

Novel Clay/Nanocellulose Biocomposite Films and Coatings in the Context of New Packaging Materials

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INTRODUCTION

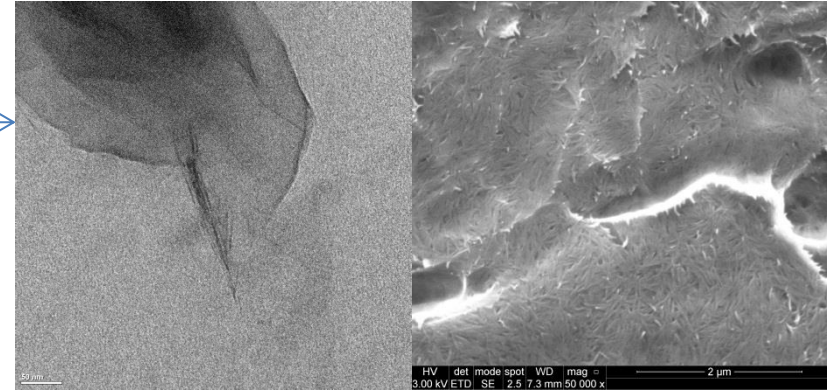
- PLA (Polylactic acid)

- ✓ 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

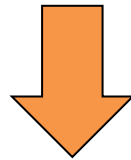
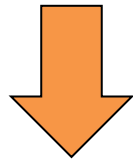
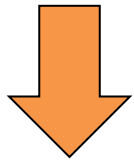
Improvement
of properties?

**Comparison vs
Synergistic**

When? How? How much?

