Structural characterisation of commercially available pasta combining small-angle x-ray and neutron scattering with contrast variation

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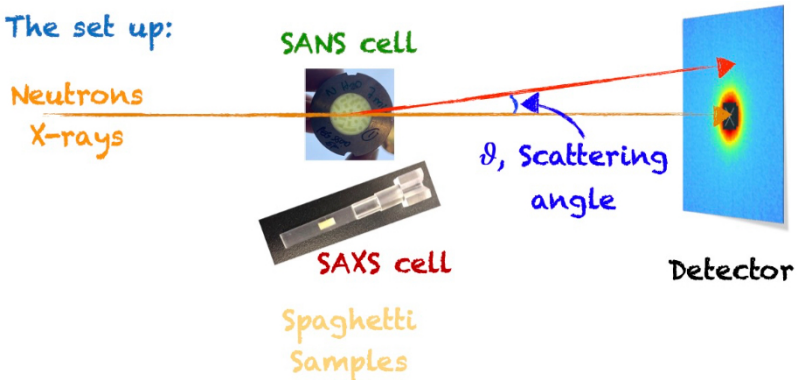
I will discuss how we performed the structural characterisation of commercially available gluten-free pasta by combining small-angle x-ray and neutron scattering with contrast variation. This will be compared to the analogous regular gluten-containing pasta variety. In particular, the use of neutron and contrast variation allowed us to isolate the information about the gluten matrix and the starch granules. The broad peak that reflects the structure of the starches is lost as a function of cooking.
This effect is more dramatic for the gluten-free pasta, indicating that the absence of gluten strongly promotes the gelation of the starches. Furthermore, the presence of salt in the cooking water is found to preserve the structural properties of the pasta, while at the same time it promotes the degradation of the starch granules. Then I will show how different mechanical processes, needed to obtain different pasta shapes, affect the internal structure of this material. Finally I will compare the internal structure of normal wheat flour with the one of flour obtained from Kernza®, a perennial grain witch might in future offer environmental advantages, including carbon sequestration, improved soil structure, reduced nutrient leaching, and lower fertiliser and pesticide inputs compared to annual cereals.

Keywords:
Structural characterisation of food, spaghetti, small-angle scattering, x-rays, neutrons, contrast variation, sustainability



Scheming sketch of a small-angle scattering experiment performed on spaghetti

References:

[1] Judith E. Houston, Ralf Schweins, Nathan P. Cowieson, Gregory N. Smith, Aandrea Scotti. A small-angle scattering structural characterization of regular versus gluten-free spaghetti. *Food Hydrocolloids* , 172: 111855 (2025). DOI (https://doi.org/10.1016/j.foodhyd.2025.111855)