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Enhancing oxidative stability of microencapsulated linseed oil using extracts from *citrus aurantium dolcis Pers* flowers

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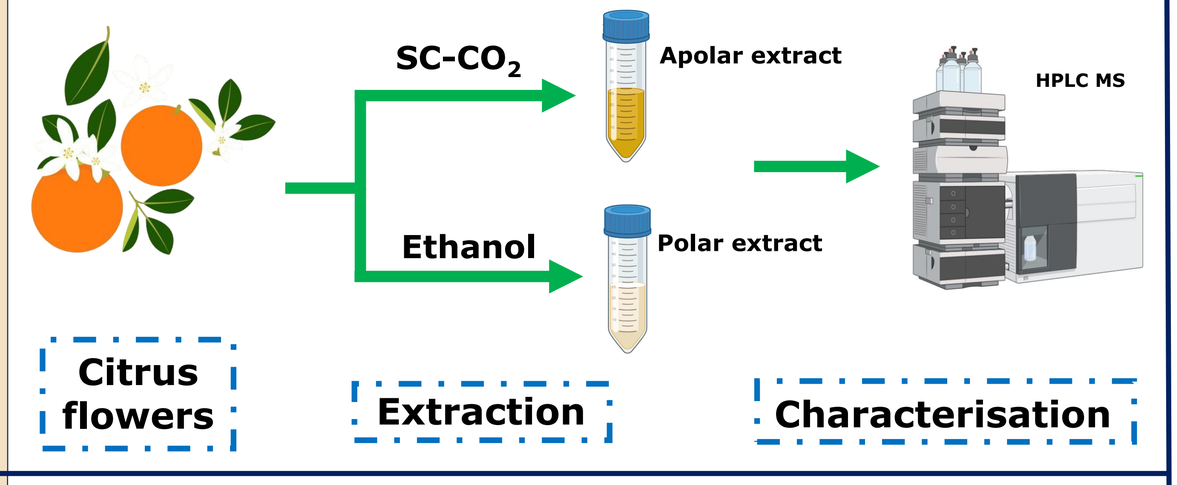
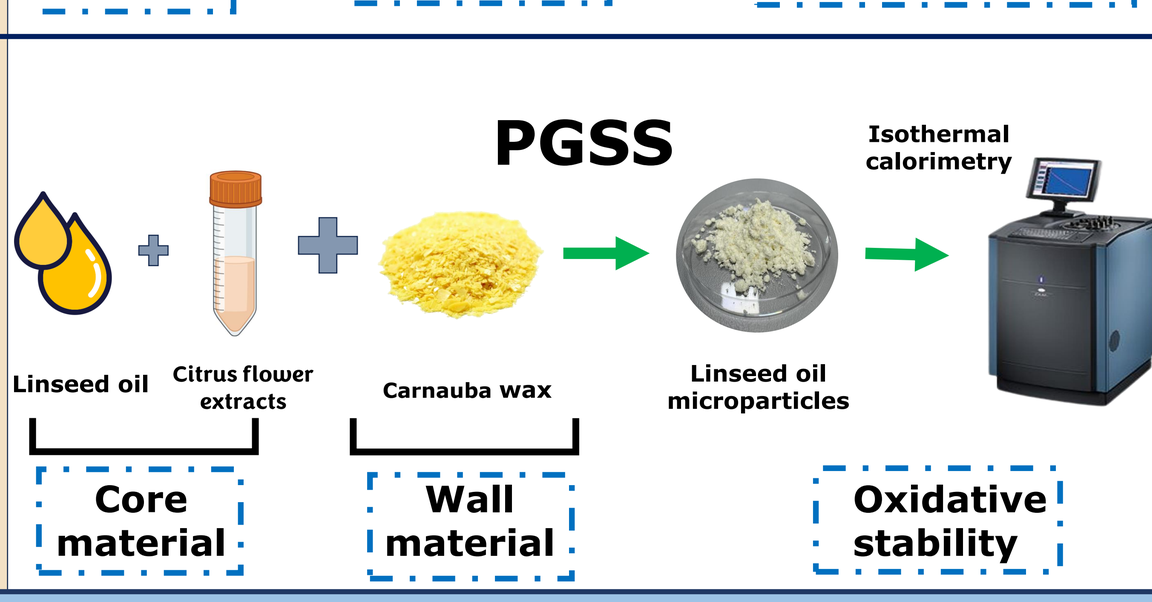
Introduction

