**Bioengineering Sustainable Microgel Particles and Multiscale Characterization of Material Properties**

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Microgel particles are deformable functional soft materials made by crosslinking polymers in a solvent with sizes of these particles ranging from hundreds of nanometers to several micrometers. Microgels have a wide range of industrial applications, such as emulsion and foam stabilization, drug delivery, biosensing and they also serve as lubricants, switchable materials, diagnostics, viscosity modifiers, cell substrates *etc.* Although advances in synthesis, experimental and simulation methodologies have clarified design principles and put microgels at the forefront of soft matter research, little focus has been placed in designing *sustainable* microgels using plant-based materials. Designing microgels with plant proteins is challenging because of their poor aqueous solubility arising from the complex quaternary structure, and their strong tendency for self-aggregation and association with other metabolites such as polyphenols in the natural state.

In this interdisciplinary PhD project involving academics from Food Colloids, Nutrition, Biophysics, Theoretical Physics and Collaborators from Oatly, we aim to design new plant-based sustainable microgel and create new fundamental understanding of the relationship between structural features and mechanical properties relevant to industrial processing as well as oral processing in the mouth. The student will create novel sustainable microgels using oat protein polysaccharides and ions using an array of biotechnological and physical approaches. In addition to experimental work on structure-property relationship at macro-to-nanoscale combining multiple techniques (*e.g.* light scattering, SAXS, SANS, confocal and electron microscopy imaging, rheology, tribology, Rheo-SANS), coarse grain modelling of microgels at single particle level as well as microgel-microgel interaction levels will be carried out to provide a predictive theoretical indication of bulk properties. There will be also an interesting opportunity for the student to also do a placement at Sweden in the R&D facility.