

PLA BASED NANOCELLULOSE/NANOCLAY COMPOSITES FOR FOOD PACKAGING APPLICATIONS

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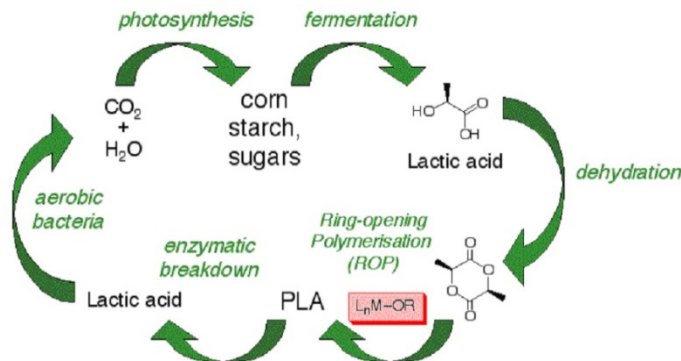
INTRODUCTION

- PLA (Polylactic acid)

- ✓ Renewable source
- ✓ Biodegradable
- ✓ Suitable for industry
- ✓ Good Mechanical properties
- ✓ Transparent

~ Cost

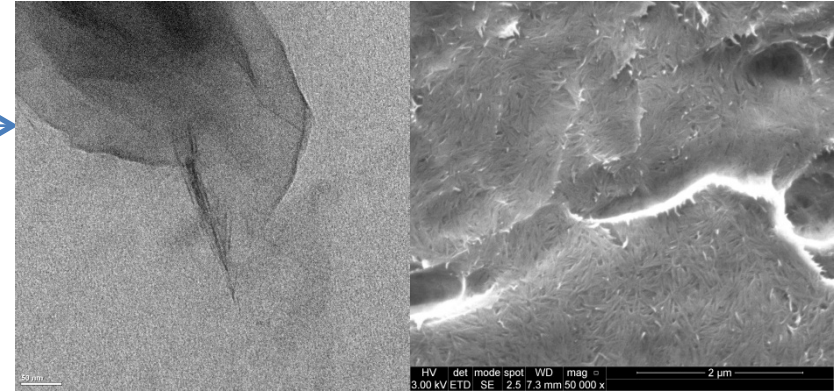
- X Barrier properties
- X Thermomech. properties
- X Slow crystallization
- X Brittleness



NANOCOMPOSITE



**NEED TO
BE FIXED**



C30B

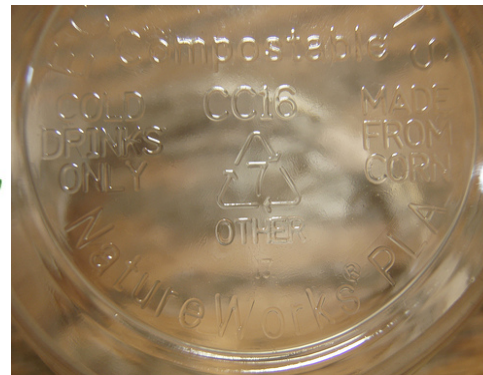


CNF

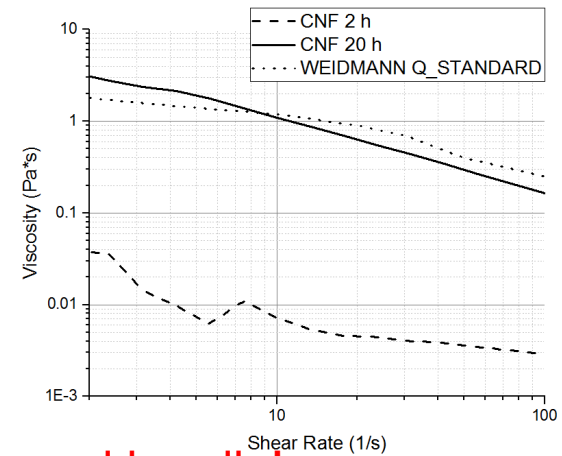
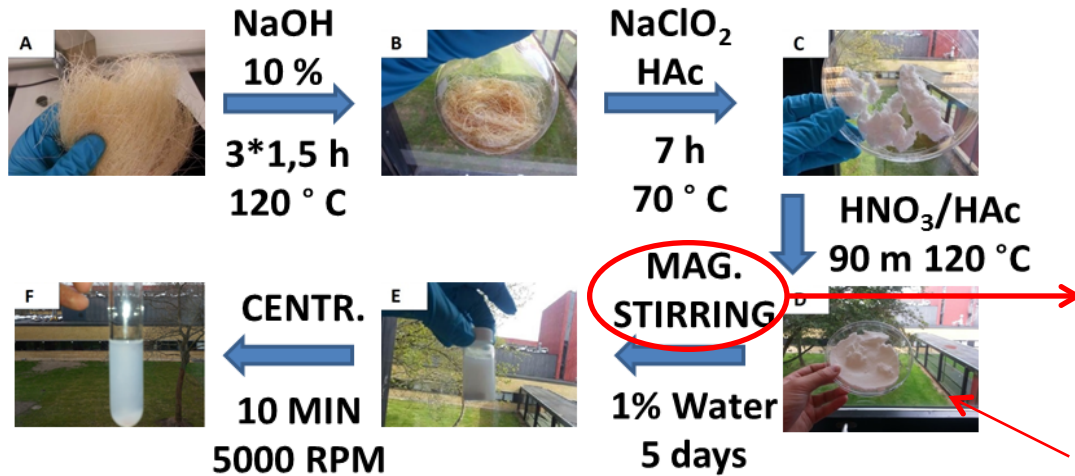
Improvement
of properties?

