Finish coatings to reduce microplastics release from recycled textiles

PRESERVE: High performance sustainable bio-based packaging with tailored end of life and upcycled secondary use

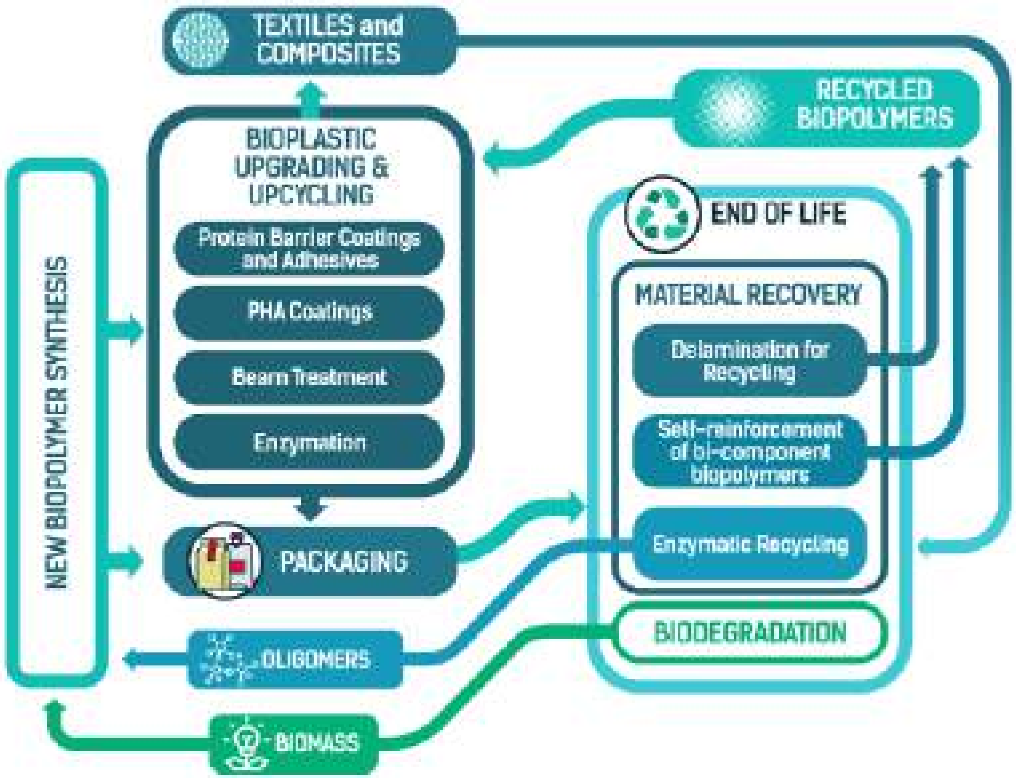
This project is funded by the Horizon 2020 Framework Programme of the European Union under Grant Agreement Number **952983**

Teresa Calvo – Project Manager (ITENE) **teresa.calvo@itene.com**

Contents

This project is funded by the Horizon 2020 Framework Programme of the European Union under Grant Agreement Number **952983**

PRESERVE EU-Project



Enhance bio-based packaging properties that currently limit the application of bioplastics

Develop upcycling technologies of plastics for food, personal care and transport packaging applications ensuring that microplastics are avoided.

Develop novel standards and certification schemes applicable to packaging materials made from recyclable and biodegradable bio-plastic.

This project is funded by the Horizon 2020 Framework Programme of the European Union under Grant Agreement Number **952983**

PRESERVE EU-Project partners

- IRIS
- ITENE Research Center
- NEXT TECHNOLOGY TECNOTESSILE
- ALMA MATER STUDIORUM UNIVERSITÀ DI BOLOGNA
- CENTEXBEL
- AIMPLAS PLASTICS TECHNOLOGY CENTRE
- Bostik smart adhesives
- Fraunhofer
- ISDIN
- CARBIOLICE
- SÜDPACK
- Graphic Packaging International
- SIBO group
- Hochschule Albstadt-Sigmaringen / Albstadt-Sigmaringen University
- OWS
- Kneia
- ROMEI REPLASTICS
- Crowdhelix
- european bioplastics
- DANONE ONE PLANET. ONE HEALTH
- FERRERO

This project is funded by the Horizon 2020 Framework Programme of the European Union under Grant Agreement Number **952983**

Contents

- PRESERVE EU-Project
- **ITENE and its role in PRESERVE**
- Finish coatings to reduce microplastics
- Scale up and validation

This project is funded by the Horizon 2020 Framework Programme of the European Union under Grant Agreement Number **952983**

ITENE and its role in PRESERVE

Packaging, Transport and Logistics Research Center

+180 professionals

+120 researchers and technicians in R&D&i

+30 professionals promoting innovation projects with companies

+60% with a master's degree or doctorate in his or her field of specialisation

This project is funded by the Horizon 2020 Framework Programme of the European Union under Grant Agreement Number **952983**

