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OXIDATIVE AND INTERFACIAL BEHAVIOR OF NATIVE OIL BODIES FROM WALNUT



Jeanne Kergomard^{1,2}, Véronique Vié², Gilles Paboeuf², Nathalie Barouh¹, Bruno Barea¹, Pierre Villeneuve¹,

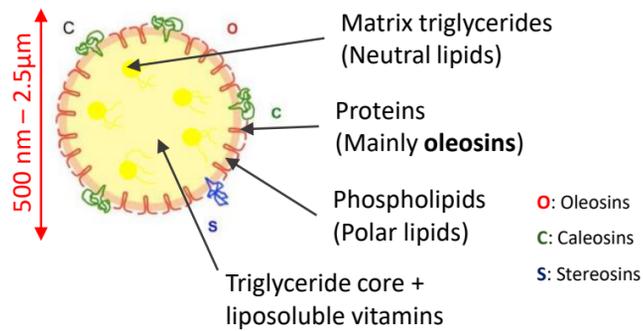
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Walnuts are among the most widely consumed commercially grown tree nuts in the world. Indeed, their consumption is associated with many health benefits, such as reducing the risk of cardiovascular disease, coronary heart disease and other neurological disorders. These benefits are attributed to their fatty acid profiles, which is rich in polyunsaturated fatty acids (PUFA) [1]. As a result, walnuts are used in several food products, such as walnut-based beverages, where fat is partly dispersed under the form of natural lipoproteic assemblies, which are called oil bodies (OB).

Two questions remain pressing: what is walnut OB's oxidative behavior and what are the consequences of oxidation on its interfacial reactivity?

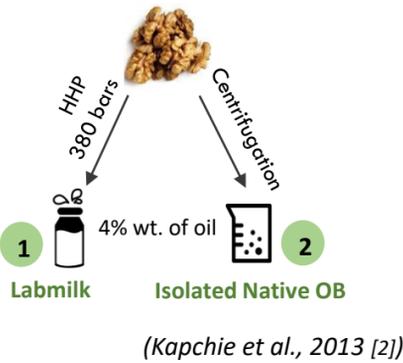
What is OB?



The negative charges of **oleosins** at physiological (neutral) pH trigger object repulsion and avoid coalescence phenomena in walnut system.

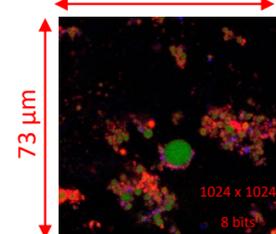
Material and methods

Matrix preparation

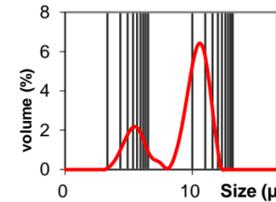


HHP* = High Pressure Homogenization

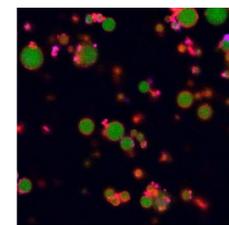
1 Labmilk



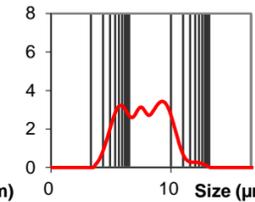
Bimodal: 18.7 μm, 0.6 μm



2 Isolated Native OB



Trimodal: 7.6 μm, 0.6 μm, 2.8 μm



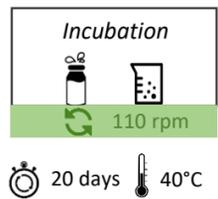
Confocal laser scanning microscopy

Phospholipids
 Triglycerides
 Proteins

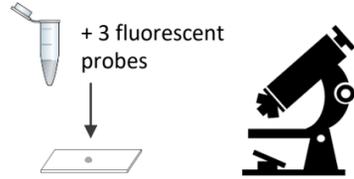
Size profile

Material and methods - characterization

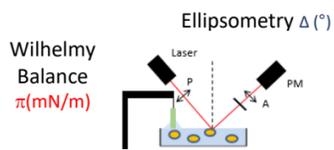
Oxidative challenge test (PV, TBARS)



Confocal microscopy

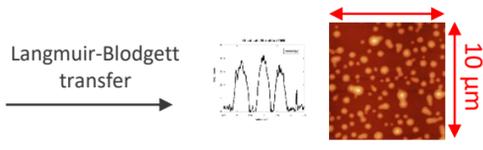


Tensiometry/Ellipsometry



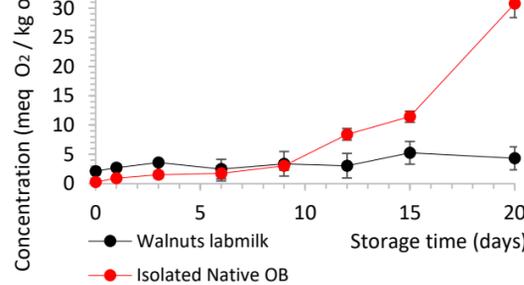
π (surface pressure) is indicative of protein insertion
 Δ (ellipsometric angle) is related to the amount of matter at the interface

