Biobased cellulose nanofibrils-oil composite films for active edible barriers

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PRESENTED BY:

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Introduction

Aim of this work

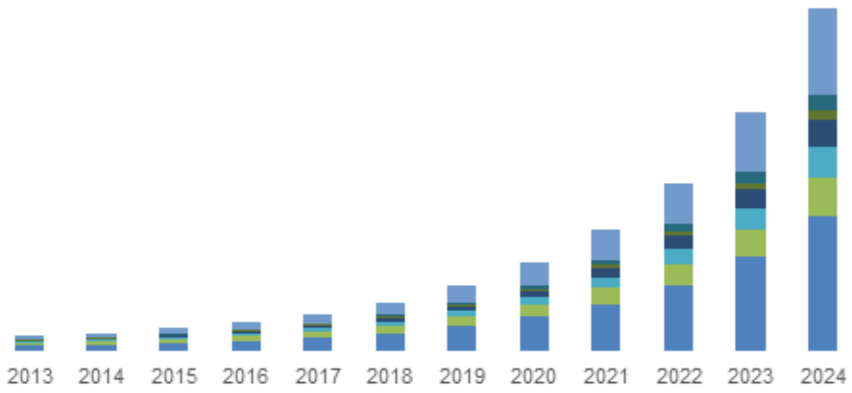
The dream of a packaging material:

- Biodegradable and Sustainable
- CHEAP
- No chemical modifications
- Preferably no additives
- Edible?

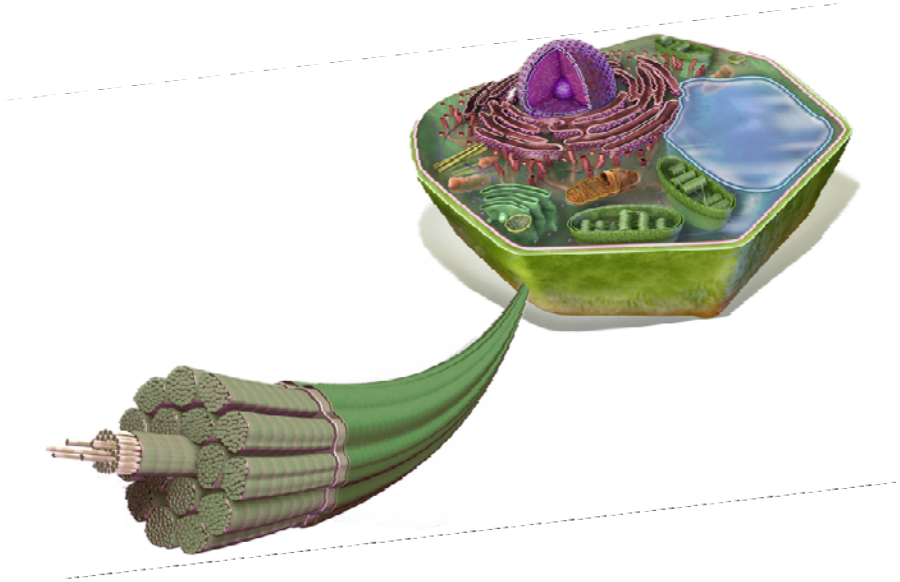
- Decent mechanical properties
- (ductile material)
- Low moisture uptake
- UV-protecting properties
- Increase the storage-life of food

