



BIOMETRA
DIPARTIMENTO DI BIOTECNOLOGIE
MEDICHE E MEDICINA TRASLAZIONALE



PhD project

SUN FORMULA: SUsustainable and Natural structurants for FORMULATED liquid products

TOPIC

Household and personal care products are typically based on aqueous surfactant solutions. To trap particles and capsules, and to tune their rheological properties, stucturants like colloidal fibers and microgels can be added, which provide **yield stress** through entangled networks [1] or space-filling suspensions [2]. However, the most common rheology modifiers in industrial products are of synthetic origin or require several processing and functionalization steps, which results in energy consumption and chemical waste. Therefore, more **sustainable solutions for liquid-formulated products** are pursued, like **cellulose-based microfibrils or nanocrystals**, widely available as a waste material.

Exploiting the full potential of alternative materials requires to control structurants' interactions with surfactants and their stability; above all, it requires to explore and understand the physical mechanisms of different yield stress strategies (**fibers vs. microgels, gels vs. glasses**) and the interplay between structure, microscale response and macroscale behavior.

The project will address the underlying **soft matter physics** and will investigate the performance of cellulose-based materials, in collaboration with **Procter & Gamble R&D in US and Belgium**.

OBJECTIVES

- To investigate and model the **rheological behavior of model soft materials** and liquid formulations, with the addition of structurants with various **microstructures**;
- To apply and develop novel **optical techniques** to assess **microscopic dynamics** and local rearrangements when the samples are subjected to shear deformations, including **microrheology** [2,3] and **rheo-microscopy** [4];
- To investigate the rheological performance of **cellulose-based materials** as a function of morphology, concentration, surface properties.

WHERE

The experimental activity will be based at the Complex Fluids and Molecular Biophysics lab (**University of Milano, Department of Medical Biotechnology and Translational medicine**, LITA Segrate).

A secondment of 6-12 months is planned at Procter & Gamble R&D centre in Bruxelles (Belgium).

REFERENCES

[1] Zanchetta *et al.*, *Colloid and Polymer Science* **296**, 1379 (2018)

[2] Vitali *et al.*, *Soft Matter* **17**, 3105 (2021)

[3] Vitali *et al.*, *Scientific Reports* **10**, 5831 (2020)

[4] Edera *et al.*, *Soft Matter* **17**, 8553 (2021)

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