PLA BASED NANOCOMPOSITES

SOLVENT CASTING → BETTER FOR THE "PROOF OF THE HYPOTHESIS"
→ "UPSCALING" → FUTURE RESEARCH → **MULTIPLE POSSIBILITES**



PLA &
PLA +
C30B

PLA +
CNF

PLA +
CNW

PLA +
CNF +
C30B

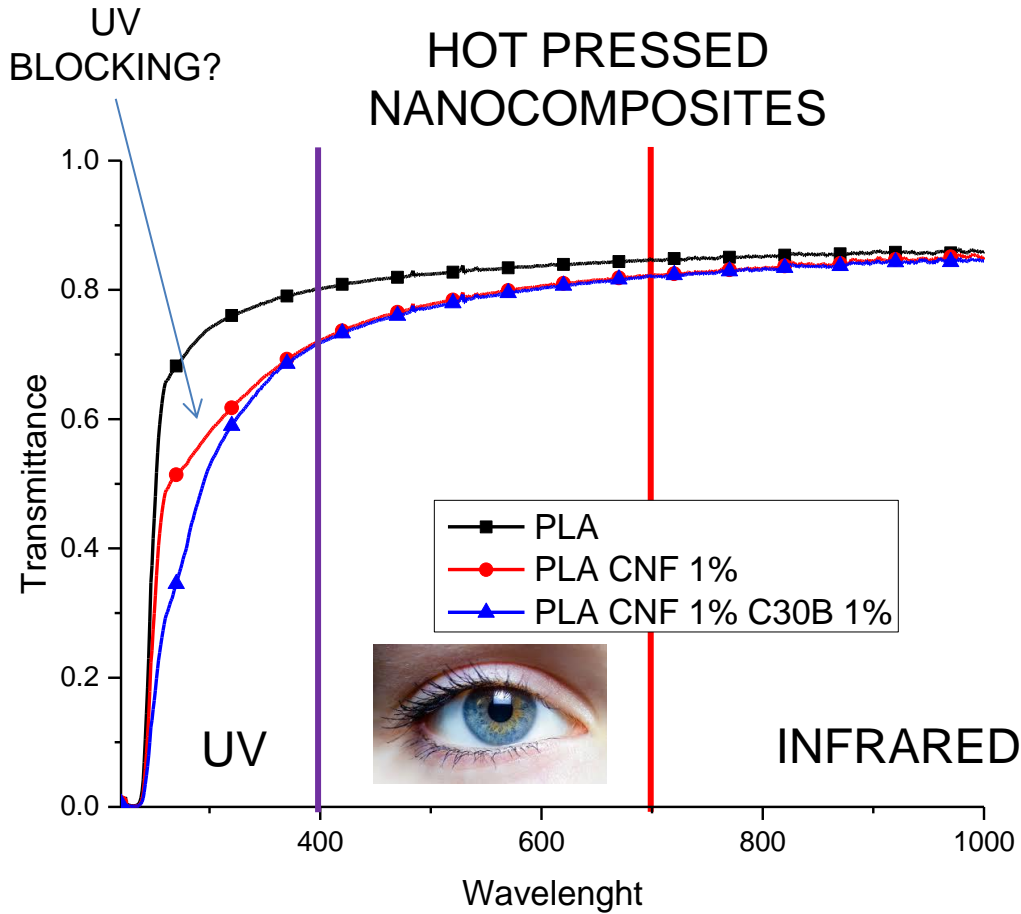
PLA +
CNW +
C30B

DCM
15 h 23 C

DMF + 15 h 80 C

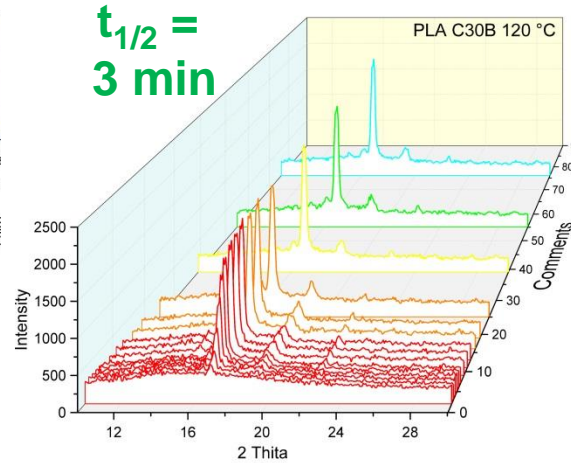
