

Supercritical carbon dioxide impregnation of cinnamaldehyde into PLA as a route to develop antimicrobial food packaging materials

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INTRODUCTION

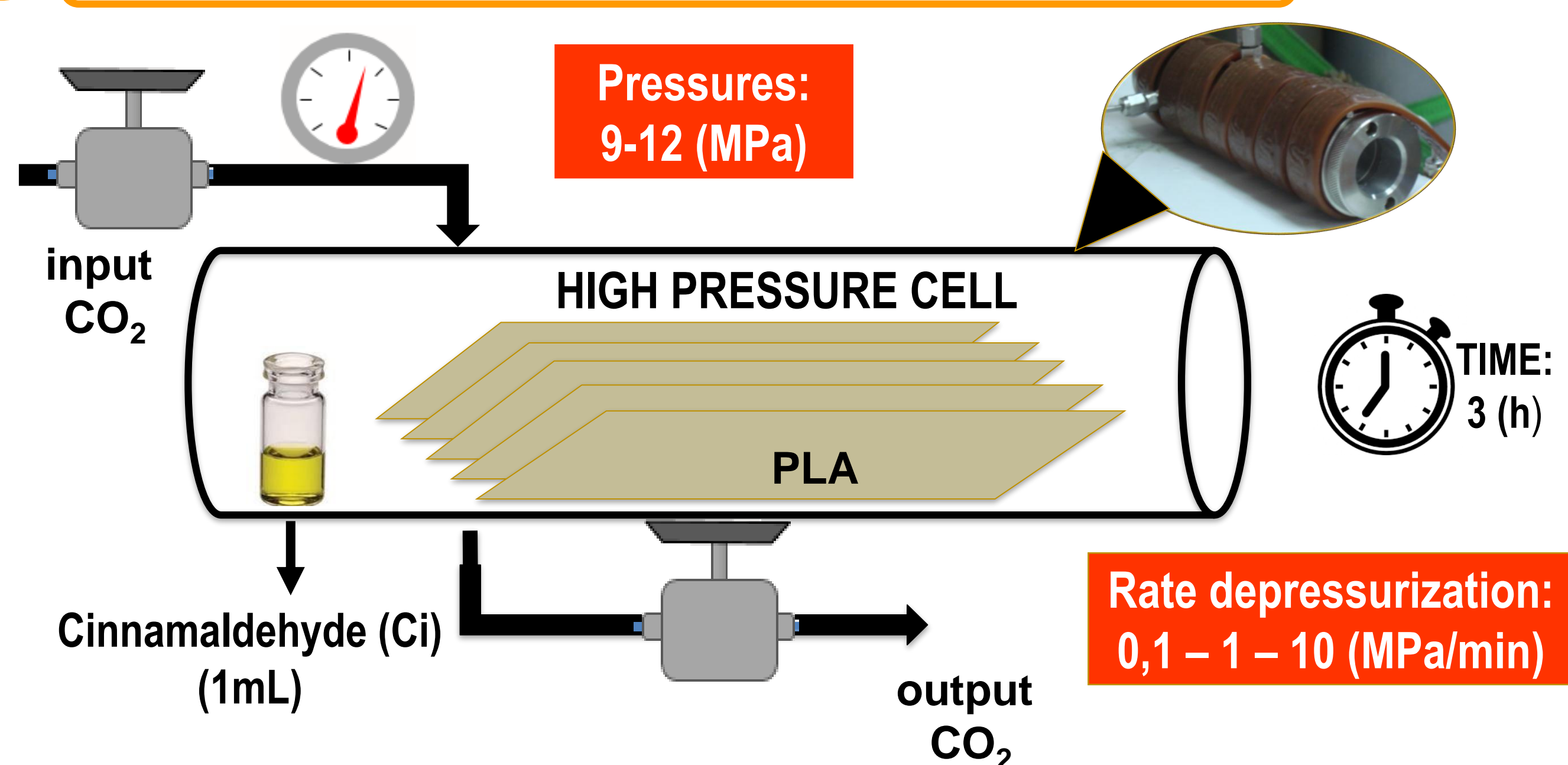
There are several methods for incorporating active agents into polymeric matrices, such as the coating, extrusion and casting method. However, some of these have certain disadvantages, including the use of solvents and high temperatures during the process [1]. This has led to the development of new techniques to incorporate such agents as supercritical impregnation, which consists of advantage of the supercritical properties of certain fluids, which carry the active agent to the polymer matrix.

