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Influence of process parameters on nutritional profile and physical stability of innovative infant follow-on formulas based on animal and plant oil bodies

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Introduction

Only 34% of infant worldwide are still breastfed at 6 months despite WHO recommendations

→ Majority of formula-fed infants WHO, 2022

Lipids mainly from plant oils derived from extraction processes employing organic solvents posing environmental issues and unstructured

(only 14% of IFF include dairy fat)

Cancalon et al., Recherche Data Gov, 2023
Cancalon et al., Data in brief, 2023

Interest of oil bodies (OB)

- Structured lipids (fat globules, oleosomes)
- From more sustainable extraction processes
- Profile of fatty acids of nutritional interest

AIM OF THE STUDY

Introduction of animal and plant OB obtained from more sustainable procedure into infant follow-on formulas (IFF) and assess their stability under different processing conditions

Materials and methods

Introduction of animal-derived OB (aOB) with dairy cream or plant-based OB from the grinding of sunflower, oleic Sunflower, and rapeseed seeds

Formulation of three IFF (40% dry matter*) differing in lipid origin

*To avoid evaporation before spray-drying



PO - based on plant oils



PO/aOB - based on plant oils and animal OB



pOB/aOB - based on animal and plant OB

Production under different operating conditions

High-pressure homogenization (HPH)

80/20 bars

OR

140/40 bars

Heat treatment (HT)

73°C, 1 min

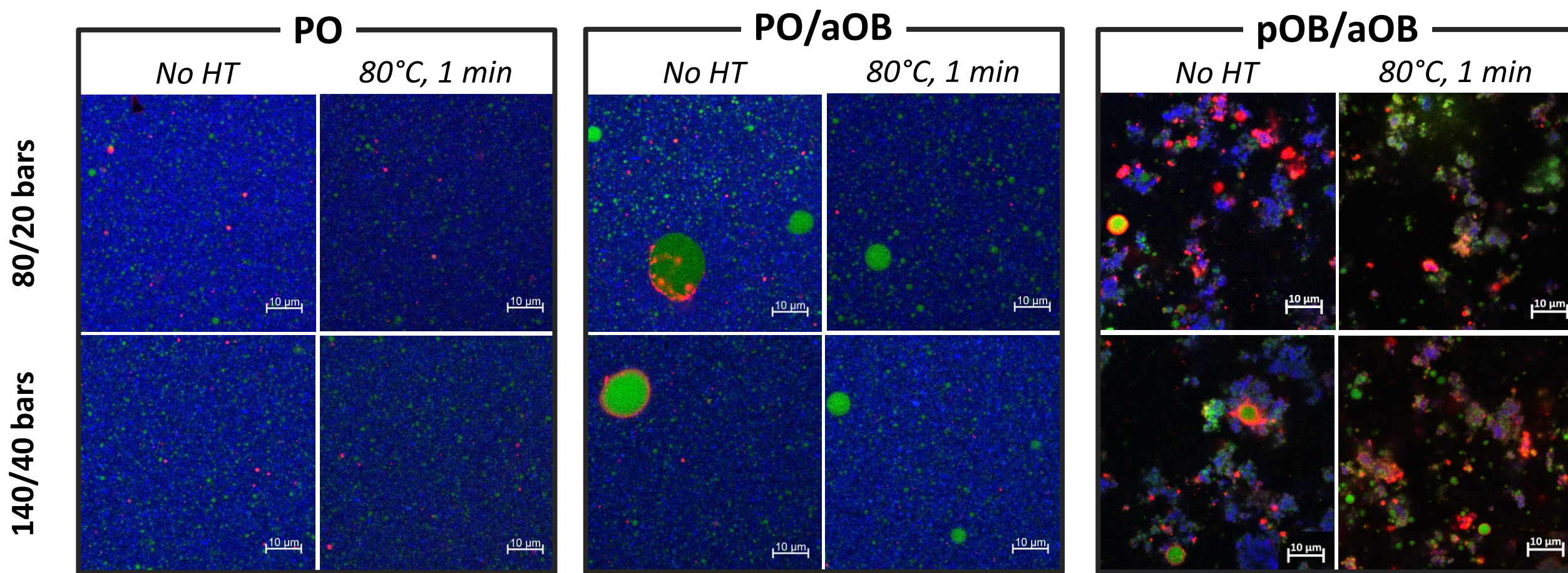
OR

80°C, 1 min

What impact do process conditions have?

