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Solid lipid nanoparticles (SLN) increase barrier properties of protein coatings during deep-frying

Verena Wiedenmann¹, Claudia Christophliemke², Elisabeth Scieurba², Kathleen Oehlke¹

¹Max Rubner-Institut, Federal Research Institute of Nutrition and Food, Department of Food Technology and Bioprocess Engineering, Karlsruhe, Germany

²Max Rubner-Institut, Federal Research Institute of Nutrition and Food, Department of Safety and Quality in Cereals, Detmold, Germany

More than half of the fat content of deep-fat fried pastry originates from fat uptake during and especially after deep-fat frying. During frying heat and mass transfer cause the water to escape from the dough leaving behind capillaries that will serve as entrance for adhering frying fat during cooling. A strategy to reduce the fat uptake involves coating of the dough prior to frying. The suitability of such a coating depends on its water vapor permeability, surface hydrophobicity, thickness and mechanical stability, among others.

This study aimed at limiting limit the fat uptake by reducing the water evaporation through coating the dough with protein films. To modulate the above mentioned properties, solid lipid nanoparticles (SLN) were incorporated in the protein coatings. The coating forming solutions contained 5.6% whey protein isolate and different concentrations of SLN (0, 5, 20 and 33% of dry mass). The mixtures were heat treated at 90 °C for 30 minutes to denature the protein. Glycerin (80% of protein) was added as plasticizer. The solutions were cast and dried to prepare model films. The films were characterized regarding their surface hydrophobicity by contact angle measurements, thickness, water vapor permeability, and swelling properties. Furthermore, coating forming solutions containing 0, 5 or 20% SLN were applied onto standardized dough pieces for baking experiments. The dough was deep fried in peanut fat and the total fat content in dry matter was analyzed using the soxhlet extraction.

The thickness of the films increased as the SLN content increased. The addition of SLN led to increased surface hydrophobicity of the model films whereas the water vapor permeability decreased with increasing SLN content. This was probably due to reduced hydrophilicity of the films as the amount of hydrophobic ingredients (i.e. SLN) increased.

Coating the dough with protein-SLN-mixtures containing 45% SLN decreased the fat uptake by approx. 15%. Hence, protein coatings with incorporated SLN showed promising reduction in the fat uptake of deep fried pastries.