ITENE and its role in PRESERVE

RESEARCH CENTER ITENE

We generate knowledge and technology to build together a safer and more sustainable future through four main areas of work

MATERIALS AND TECHNOLOGIES FOR THE CIRCULAR ECONOMY

PACKAGING SAFETY, DESIGN AND FUNCTIONALITY

SAFETY AND ENVIRONMENTAL MONITORING TECHNOLOGIES

TRANSPORT, LOGISTICS AND MOBILITY

This project is funded by the Horizon 2020 Framework Programme of the European Union under Grant Agreement Number **952983**

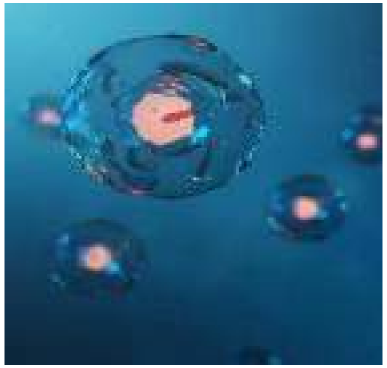
ITENE and its role in PRESERVE

FINISH COATING TO REDUCE MICROPLASTICS RELEASE

FOOD SAFETY ANALYSIS

RESEARCH CENTER ITENE

PRESERVE



SAFE BY DESIGN (SbD)

EVALUATION OF CIRCULARITY

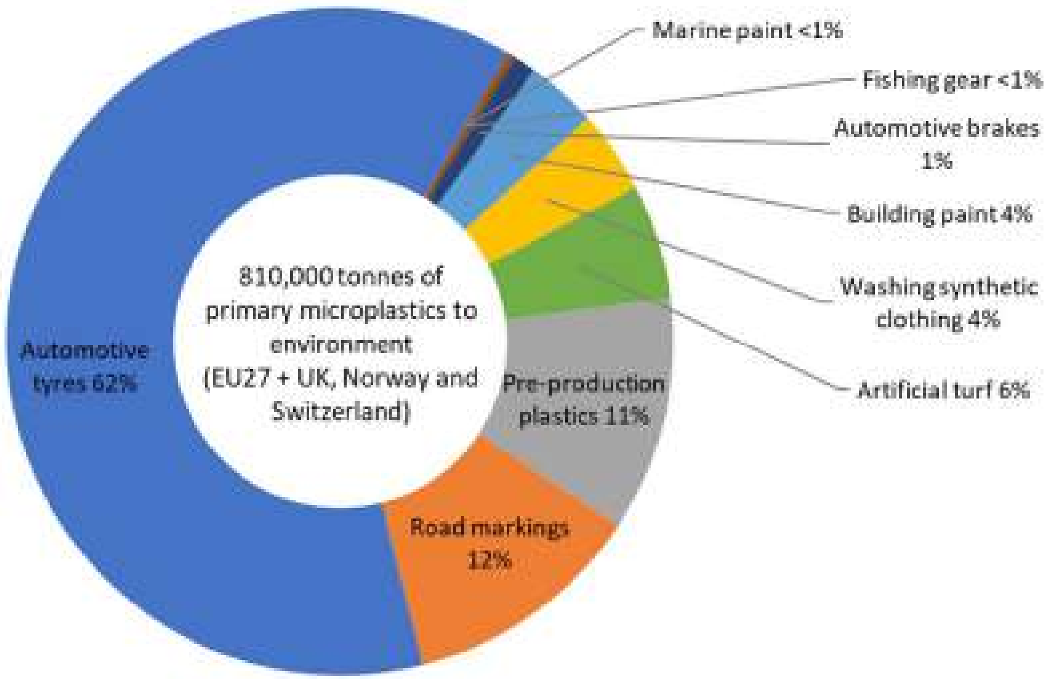
This project is funded by the Horizon 2020 Framework Programme of the European Union under Grant Agreement Number **952983**

Contents

This project is funded by the Horizon 2020 Framework Programme of the European Union under Grant Agreement Number **952983**

