PRESERVE

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Sustainable packaging with tailored end of life

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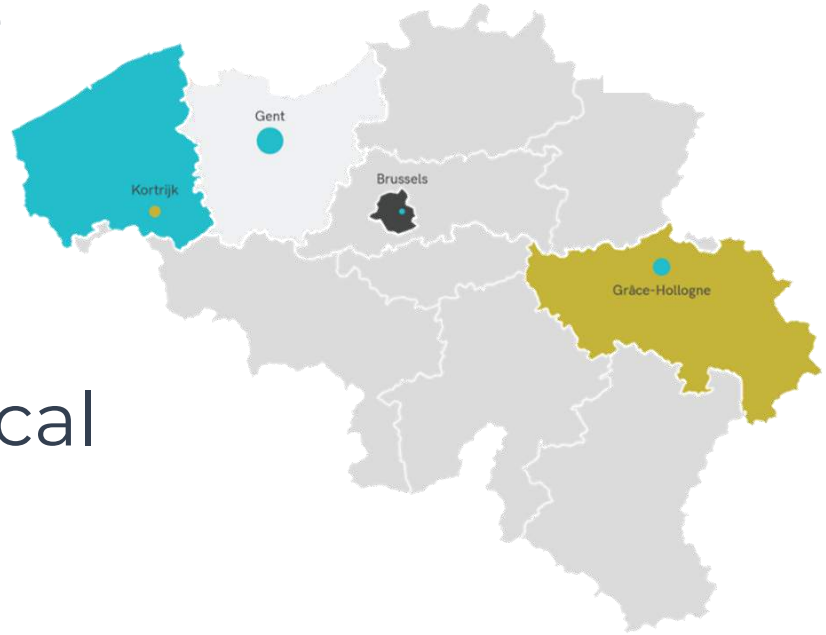
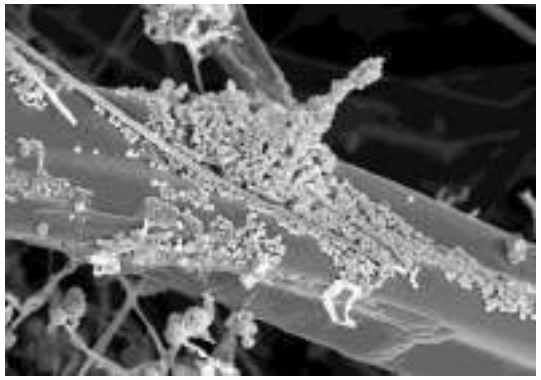
CENTEXBEL

- Collective research and technical centre
- Focus on ‘Textiles’ and ‘Plastics’
- 180 collaborators - 3 sites in Belgium
- Well-equipped testing laboratories:
  physical – chemical – fire – microbiological
- Pilot platforms:
  extrusion – textile – coating & finishing





PRESERVE DRIVE

- 8M ton of food packaging produced in 2020
- Recycling rates in EU vary between 26-52% (2018)
- EU sustainability goals require 70% recycling by 2030
- Shift towards renewable resources

Need for high performance biobased packing to meet EU sustainability goals

PRESERVE GOAL

Need for high performance biobased packing to meet EU sustainability goals

- Enchance bio-based packaging properties and recyclability
- Recovery and reintroduction of biopolymers
- Upcycling of secondairy raw materials in non-food

PRESERVE DEMO'S

Biobased & recyclable food packaging

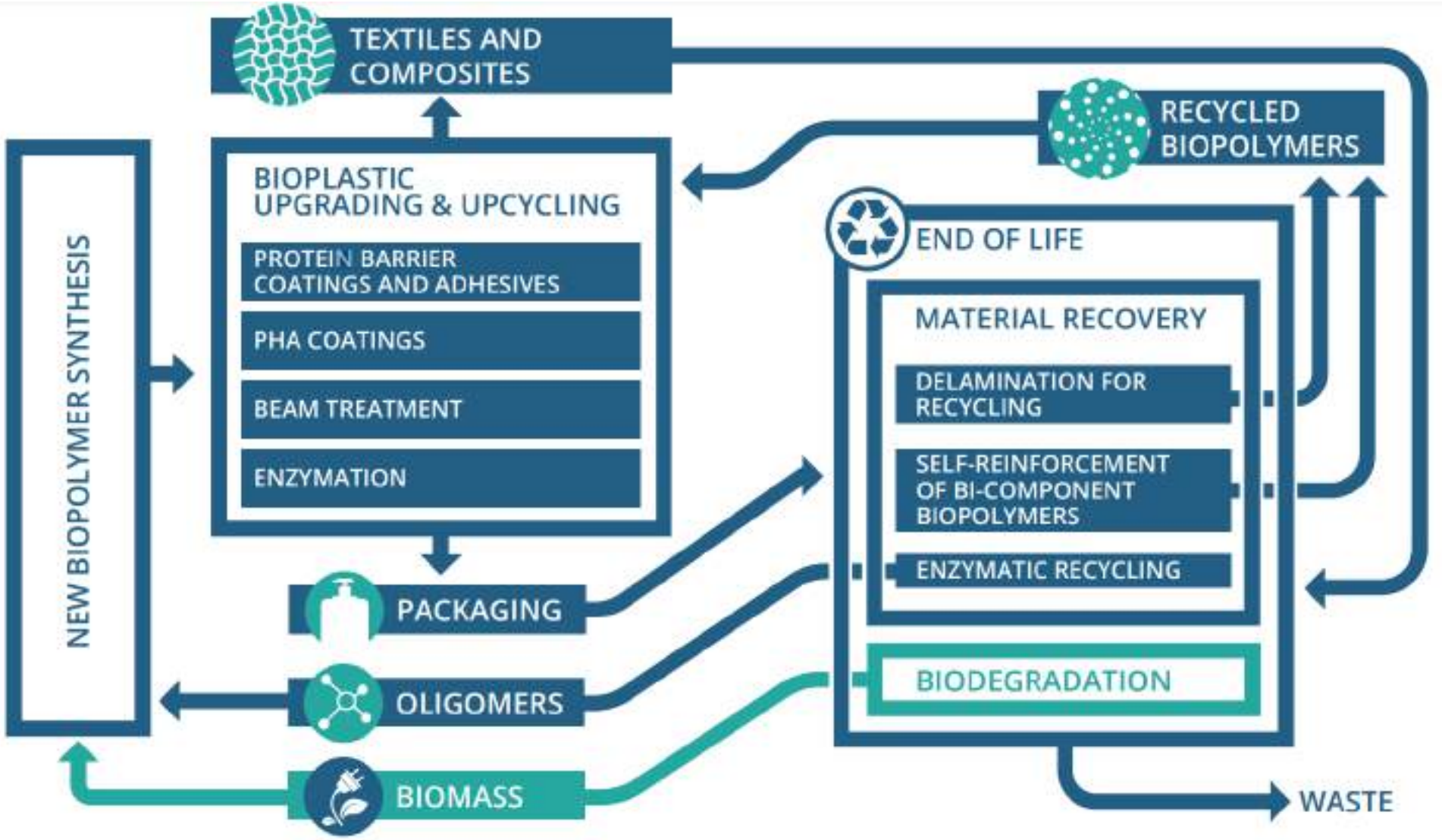
- Flowpack
- Beverage cups, bricks
- Etc.



