Analysis of micro-structure in raw and heat treated meat emulsions from multimodal X-ray microtomography - DTU Orbit (10/12/2018)

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This study presents a novel non-destructive X-ray technique for analyzing meat emulsions before and after heat treatment. The method is based on X-ray grating-interferometry where three complementary imaging modalities are obtained simultaneously measuring the absorption, refraction and scattering properties of the sample. Enhanced contrast capabilities of this X-ray technique makes studies on materials with similar attenuation properties possible. The emulsion samples were imaged both in a raw and cooked state. Additionally, different fat types were used in the emulsions in order to compare microstructural differences when either pork fat or sunflower oil was added. From the reconstructed tomograms the different constituents in the emulsions were segmented using a multivariate segmentation method. From this, a quantitative analysis was performed between the different samples, determining properties such as percent object volumes, porosity, average structure thickness and cooking loss. The grating-based X-ray technique and multivariate segmentation made the analysis of the microstructure possible which further gives insight to how both heat treatment, and the use of different lipid types, affect the final protein network quality.

Industrial relevance: Meat emulsions have previously been thoroughly studied, and the use of various fat substitutes and protein stabilizers has been investigated. The grating-based multimodal X-ray tomography method presented here is a feasible method to investigate the microstructural changes induced by heat treatment. It provides high-resolution three dimensional spatial information and in contrast to 2D imaging methods, quantitative parameters can be extracted by image analysis for the entire sample volume. Additionally, the non-destructive method allows for imaging the same sample before and after cooking.

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