The competition between endogeneous phospholipids and proteins from pea protein ingredients rules their interfacial properties

Eléna Keuleyan, Jeanne Kergomard, Perrine Gélébart, Valérie Beaumal, Adeline Boire, Véronique Vié, Anne Meynier, Claire Berton-Carabin, Alain Riaublanc

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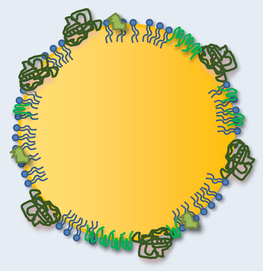

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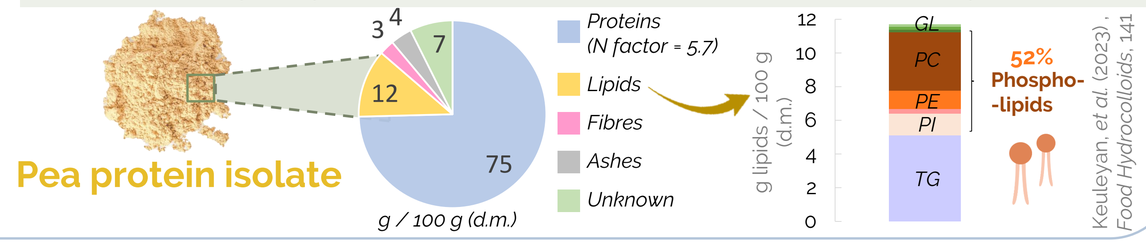
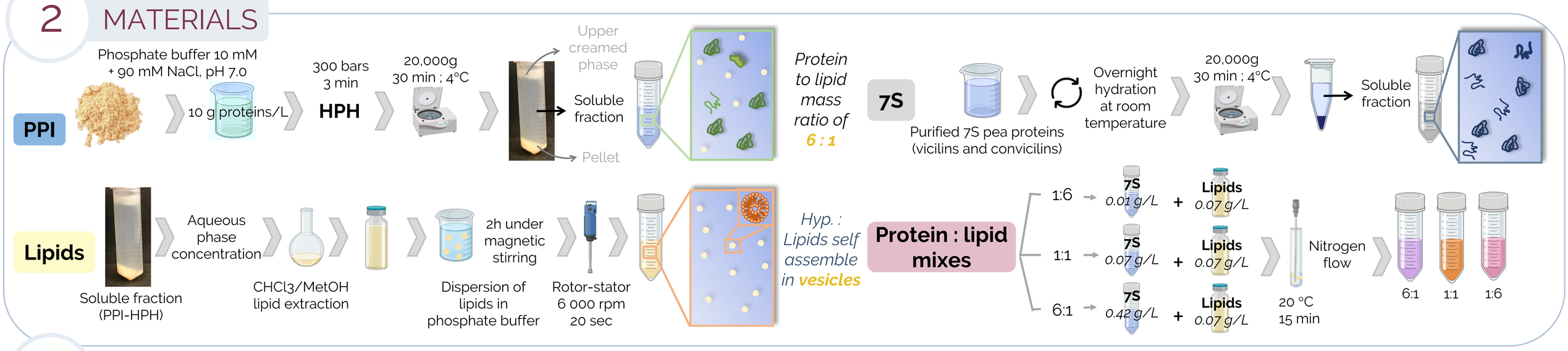
1 INTRODUCTION

Sustainable incentives foster the use of **plant-based ingredients** as emulsifiers, but their composition, functionality and interfacial properties deserve more attention. We recently discovered high contents of endogenous **phospholipids** in **pea** ingredients and the potential of **high-pressure homogenization** (**HPH**) to release submicron lipid structures in aqueous suspensions. Those findings raised the burning question of the **interplay** between proteins and phospholipids for interfacial adsorption.

The aim of this work was to investigate the possible competition between endogenous polar lipids and proteins from a commercial pea protein isolate (PPI) for interfacial adsorption.



