

„The Interface as Microenvironment and its Impact on Lipid Oxidation and Antioxidant Activity in Emulsions”

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Different properties of emulsifier rich pseudophases (o/w interface and co-existing micellar phase) have been determined and related to the oxidative stability and antioxidant activity in o/w-emulsions. Apart from physico-chemical aspects, reaction pathways have been considered. First, ultrafiltration (UF) and dialysis techniques for the determination of the partitioning behaviour of emulsifiers were developed and validated by the analysis of the emulsions utilising small-angle neutron scattering (SANS). SANS was also applied to characterise structural properties of the o/w interface of emulsions containing Brij 58. Together with results from storage experiments, conclusions about the impact of the fluidity of the interface and the interfacial thickness on oxidative stability could be drawn. A high fluidity of the inner interface accelerated lipid oxidation, whereas a slightly increasing thickness had no observable effect in the present study. Spectrophotometric titrations of ferulic acid (FA) and isoferulic acid (iFA) in micellar solutions of SDS, CTAB and Brij allowed a characterisation of the solubilisation sites of these antioxidants in the respective emulsifier pseudophases. A high degree of dissociation of the carboxy group in CTAB, proximity to the polar headgroup of SDS and deeper intercalation into the headgroup region of Brij increased the activity iFA compared to FA in emulsions. Furthermore, investigations of the stability and activity of Trolox and its degradation products have been carried out. Molecular interactions with Brij and a low molecular mobility in the confined CTAB environment were assumed to be responsible for the stabilisation of the degradation products, which acted as pro-oxidants in SDS emulsions, which are characterised by lower interactions and higher mobility. In conclusion, it could be shown that the impact of the investigated factors strongly depend on the combination of antioxidant and emulsifier.