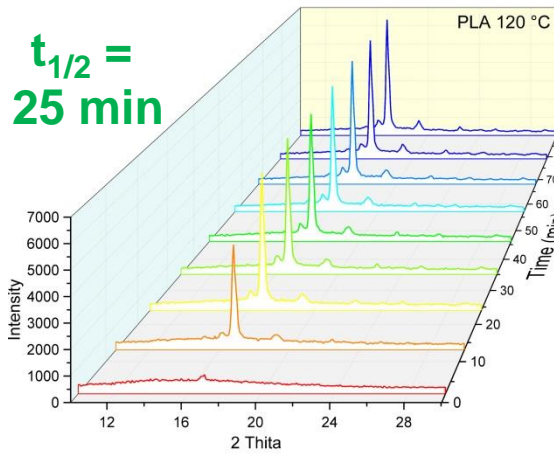
BEST CONDITIONS FOR EACH NANOCOMPOSITE

TRANSPARENCY



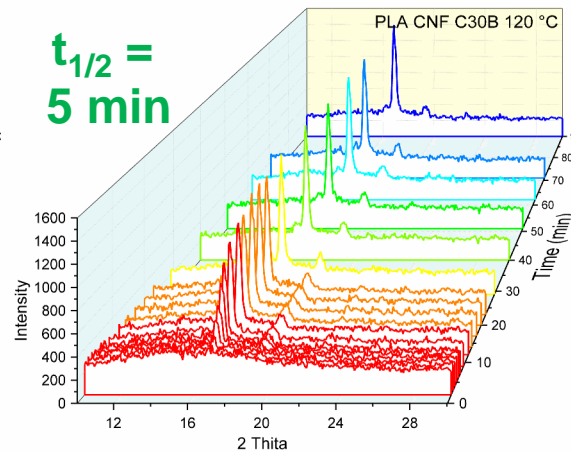
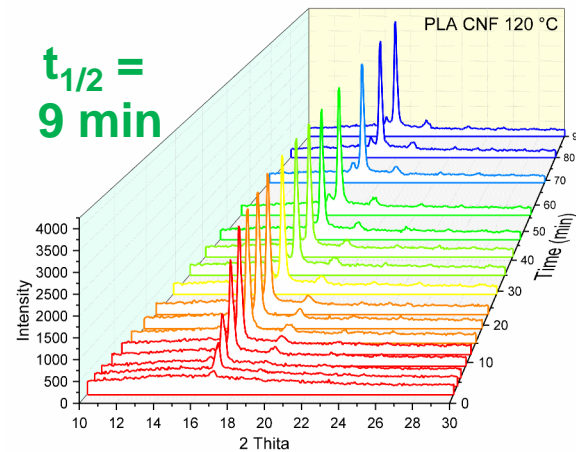
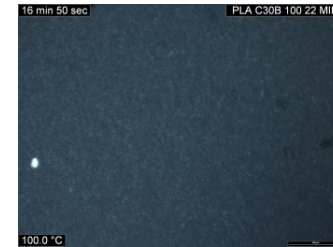
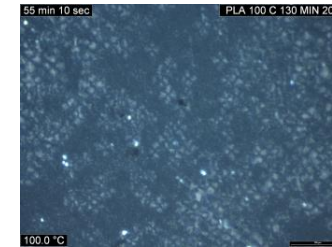
PLA/CNF 1%/C30B 1%
**TRANSPARENT
AND CLEAR**