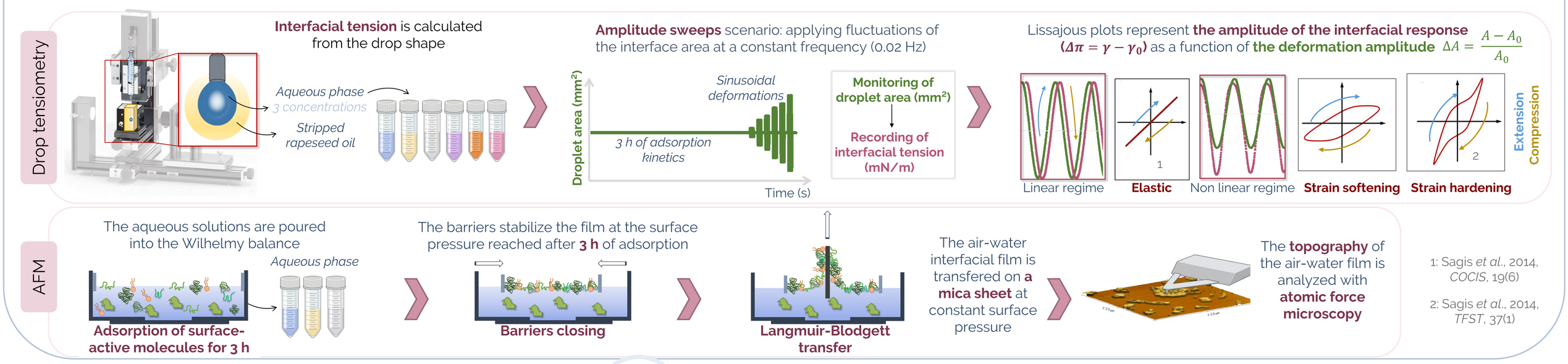
2 MATERIALS



3 METHODS

Interfacial dilatational rheology (**oil-water interface**): adsorption kinetics and Lissajous curves.

Interfacial topography (**air-water interface**): atomic force microscopy on Langmuir-Blodgett films.

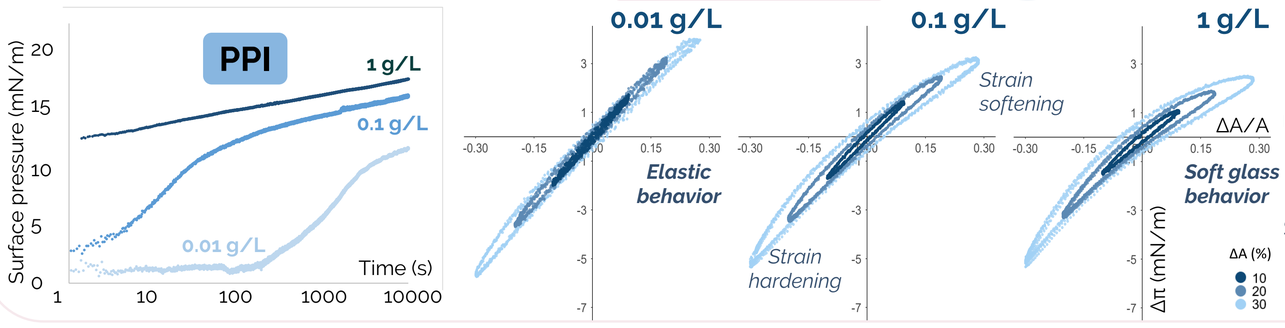


1: Sagis *et al.*, 2014, *COCIS*, 19(6)

2: Sagis *et al.*, 2014, *TFST*, 37(1)

