Exploiting small-angle neutron scattering to reveal the structure of food materials

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When designing new food products for the marketplace, a fundamental understanding of the structure-function-property relationships between, and within, food constituents is essential. The creation of novel functionalities of active ingredients in complex food systems requires knowledge of not only the structure of native agricultural materials but also the changes in their structure across a wide range of length scales brought about by food processing and digestion. It is the inherent complexity of modern food systems that calls for interdisciplinary scientific approaches to be applied.

To measure and control food structure, to make predictions of behaviour and to deliberately engineer consistent or new products, characterisation techniques are essential and, as non-destructive tools with the ability to reveal structure in the 'native' state, scattering methods are indispensable in this regard. This presentation will describe a range of examples and advances in the application of small-angle scattering techniques [1-3], with a focus on neutrons, illustrated with outputs from "Food Materials Science" [4].

Figure 1: Hierarchical structure of starch – corn kernels (mm), starch granules (micron) and small-angle scattering (nm) [1].

References:
1. "Small Angle X-Ray and Neutron Scattering in Food Colloids", Elliot Paul Gilbert, **Current Opinion in Colloid & Interface Science**, 42 (2019) 55-72. doi.org/10.1016/j.cocis.2019.03.005
2. "Food Structure Characterisation using Small-Angle Scattering Methods", Elliot Gilbert, Marta Martinez-Sanz, and Amparo Lopez-Rubio in **Handbook of Food Structure Development; Food Chemistry, Function and Analysis** No. 18, Editors: Fotis Spyropoulos, Aris Lazidis & Ian T. Norton, The Royal Society of Chemistry (2020). ISBN 978-1-78801-216-4 doi.org/10.1039/9781788016155
3. "Neutron Scattering: A Natural Tool for Food Science and Technology Research", Amparo Lopez-Rubio and Elliot Paul Gilbert, **Trends in Food Science and Technology** 20 (2009) 576-586. doi.org/10.1016/j.tifs.2009.07.008
4. https://www.ansto.gov.au/our-science/projects/food-materials-science