Physical stability of (plant-)protein emulsions

Jiarui Cao, **Meinou Corstens, Karin Schroën**

Food Process Engineering, Wageningen university, Wageningen, The Netherlands

Background

Challenge:

Many foods are **emulsions**, such as pesto and mayonnaise, which tend to **destabilize** to reduce the amount of oil-water interface. Making and keeping such emulsions stable is a challenge. To prevent destabilization, emulsifier (protein) is generally added to the system.

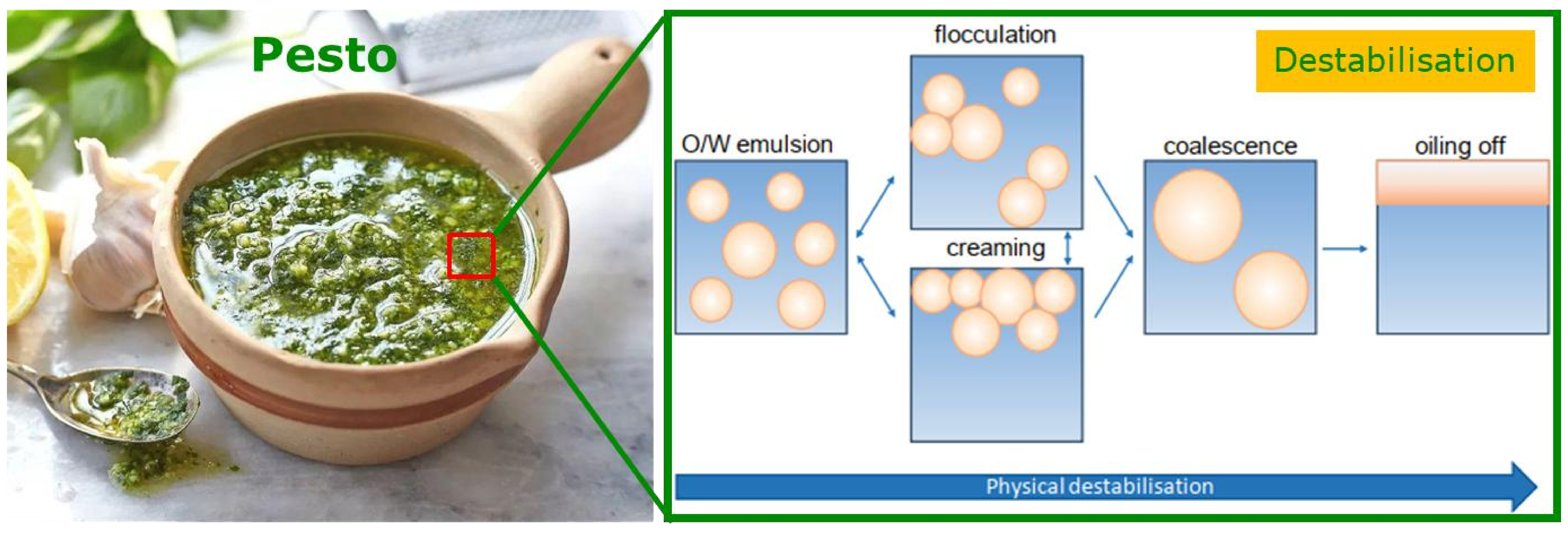
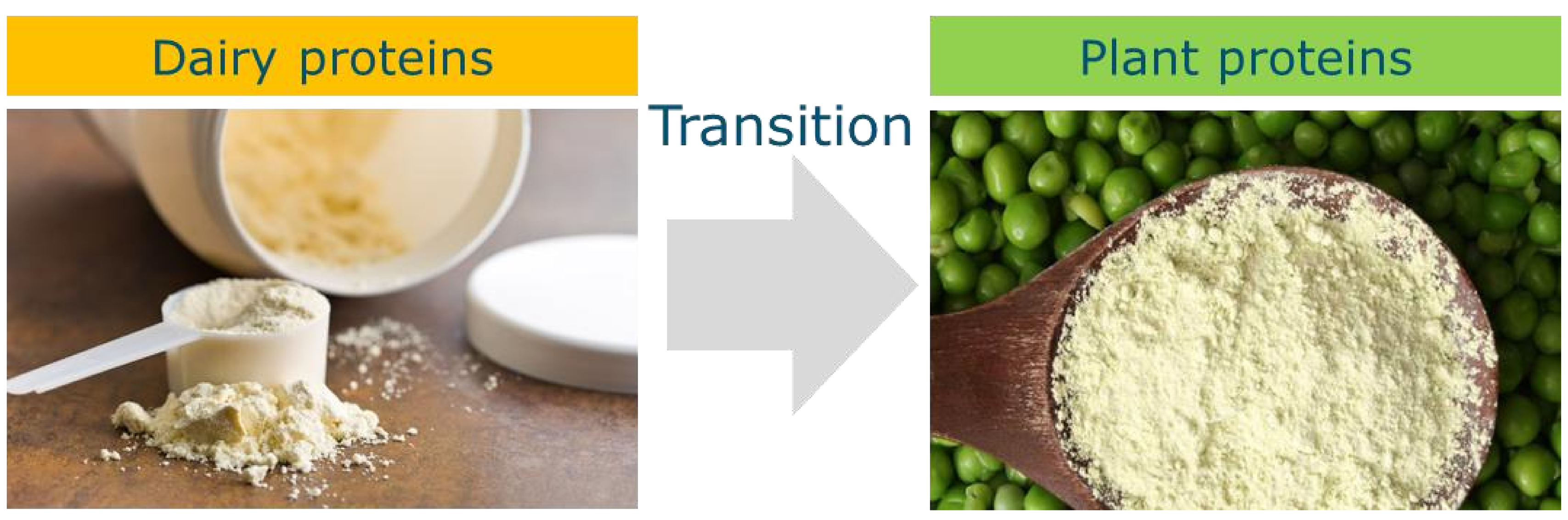