Actual market development for nanocellulose

Nanocellulose production volumes tons per year



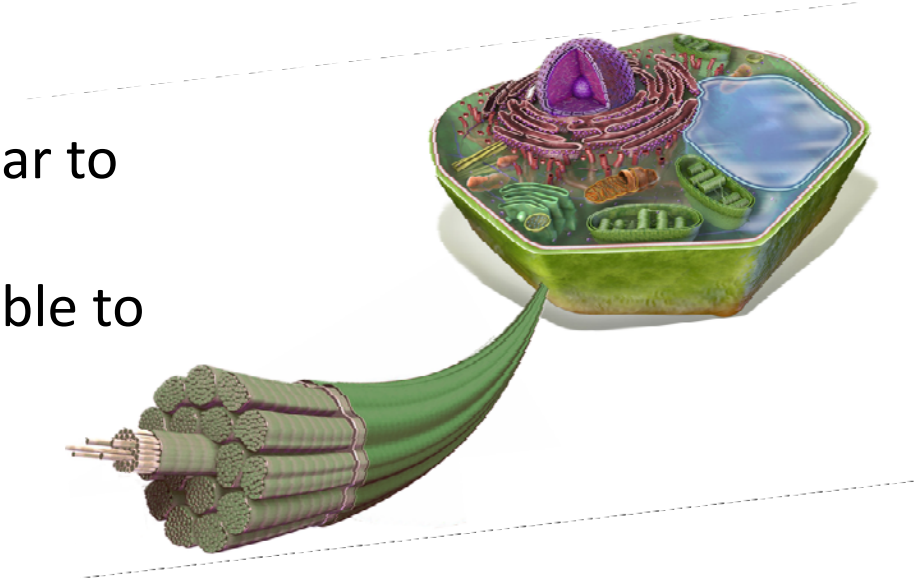
https://www.gminsights.com/industry-analysis/nanocellulose-market



LV1
LV2
LV3
LV4

Nanocellulose for food packaging applications: Why?

- Abundant
- Biodegradable and renewable nature
- Tensile strenght is about 500 Mpa (similar to aluminum)
- Stiffness around 140-220 Gpa (comparable to Kevlar)



Slide 5

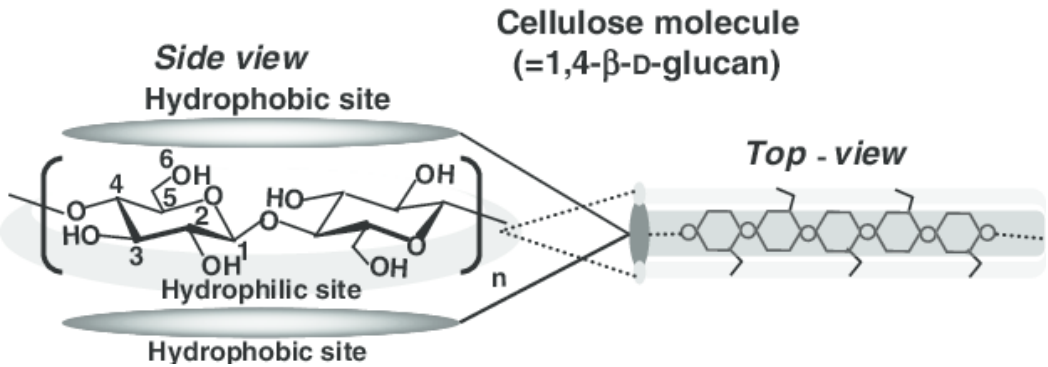
LV1 1. Cellulosic fiber
Luis Valencia, 1/11/2018

