CPP 75: Physics of Food (joint session CPP, BP)

Time: Thursday 18:00–18:30 Location: C 264

CPP 75.1 Thu 18:00 C 264

Small-angle scattering study on the structure of the lecithin stabilizer layer in tetracosane-water nanoemulsions and -suspensions — •Martin Schmiele and Tobias Unruh — Physik Department, Friedrich-Alexander-Universität Erlangen–Nürnberg, Staudtstr. 3, 91058 Erlangen, Germany

Tetracosane (C_{24}, TCS) o/w nanoemulsions stabilized by the lecithin 1,2-dimyristoyl-sn-glycero-3-phosphocholine (DMPC) were prepared by high-pressure melt homogenization. The droplets (diameters of about 65 nm as measured by photon correlation spectroscopy) exhibit a strong super-cooling (ΔT about 20 K) and crystallize in a for TCS unusual orthorhombic crystal structure (space group $Pca2_1$ as verified by wide-angle x-ray scattering).

Using small-angle x-ray and neutron scattering and nanodispersions with different neutron scattering contrasts for the TCS core and the DMPC stabilizer layer, the molecular arrangement of DMPC in the interfacial layer was studied. For the nanoemulsions a dense monolayer of DMPC with a thickness of about 16.2 Å was found with only a minor interpenetration between TCS and the acyl chains of DMPC. For the nanosuspensions a monolayer thickness of 10.5 Å is found, indicating a more flat arrangement of the DMPC molecules at the interface. This could be explained by the expanded surface of the nanocrystals with respect to the emulsion droplets.

The structure of the interfacial stabilizer layer of lipid emulsions and suspensions is highly relevant with regard to lipid oxidation of bioactive compounds in food and the crystallization of nanoemulsions.

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Lipid migration in multicomponent food products such as chocolate — •Svenja Reinke[1], Stephan V. Roth[2], Gonzalo Santoro[2], Josélio Vieira[3], Stefan Palzer[4], and Stefan Heinrich[1] — [1]Hamburg University of Technology, Denickestr. 15, 21073 Hamburg, Germany — [2]DESY, Notkestr. 85, 22607 Hamburg, Germany — [3]Nestlé Product Technology Centre York, P.O. Box 204, Haxby Road, York YO91 1XY, United Kingdom — [4]Nestlé SA, Avenue Nestlé 55, 1800 Vevey, Switzerland

Our aim is to obtain a deeper understanding of the preferred pathways of lipid molecule migration in multicomponent food materials. A profound understanding of the mechanisms is the basis for controlling undesired fat migration leading to degradation of the material quality, e.g. fat blooming of chocolate, resulting in large sales losses for the food industry. Synchrotron X-ray tomography revealed voids in an industrial chocolate sample, which are considered as having a strong impact on the plausible migration pathways. In addition, oil migration into particles with cocoa butter, which resulted in structural changes, were tracked using spatially resolved small angle X-ray scattering (SAXS). Oil migration has been observed in artificial pores produced in cocoa butter matrices with embedded particles and the analysis of wetting properties of the material has provided further insights into the migration mechanism. Although we have not yet elucidated the exact migration mechanism, our results suggest that migration could occur through the pores of the material. Future research will further clarify the role of the porous structure in chocolate fat blooming.