**Comparisson vs
Synergetic**

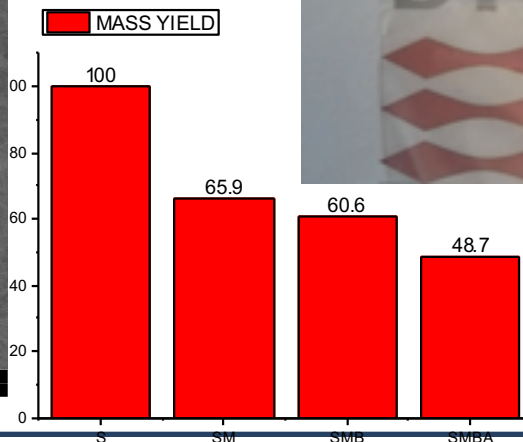
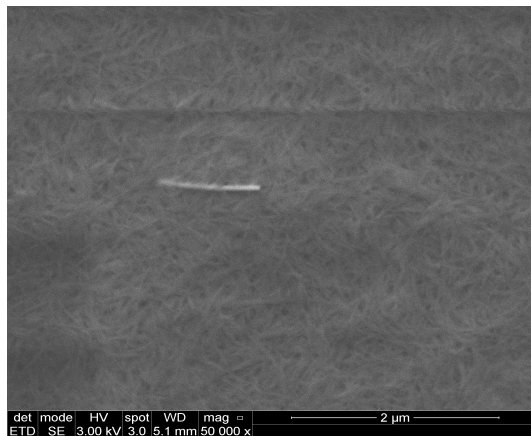
When? How? How much?



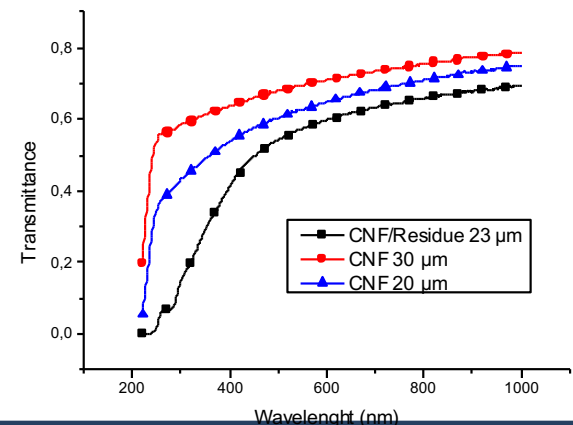
NANOCELLULOSE PRODUCTION



Easy to clean and handle!