Recycled personal care and transport packaging

- Carrier box
- Injected jar
- Etc.


UPCYCLING OF MATERIALS AND BLENDS



PARTNERS

IRIS

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Albstadt-Sigmaringen University

CENTEXBEL

Fraunhofer IVV

AIMPLAS
PLASTICS TECHNOLOGY CENTRE

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NEXT TECHNOLOGY TECNOTESSILE

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CARBIOLICE

Bostik
smart adhesives

Graphic Packaging
INTERNATIONAL
Inspired packaging. A world of difference.

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LOVE YOUR SKIN

DENIMX
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ROMEI REPLASTICS

european bioplastics

Kneia

FERRERO

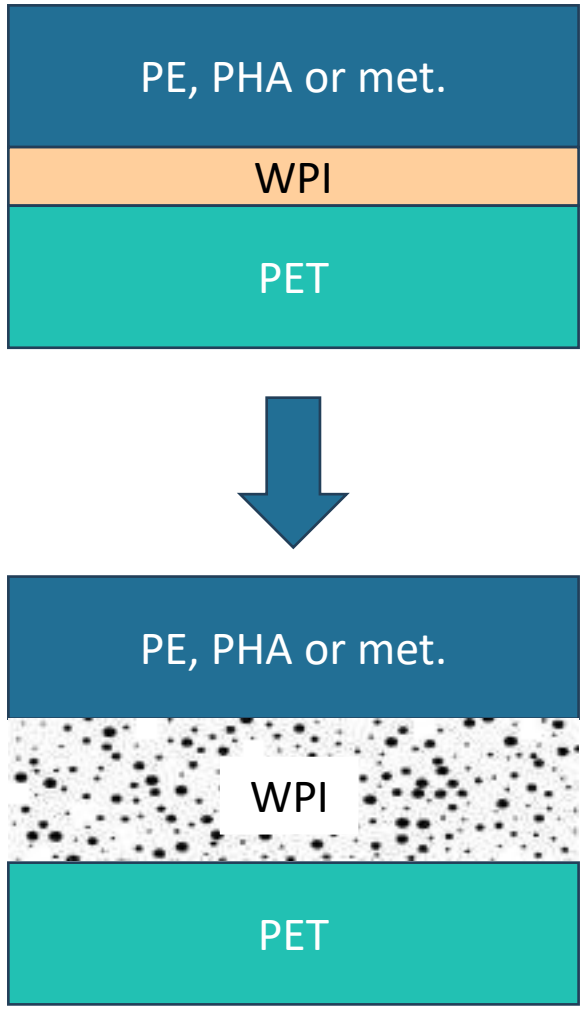
DANONE
ONE PLANET. ONE HEALTH

BIOBASED FOOD PACKAGING

- Can we switch to biobased (PLA, BIOPET) multilayers
- Can we switch to biobased (PHA) barrier coatings?
- How do we ensure recyclability?

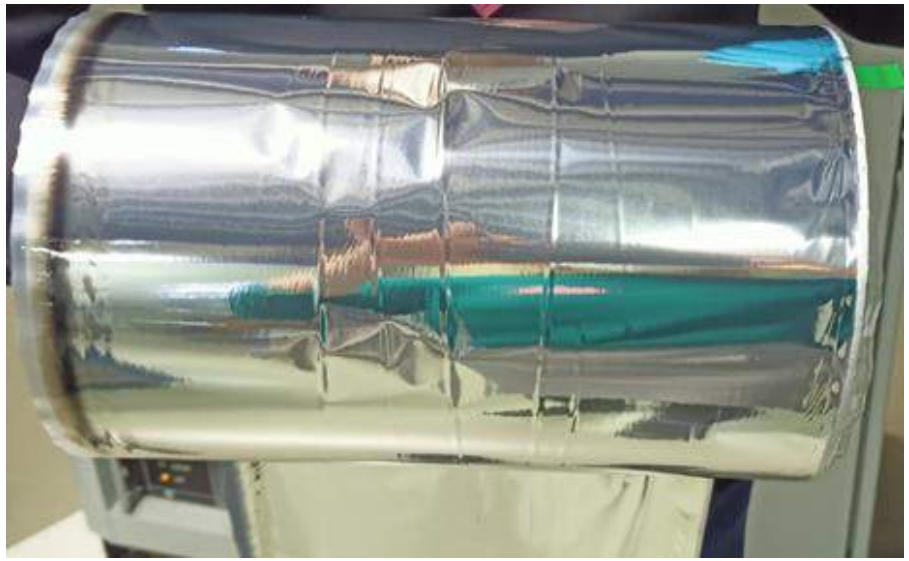
PLA, BIOPET MULTILAYERS

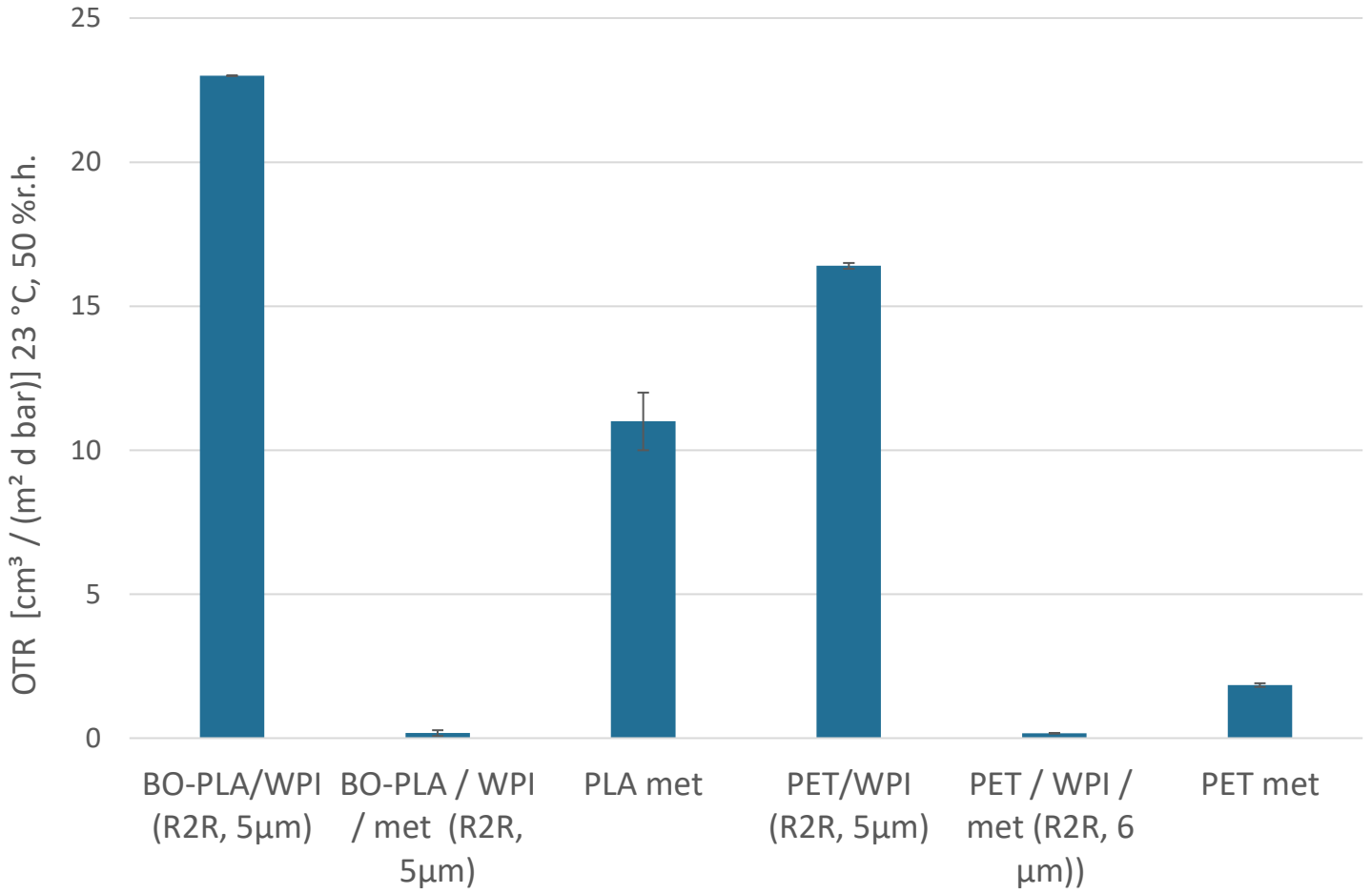
- Require separation for recycling
- Require improved OTR
- **Whey protein!**
  - By product of cheese production
  - Mostly discarded
- Bio alternative to EVOH
- Sacrificial layer allows separation