4 RESULTS & DISCUSSION

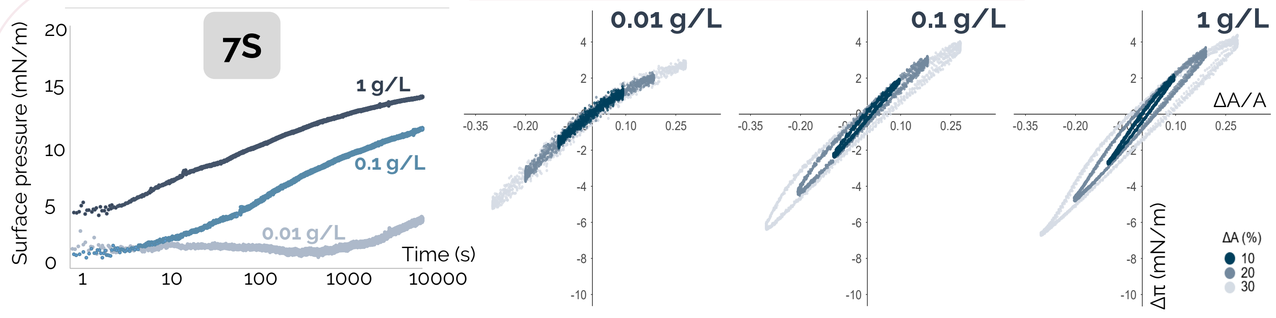
4.1 - PPI results



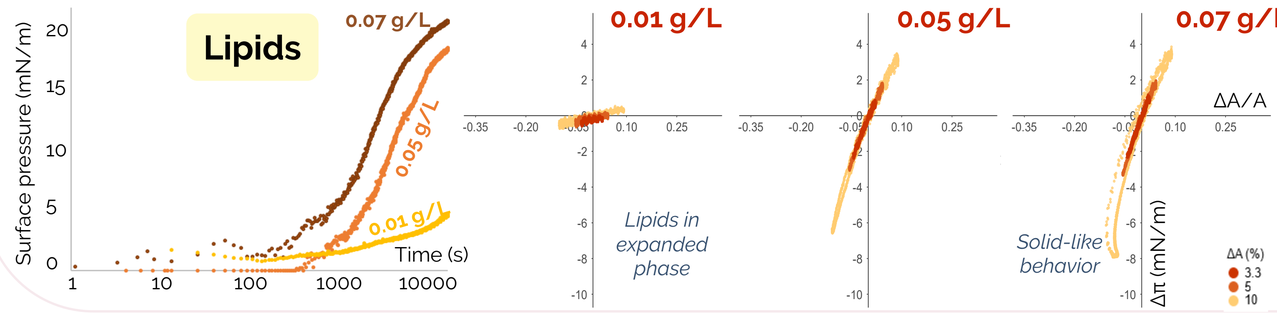
Observation of a **concentration dependency** of the rheological behavior, with an **increase in non-linearities**.

Suggesting **different interfacial film composition.**

4.2 – Purified components results



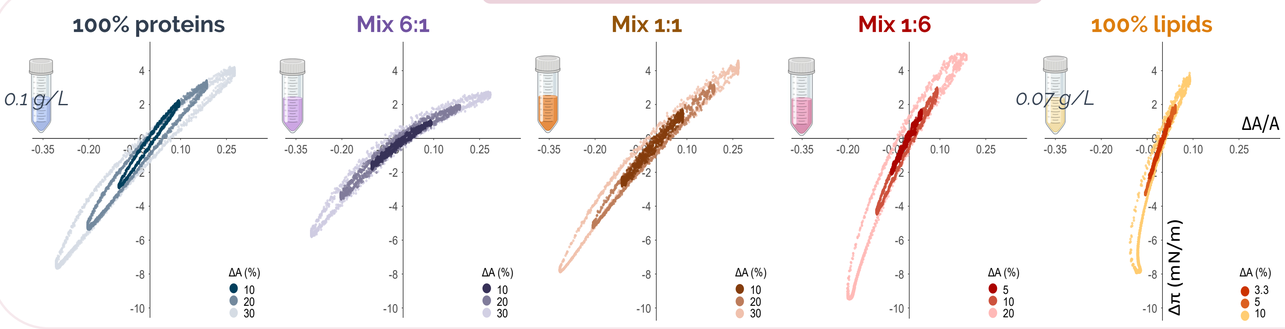
Limited asymmetric behavior: the applied deformation does not strongly affect the interfacial film.