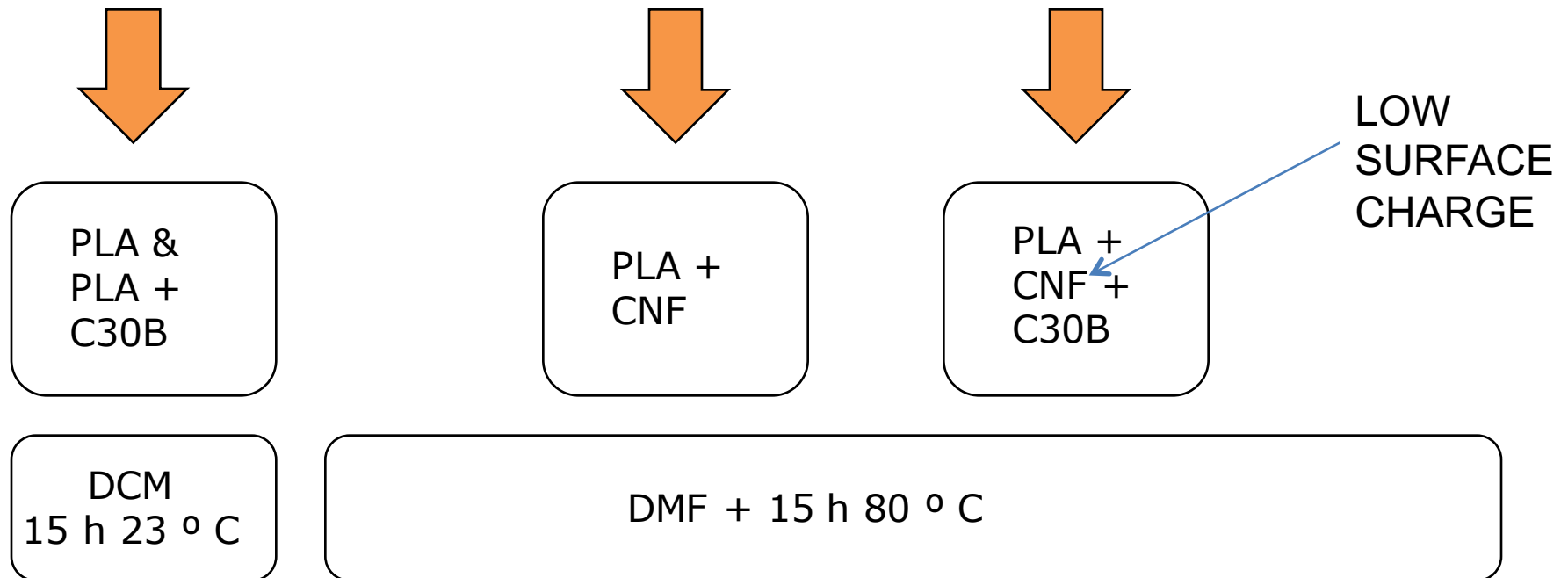


70% Clarity



PLA BASED NANOCOMPOSITES

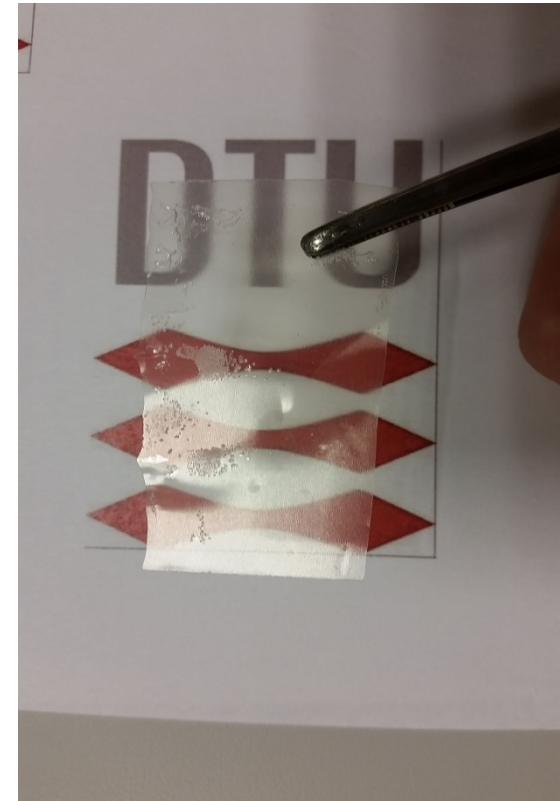
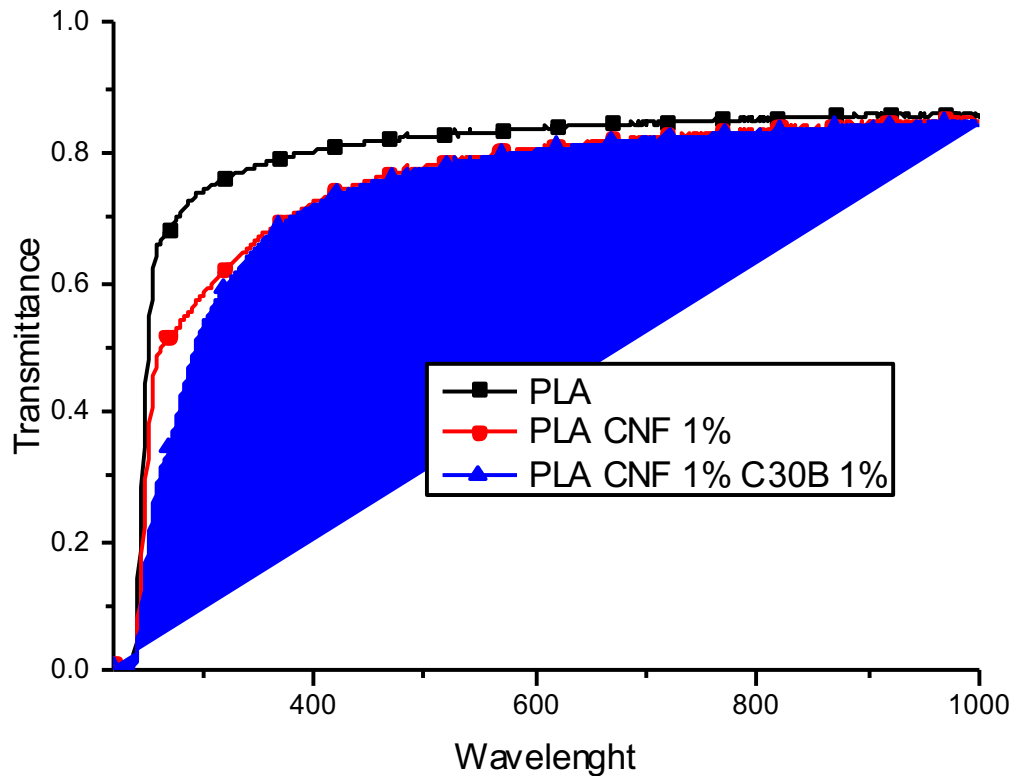
SOLVENT CASTING → BETTER FOR THE "PROVE THE CONCEPT"
→ "UPSCALING" → NEXT RESEARCH → **MULTIPLE POSSIBILITIES**



