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Book of Abstracts

USE OF SYNCHROTRON RADIATION MICROSCOPY IN FOOD RESEARCH

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ABSTRACT

The relationship between the structure of a food and its properties/functionalities is of fundamental interest in food science. Quality of a food product is not only related to its sensorial (shape, size, colour) characteristics but also to mechanical (texture) characteristics. These features are strongly affected by the food structural organization that can be studied at molecular, microscopic and macroscopic levels. In particular, microstructure and interactions of components such as protein, starch, and fat determine the texture of a food that could be defined as the "external manifestation of this structure".

Cell wall thickness, cell size, and uniformity of cell size affect the texture of bread crumb and also the appearance, taste perception and stability of the final product. Crumb elasticity can be predicted from its specific volume and is strongly affected by the amylose-rich regions joining partially gelatinized starch granules in the crumb cell walls.

The structural organization of the components of a cheese, especially the protein network, affects the cheese texture: in particular the stress at fracture, the modulus and work at fracture could be predicted very well from the size of the protein aggregates. Cheeses having a regular and close protein matrix with small and uniform (in size and shape) fat globules show a more elastic behavior than cheeses with open structure and numerous and irregular cavities.

The mechanical properties of cocoa butter are strongly dependent from its morphology at microscopic level and, in particular, from the polymorphic transformation of the fat crystals and the coexistence of different polymorphic forms.

Currently we are far from being able on a routine basis to relate food structures to functionality, and only in rare cases is it possible to establish a direct relationship, but from the evidence that microstructure affects food sensorial properties, an important consideration derives: foods having a similar microstructure also have a similar behaviour. Since microstructure is determined both by nature and processing, food processing can be considered as the way for obtain the desired microstructure (and consequently the desired properties) from the available food components. As a consequence, knowledge of microstructure must precede the regulation of texture and other food attributes.

Studies on food structure at a microscopic level can be performed by using a large variety of microscopic techniques. We will briefly review the most suitable of these techniques with a particular emphasis on X-ray imaging techniques with synchrotron radiation.