Network formation in chitosan-modified silica suspensions relevant for emulsion stability

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The development of a three-dimensional network that percolates through the continuous phase of emulsions is known to play a role in their stability, reducing the droplets' mobility and preventing gravitational effects [1]. Previous studies have reported particular viscoelastic properties of colloidal agglomerates and continuous network formed due to interactions between fumed silica and chitosan [2-3]. In this work, a novel system combining initially non-aggregated silica nanoparticles and a water-dispersible chitosan has been developed. The rheological properties of silica nanoparticle suspensions coated by electrostatically adsorbed chitosan are studied to shed light on the beneficial role of the percolating network in terms of emulsion stability. Such gelled systems evolve with time and are obtained only for certain pH, silica and chitosan concentrations. By studying these parameters, it was found that aggregates strongly interconnect to form a gel-like network with solid-like mechanical properties only for specific conditions (Figure 1). While it is know that the singular links between the agglomerates come from the fibrous character of the chitosan [4], the determination of their size and their observations by cryo-SEM enable a better understanding of the aggregation mechanism and the network formation. The development of this particle gel microstructure is at the origin of network stabilization in food-grade emulsions.

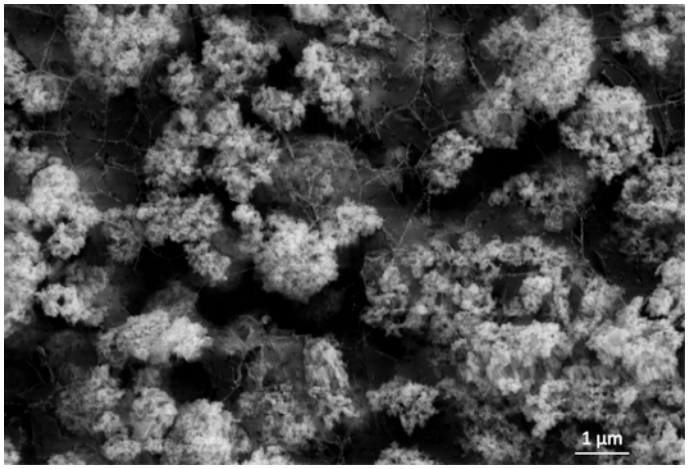

Figure 1 Cryo-SEM image of a network formed due to agglomeration of colloidal particles in an 8.7wt% aqueous silica suspension modified with 0.435wt% of chitosan at pH 5.5.

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