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Encapsulation of essential oil lemon and physicochemical characterization of the encapsulated powders

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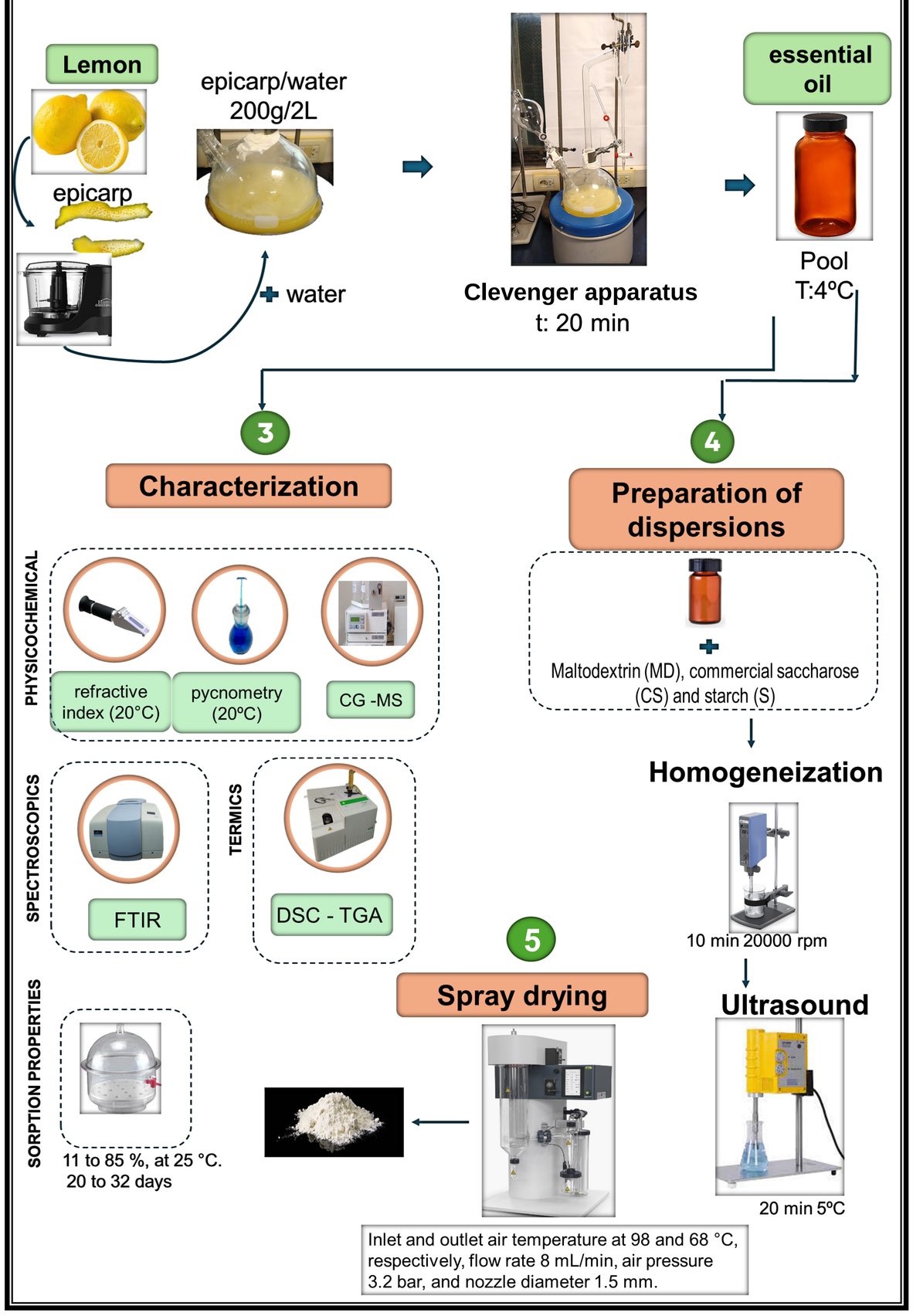
INTRODUCTION & AIM

Essential oils (EO) can be obtained from the wastes or subproducts from lemon production, and are highly valued by pharmaceutical, cosmetics and food industries.

It should be noted that EO are very susceptible to deterioration reactions, which is why spray encapsulation in adequate matrices is frequently used.

The aim of this work was to obtain and characterize the EO obtained by hydrodistillation of the epicarp of fresh lemons (*Citrus limon* L.) and combine them with different matrices as a tool to improve the quality and physical stability of dehydrated systems.