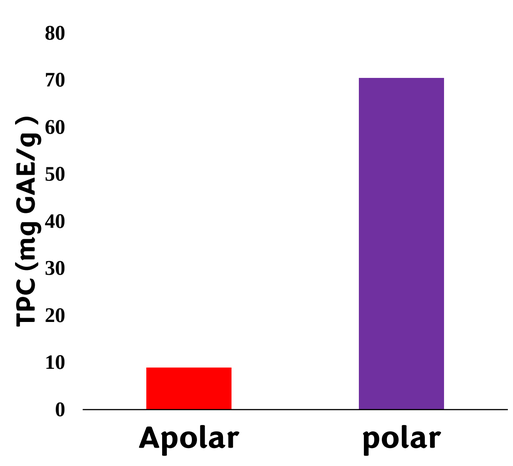
- Lipid oxidation has adverse effects on food quality and human health.
- Microencapsulation allows to formulate unstable oily molecules into free-flowing and stable powders.
- The addition of antioxidants can further enhance oxidative stability.
- Citrus flowers, rich in natural antioxidants, can be valorised through co-encapsulation to enhance oil stability.

Materials and Methods





Results



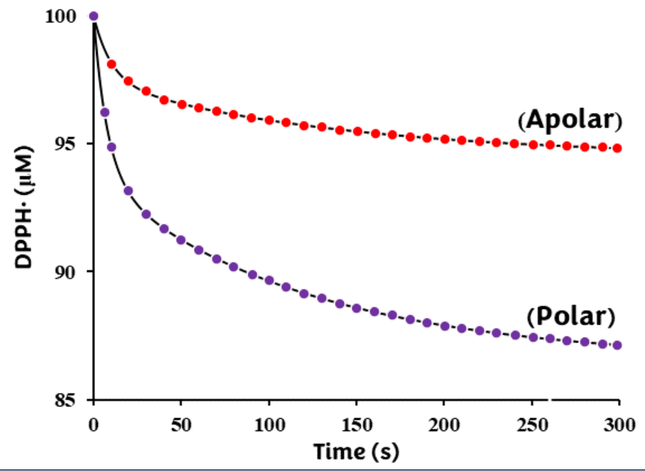


Figure 1. Total phenolic content and antioxidant activity of apolar and polar citrus flower extracts

