



Exploring plant biodiversity to extract oil bodies for sustainable food applications

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► To cite this version:

Nathalie Barouh, Claire Berton-Carabin, Thierry Chardot, Sabine D'andrea, Jean-Francois Fabre, et al.. Exploring plant biodiversity to extract oil bodies for sustainable food applications. AOCS Annual Meeting, May 2022, Atlanta, United States. hal-03794044

HAL Id: hal-03794044

<https://hal.science/hal-03794044>

Submitted on 3 Oct 2022

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CONTEXT. Oilseeds and cereal seeds enclose a wide range of nutriment such as lipids, proteins, polysaccharides and various mineral and organic micronutrients. *In planta*, these nutrients are found under the form of natural assemblies such as oil bodies (OB), protein bodies or starch granules, that have interesting properties (micronic sizes, surface activity, high physicochemical stability, etc.). Up to now, these assemblies are extracted by various processes using energy, organic solvents, steam, alone or in combination. Thus, their natural structures are often strongly damaged, and thereby some of their functionalities are lost. Storming through natural assemblies' biodiversity to address the societal demand for more natural and minimally-processed food, seems promising. Indeed, the soft extraction of such assemblies could be an alternative to traditional intensive fractionation methods of plant raw materials to isolate target ingredients (sucrose, starch, refined oils, etc.). This would allow for energy savings and avoid solvent use, but must be balanced with potential challenges of this new green refinery scheme.

- To highlight the physicochemical properties of various OB in the spotlight of the OBTAIN** consortium
- To present the green refinery scheme proposed for their extraction

*HO : high oleic
References: [1-5]

References: [1; 6-7]

References: [8,9]

- Avoid solvent extraction (REACH)
 - Limit the use of synthetic surfactants / surface activity of oleosins
 - Alternative to soy lecithins
 - PUFA* rich membrane / OB
 - Relative physical stability of OB
 - Assembly extraction / Minimal processing
 - High demand for vegetal juices
- 

*PUFA: polyunsaturated fatty acids

%	Rapeseed	Sunflower	Soybean	Linseed	Mustard	Cottonseed	Maize	Peanut	Sesame
PC	59.9	79	57.1	57.2	53.1	58.9	64.1	61.6	41.2
PE	5.9	13	13.5	2.8	15.5	4.6	8.1	5.0	15.8
PI	14.0	8	15.6	6.9	13.1	18.1	7.6	8.4	20.9
PG	(-)	(-)	3.4	(-)	(-)	(-)	(-)	(-)	(-)
PS	20.2	(-)	(-)	33.1	18.3	18.7	20.2	25.0	22.1

Phospholipids PL
Triacylglycerols (TAG)
Proteins

Walnut OB

High pressure Homogenized (HHP)
High pressure Homogenized + heat-treated (HHPT)

Processed OB (HHP / HHPT)
Minimally-processed OB
Processed Vegetal juice

STRATEGY

Secondary oxidation products (40°C)

TBARS Values

Concentration (mmol MDA/kg fat)

Time of storage (days)

HHP
OB
HHPT
juice

Time of storage (days)	HHP (mmol MDA/kg fat)	OB (mmol MDA/kg fat)	HHPT (mmol MDA/kg fat)	juice (mmol MDA/kg fat)
0	0.5	0.5	0.5	0.5
5	1.5	1.0	1.0	1.0
10	3.0	1.5	1.5	1.5
15	9.0	2.0	2.0	2.0
20	7.0	4.5	1.5	1.5

- ✓ Minimally-processed walnut OB extracted by wet milling present good oxidative stability

References: [5; 11-12,

Gastric behavior:
Aggregation but stability

Isoelectric point 5.5-6.7

Intestinal behavior:
Phospholipids
PLA2 PE > PC
lysoPL + FA
Latence in PTL lipolysis

leptin

Gastric lipolysis (10%)
pH 3-5

Cholecystokinin

Intestinal lipolysis (56%)
pH 7.2

Enterostatin
GLP1 and PYY36

FA: fatty acids, PLA2: pancreatic phospholipase A2,
PTL: pancreatic triacylglycerol lipase, lysoPL: lysophospholipids

References: [13-15]

CONCLUSIONS. Oil bodies can thus constitute new dietary carriers of $\omega 3$ and other bioactive molecules. Moreover, the combination of oil bodies with specific features (fatty acid profiles, stabilities, vitamin contents) can help meeting the requirements of specific nutritional targets (infants, children, elderly, athletes, etc.). Altogether, we are convinced that the valorization of these diverse oil bodies can be a strategic route in the development of sustainable food systems.

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