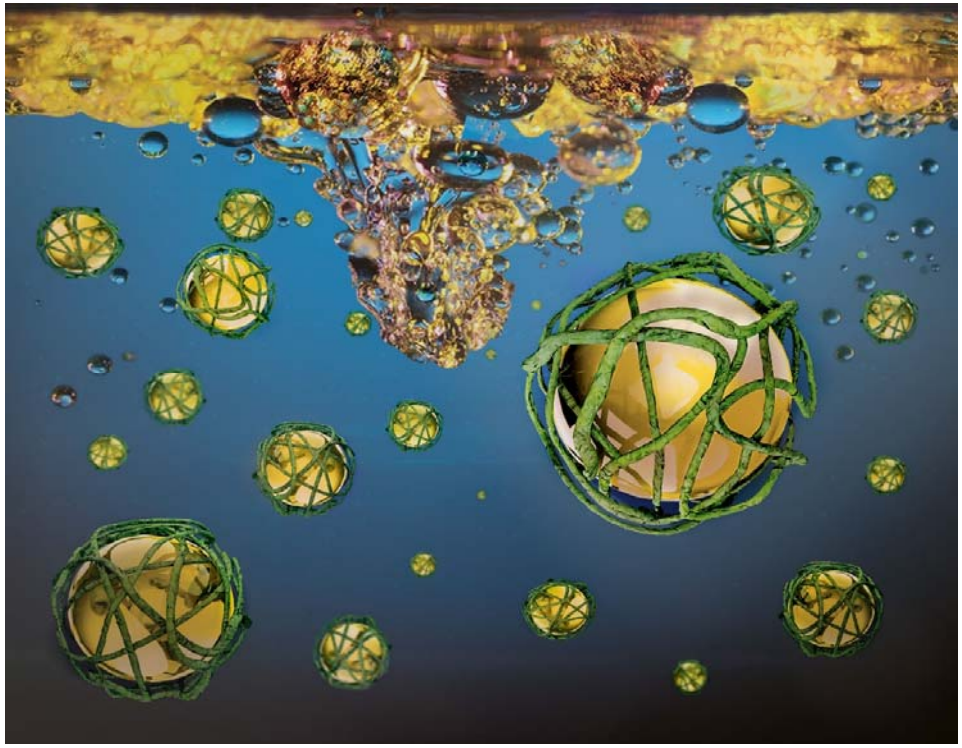
LV2 2.
Luis Valencia, 1/11/2018

LV3 Microfibrillated cellulose
Luis Valencia, 1/11/2018

LV4 Nanofibrils
Luis Valencia, 1/11/2018

Nanocellulose-stabilized Pickering emulsions





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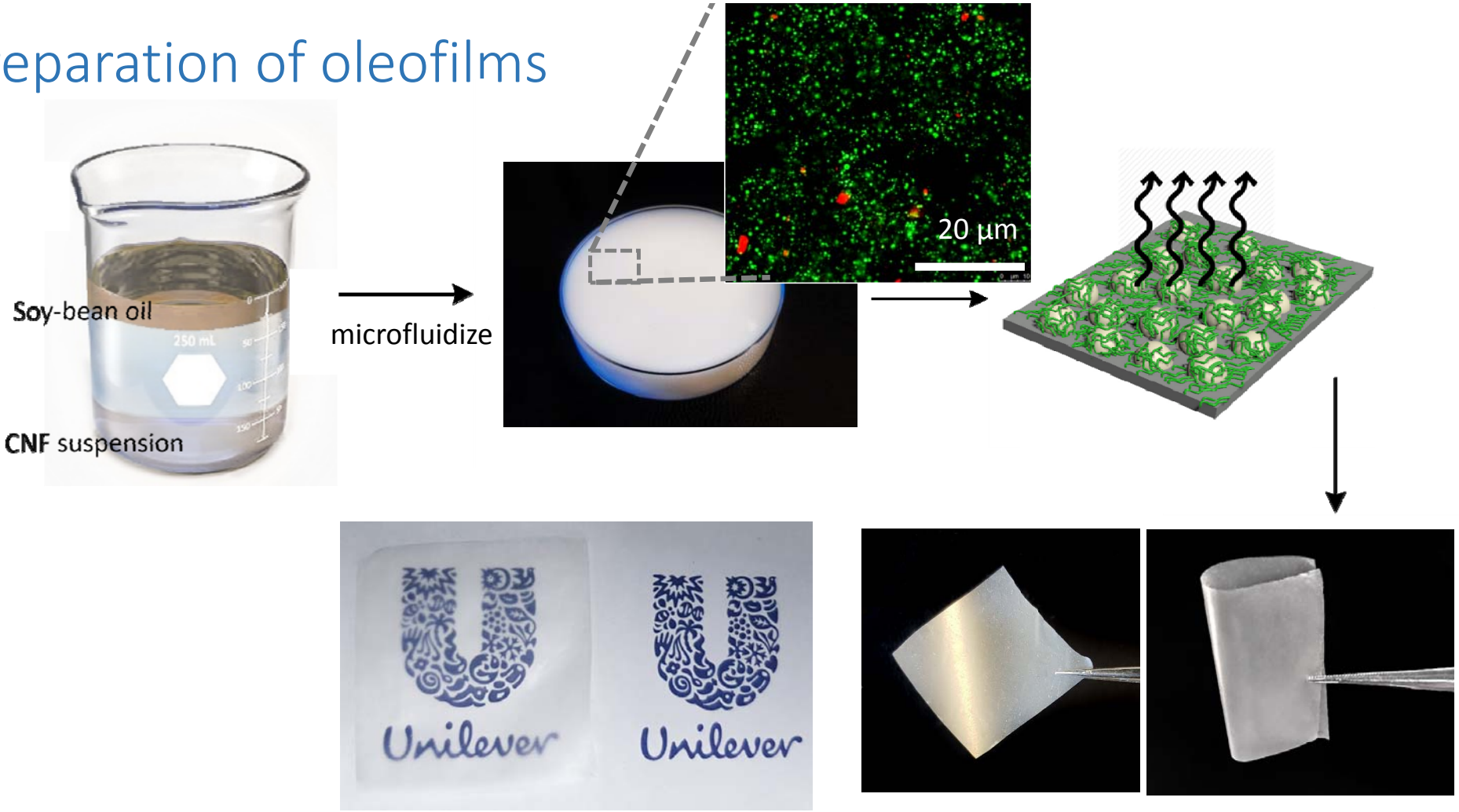
Preparation of oleofilms



