Influence of interfacial viscoelastic properties on foam stability

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Dispersed systems like foams and emulsions are common to foodstuffs, consumer products, biological systems, industrial processes, etc. Depending on their application, the involved industries are interested in either a high or a low stability. The first one is typically obtained by adding surface-active molecules (surfactants, proteins, amphiphile molecules, etc.). Low stability, on the contrary, facilitates the separation of the phases and allows for instance wastewater treatment. The coalescence is thus easily obtained, allowing an easy separation. Often, the rate determining step in coalescence is thin film drainage. The influence of interfacial rheological stresses, occurring in the stress boundary condition, on the hydrodynamic film drainage has been pointed out, but the detailed influence of the interfacial rheological response is still not fully understood[1]. The aim of this work is to contribute to the experimental data and correlate this influence of interfacial rheology with macroscopic scale destabilization. The globular protein Bovine Serum Albumin (BSA) was chosen to study the impact of microscopic properties on foam stability because it leads neither to strong electrostatic repulsions nor to outspoken Marangoni effects. This system offers the opportunity to focus on the effects of interfacial viscoelastic properties. The microscopic scale study was carried out with a dynamic Thin Film Balance technique [2] to determine the drainage rate, thickness at rupture and the mobility factor of thin films formed between two bubbles. Interfacial rheological properties of air- water interfaces were measured with a Double Wall Ring (DWR) geometry, while the foam stability was assessed through a Dynamic Foam Analyzer and a gas flotation column (technology used in wastewater treatment by the oil industry). The results suggest that the interfacial viscoelastic properties sufficiently affect the boundary conditions by reducing the drainage rate compared to that of interfaces without rheological properties (fig.1a). We observed a simple correlation between the stability of foams and the elastic surface rheological properties.

(a)

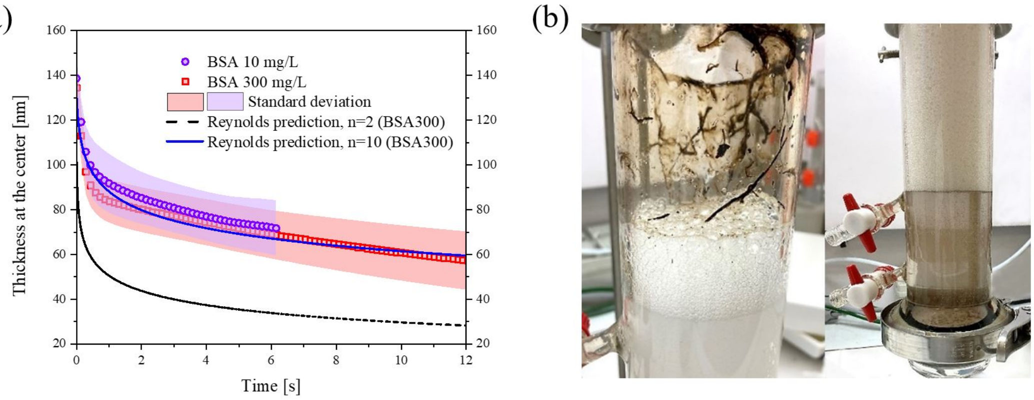

Figure 1: (a) Thin Liquid Film drainage rate. (b) Flotation technique.

[1]E. Chatzigiannakis et al., *Curr Opin Colloid Interface Sci.* **53**, 101441 (2021).
[2]L.G. Cascão Pereira et al., *Colloid Surface Physicochem Eng Aspect.* **186**, 103 (2001).