HAL open science

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

Jeanne Kergomard, Mélina Robert, Nathalie Barouh, Gilles Paboeuf, Bruno Barea, Pierre Villeneuve, Olivier Schafer, Tim J Wooster, V. Vié, Claire Bourlieu-Lacanal

To cite this version:

Jeanne Kergomard, Mélina Robert, Nathalie Barouh, Gilles Paboeuf, Bruno Barea, et al.. Effects of processing and concentration on the oxidative stability and interfacial behavior of tree nuts oil bodies (OB). Euro Fed Lipid 2021, Oct 2021, Leipzig - Online, Germany. hal-03384882

HAL Id: hal-03384882

https://hal.science/hal-03384882v1

Submitted on 19 Oct 2021

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

Euro Fed Lipid
european federation for the science and technology of lipids
17-21 October 21

EFFECTS OF PROCESSING AND CONCENTRATION ON THE OXIDATIVE STABILITY AND INTERFACIAL BEHAVIOR OF TREE NUTS OIL BODIES (OB)

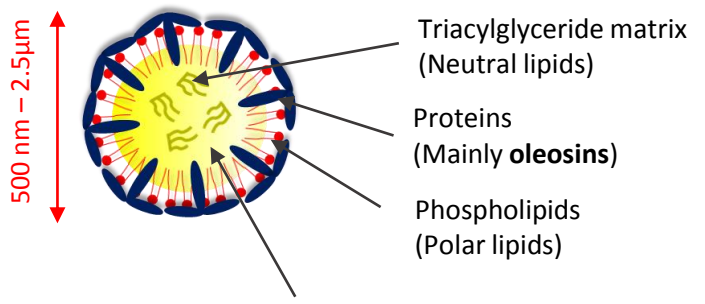
Jeanne Kergomard[1,2*], Mélina Robert[3], Nathalie Barouh[3], Gilles Paboeuf[2], Bruno Barea[3], Pierre Villeneuve[3], Olivier Schafer[4], Tim J. Wooster[4], Véronique Vié[1] and Claire Bourlieu[2]

[1]IPR Institute of Physics, UMR UR1 CNRS 5261, Rennes 1 University, France ; [2]IATE, Univ Montpellier, INRAE, Institut Agro, Montpellier, France ; [3]QUALISUD, Univ Montpellier, CIRAD, Institut Agro, IRD, Univ Réunion, Montpellier, France ; [4]Institute of Materials Science, Nestlé Research, Lausanne, Switzerland

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?



In tree nuts, OB are remarkably stable lipoprotein assemblies that are rich in **essential nutrients** (polyunsaturated fatty acids, tocopherols, antioxidant phenolic compounds…).

Material and methods

Matrix preparation

Cashew juice/paste (roasted) — *OB dispersion (roasted)*

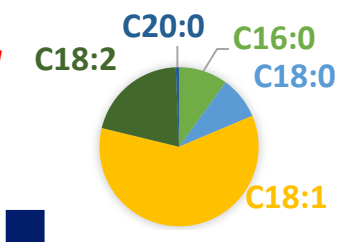
Modalities:

Level of processing

HHPH* vs HHPL**

Fat content

4 *vs* 25 *vs* 38% wt.



Characterization

Oxidative challenge tests (PV, TBARS)

