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Effects of processing and concentration on the oxidative stability and interfacial behavior of tree nuts oil bodies (OB)

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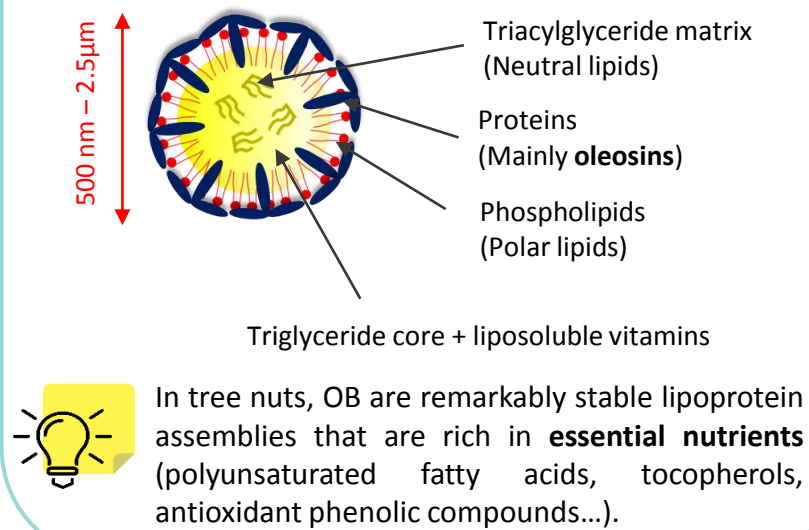


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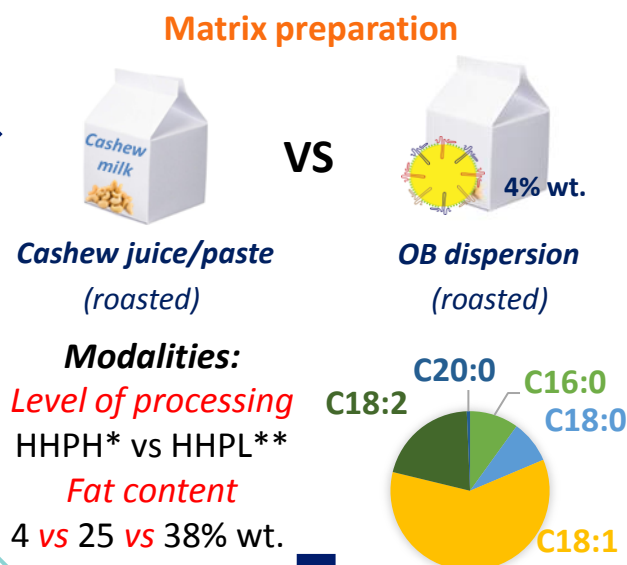
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Introduction: The demand for **plant-based beverages** as an **alternative to dairy products** has considerably increased over the recent years. To preserve the **nutritional qualities** of tree nut oil bodies (OB) in these products, we need to control their **physico-chemical stability**. In this aim, we need to understand i) **the impact of fat content** in the matrix, and ii) **the modification of ultrastructure** induced by usual **industrial processes** (High pressure homogenization, heat treatment).

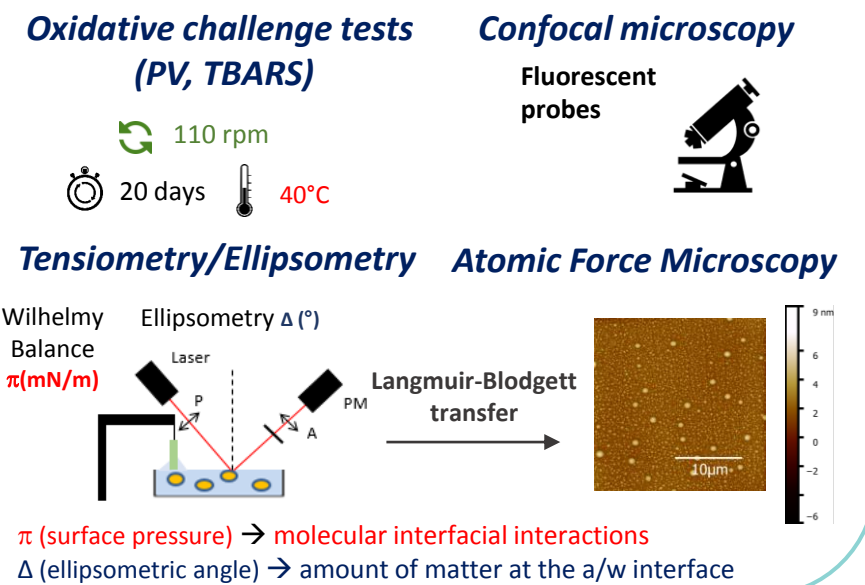
What are OB?