WHEY PROTEIN LAYER

- Transparent coating
- <0,2 $cm^3/m^2.d.bar$
  - BioPLA ref: 600
  - BioPET ref: 57





BIOBASED ADHESIVE

- Laminate multilayers
- Bio-PU formulations
  - Bond strength up to 3-4N/15mm (release of protein coating from its substrate)
  - Seal strength up to 20N/15mm (PE break)
- Biodegradable hotmelt adhesive
  - Bond strength improvement required

Bostik smart adhesives
Fraunhofer IVV

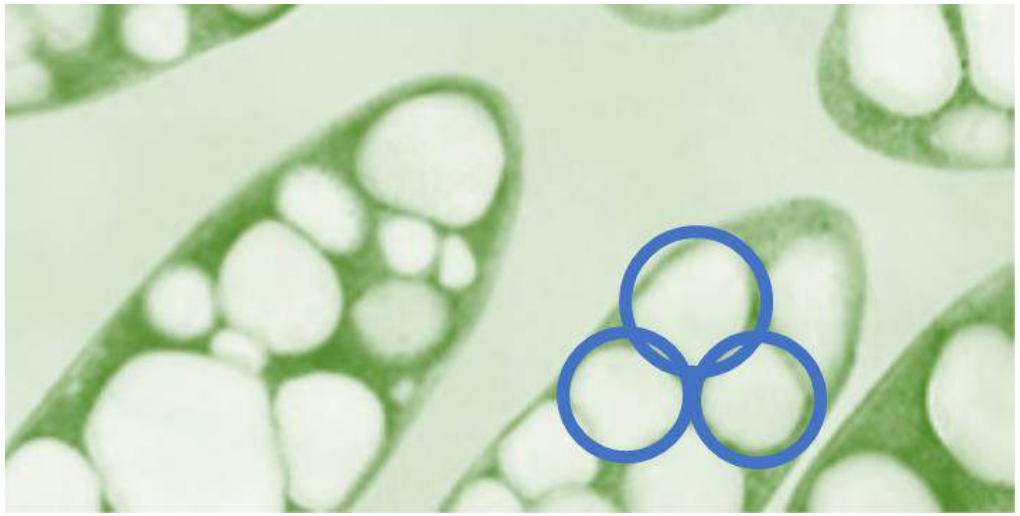
PAPER BASED MULTILAYER PACKAGING

- Can we make PE/paper packaging easier to recycle ?
- Can we switch to biobased barrier coatings for cups, bricks, trays, etc.?

PHA!

PHA : POLYHYDROXYALKANOATE

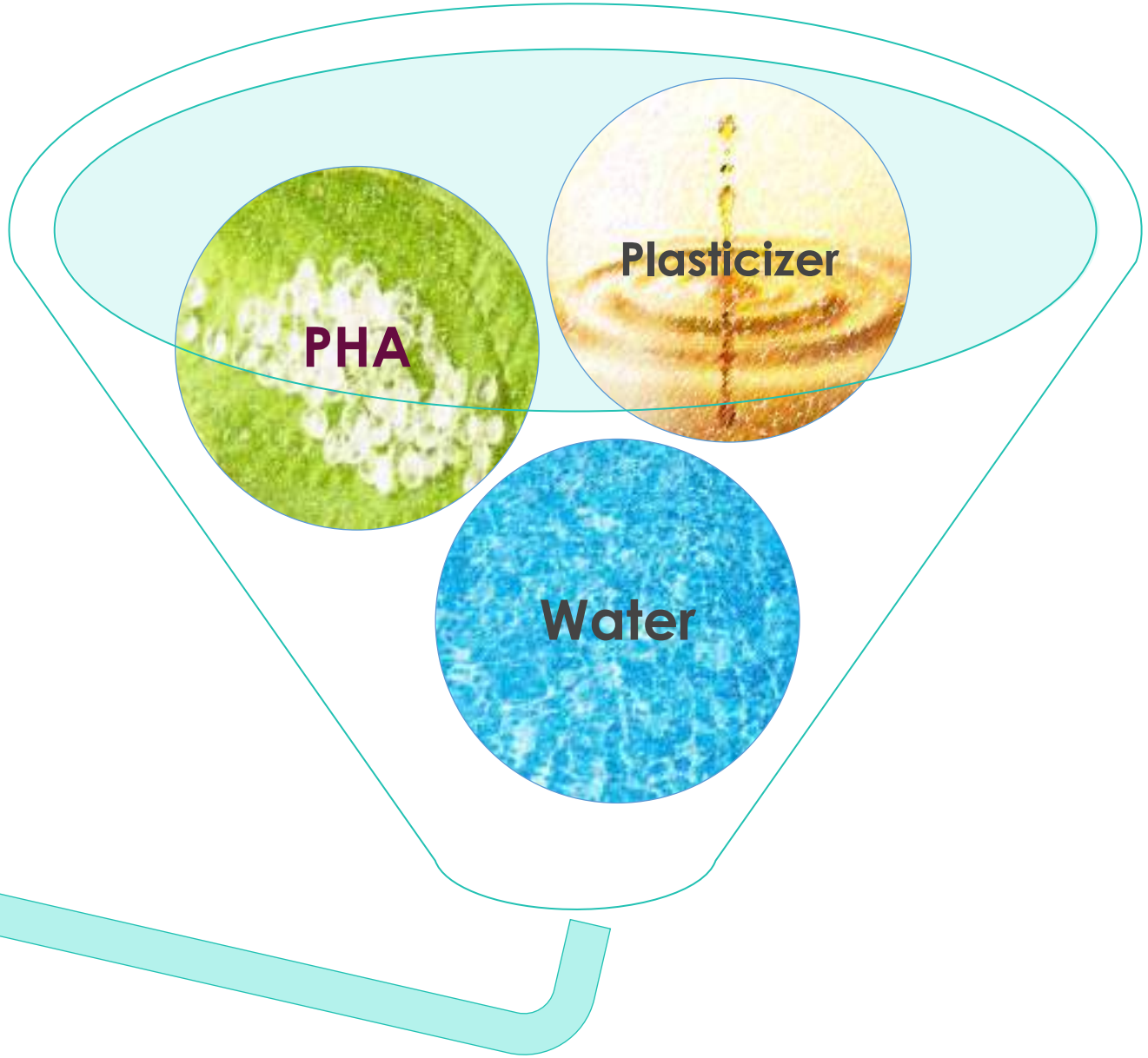
- Bacterial polymer
  - High abuncance of carbs
  - Low availability of nutrients
- Fat layer of bacteria/plants
- Thermoplastic
- Promising barrier properties



