Topical Research Meeting on
Physics in Food Manufacturing

Session: Simulation

Statistical thermodynamics of food from first principles: application to biomolecular stability, gelation and flavouring

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Profound changes take place in biomolecular gelation, denaturation and aggregation, as well as solubilisation that take place when we add the third component to the aqueous solution [1-3]. The third component (referred to as cosolvent) has been used widely in food as gel stabilizers or flavour solubilizers, and have acquired confusingly diverse terminologies, such as osmolytes, hydrotropes, cosolutes and denaturants [4-6]. Beneath the diversity of terminologies and phenomena, we have shown that there is a universal mechanism at work of cosolvent action [1-6]. Cosolvent-biomolecule interactions are often weak and non-specific, and have therefore eluded the traditional chemical approach through stoichiometric binding [1,2,7]. Based upon a rigorous statistical thermodynamic approach, we have successfully established a way to characterize such weak, nonspecific interaction [1,2,7] at work in food, and have successfully applied our theory to clarify the molecular-based mechanisms of the role of sugars on the gelation of gelatin, agarose [3], carrageenan [5] and tofu [7], as well as some of the molecular interactions present in caffeinated beverages [4].

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