Material and methods

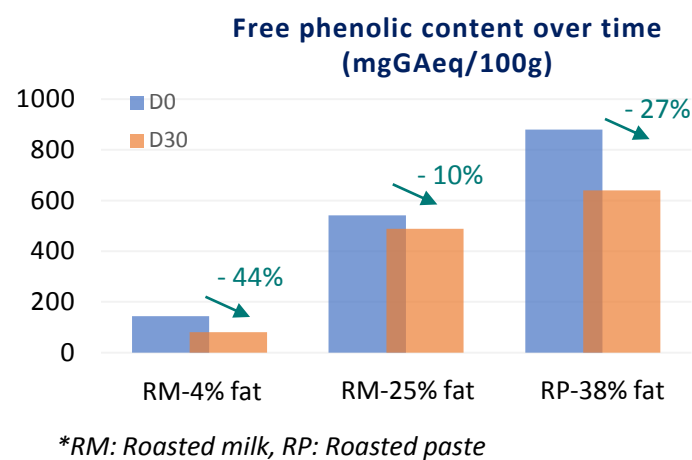
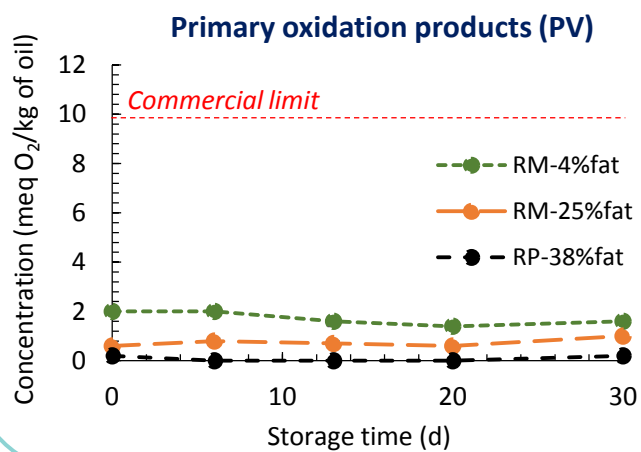


Characterization



Results: Impact of fat content – Does increasing fat concentration tend to stabilize the systems?

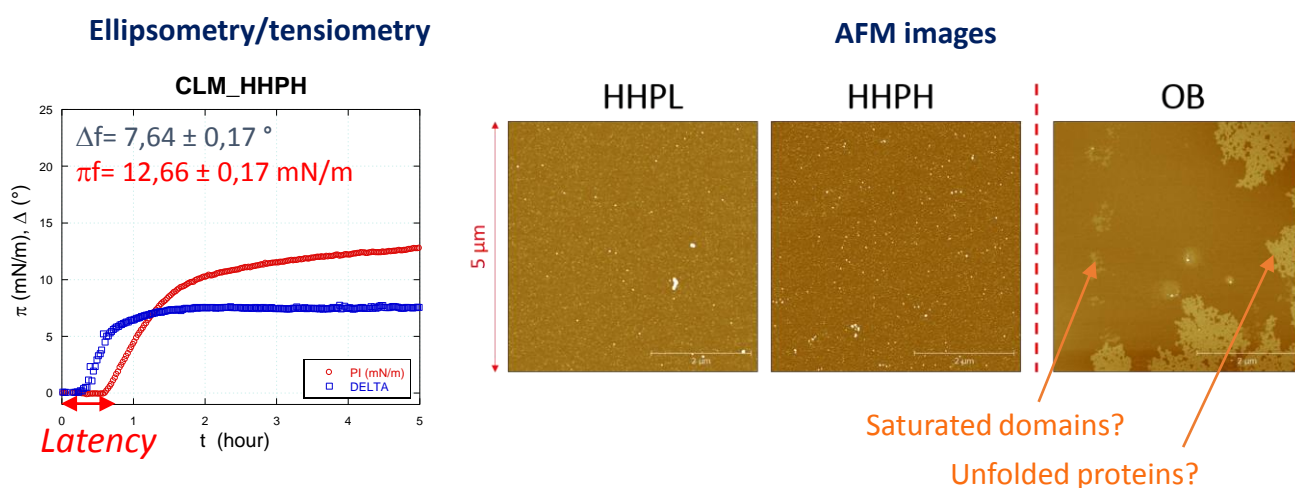
Nut-juice 4% wt. vs Nut-juice 25% wt. vs Paste 38% wt.



Conclusion: The results show that **increasing fat content tends to stabilize the systems** over time. Values of 25.2 ± 2.6 and 68.4 ± 5.2 meqO₂/kg of fat were reported for 4% wt and 25% wt. respectively after 75 days, supporting this hypothesis. The **stability** of the three matrices over 30 days of storage can be explained by their **high content of free phenolic compounds**, which can act as **sacrificial agents and protect lipids from oxidation**. The **FA composition** may also contribute to the chemical stability of the systems, as the samples are composed of 20% saturated fatty acids and 60% oleic acid, **less prone to oxidation than PUFA**.

Results: Impact of ultra-structure – Does processing induced an increase in the reactivity of the systems?

Milk HHPL vs Milk HHPH vs OB (4% wt.)



*HHPH: High pressure homogenization High strength (300/30 bars), **HHPL: High pressure homogenization Low strength (90/10 bars)

Conclusion: The results of the storage test on 4% wt. milks indicate that **HHPH* tends to destabilize the systems**, however no significant difference was obtained between homogenization strength (around 2.0 meqO₂/kg of fat for HHPH and HHPL after 30 days of storage test). Nevertheless, ellipsometric studies indicate that **HHPH caused greater deterioration** of compounds in the nut-juice system than HHPL. Indeed, the **lag phase** observed before the increase of the surface pressure indicates that the particles cannot properly stabilize at the interface, probably due to a reduction in hydrophobic interactions. AFM images confirm the hypothesis, with more aggregation at the interface of the HHPH sample. **OB also show a very good stability to oxidation**, which confirms the relevance of keeping the native assembly, as shown in a previous study on walnuts [Kergomard et al., Food Chem, 2021].

Conclusion: Overall, the results indicate that the fat content tends to stabilize the cashew juices and pastes, in particular thanks to the presence of free phenolic compounds in the matrix, which plays the role of sacrificial agents against oxidation. The FA profile, rich in saturated and monounsaturated fatty acids, also helps to limit the phenomenon of lipid oxidation. The processing tends to destabilize the systems and the larger scale of homogenization has induced an alteration of the OB interface. As previously described, the native OB assemblies are remarkably stable against oxidation, which raises the interest of their use in food applications.