CRYSTALLIZATION: XRD, MDSC & POM



PLA

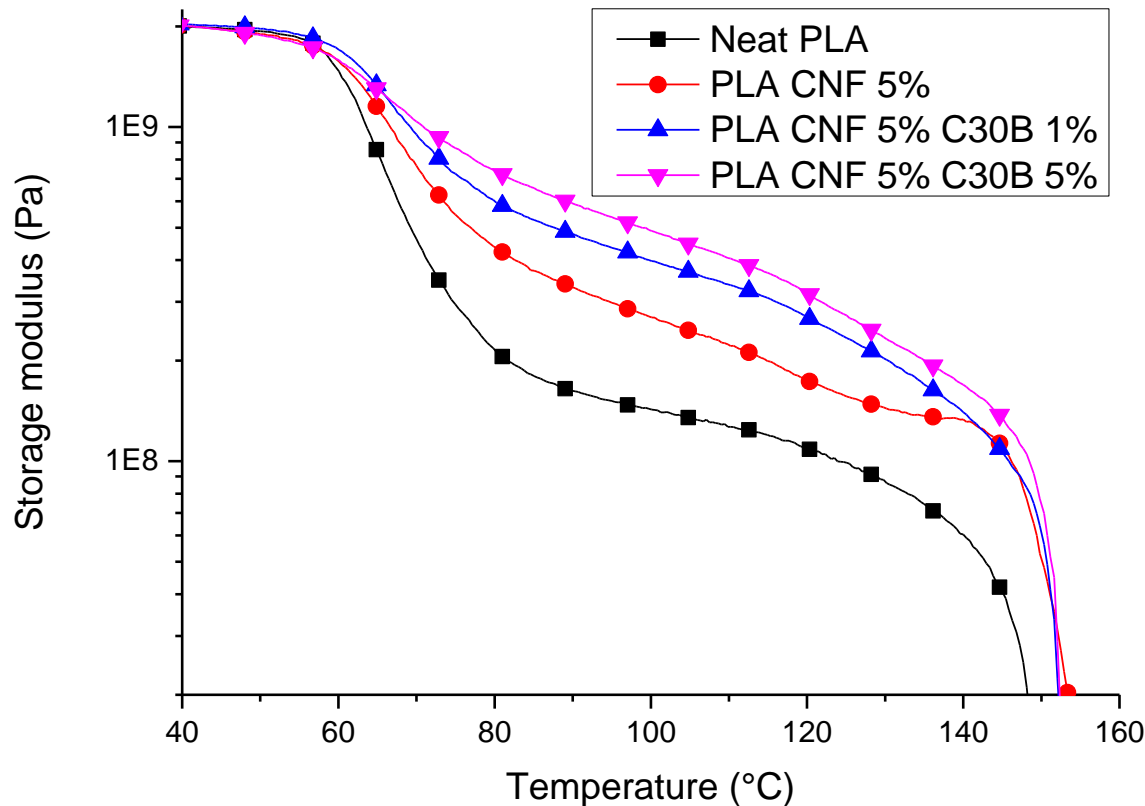
PLA/C30B



PLA/CNF

PLA/CNF/C30B

THERMOMECHANICAL PROPERTIES



There is also a synergistic behaviour

The improvement is really meaningful even at low loading