On the other hand, cinnamaldehyde (Ci) is an antimicrobial and antifungal active agent, the principal component of cinnamon essential oil extract and considered GRAS (Generally recognized as safe) according to FDA [2].

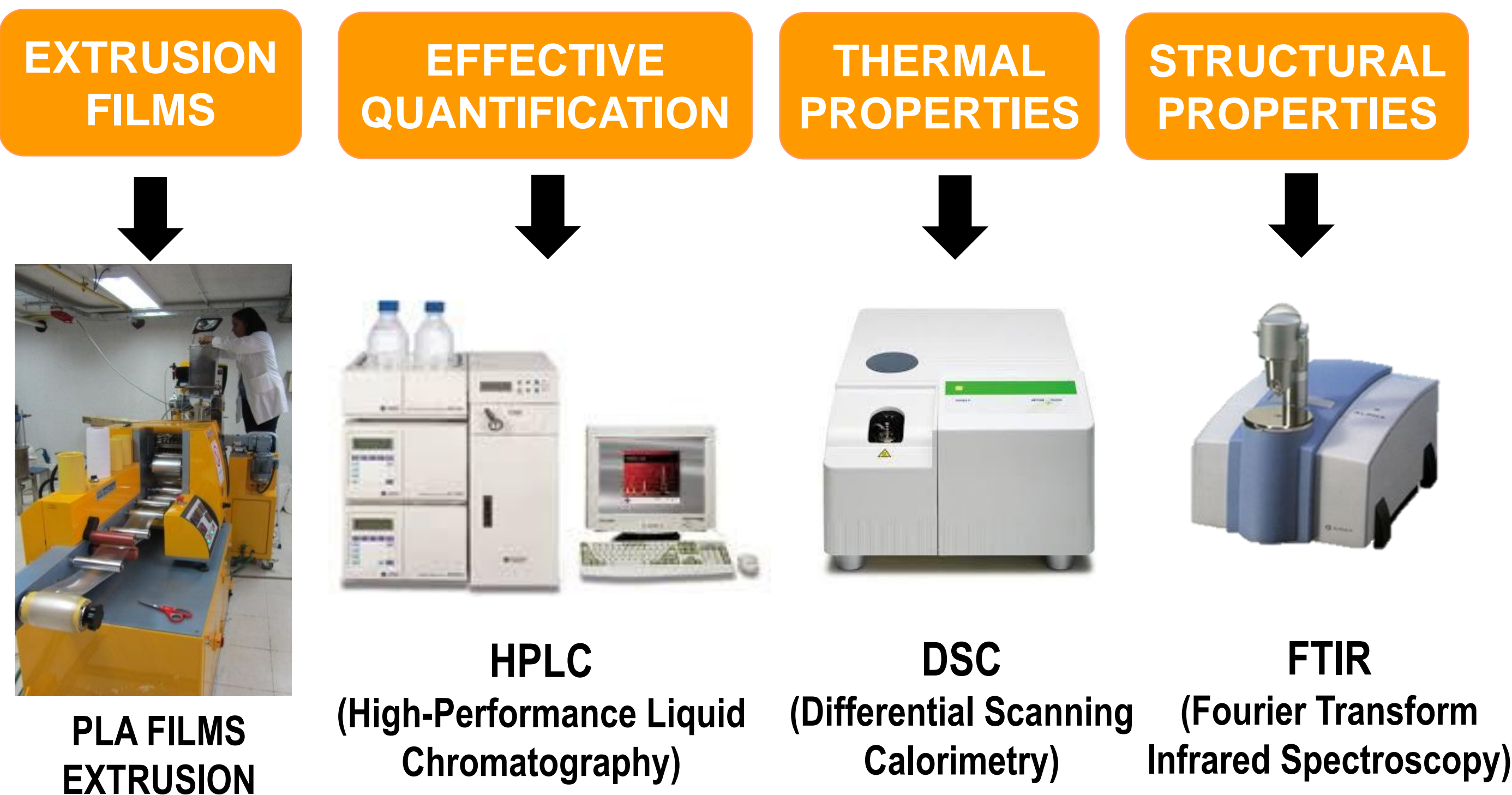
The objective this study provides an innovative route to the development of antimicrobial materials that could be of potential interest for further applications in areas such as active food packaging.

METHODOLOGY

1 IMPREGNATION (LABPROSEM-USACH)



2 FILMS CHARACTERIZATION (LABEN-USACH)



RESULTS AND DISCUSSION

Table 1. Impregnation scCO₂ cinnamaldehyde (Ci) conditions and amount of impregnated (%p/p).

