Nanostructure of polysaccharide-based gels and their behaviour upon gastrointestinal digestion

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Polysaccharides are the major components in foods such as fruits and vegetables and they are crucial for the food industry due to their capacity of providing different functionalities to foods (e.g. thickening, gelling, emulsifying, etc.). Furthermore, some polysaccharides, such as agars and carrageenans, are able to form different types of gel-like structures, such as hydrogels, emulsion gels and aerogels. These structures are extremely useful as ingredients to modify food functional properties (e.g. texture), develop novel foods with improved nutritional aspects (e.g. reduced animal fat content, increased satiating effect) or as templates to protect bioactive compounds. In this context, understanding the relationship between structure and functionality is essential to exploit the full potential of polysaccharides and design novel food products with improved nutritional and techno-functional properties. To this end, small angle scattering techniques are an extremely powerful tool, since they allow investigating the structure of highly hydrated polysaccharides, as found in their raw sources or when forming gel-like structures.

In this talk, some examples will be shown to demonstrate how SAXS and SANS, combined with complementary techniques such as microscopy, spectroscopy and rheology, can provide very useful information on the multi-scale structure of cellulose in plant cell walls, the gelation mechanism of sulphated polysaccharides and the nanostructure of novel polysaccharide-based gel-like materials. Furthermore, these techniques can be used to investigate the structural evolution of polysaccharide-based systems during the gastrointestinal digestion process and evaluate the type of structural features formed by the digestion products. This will be of high relevance to assess the nutritional impact and health benefits of novel food sources and ingredients.