New approach for the characterisation of dairy protein foams stability

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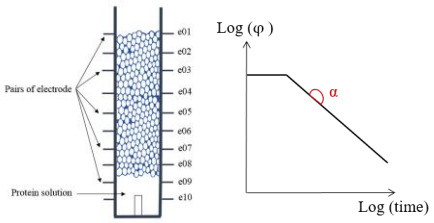

Figure 1. Method (A), drainage rate

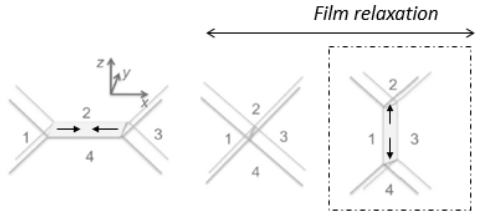

Figure 2. Method (B), T1 rearrangements between 5 films (like 4 bubbles)

The main destabilisation processes in aqueous foams are liquid drainage, coalescence and disproportionation. In food sciences, the measurement of protein foam stability integrates all of them in a "global stability" and a challenge is to correlate foam stability to film interfacial properties. However, foam stability is complex because each of these mechanisms contributes to the foam lifetime and may occur simultaneously. Thus, understanding the respective relation of these mechanisms to interfacial properties may help to understand foam stability.

Several methods have been developed to study foam stability, essentially for low-molecular-weight (LMW) surfactants. First, electrical conductivity measurements of foams as a function of height and time (A) may be converted into liquid fraction φ using an empirical relationship. When drainage is the only instability phenomenon, the variation of the liquid fraction φ within a foam as a function of time follows a power-law: $\varphi \propto t^{-\alpha}$ where α, the drainage rate, is related to interfacial mobility (A. Saint-Jalmes and D. Langevin, *Journal of Physics: Condensed Matter* 14 (40): 9397-9412, 2002). Foam stability is also related to structural dynamics and to the aptitude of films to resist to topological rearrangements, which may lead to coalescence. T1 rearrangements happen spontaneously during the foam lifetime and their film relaxation time (B) is related to surface properties (A.L Biance, A. Delbos and O. Pitois, *Physical Review Letters* 106 (6), 2011).

Thus, the goal of this work is to adapt methodologies essentially applied to LMW surfactants to macromolecules such as dairy proteins and to enlighten multiple dimensions of protein foam stability. Whey protein isolate (WPI) and purified β-Lactoglobulin, the main protein in WPI, have been evaluated. The impact of protein modifications has been also studied. Links between global stability, drainage rate, coalescence and film relaxation time will be discussed.