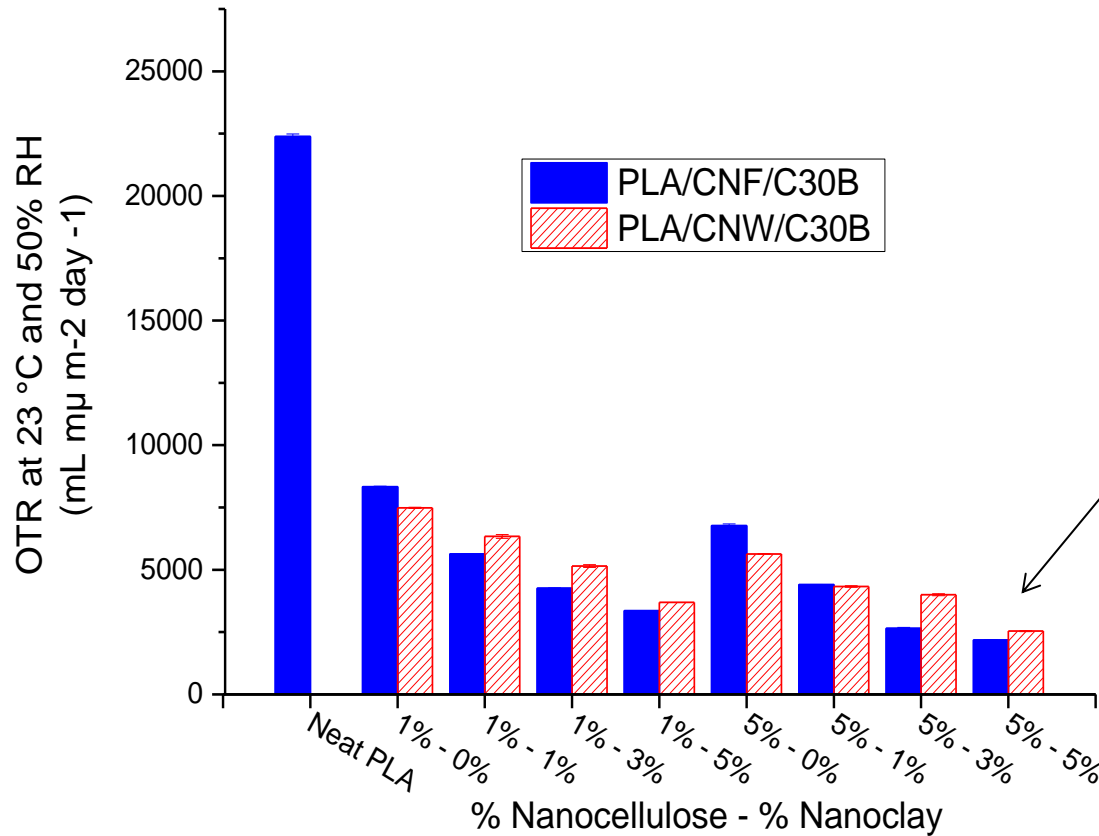


Neat PLA



PLA CNF/C30B
1% 1%

OXYGEN BARRIER PROPERTIES

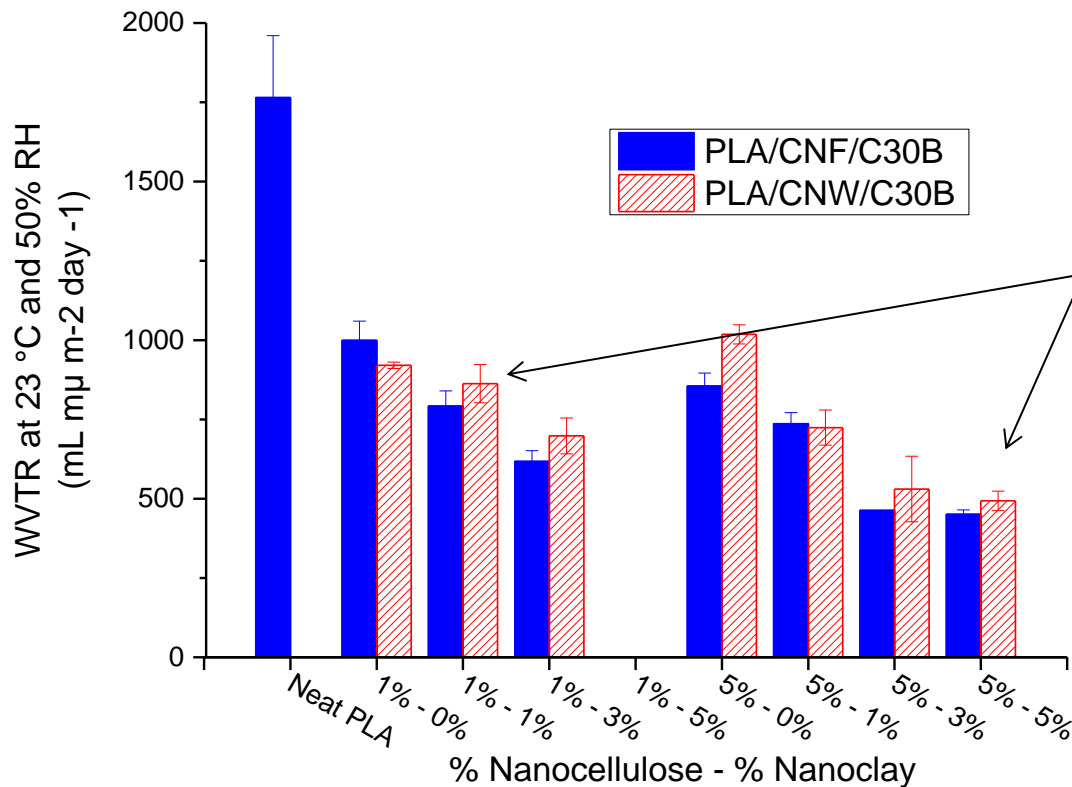


Similar results for
0% and 50% RH

There is a synergistic
behaviour

Decrease of up to
90% in the OTR

WATER VAPOR BARRIER PROPERTIES

