HeteroProtein Complex coacervates: mechanisms and potential applications

Saïd Bouhallab[a*], Thomas Croguennec[a]

a. UMR1253, INRA, Agrocampus-Ouest, STLO, 65 rue de Saint-Brieuc, F-35042 Rennes, France

* said.bouhallab@inra.fr

The application of fundamental physicochemical concepts for rational design of functional assemblies from food proteins constitute a response to the growing trend toward the development of new and innovative food products and also an opportunity to generate new protein-based supramolecular structures with new applications. Because of their omnipresence in food systems and their biodegradability, proteins are the focus of many attempts for their use as building blocks for such supramolecular structures. Controlled self- co-assembly of proteins can generate a variety of supramolecular structures that vary in shape, size and density (fibrils, spherulites, nanotubes, etc). For instance, well-defined microspheres called heteroprotein complex coacervates (HPCC) can be formed by control mixing of oppositely charged proteins.[1] The objective of our research is to understand the mechanisms behind HPCC process from initial spontaneous molecular interaction to micro-scale characterization. In this communication, we will summarize our results on several binary protein systems and will show that co-assembly of proteins into complex coacervates (Figure) is a generic process that is, de facto, independent of the protein amino-acid sequence. We will report on the requirements that drive such spontaneous co-assembly: protein conformational state and flexibility, molar stoichiometry, total protein concentration, charge anisotropy, etc. The Research challenges and the promising uses of HPCC in food and non-food sectors (encapsulation of bioactives, design of edible films) will be discussed.

[1] T. Croguennec, G. Miranda-Tavares, S. Bouhallab, S., Heteroprotein complex coacervation: A generic process, Adv. Colloid Interface Sci., 2017, **239**, 115-126.