Biobased, biodegradable (home composting, marine, etc.), recycable, biocompatible

PHA COATING?

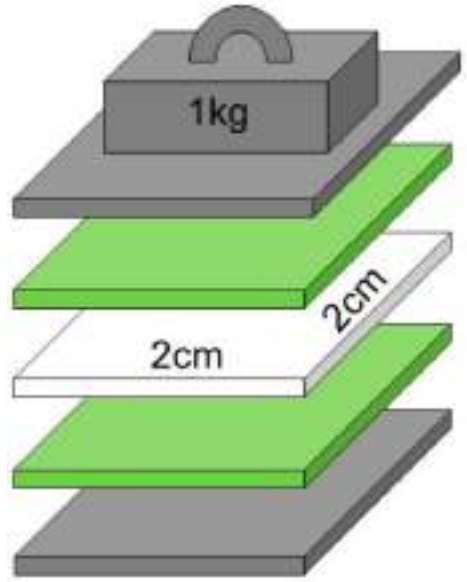
- Inspiration from PVC
- Thermoplastic powder + plasticizer
  - PHA (or PLA)

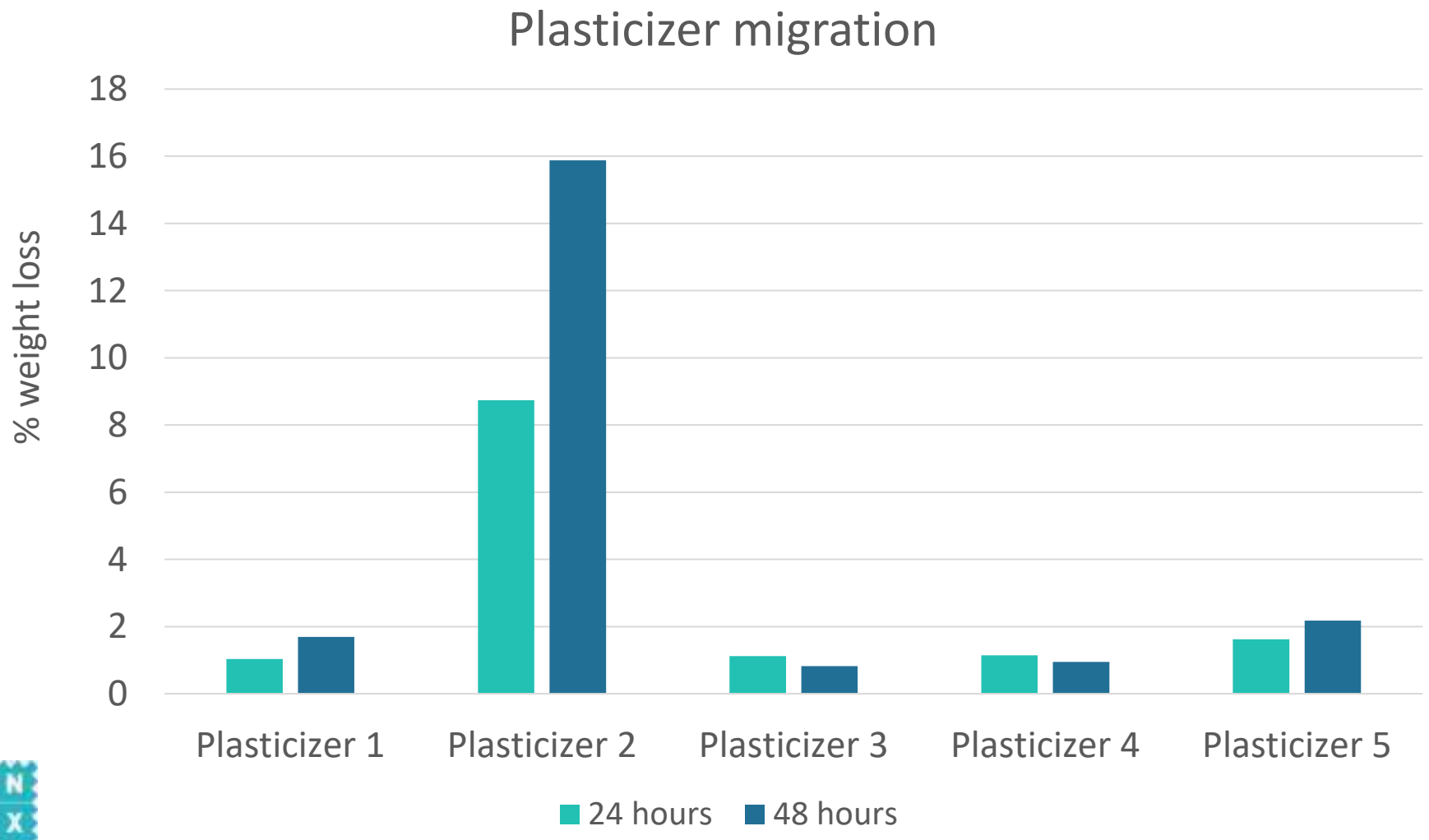


PHA COATING

- Applicable on paperboard
- Fusing 2’
- Fully food contact approved components
- PHA film fully disintegrates after 29 days