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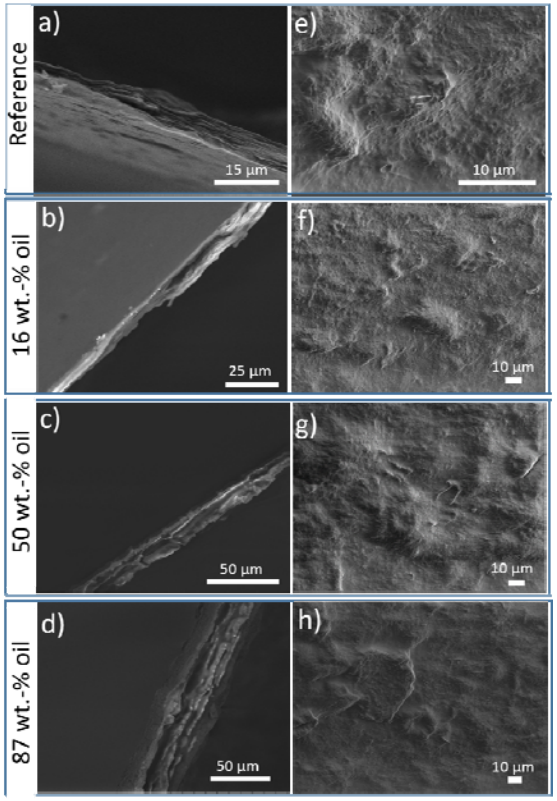
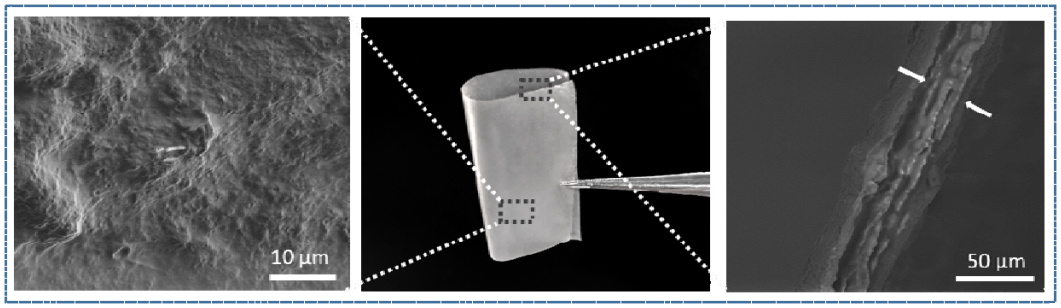
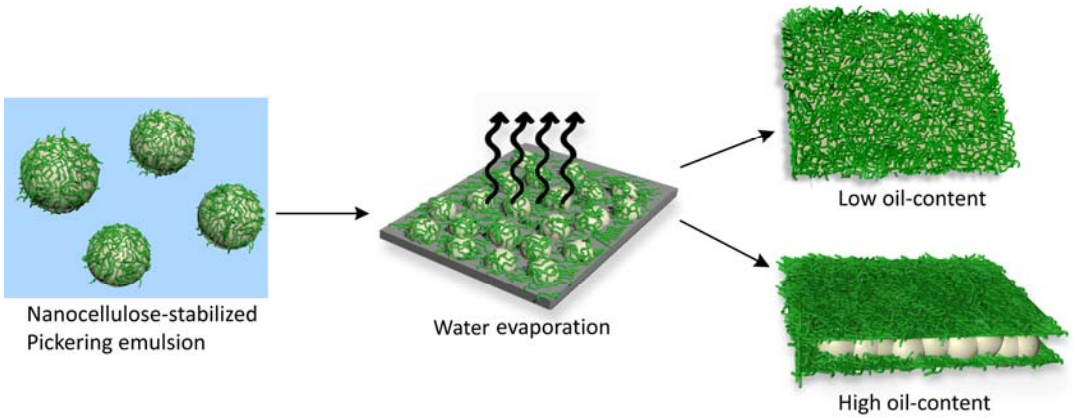
Structure of oleofilms