Figure 1. Schematic of the main physical destabilization mechanisms in O/W emulsions.

Emulsifier-Why protein transition?

Plant proteins:

- ✓ **More sustainable**
- ✓ Demanded from a consumer perspective
- ✓ Nutritional value
- ✓ Lower cost



Objectives

- To understand coalescence stability of O/W emulsions by using **microfluidic tools**.
- To elucidate the effect of environmental conditions on **model emulsions.**
- Thus, to provide guidelines for the design of **sustainable (plant-)protein-stabilized emulsions**.

Approach

Microfluidic techniques and conventional emulsification techniques will be used to make droplets and emulsion products.

Microfluidic technology:

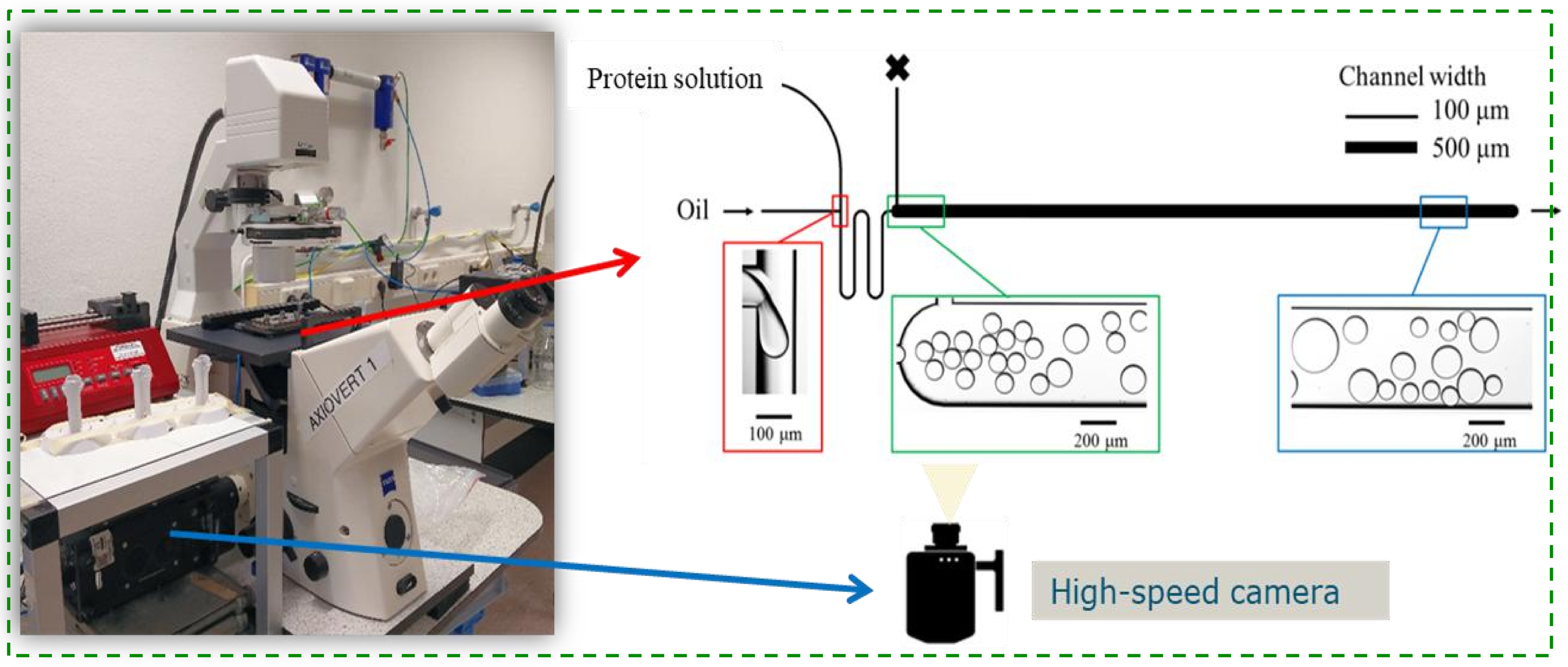


Figure 2. Microfuidic set-up with a coalescence chip.

In the microfluidic coalescence cell droplets are made at a T-junction (red rectangle) under highly specified conditions. The droplets move toward the coalescence chamber where they meet, and if instable coalesce. By using image analysis at different positions along the coalescence chambers (e.g., green and blue rectangles) the physical stability of droplets can be monitored.

Model emulsions and properties:

Besides microfluidic observations, model emulsions will be prepared using high pressure homogenization (colloid mill), and various properties will be measured:

- Droplet size distribution
- Droplet surface charge
- Droplet morphology

References

[1] Ho, K. K. H. Y., Schroën, K., San Martin-Gonzalez, M. F., & Berton-Carabin, C. C. (2018). Synergistic and antagonistic effects of plant and dairy protein blends on the physicochemical stability of lycopene-loaded emulsions. Food Hydrocolloids, 81, 180-190.

[2] Schroën, K., Ruiter, J. de., & Berton-Carabin, C. C. (2020). Microtechnological Tools to Achieve Sustainable Food Processes, Products, and Ingredients. Food Engineering Reviews, 12, 101-120.

[3] Hinderink, E., Sagis, L., Schroën, K., & Berton-Carabin, C. C. (2021). Sequential adsorption and interfacial displacement in emulsions stabilized with plant-dairy protein blends. Journal of Colloid and Interface Science, 583, 704-713.

Jiarui Cao
Laboratory of Food Process Engineering, Wageningen University
Bornse, Weilanden 9, 6708 WG Wageningen, the Netherlands
E-mail: Jiarui.cao@wur.nl
T +31 (0)6 44 78 70 19