BEST CONDITIONS FOR EACH NANOCOMPOSITE

TRANSPARENCY

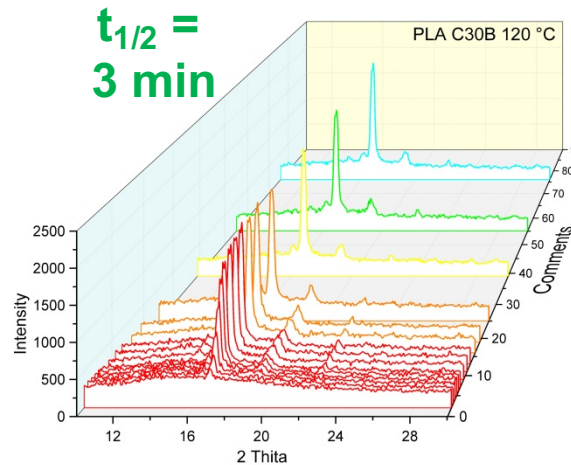
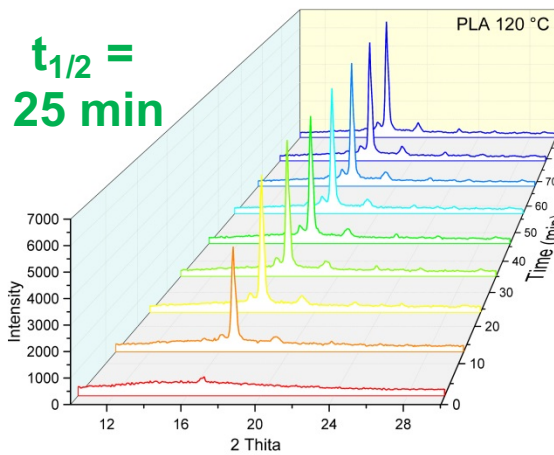
HOT PRESSED
NANOCOMPOSITES



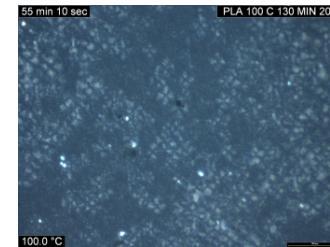
PLA/CNF 1%/C30B 1%

**TRANSPARENT
AND CLEAR**

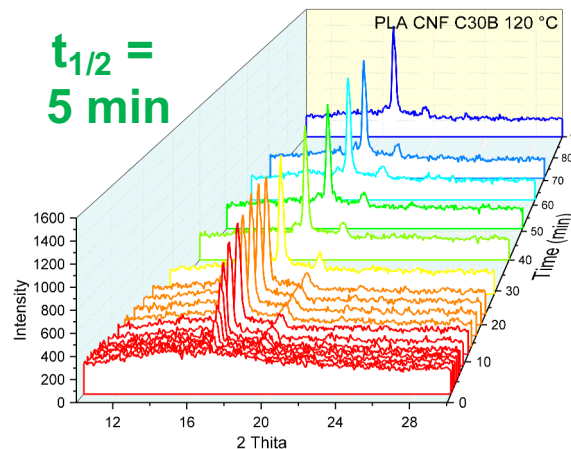
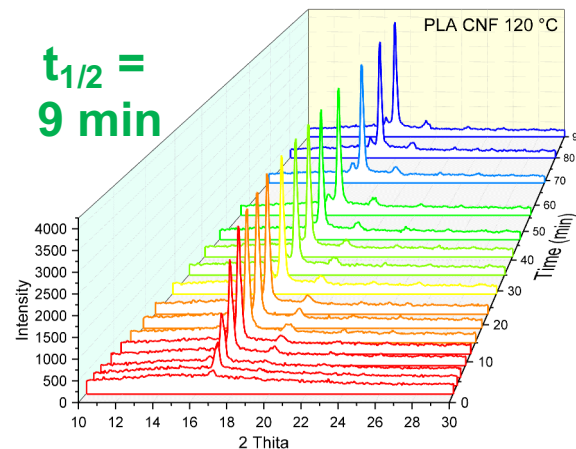
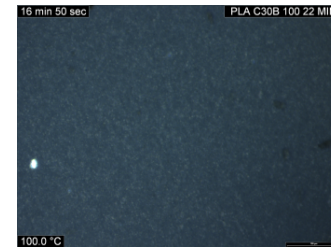
CRYSTALLIZATION: XRD, MDSC & POM