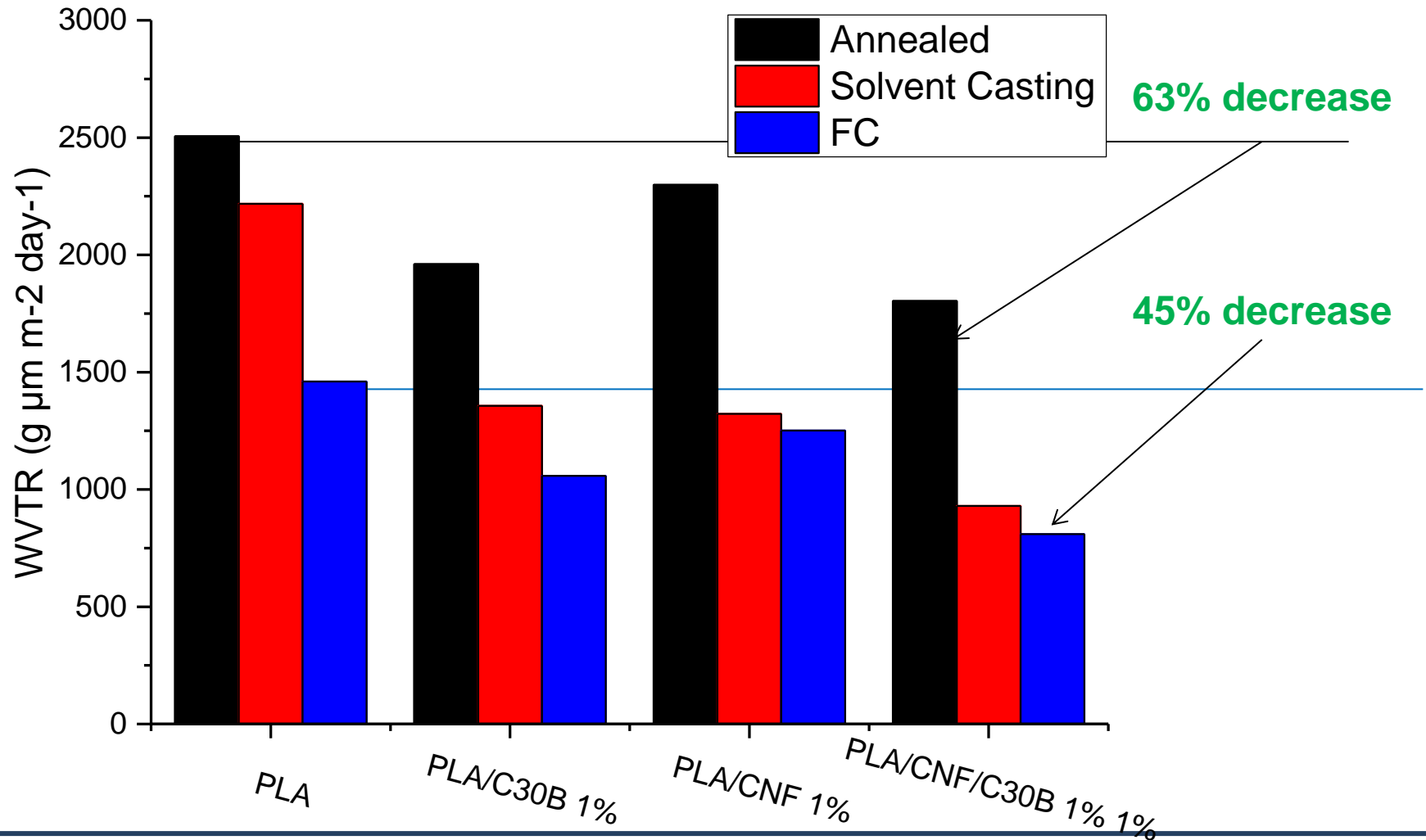


Decrease of up to 75% in the WVTR (best improvement)

Decrease of up to 60% in the WVTR (lower amount of nanofillers)

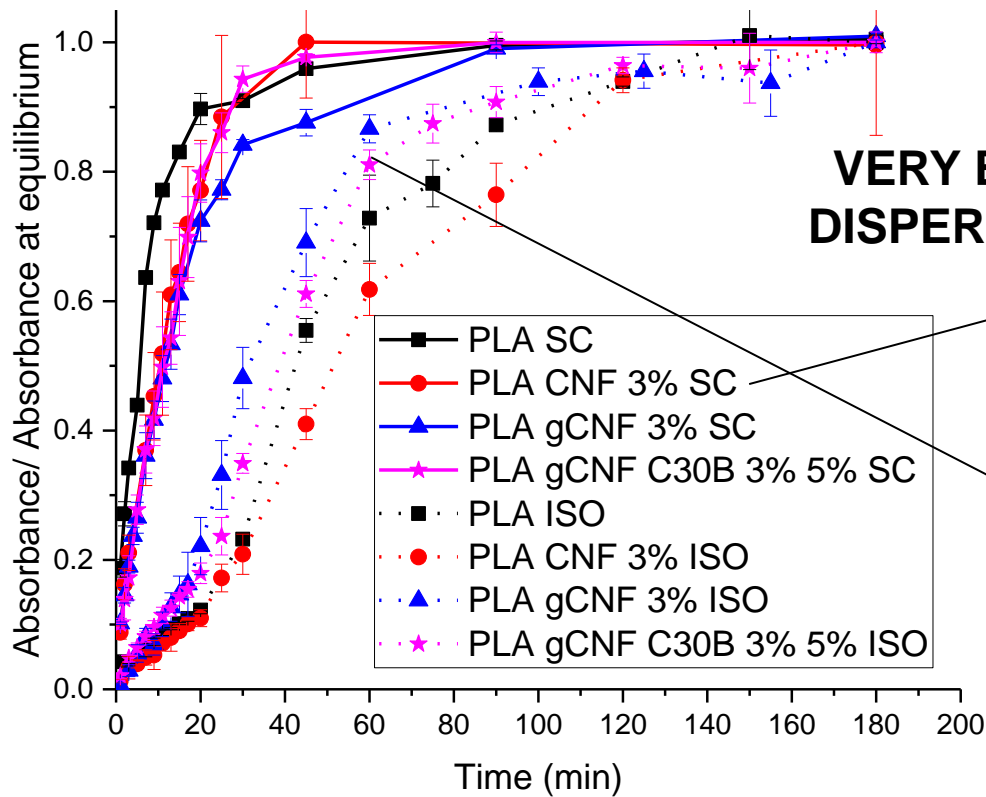
45% of decrease under isothermal crystallization conditions