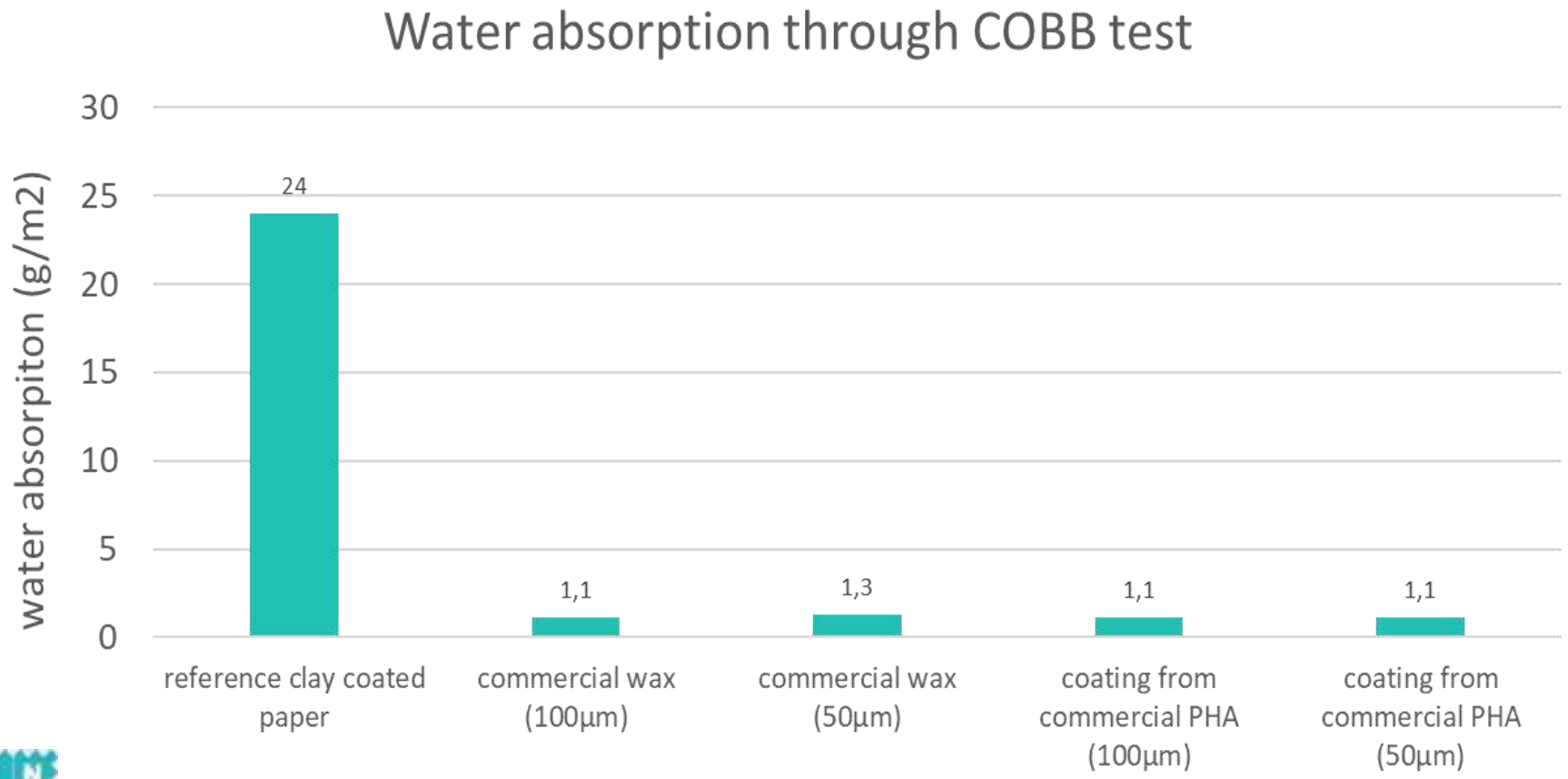
PLASTICIZER SELECTION





BARRIER PROPERTIES

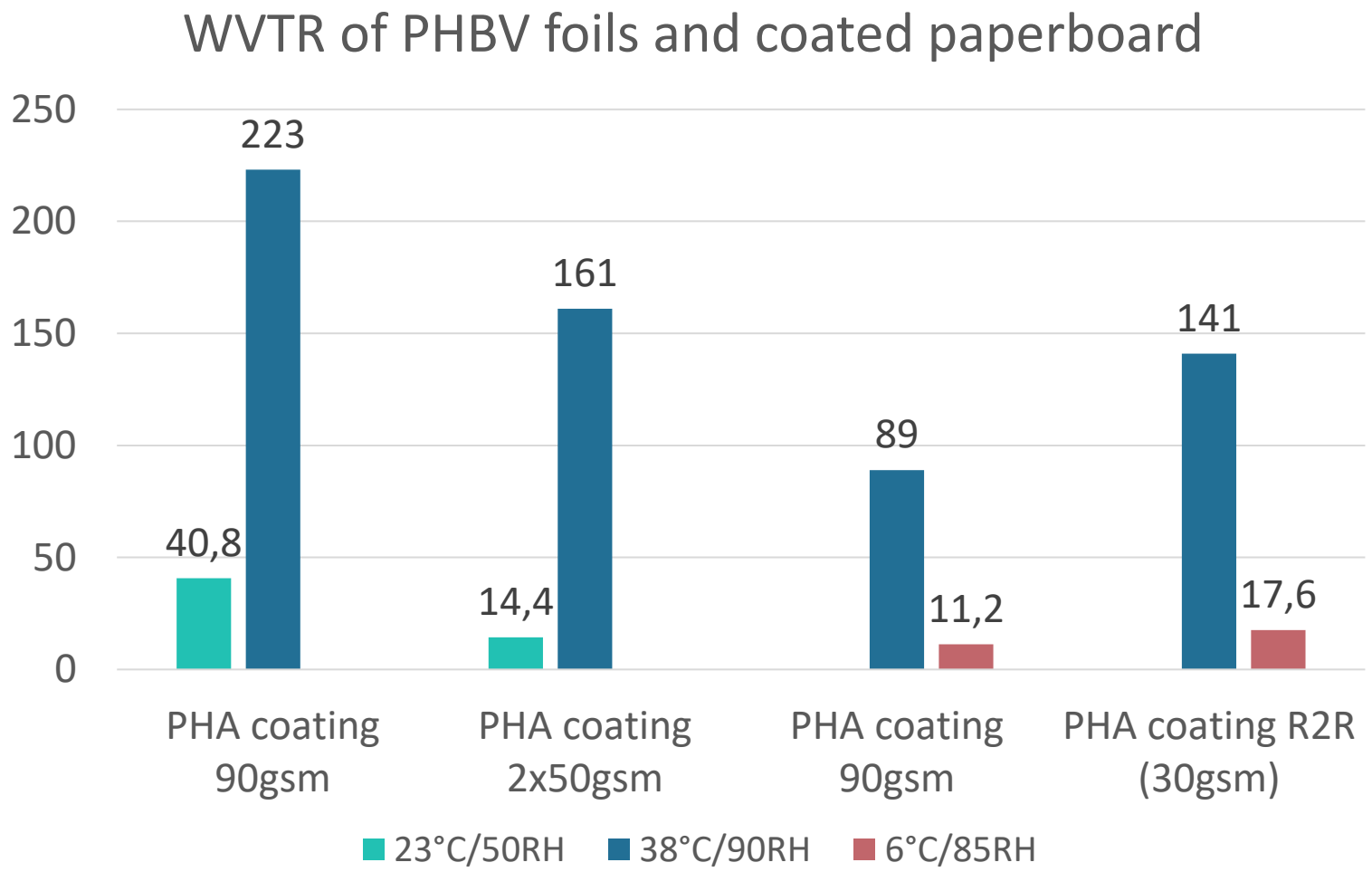
COBB test (120s)