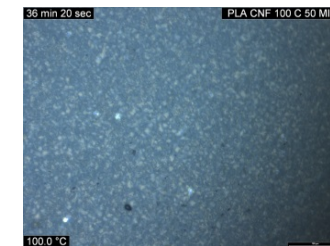
PLA



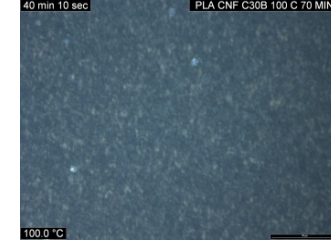
PLA/C30B



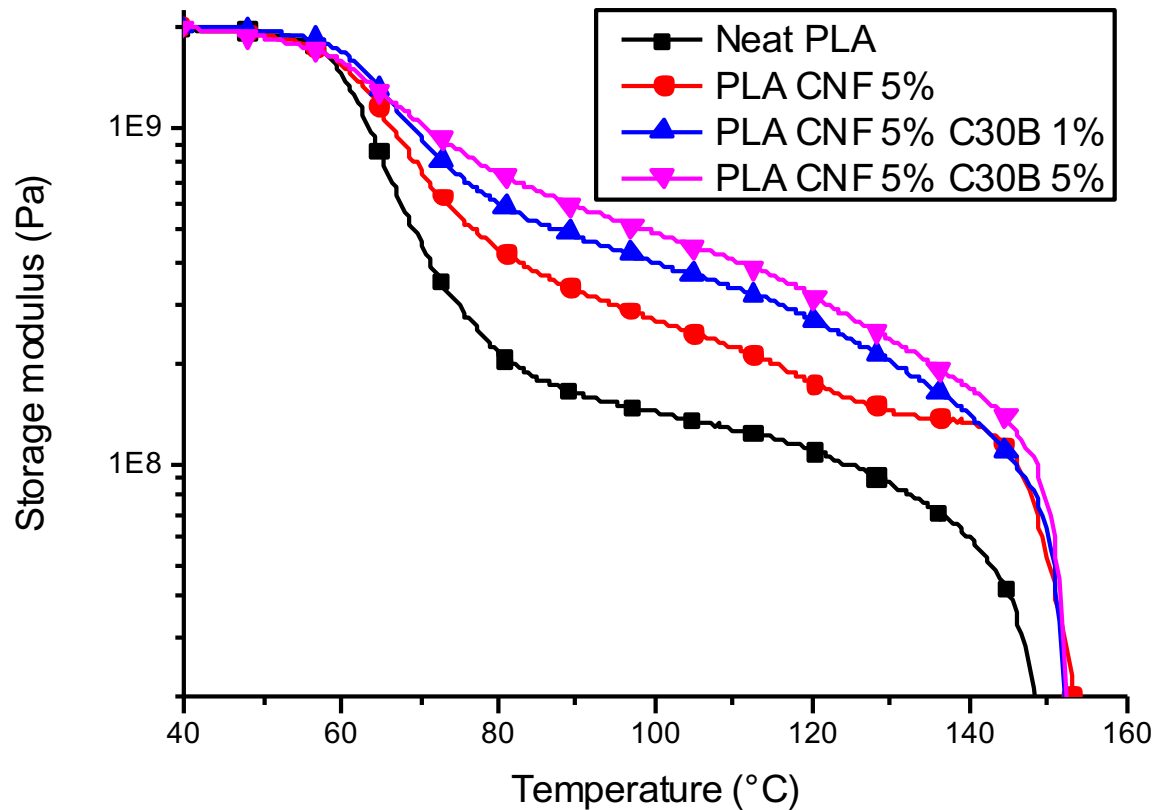
PLA/CNF



PLA/CNF/C30B



THERMOMECHANICAL PROPERTIES



There is also a synergetic behaviour

The improvement is really meaningful even at low load