WATER VAPOR TRANSMISSION RATE



CONTROLLED RELEASE

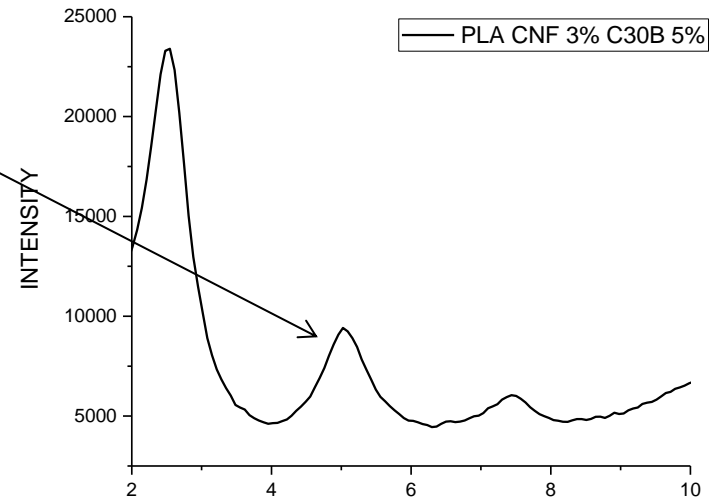
RELEASE OF CARVACROL ON FATTY FOOD
(MeOH 95% V/V)



**VERY BAD
DISPERSION!**



CNF grafted with absorbent



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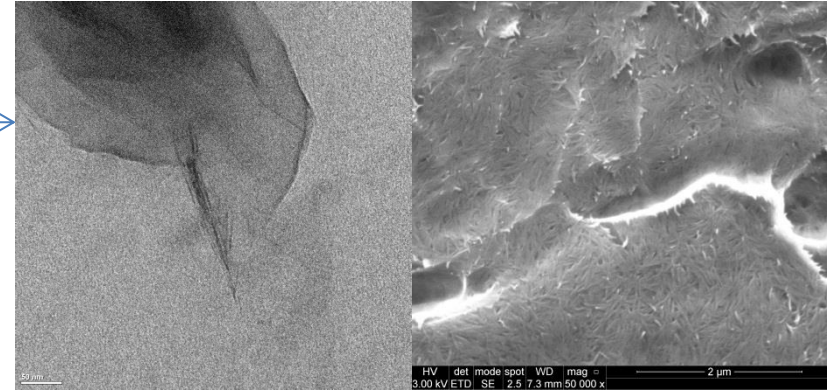
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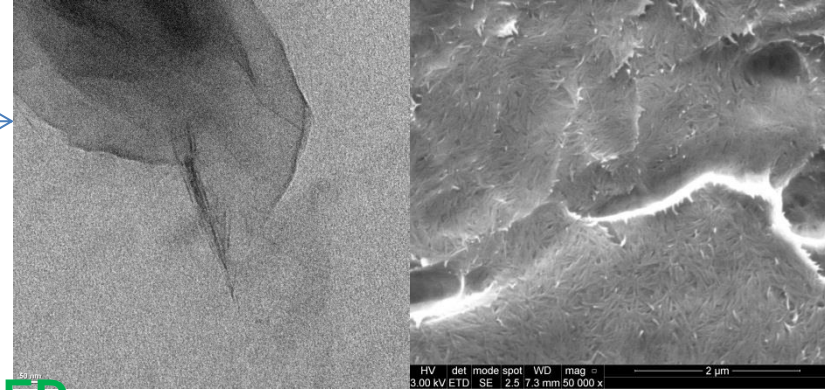
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C30B