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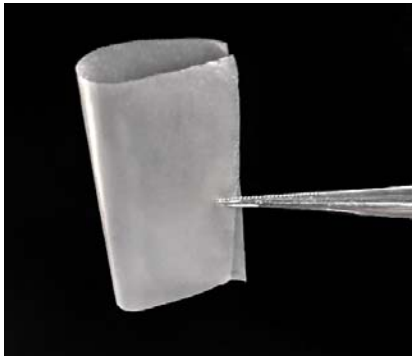
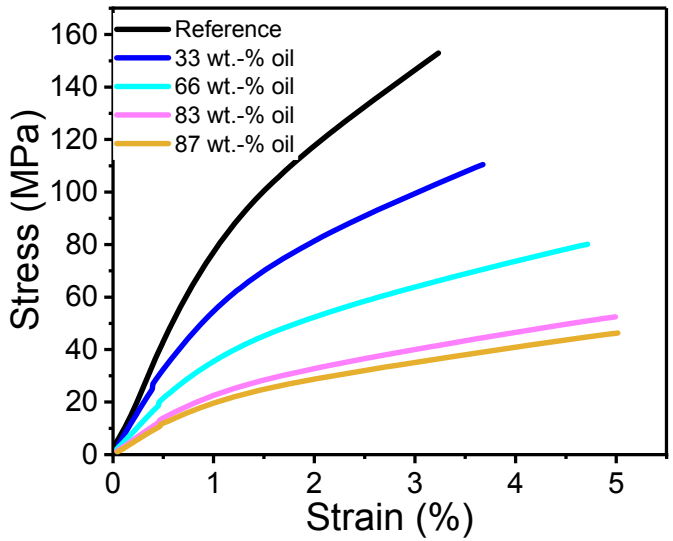
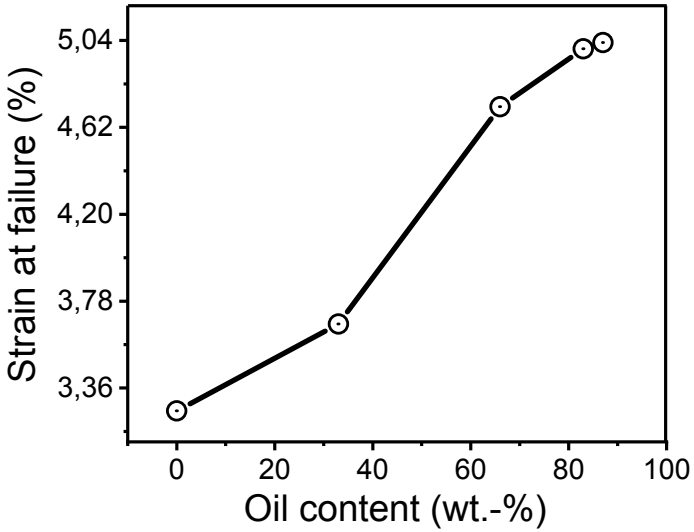
Properties of oleofilms







- Oleofilms get more ductile by increasing oil concentration
- Oil acting as a plasticizer!
- Suitable for packaging applications!