SAMPLE	Depressurization rate (MPa min ⁻¹)	Cinnamaldehyde (Ci) impregnated (% p/p)	
9 MPa PLA/scCO ₂ /Ci	10,0	11 ± 2 ^{a,b}	
	1,0	8 ± 2 ^a	
12 MPa PLA/scCO ₂ /Ci	10,0	13 ± 2 ^b	
	1,0	9 ± 2 ^{a,b}	
	0,1	11 ± 2 ^{a,b}	
	0,1	13 ± 3 ^{a,b}	

The addition of Cinnamaldehyde was INDEPENDENT of pressure and depressurization rate

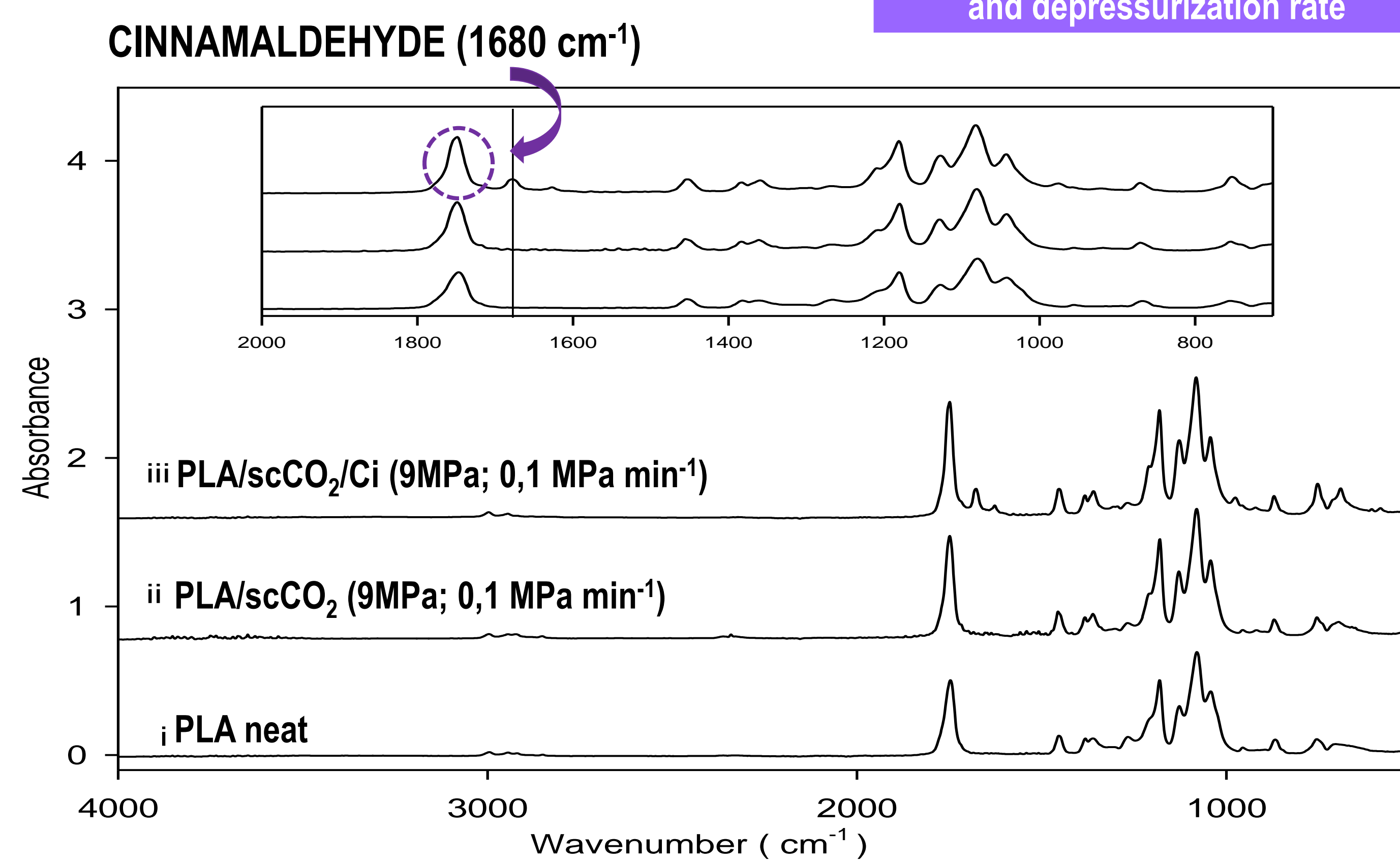


Figure 1. FTIR spectra films

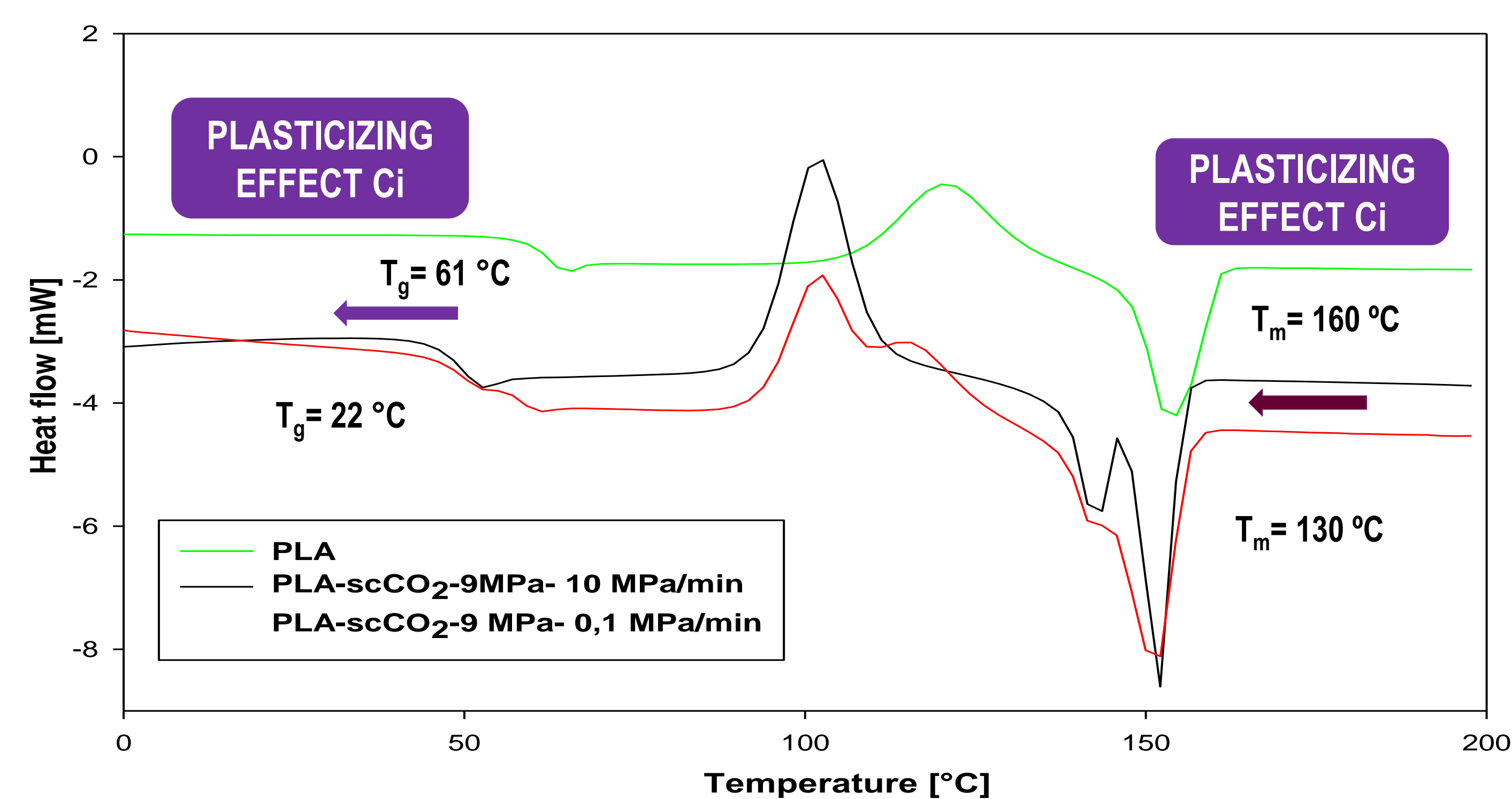


Figure 2. Thermogram PLA films

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CONCLUSIONS

- Cinnamaldehyde was incorporated into the polymer matrix of PLA by supercritical impregnation.
- At the conditions used in this research, the incorporation was not influenced by pressure or depressurization rate conditions.
- The thermal properties of PLA are affected by the presence of active compound, lowering its temperature; glass transition, crystallization and melting of the polymer.