of the model strain *Lactobacillus paracasei* F19 was investigated. Possible structural differences between the microwave-enhanced drying processes compared to the conventional freeze, vacuum drying and further spray drying should be studied. While freeze-dried and microwave freeze-dried cells had the highest measured survival rates, vacuum-dried and microwave vacuum-dried cells showed the best storage stabilities among all samples. Thus, microwave application itself was neither affecting cell survival nor did it have an impact on the shelf life of the cultures. Scanning electron micrographs together with surface measurements demonstrated large differences in the microstructure as well as the overall appearance between freeze-dried, vacuum-dried and spray-dried cultures. Differences between microwave-enhanced and conventional drying processes on the other hand were only subtle. Thus, the mode of water removal (sublimation vs. evaporation) is a more decisive factor for the resulting product appearance and microstructure than energy application (microwaves vs. conduction). When storing a product at comparable environmental conditions, we found that the microstructure correlated well with storage stability. In summary, microwave energy can be used instead of conventional heat transfer to achieve a much more efficient, but equally gentle drying.