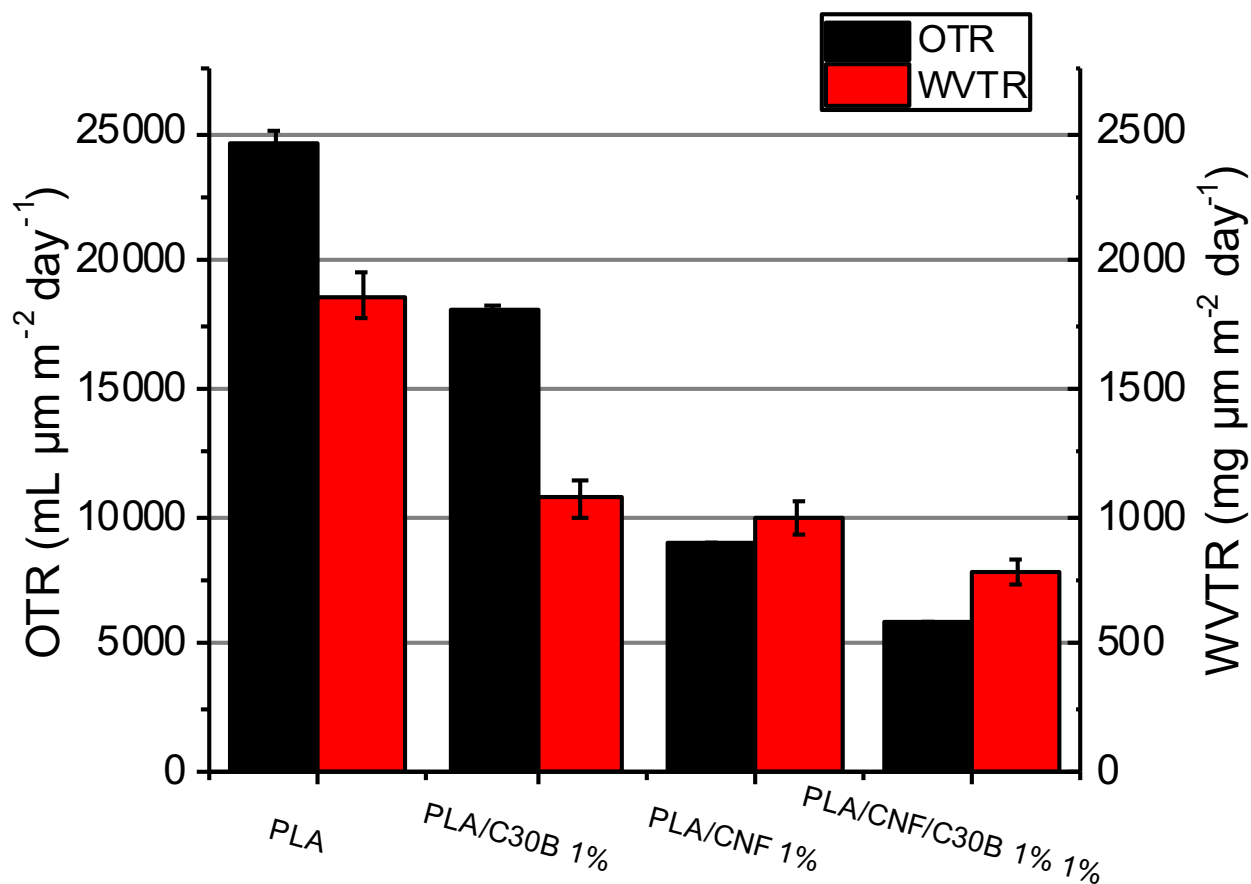


Neat PLA



PLA CNF/C30B
1% 1%

BARRIER PROPERTIES



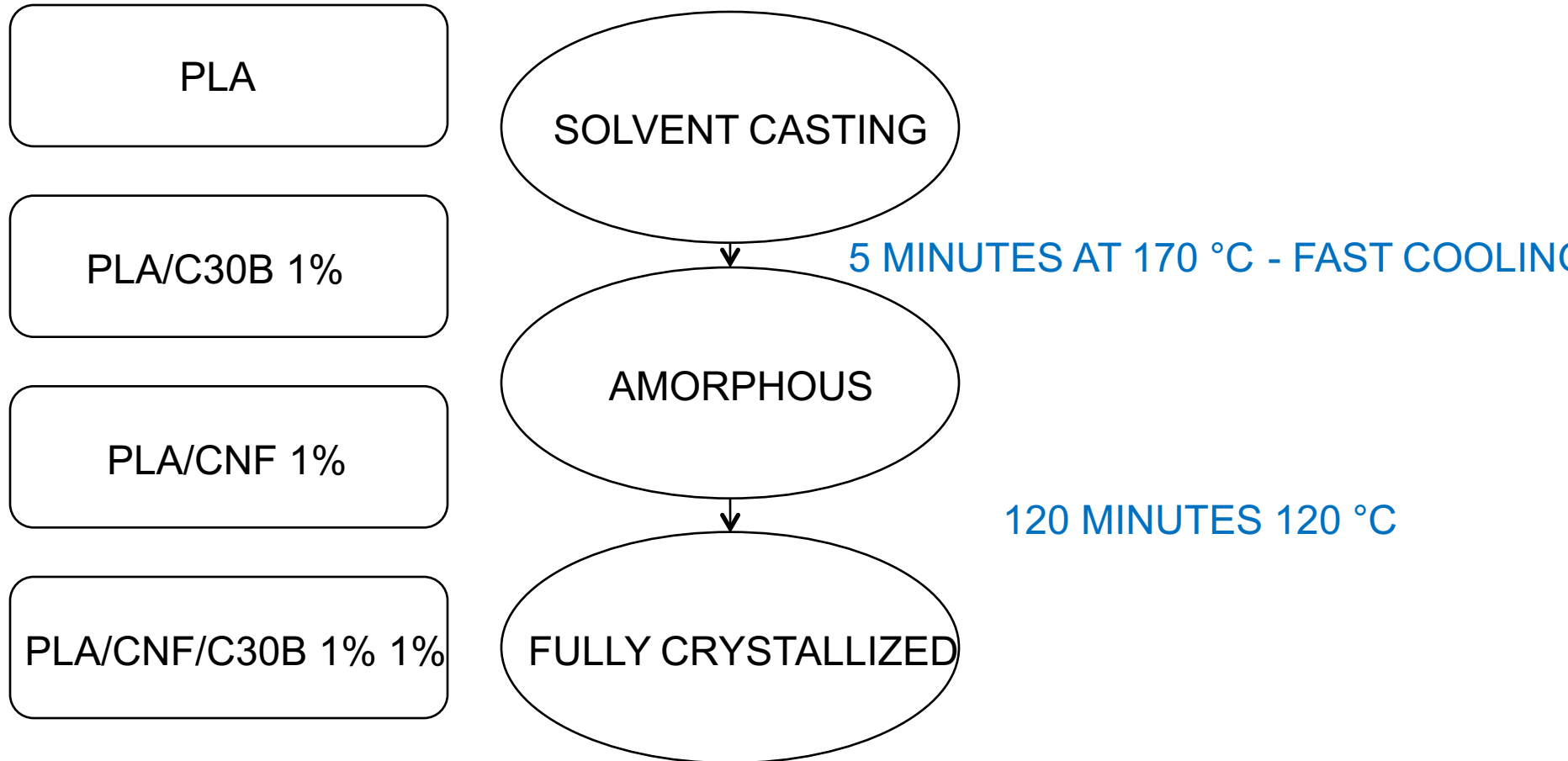
PLA/CNF/C30B 1% - 1%

- 73% DECREASE OTR
- 63% DECREASE WVTR

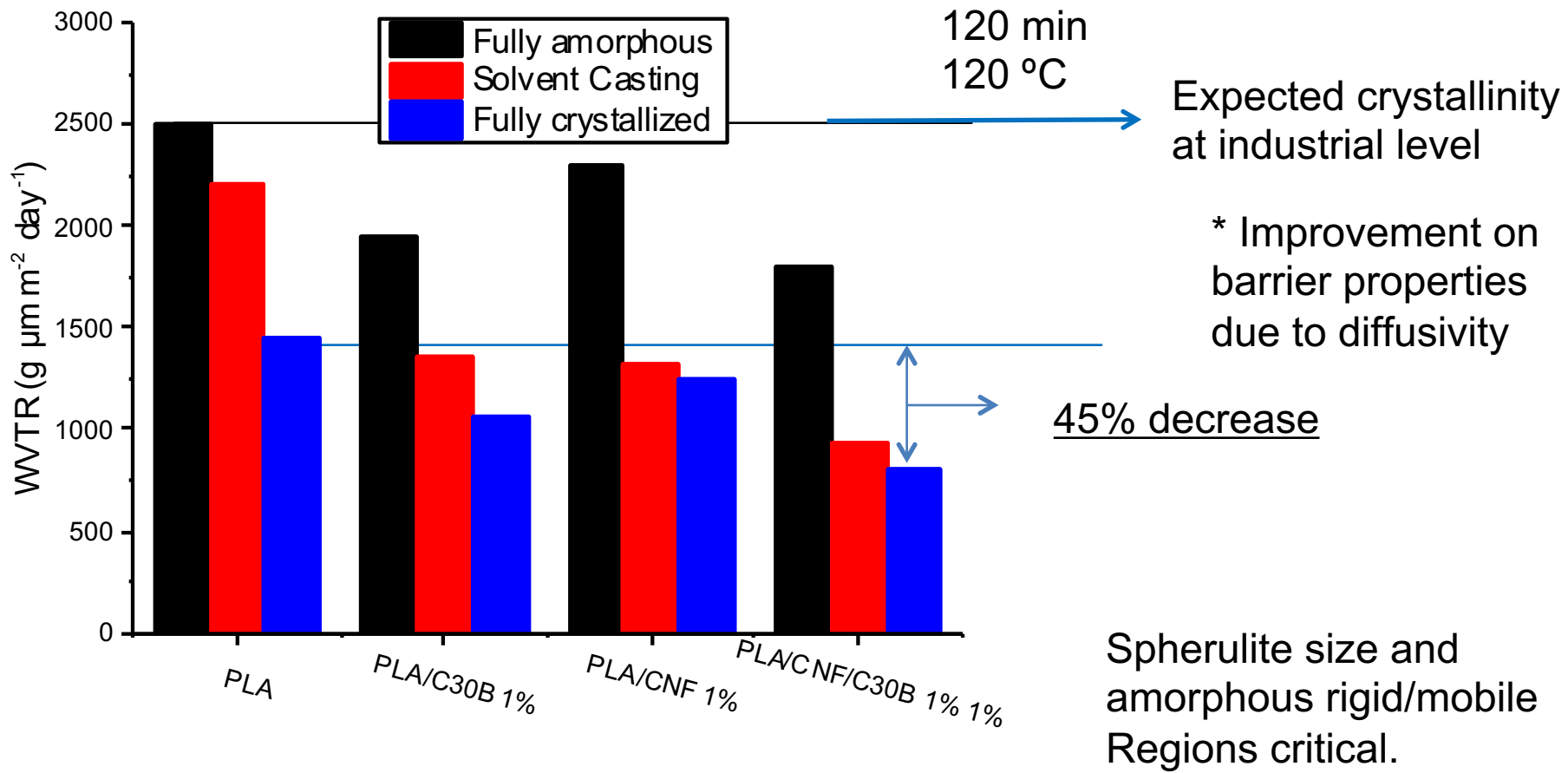