METHOD



RESULTS & DISCUSSION

Physicochemical analysis

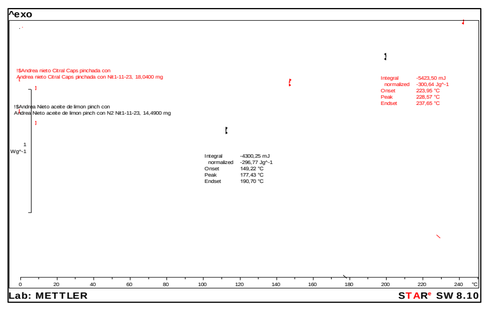
A few components of essential oils obteined by CG-MS

Order	tR (min)	Kovats index	EO Components	Área (%)
1	4,93	939	α-pinene	1,47
2	5,90	975	sabinene	1,91
3	6,00	979	β-pinene	10,1
4	6,35	990	myrcene	1,30
5	7,38	1017	α-terpinene	0,87
6	7,58	1029	limonene	67,7
7	8,50	1059	γ-terpinene	7,55
8	9,52	1088	terpinolene	0,39
9	9,93	1096	linalol	0,22
10	13,44	1188	α-terpineol	0,39
11	15,53	1238	neral	1,53
12	16,77	1267	geranial	2,03

relative density	0.851
absolute density	0.855 g/ml
refraction index	1.473

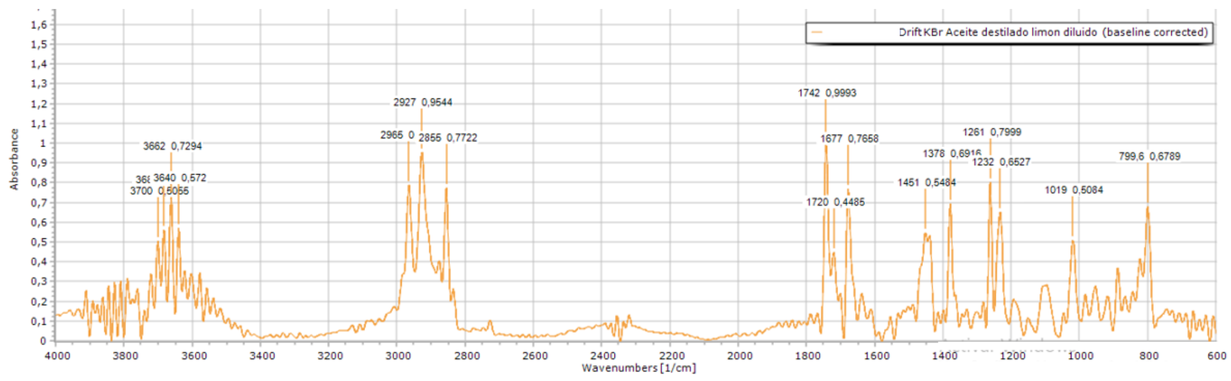
Differential scanning calorimetry (DSC)

DSC Citral (red line) and AE (black line) profile in N_2 atmosphere



ΔHv: AE: 296,7J/g; citral: 300,6 J/g,
Tb: AE: 149,2 °C; citral: 223,9 °C
Tv: AE 177,4 °C; citral: 228,5 °C

Fourier transform infrared spectroscopy analysis FT-IR



Estimated water adsorption parameters of encapsulated EO at 25°C

D'Arcy Watt

system	Qm	K	P	W	r^2
EO+S+MD+CS	3,12	29,2	0,829	2,8	0,998
Citral+S+MD+CS	32,4	0,65	1,042	0,13	0,995
EO+S+MD	21,3	1,09	1,118	0,04	0,998
Citral+S+MD	6,3	4,4	0,866	0,94	0,997

GAB

system	m_m	C	K	r^2
EO+S+MD+CS	5,9	6,3	0,89	0,997
Citral+S+MD+CS	5,5	7,9	0,90	0,994
EO+S+MD	4,3	15,1	0,90	0,985
Citral+S+MD	5,1	6,4	0,86	0,998

S: sucrose; MD: maltodextrin DE 15; CS: corn starch

CONCLUSIONS

- **The physicochemical characteristics of lemon essential oil obtained by hydrodistillation of lemon residues, are in agreement with the data reported in the literature.**
- **Water sorption isotherms of the encapsulated EO showed a typical behavior of amorphous materials, with the GAB model providing the best fit (MRE < 10%).**
- **Formulations AE+S+MD+CS and Citral+S+MD+CS presented higher monolayer moisture values, attributable to the presence of sucrose. AE+S+MD+CS achieved an optimal balance between moisture retention and multilayer, while AE+S+CS, although providing excellent retention, showed limitations in its multilayer capacity.**
- **The D'Arcy-Watt and GAB models were used to describe the data obtained. Both models were complementary for the best interpretation of the water sorption mechanisms and the structure of the wall materials.**

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FUTURE WORK

The data collected will allow the development of processes for the sustainable use of lemon industry subproducts.