BARRIER PROPERTIES

ASTM E96/E96M(2021)

Water vapour transmission rate



AIMPLAS PHA COATINGS

- Water and solvent based
- Applicable using flexo & gravure
- COBB value of 1 g/m² for water based
- WVTR 81 g/m².day (12µm, 38°C, 85%RH)

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AIMPLAS PHA COATINGS

- Water based formulation
- Adapted for spray application
- Moulded pulp
- Optimization ongoing

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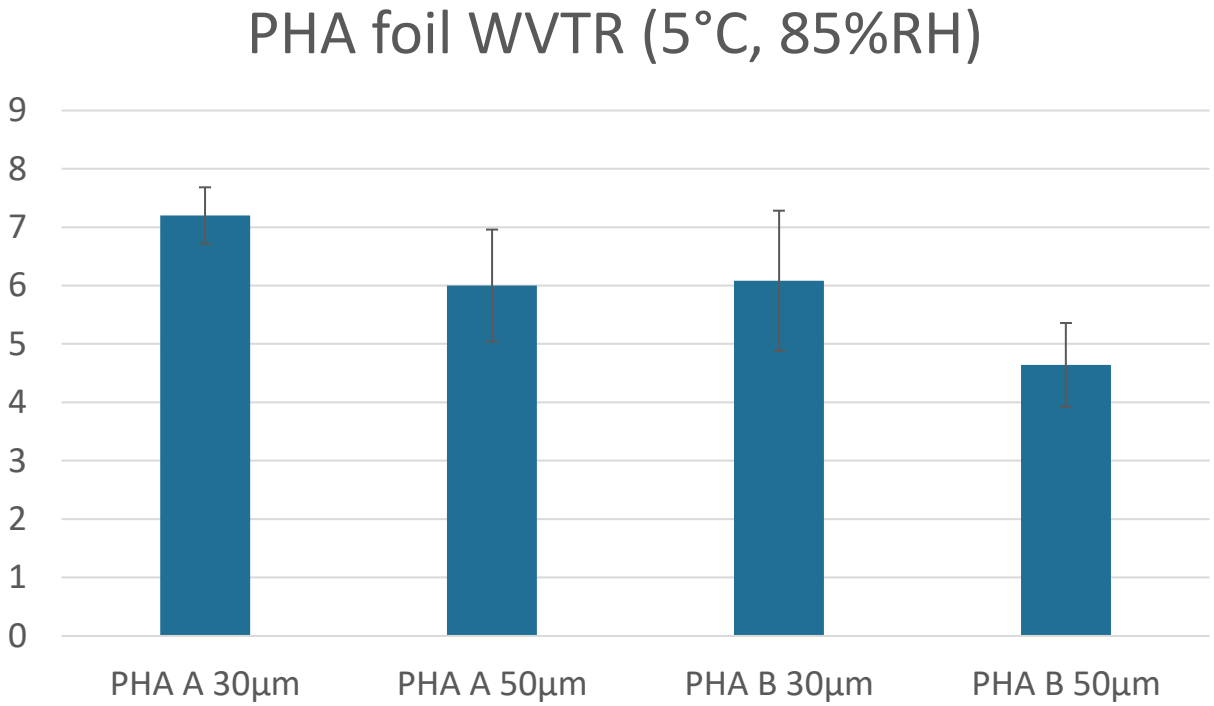
PHA EXTRUSION COATING

- Alternative to wet coating
- Extrudable on paper-based packaging



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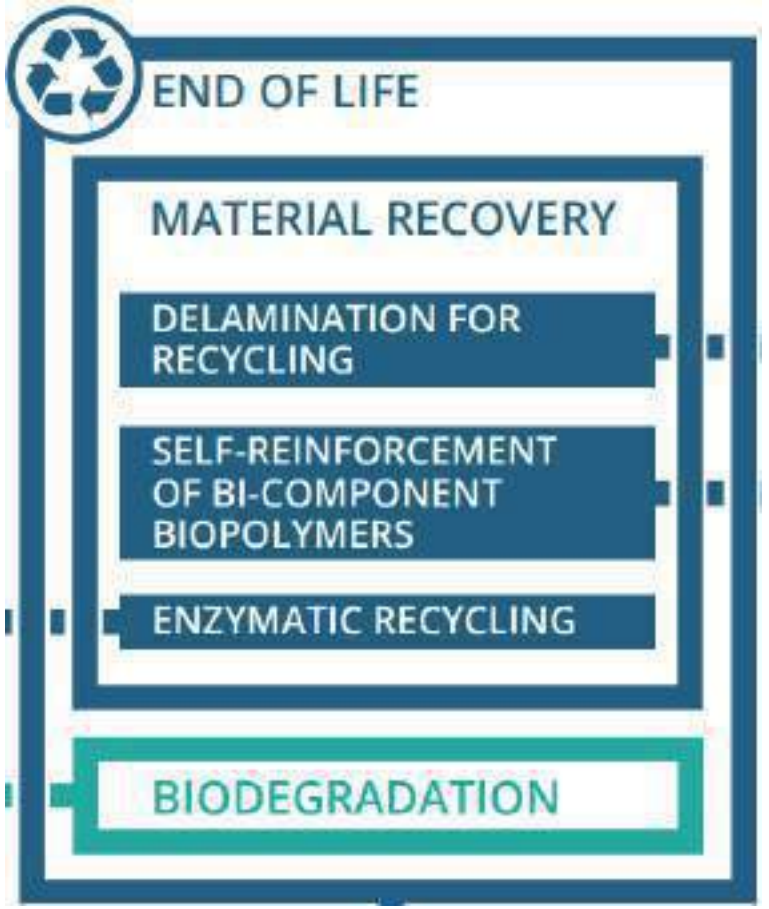
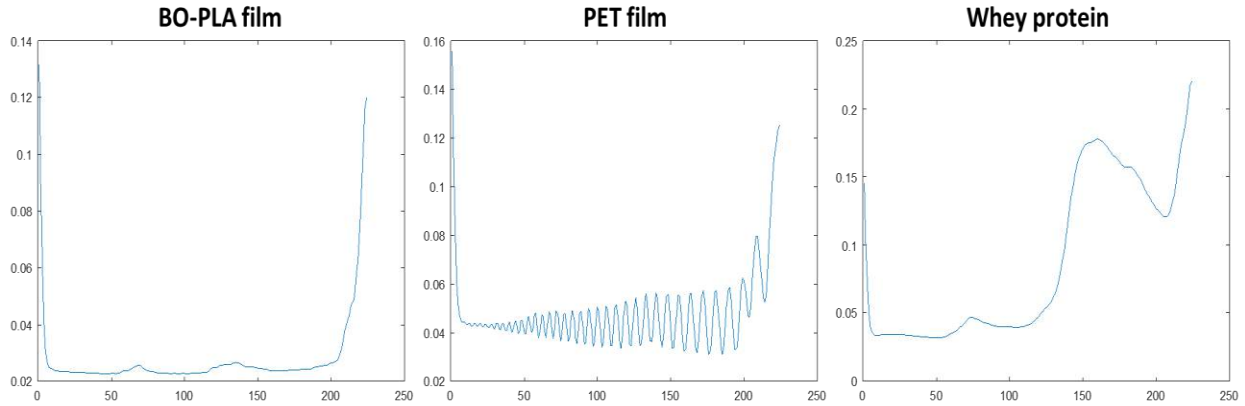
HOW TO RECYCLE?