Results

Confocal microscopy

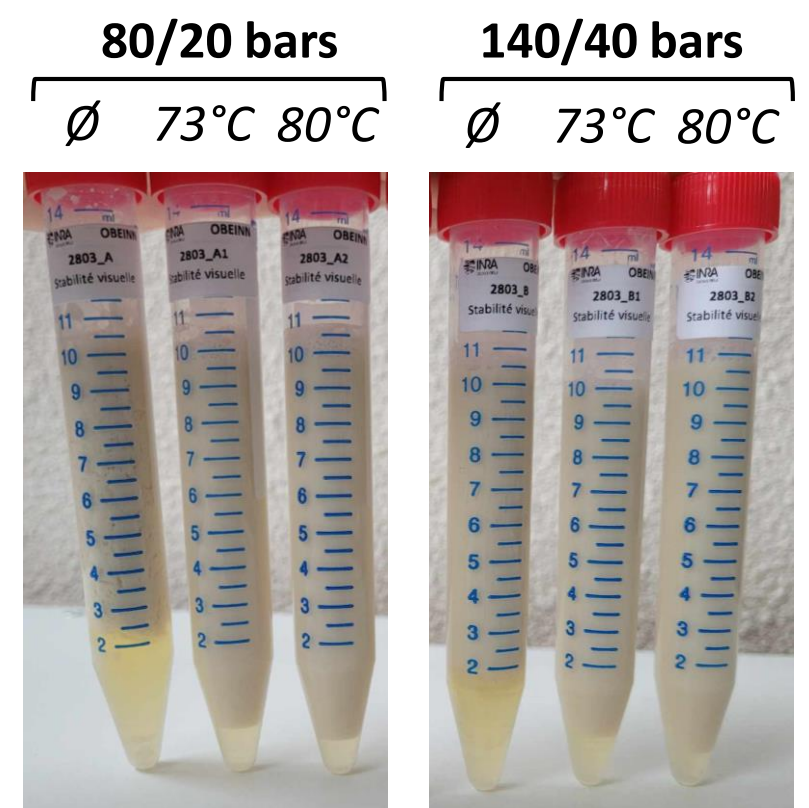


Replacement of phospholipid-stabilized interfaces by protein-stabilized interfaces after HPH
Aggregation for pOB/aOB

Fluorescent probes

- Lipids, Lipidtox®
- Amphiphiles, Rd-DOPE®
- Proteins, Fast green FCF

Physical stability

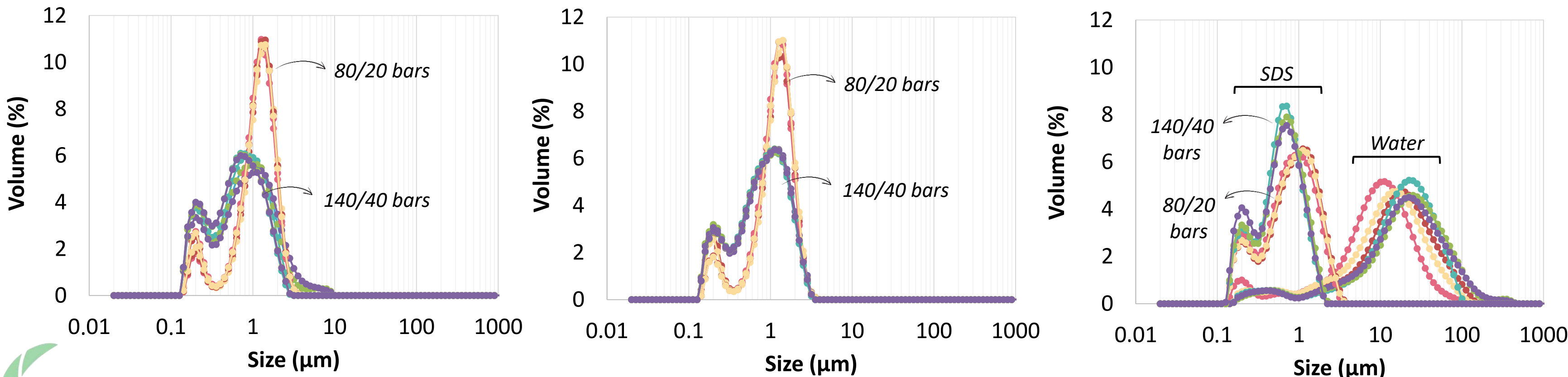


Phase separation for pOB/aOB

Increasing HT temperature limits phase separation

- 80/20 bars, no HT (A)
- 80/20 bars, 73°C/1 min (A1)
- 80/20 bars, 80°C/1 min (A2)
- 140/40 bars, no HT (B)
- 140/40 bars, 73°C/1 min (B1)
- 140/40 bars, 80°C/1 min (B2)