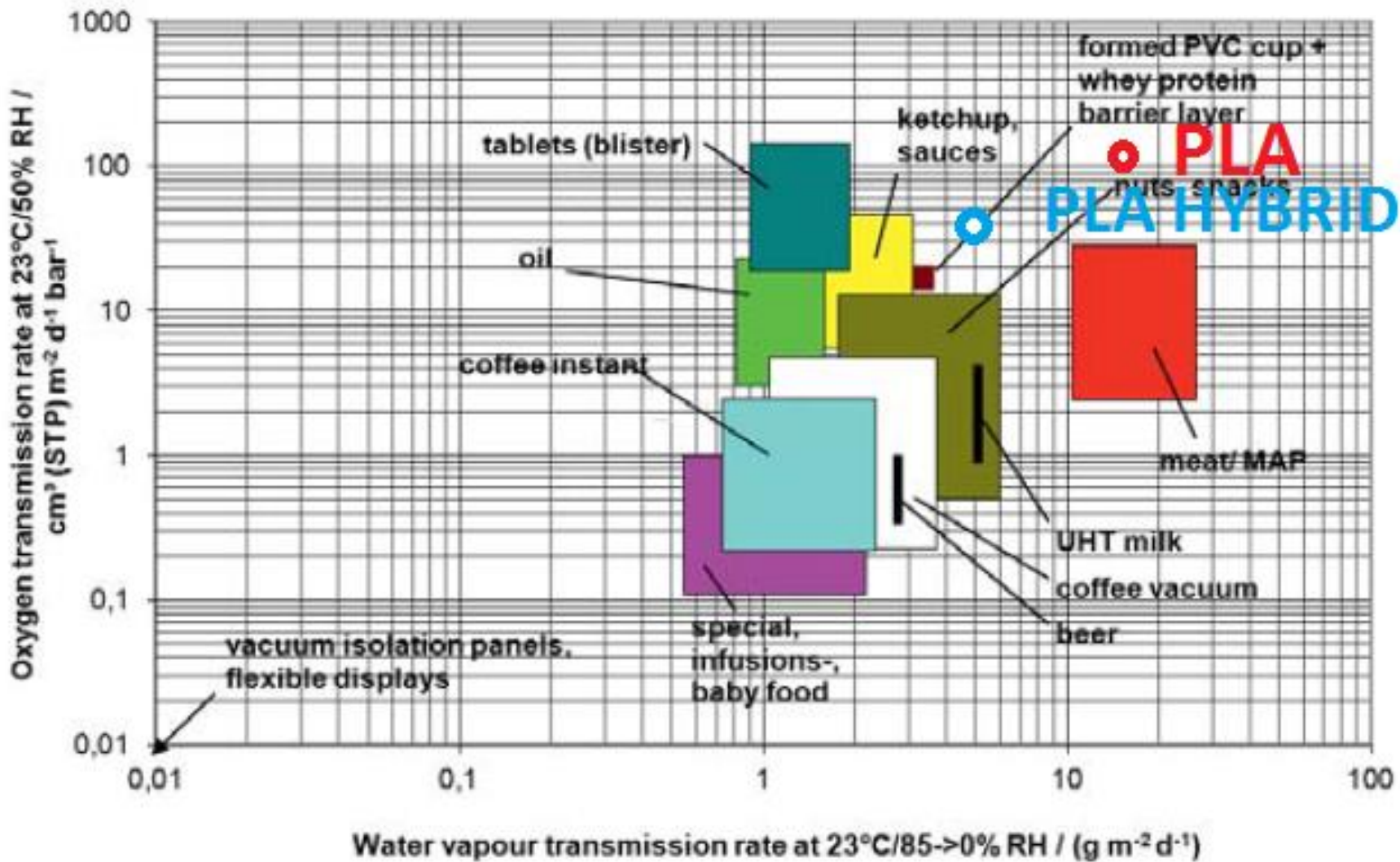


CNF

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Langowski, H.-C., (2008) Permeation of Gases and Condensable Substances through Monolayer and Multilayer Structures. In: Plastic Packaging: Interactions with Food and Pharmaceuticals (Eds. Piringer O.G., Baner A.L.) 2008: Wiley-VCH, 297-347.

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- But specially

**TO ALL OF YOU FOR BEING SUCH
GOOD FRIENDS!**

obrigado

Dank U

Merci

mahalo

Köszi

спасибо

Grazie

Thank
you

maururu

Takk

Gracias

Dziękuję

Děkuju

danke

Kiitos