PLA/CNF/C30B 5% - 5%

- 90% DECREASE OTR
- 76% DECREASE WVTR

CRYSTALLINITY AND BARRIER PROPERTIES

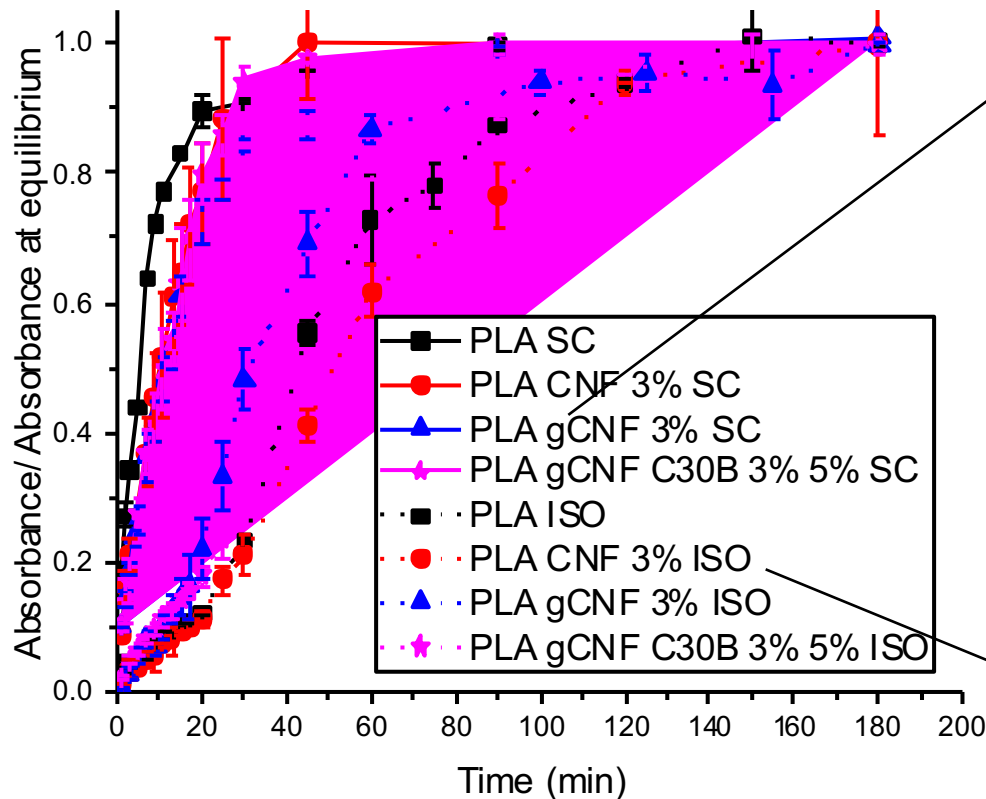


WVTR



CONTROLLED RELEASE

RELEASE OF CARVACROL ON FATTY FOOD
(MeOH 95% V/V)



CNF grafted with absorbant
Better dispersion!