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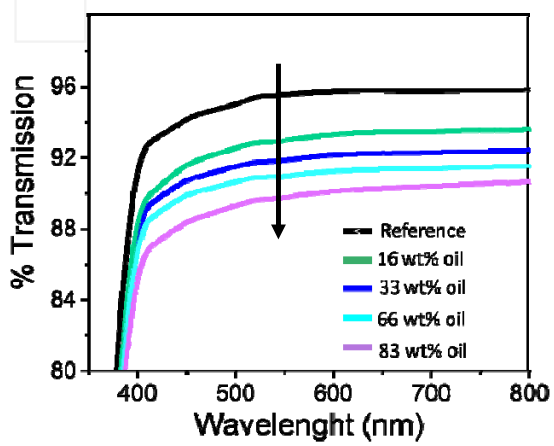
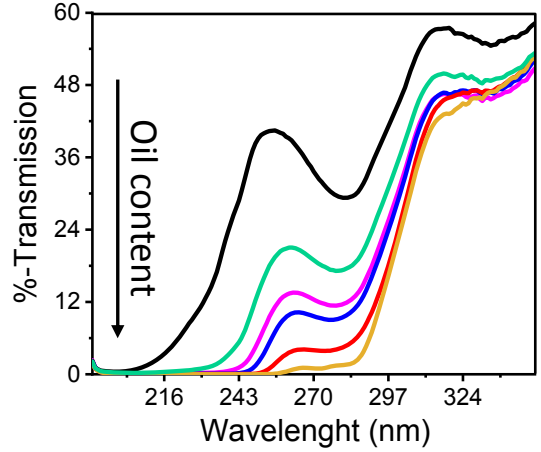
Properties of oleofilms

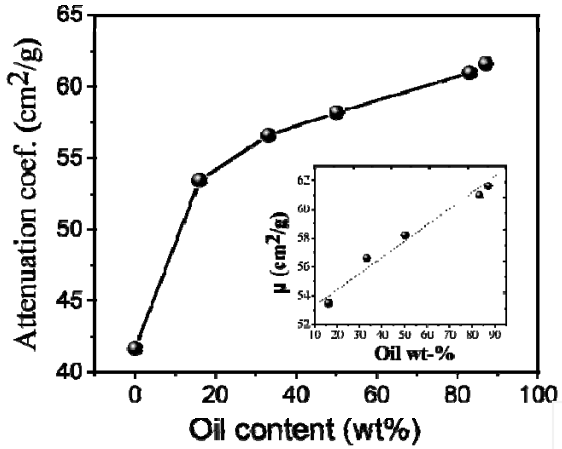




- Highly transparent!
- Good UV-protection

$$I = I_0\, e^{-\mu x}$$

I/I_0 = transmission
μ = mass attenuation coefficient
x = mass thickness



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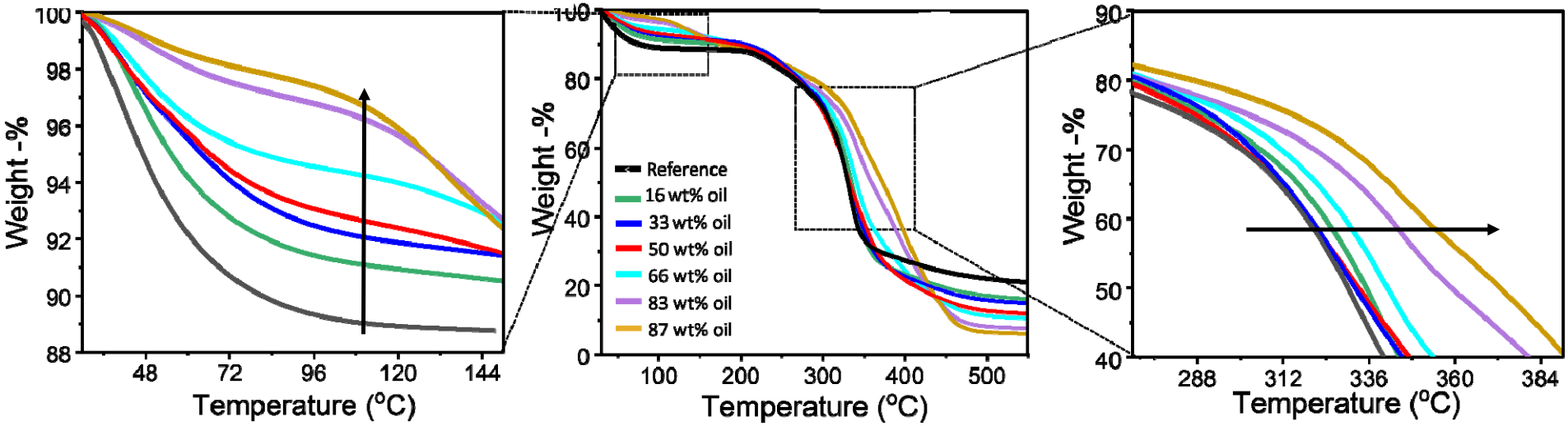
Properties of oleofilms



- Significant enhancement of thermal stability of the films
- Lower moisture uptake!