Droplet size distribution

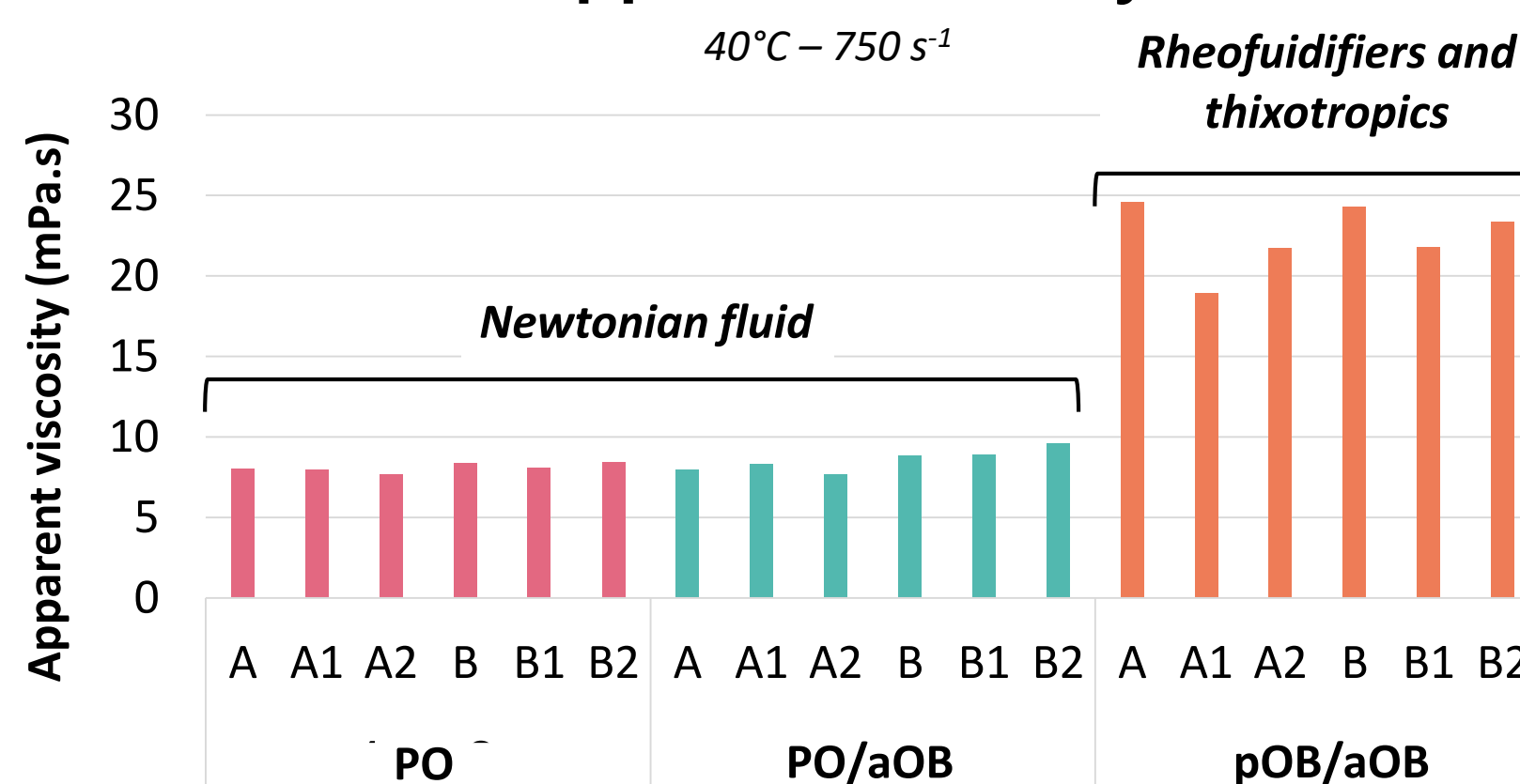


Bimodal distribution with mode between 1.2 and 1.4 µm or 0.7 and 1.3 µm for HPH of 80/20 and 140/40 bars

No impact of HT on size distribution

Significant aggregation in pOB/aOB (larger size for measurements in water than in SDS)

Apparent viscosity



Conclusions

These results demonstrated the feasibility of homogenization and heat treatment on innovative IFF. The influence of the addition of minerals and of the spray-drying of these IFF will be evaluated, before investigating the nutrient bioaccessibility using *in vitro* digestion models.

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