Atomic Force Microscopy

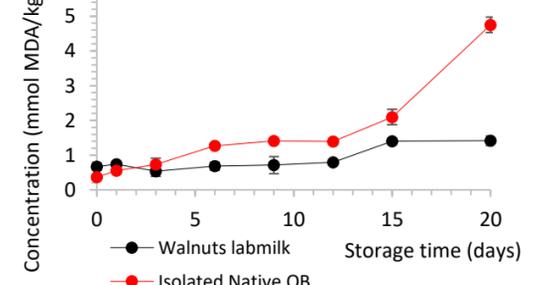


Results - Oxidative behavior

PV value



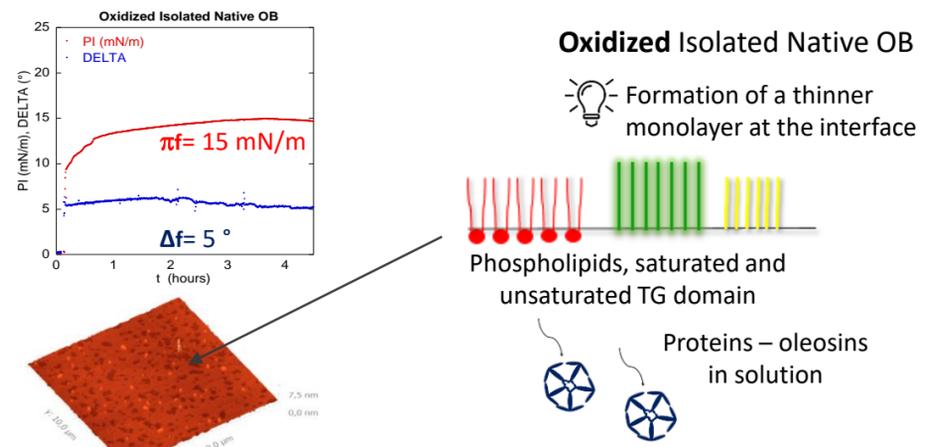
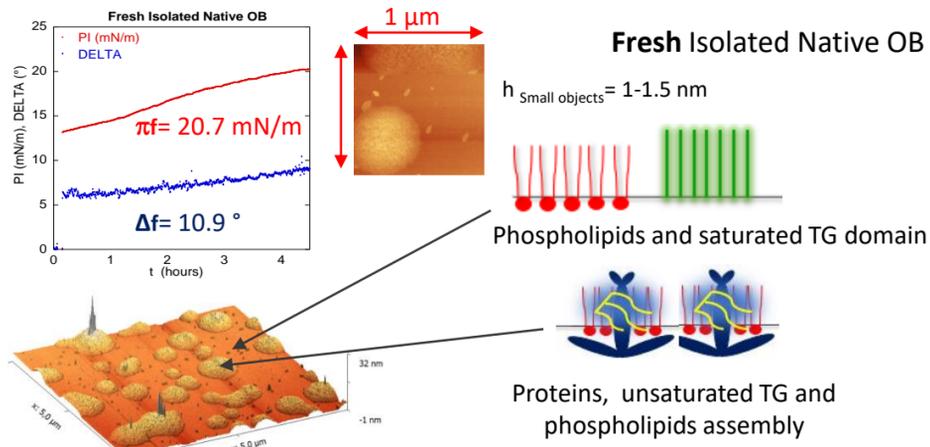
TBARS value



Conclusion: Walnuts OB were **stable to oxidation** on the short term (few days). This phenomenon is related to the “assembly effect” of OB and to their antioxidant content in **vitamins E** (41.0 ± 20.7 % wt.) [3]. The stability of lipid dispersion was higher under “milk” form due to a complex “matrix effect”.

Results - Interfacial behavior

How does the **structural changes** of oxidized OB affect the behaviour at the interface?



Conclusion: When OBs are intact, they open at the interface and spread out in domains and assemblies thanks to **good cohesiveness** between the different molecules. **Oxidation phenomenon** modified the **physical integrity** of the OB, decreasing intermolecular forces, which resulted in a **different interfacial organization with a majority of lipids at the interface and solubilization of proteins**.

CONCLUSION: Altogether, this study unveiled the **interesting stability of OB** and their **specific interfacial reactivity** opening the way to interesting food applications of these natural lipoproteic assemblies.

References

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