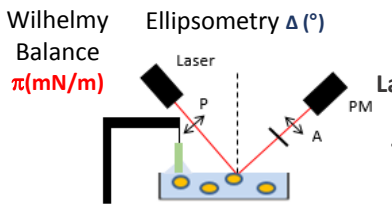
110 rpm

20 days — 40°C

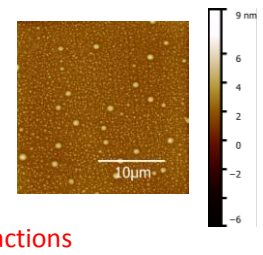
Confocal microscopy

Fluorescent probes

Tensiometry/Ellipsometry



Atomic Force Microscopy

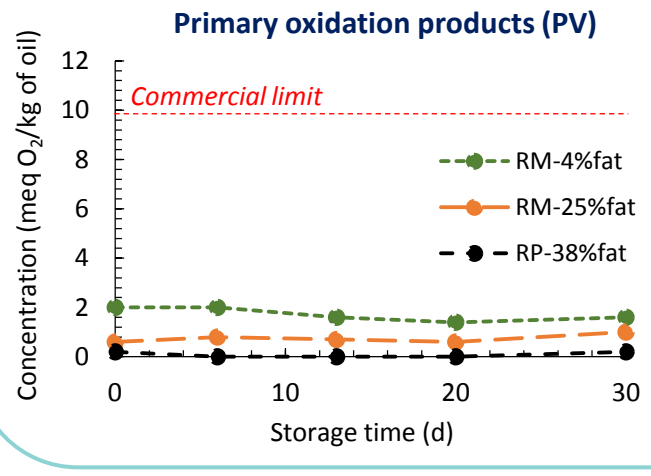


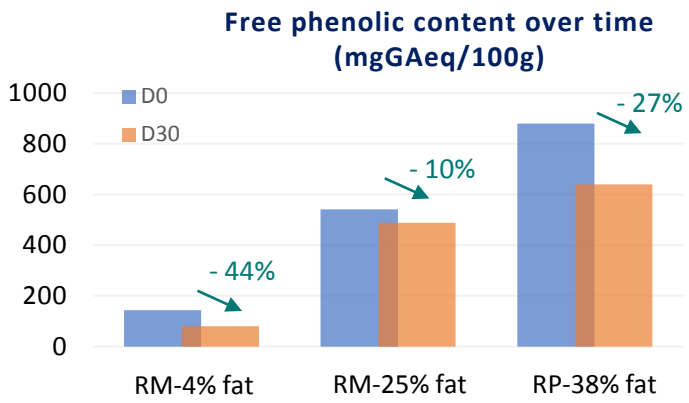
π (surface pressure) → molecular interfacial interactions

Δ (ellipsometric angle) → amount of matter at the a/w interface

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.





**RM: Roasted milk, RP: Roasted paste*

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 meqO_2/kg of fat were reported for 4% wt and 25% wt. respectively after 75 days, supporting this hypothesis.

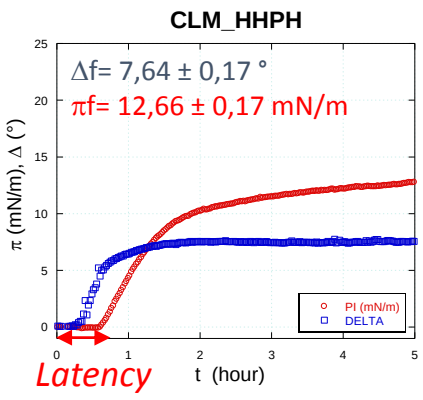
The **stability** of the three matrices over 30 days of storage can be explained by their **high content of free phenolic compounds**, which can act as **sacrificial agents and protect lipids from oxidation**.

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**.

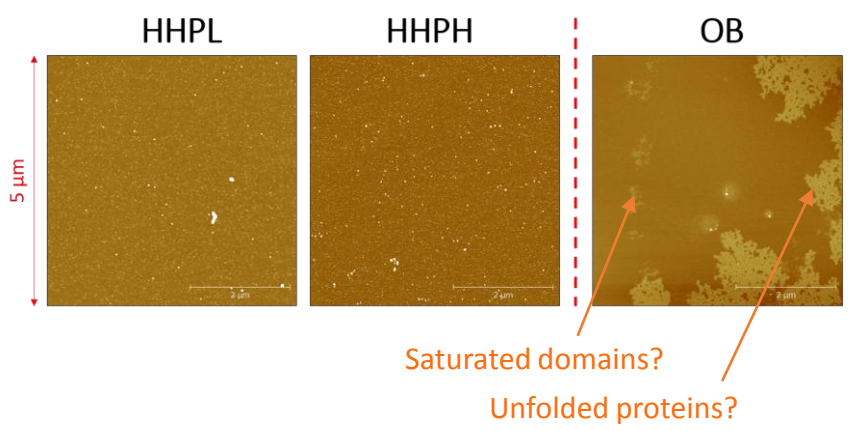
Results: Impact of ultra-structure – *Does processing induced an increase in the reactivity of the systems?*

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

Ellipsometry/tensiometry



AFM images



Conclusion: The results of the storage test on 4% wt. milks indicate that **HHP* tends to destabilize the systems**, however no significant difference was obtained between homogenization strength (around 2.0 meq0_2/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].

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

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.

**Corresponding author:*
Jeanne.kergomard@univ-rennes1.fr

IPR PHYSIQUE · UMR iAte Agropolymer engineering & emerging technologies · UMR QualiSud · INRAE · cirad · Nestlé