- Optimizing layer separation
- Verifying automated sorting
- Repulpability
- Compostability
  - PLA with improved compostability
- Upcycling of materials or blends



LAYER SEPARATION & SORTING

- Use of enzymes to accelerate removal of WPI layer
- Able to remove sacrificial WPI layer in combination with:
  - PLA/PLA, optionally metalized
  - PET/PE
- Not yet for PET/met./PE
- Automated detection of material



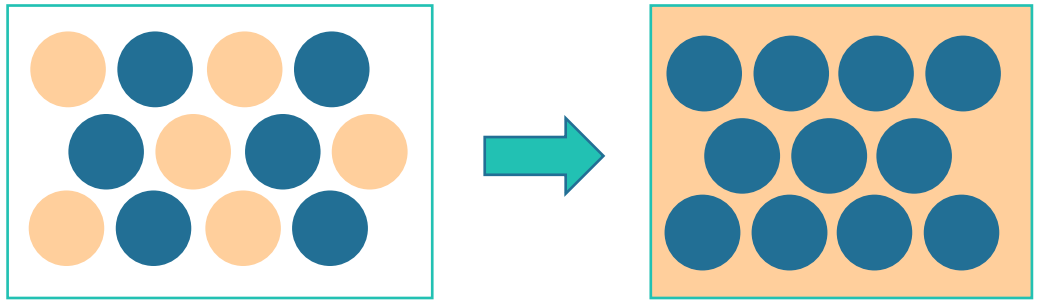
UPCYCLING

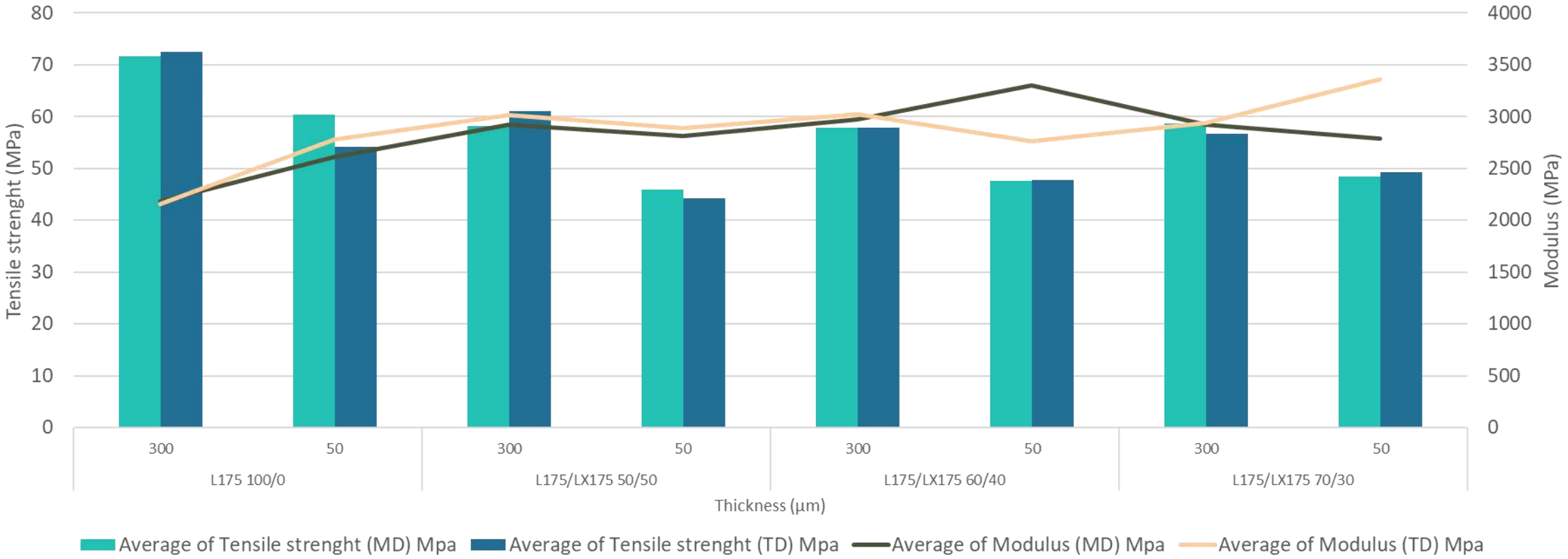
Improve properties of recycled material

- Improve recycled monomaterial
  - ➡ Self reinforcement
- Deal with mixed material streams
  - ➡ Microfibrillar reinforcement

SELF REINFORCED PLA

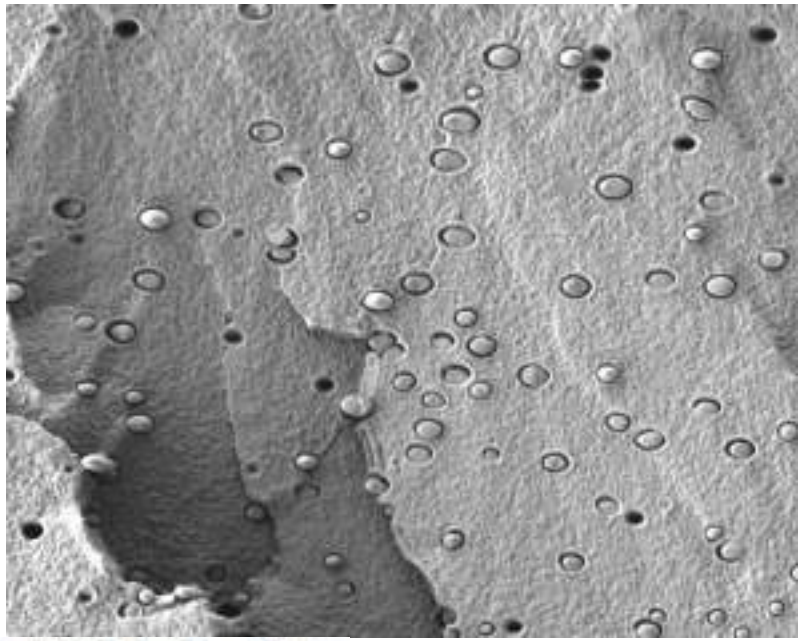
- High and low melting PLA
- up to 25% increase in modulus