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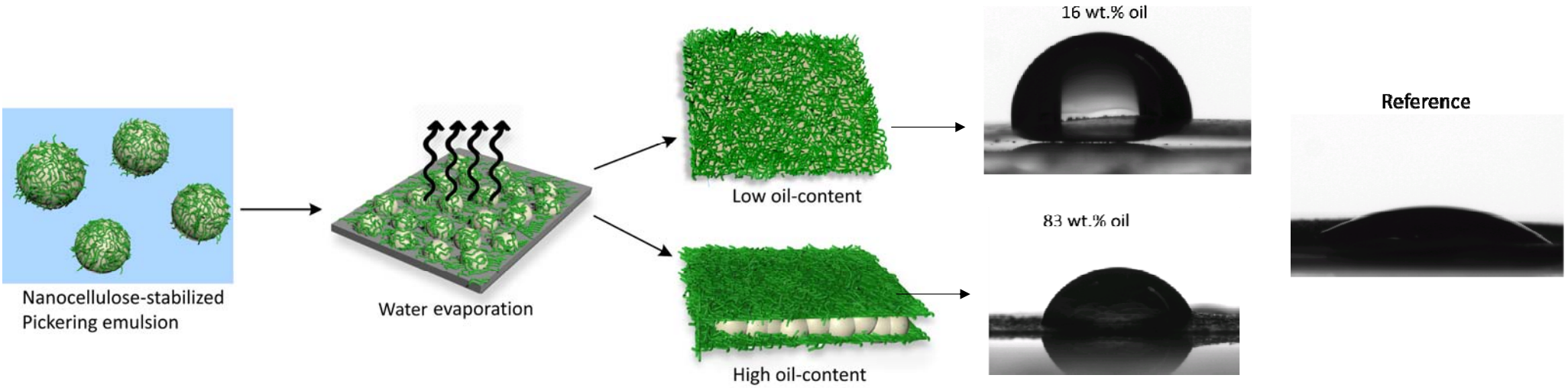
Properties of oleofilms



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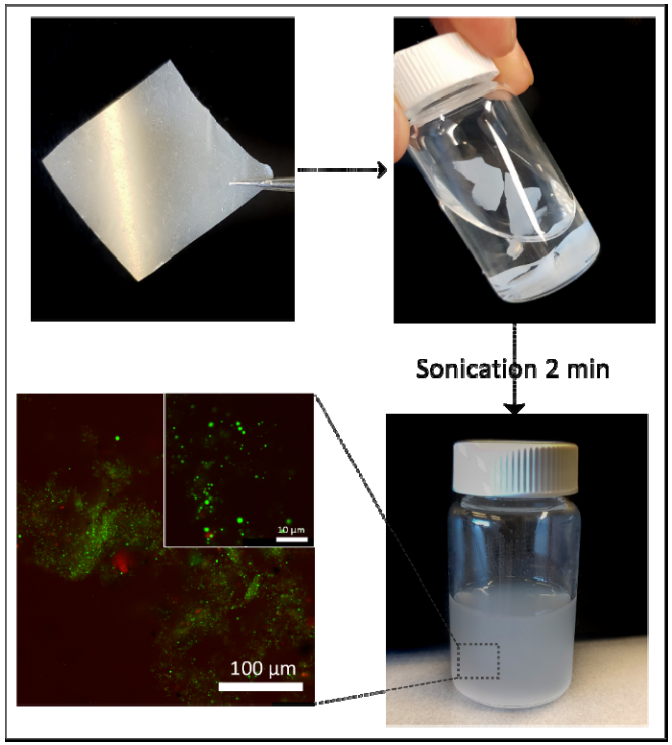
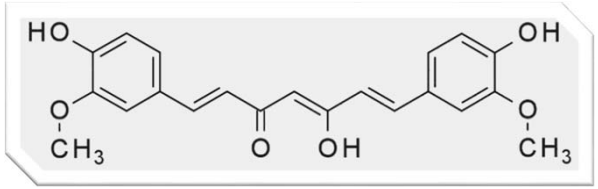
Properties of oleofilms