Interface extremely **stiff**, for very low concentrations.

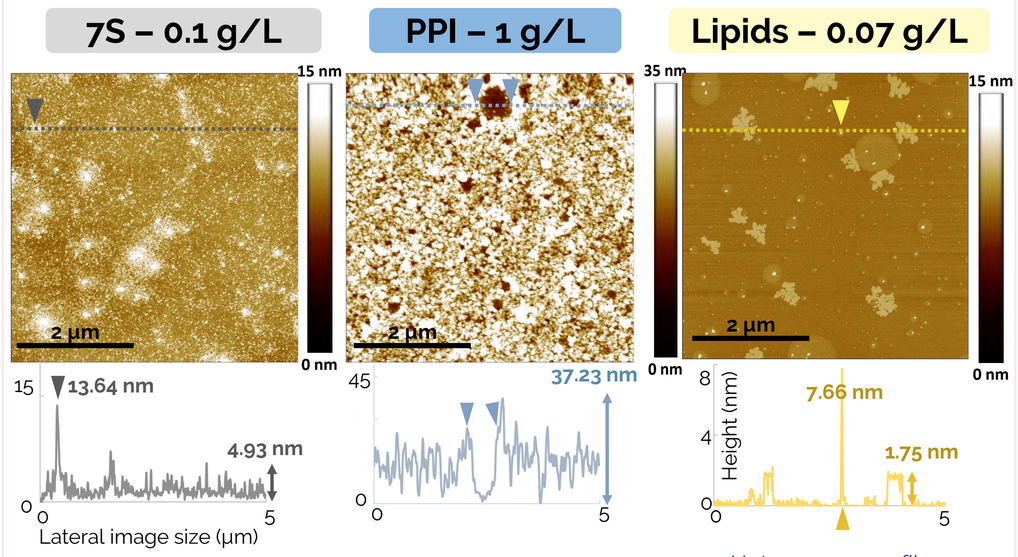
Very strong resistance against the deformation.

4.3 – Protein to lipid mixes results



Close signatures between PPI (1 g/L) and the 6:1 system: the interfacial film of PPI **comprises both proteins and phospholipids**, **competing** for interfacial adsorption.

4.4 – Atomic force microscopy

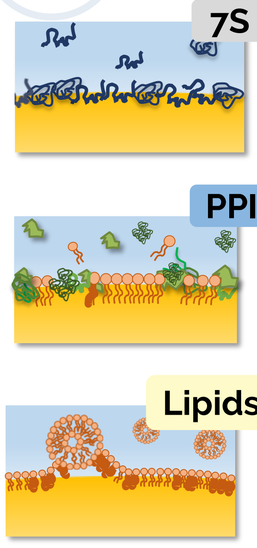


Homogeneous film, with **protein aggregates** all over the sample.

Very **high protein clusters (aggregates)** amongst which circular and low domains are forming « islands », very likely to be **lipid domains.**

Heterogeneous film, comprising a **fluid background**, **high clusters** (nuclei?) among **circular domains**, and **flower-shaped structures** (phospholipid monolayers?)

5 CONCLUSIONS



Proteins and **phospholipids** from a protein ingredient may adsorb and **co-exist** at fluid interfaces, forming complex and composite interfaces having **peculiar interfacial signatures**.

These results highlight that with a rational use of food processing combined with a deep compositional and functional characterization, emulsions' stabilization can be enhanced by benefiting from the natural complexity of plant protein ingredients.

AFM imaging was performed at the **BIOMIF platform** ('Biological Molecules at fluid interfaces', IPR, Rennes, France)

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