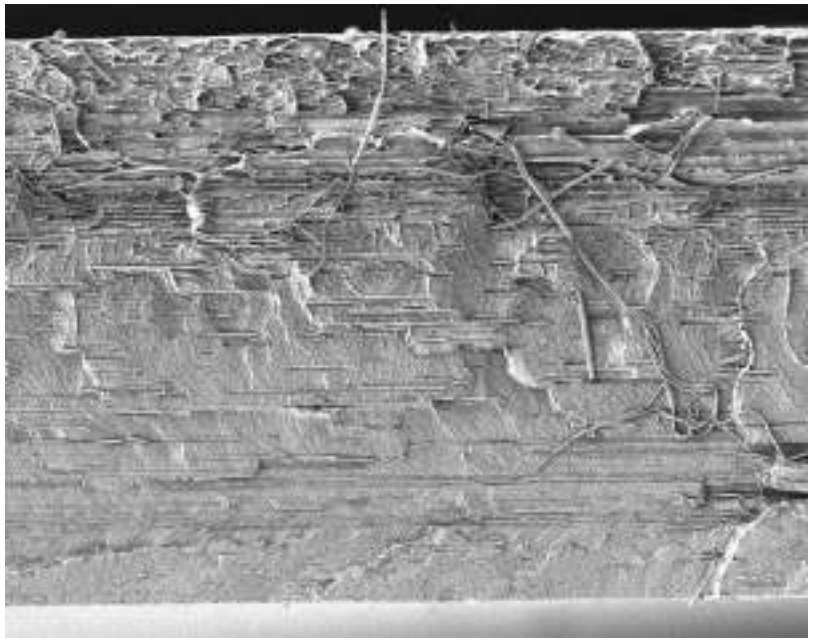




MICROFIBRILLAR REINFORCED FILM

- LDPE fortified with PA
- 10% increase in modulus
- 10% (MD) and 100% (TD) increase in tensile strength



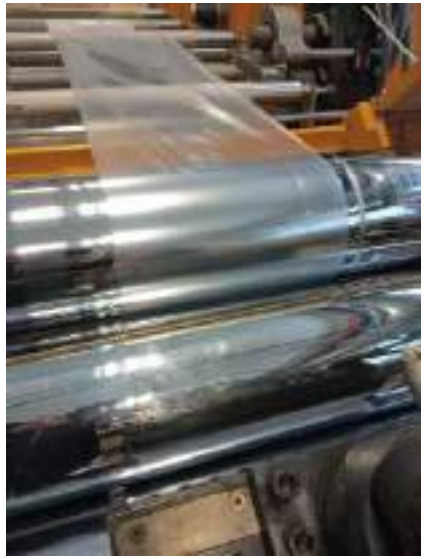


MICROFIBRILLAR REINFORCED FILM

- Stable process
- Homogeneous samples
- No defects
- Viable for dry blends and compounds

S0

S1



S2

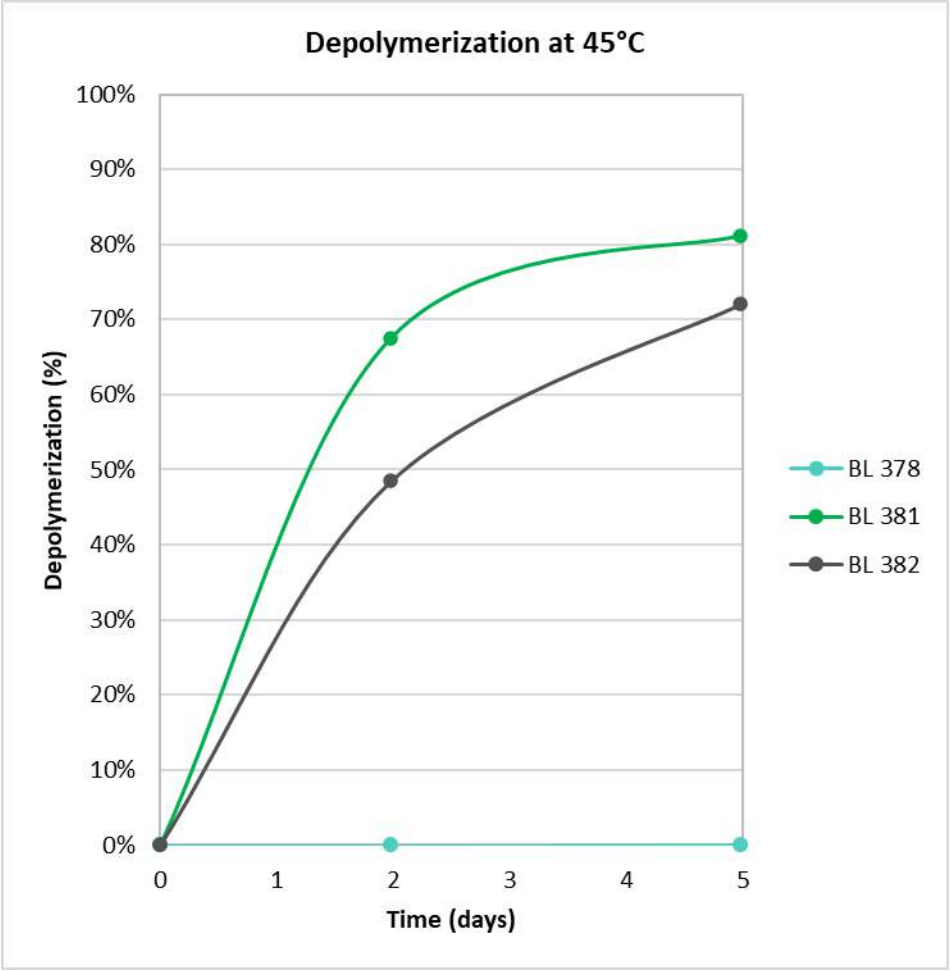
S2a

E-BEAM RADIATION

- Treatment to crosslink polymer
- OTR: reduction top to 30% at 20kGy
- WVTR: not effected by e-beam
- Colour of films not effected by irradiation ($\Delta E < 0.1$)

HOME COMPOSTABLE PLA USING ENZYMES

- Home compostability as end of life
- Addition of enzyme allows home compostability
- Enzyme activity (5% MB) assessed during depolymerisation test
- Home compostability tests ongoing



TEXTILE USE CASE

- Textile carrier box and bag
- Recycled Denim & PLA lids
  - Hybrid nonwoven
- Finish to reduce microplastic release
  - 5,6 g/m² biobased finish
  - 88% reduction

ITENE
DENIMX SMART UPCYCLING

OUTLINE

- PRESERVE and its goal
- Highlighted activities
  - Bioplastic multilayers
  - Upcycling
  - LCA
- **Take home messages**

TAKE HOME MESSAGES

- Potential for biobased multilayers
- Options for biobased design to separate & recycle
- Self-reinforced viable to improve properties
- Upscaling & LCA ongoing

Want to stay up to date with PRESERVE?

www.preserve-h2020.eu/contact

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Thank you for your attention

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