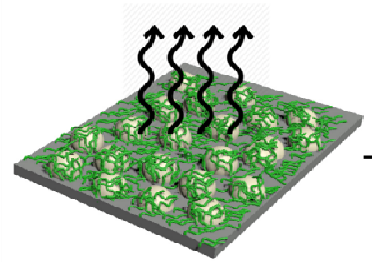


Encapsulation of bioactive compound

Curcumin,
Major component of turmeric



- Natural product
- Known to have excellent antioxidant and antibacterial properties



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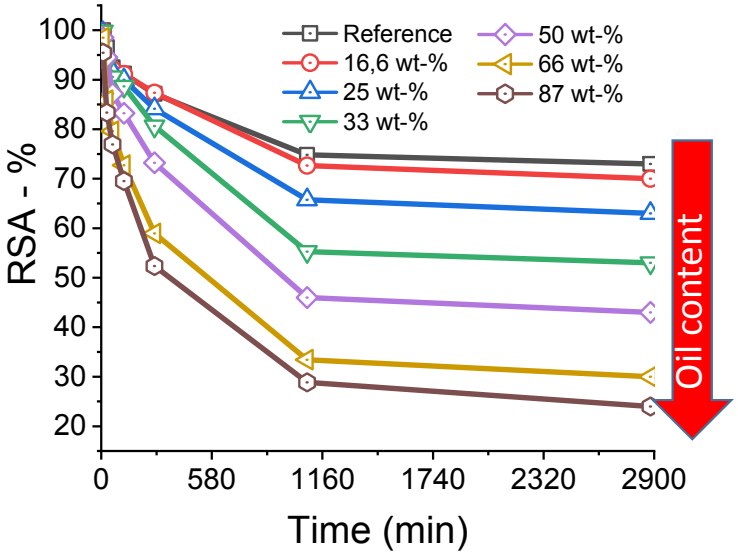
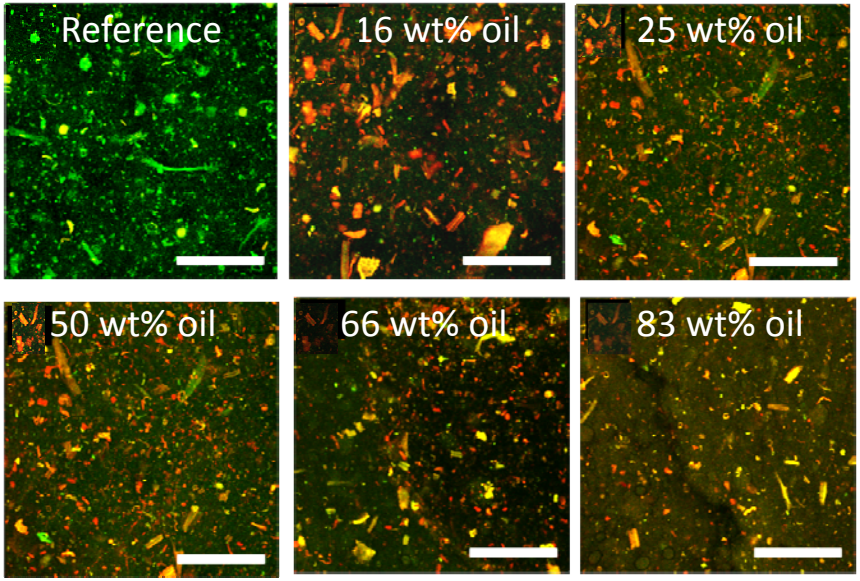
Encapsulation of bioactive compound

- **Signifantly enhanced the antioxidant and antimicrobial properties**





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Conclusions

- Novel packaging material using nanocellulose-stabilized pickering emulsions
- Structure strongly varies according to oil-content
- Enhanced thermal properties and lower moisture uptake
- Good mechanical properties appropiate for food packaging applications
- Efficient encapsulation of hydrophobic compounds to increase food storage life

Acknowledgement

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  - Prof. Krassimir Velikov (Unilever R&D, The Netherlands)
  - Prof. Aji Mathew (Stockholm University, Sweden)

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  - Emma Nomena (PhD candidate in Unilever)

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Unilever

Thank you

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