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THE FUTURE IS SCIENCE

IMPACT OF THE SIMULTANEOUS PRESENCE OF SURFACTANTS AND PARTICLES ON THE QUALITY OF A COSMETIC EMULSION: INTERACTION MECHANISMS

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INTRODUCTION

Emulsifiers used to stabilize emulsions(1)

Surfactants — *Colloidal particles*

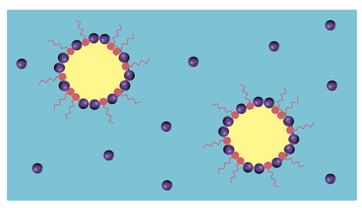
Classic emulsion(2,3): *Reversible adsorption at liquid-liquid interface of surfactants*

Pickering emulsion(4-6): *Irreversible adsorption at interface of colloidal particles*

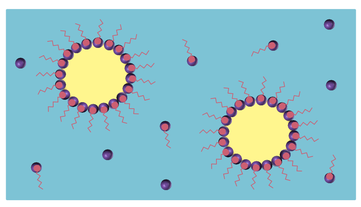
Known stabilization mechanisms

Simultaneous presence of surfactants and colloidal particles(7)?

Competition mechanism(8,9)



Synergy mechanism(8-10)



MATERIAL & METHODS

Selected emulsifiers:

Surfactants: mixture of Steareth-2 and Steareth-21 (6:4)

Particles: titanium dioxide coated with silica and cetyl phosphate

Formulas:

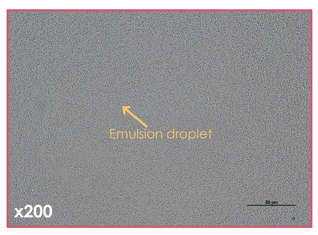
- **Classic emulsion:** 10 %wt of surfactant mixture
- **Pickering emulsion:** 10 %wt of particles
- **« Mixed » emulsion:** 5 %wt of surfactant mixture and 5 %wt of particles

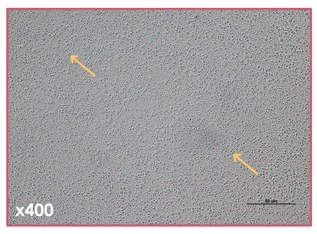
Emulsification process:

- Hot process: *80 °C*
- Emulsification: *Rotor-stator* (≃ 2 min)
- Homogenization: *Mechanical stirring* (≃ 15 min)

RESULTS & DISCUSSIONS

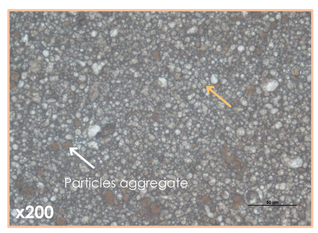
Classic emulsion:

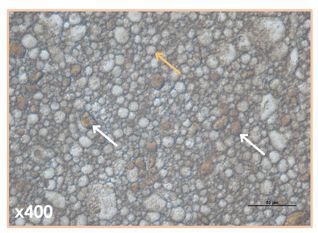




- Small droplets, homogeneous dispersion, no flocculation
- Small droplets distribution range

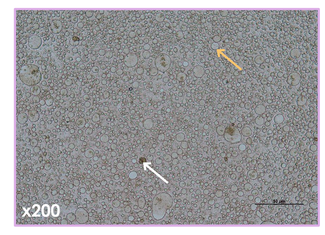
Pickering emulsion:

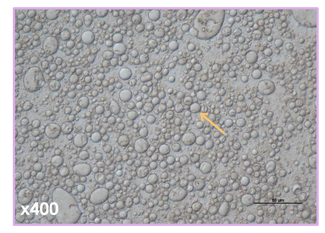




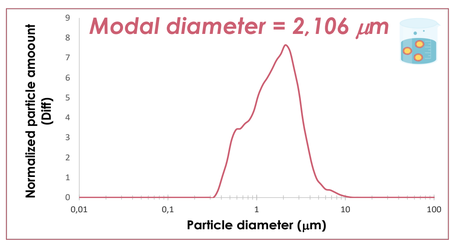
- Dense and interconnected droplets network, presence of particles aggregates

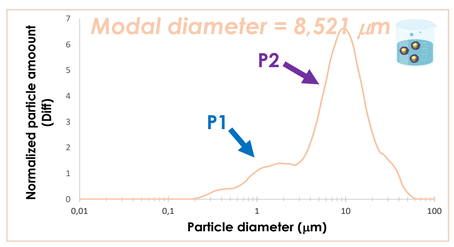
« Mixed » emulsion:

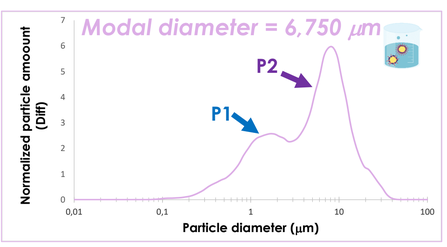




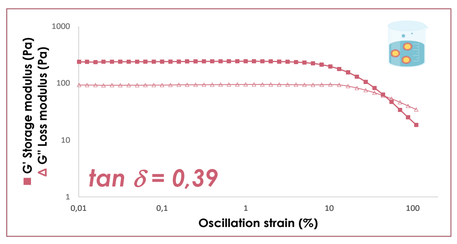
- Microstructure intermediate between classic and Pickering emulsions
- P1 represents a higher proportion than in Pickering emulsion

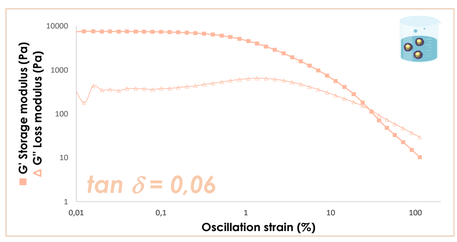


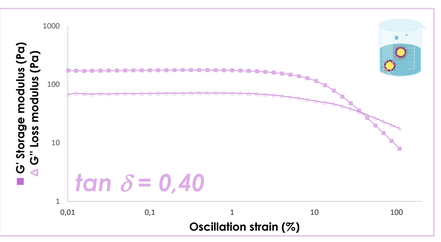




- « Mixed » emulsion microstructure close to that of Pickering emulsion







- Viscoelastic products for the 3 formulated systems
- G' and G'' values higher for Pickering emulsion than for the other two systems
- **Rheological properties of « mixed » emulsion similar to classic emulsion**

CONCLUSION & PERSPECTIVES

The aim of this preliminary study was to **investigate the behavior of emulsions stabilized by both colloidal particles and surfactants**. The initial results obtained for the « mixed » emulsion showed that the microstructure was similar to that of Pickering emulsions, and that the rheological behavior was close to that of classic emulsions. These preliminary results could highlight the contribution of both surfactants and particles in stabilizing emulsion droplets.

Measurements of interfacial tension and contact angle will be carried out to determine the type of mechanism involved. A question remains as to the **environmental fate** of particles involved in Pickering or « mixed » emulsions.

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