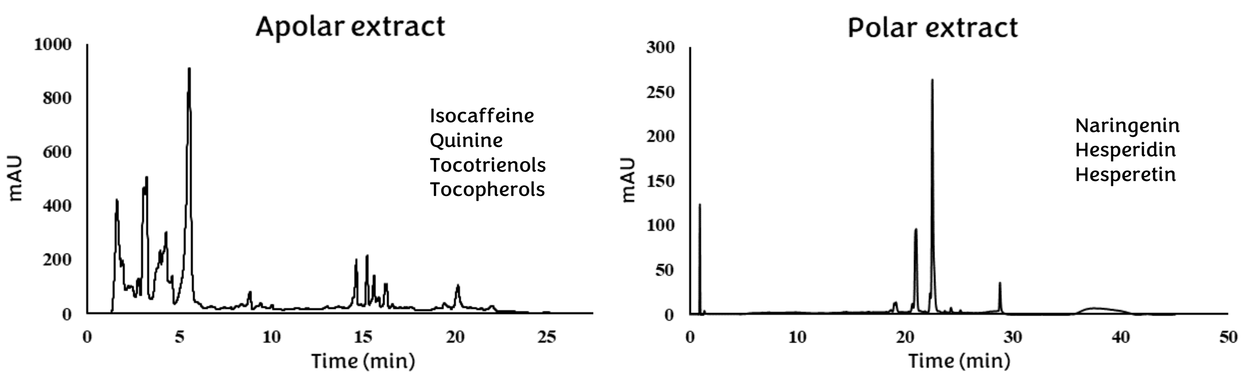


Figure 2. HPLC MS chromatogram of apolar and polar citrus flower extracts

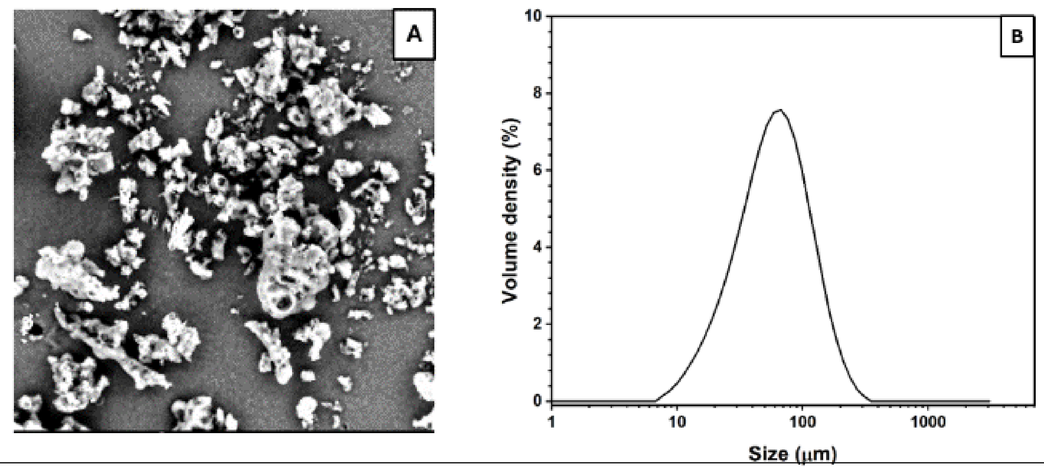


Figure 3. Scanning electron micrographs (A); and particle size distribution (B) of linseed oil PGSS microparticle.

Oxidative stability

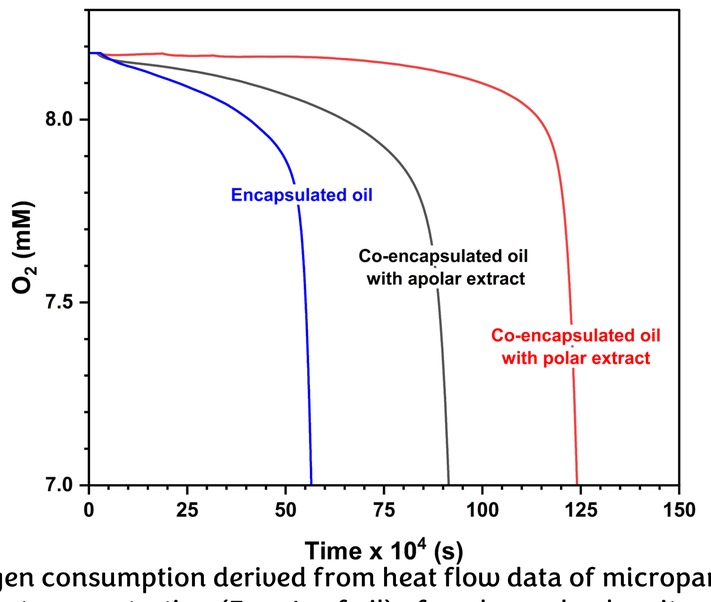


Figure 4. Oxygen consumption derived from heat flow data of microparticles formulated with equivalent concentration (5mg/g of oil) of apolar and polar citrus flower extracts

Table 1. Kinetic parameters derived using the isothermal calorimetry trace of PGSS-linseed oil microparticles at 40 °C.

Sample	Extract (mg/g of oil)	Onset time τ (10^4 s)	R_{inh} (10^{-10} M.s^{-1})	R_{uni} (10^{-7} M.s^{-1})	*A.E*
Bulk linseed oil	-	1.41±0.02^{e}	145.61±2.26^{a}	4.28±0.21^{a}	-
Encapsulated linseed oil	-	55.65±1.97^{d}	27.22±0.98^{b}	4.34±0.08^{a}	-
Encapsulated linseed oil and apolar extract	1	68.51±0.84^{c}	17.03±1.13^{c}	4.40±0.01^{a}	4.57±0.07^{a}
	2	73.83±1.13^{c}	15.42±0.56^{cd}	4.30±0.02^{a}	4,69±0.02^{a}
	5	92.37±1.55^{b}	12.71± 0.42^{c}	4.26±0.01^{a}	4.54±0.08^{a}
Encapsulated linseed oil and polar extract	1	75.70±2.26^{c}	7.28±0.02^{e}	4.26±0.03^{a}	9.65±0.04^{b}
	2	87.18±2.40^{b}	6.33±0.01^{e}	4.52±0.11^{a}	9.65±0.02^{b}
	5	123.12±2.82^{a}	4.44±0.01^{e}	4.35±0.08^{a}	9.69±0.01^{b}

Conclusion

- Differences in extraction solvents lead to variations in the composition of citrus flower extracts (CFE) and influencing its antioxidant properties.
- Co-encapsulation with CFE further improved oil stability, with polar extract showing greater antioxidant efficiency.
- IC proved to be an effective method for assessing both the oxidative stability and the antioxidant efficiency of linseed oil powders in a single analysis.

References

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