+ 7.5 min @ 120 C

INTRODUCTION

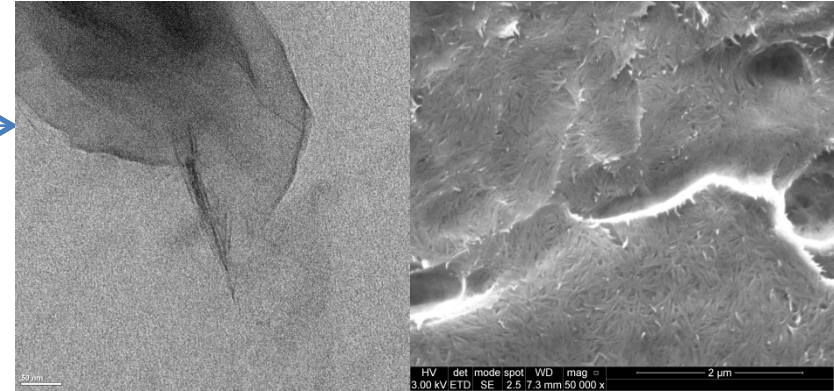
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C30B



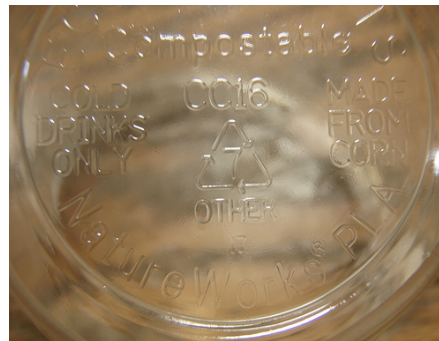
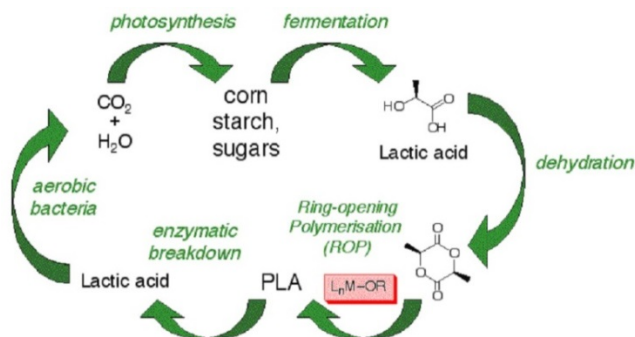
CNF

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Sinergetic**

When? How? How much?



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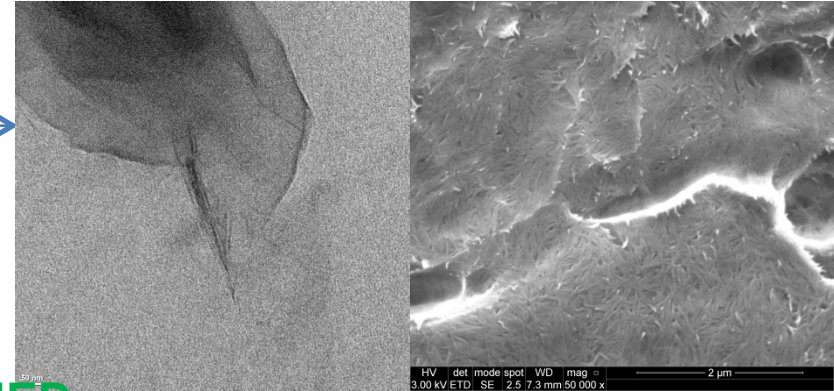
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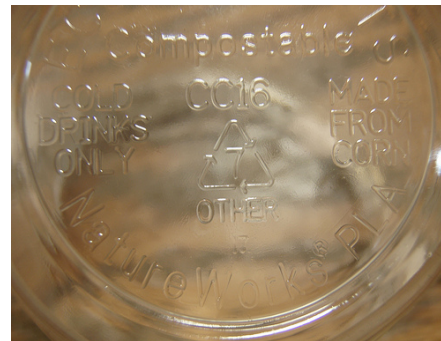
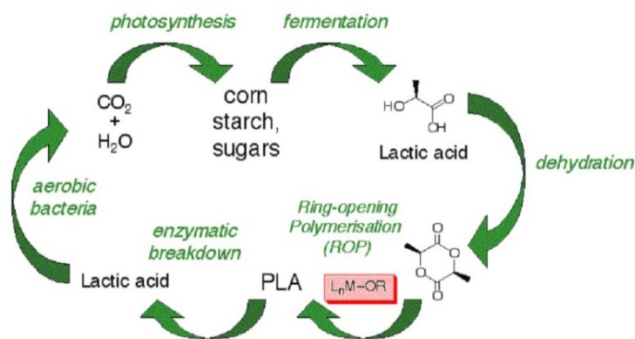


CNF

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ACKNOWLEDGEMENTS

- *To my supervisor board* for guiding me during my PhD.
- *To my coauthors* for helping me and their valuable advices.
- *In memoriam* to **Prof. Iñaki Mondragón Egaña**, whose dedication for the science is a inspiration for me.
- To the Marie Curie (ITN) Program (Project: NewGenPak project No: 290098) for the financial support.
- To the COST Program.

PhD defence on November!

Looking for new oportunities



obrigado

Dank U

Merci

mahalo

Köszi

chnacuó

Grazie

Thank
you

maururu

Takk

Gracias

Dziękuję

Děkuju

danke

Kiitos