Investigation of the interactions between polysaccharides at both molecular and macroscopic scales using fluorescence and rheology tools

Alexandre CORDINIER ; Nicolas HUCHER ; Michel GRISEL

Unité de Recherche en Chimie Organique et Macromoléculaire (URCOM),
Université Le Havre Normandie

Nowadays, due to their natural origin, reasonable price and abundance, a variety of polysaccharides are widely used in many industries such as the food or cosmetics for their gelling or thickening properties. Among all the polysaccharides available, it is established that some may interact together thus inducing large increasing of viscosity $^{and}/_{or}$ new properties such as gel forming.

Xanthan and galactomannan gum mixtures are well-known to behave this way[1,2]. For years researchers mainly[1,3,4] based their studies on macroscopic analysis techniques to investigate the association mechanism; however, no-one has yet proposed a universal model of interactions due to controversy on the mechanisms proposed. This may be explained by the diversity of chemical structures of the xanthan and galactomannan macromolecules. To solve this problem, we started to investigate fully characterized polysaccharides[5] at the molecular level, by using molecular probes, and mainly fluorescence ones in order to 1) identify the different intermolecular interactions being implied in the synergy between both polysaccharides and 2) quantify each interactions energy in order to rank them. Fluorescent measurements were conducted in parallel with other techniques such as NMR spectroscopy and rheology to link together the properties at both the molecular and the macroscopic scales. Such an approach aims to propose a universal tool to understand the behaviour of polymers alone or when mixed with other molecules in aqueous solution.

(1) Dea, I. C. M. et al., *Carbohydr. Res.* **1977**, *57*, 249–272.
(2) Higiro, J. et al., *Food Res. Int.* **2006**, *39* (2), 165–175.
(3) Tako, M. et al., *Agric. Biol. Chem.* **1984**, *48* (12), 2995–3000.
(4) Cheetham, N. W. H. et al., *Carbohydr. Polym.* **1988**, *9* (3), 195–212.
(5) Grisel, M. et al., *Food Hydrocoll.* **2015**, *51*, 449–458.