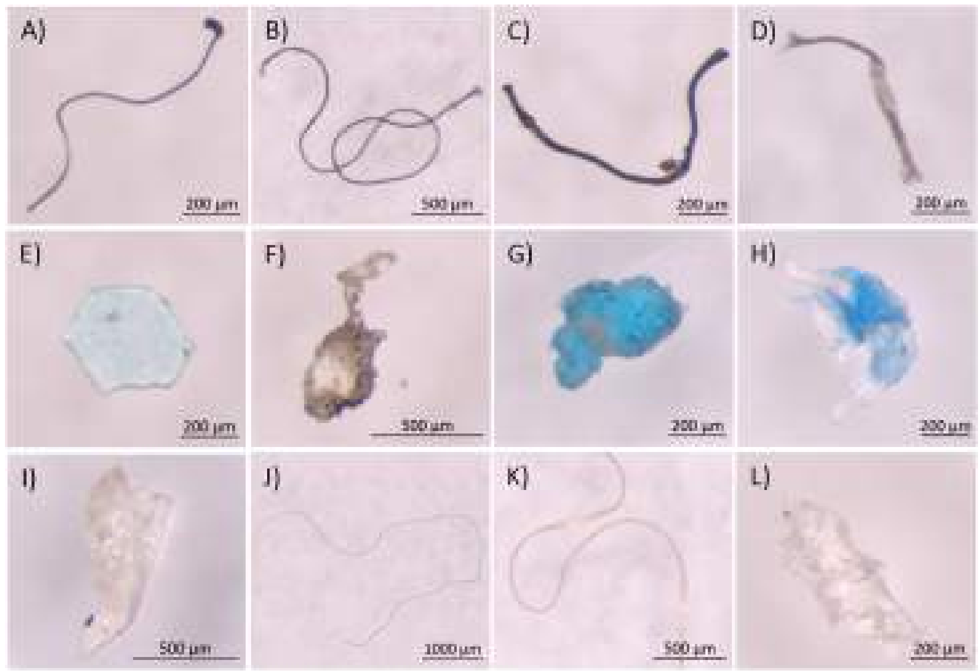
Finish coatings to reduce microplastics

The Problem



Primary microplastics emissions to water, soil and waste management (estimated yearly emissions)

Source: Source: ETC Circular economy and resource use



Typical appearance of different microplastics
(A–E) Polyester, (F–I) polyethylene, (J–K) polyamide and (L) polypropylene.

Source: Lares, M. Occurrence, identification and removal of microplastic particles and fibers in conventional activated sludge process and advanced MBR technology Water Research, 2018

This project is funded by the Horizon 2020 Framework Programme of the European Union under Grant Agreement Number **952983**

Finish coatings to reduce microplastics

PRESERVE approach

Selection of representative nonwoven substrates → **Selection of biobased formulations as finish coatings** → **Application** → **Characterization** →

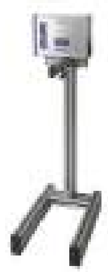
PLA
18 gsm

rPET
80 gsm
145 gsm

- PLA
- Polysaccharides
- Biobased PU

...

Baker, wire bar applicator



Dip coating

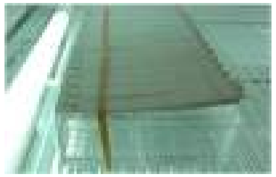
Abrasion resistance

Coating fastness
UNE-EN ISO 105-C06:201

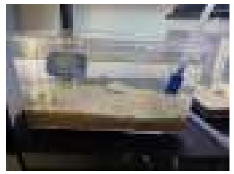
Fibre release – linting test

CENTEXBEL

Ecotoxicology
in vitro tests



Mesocosm

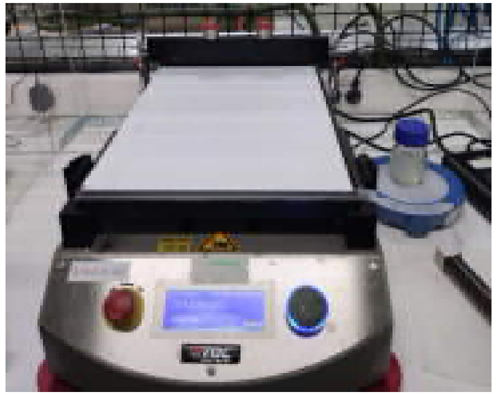


This project is funded by the Horizon 2020 Framework Programme of the European Union under Grant Agreement Number **952983**

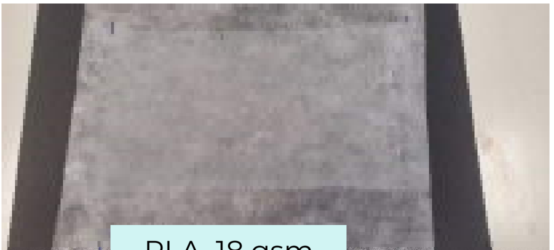
Finish coatings to reduce microplastics

Selection and application of finish coatings

SUBSTRATE	FINISH COATING	SOLID CONTENT(%)	VISCOSITY (s) Ford cup 4	DRY WEIGHT (g/m2)
PLA 18 gsm	PLA-based	4-5%	13.42	3.50 ± 0.25
PLA 18 gsm	Polysaccharide-based	1-1.5%	49.72	2.83 ± 0.15
rPET 80 gsm	PLA-based	4-5%	13.42	11.58 ± 0.87
rPET 80 gsm	Polysaccharide-based	1-1.5%	49.72	5.67 ± 0.46
rPET 145 gsm	PLA-based	4-5%	13.42	7.53 ± 0.59
rPET 145 gsm	Polysaccharide-based	1-1.5%	49.72	5.33 ± 0.40



PLA-based finish coating



PLA 18 gsm

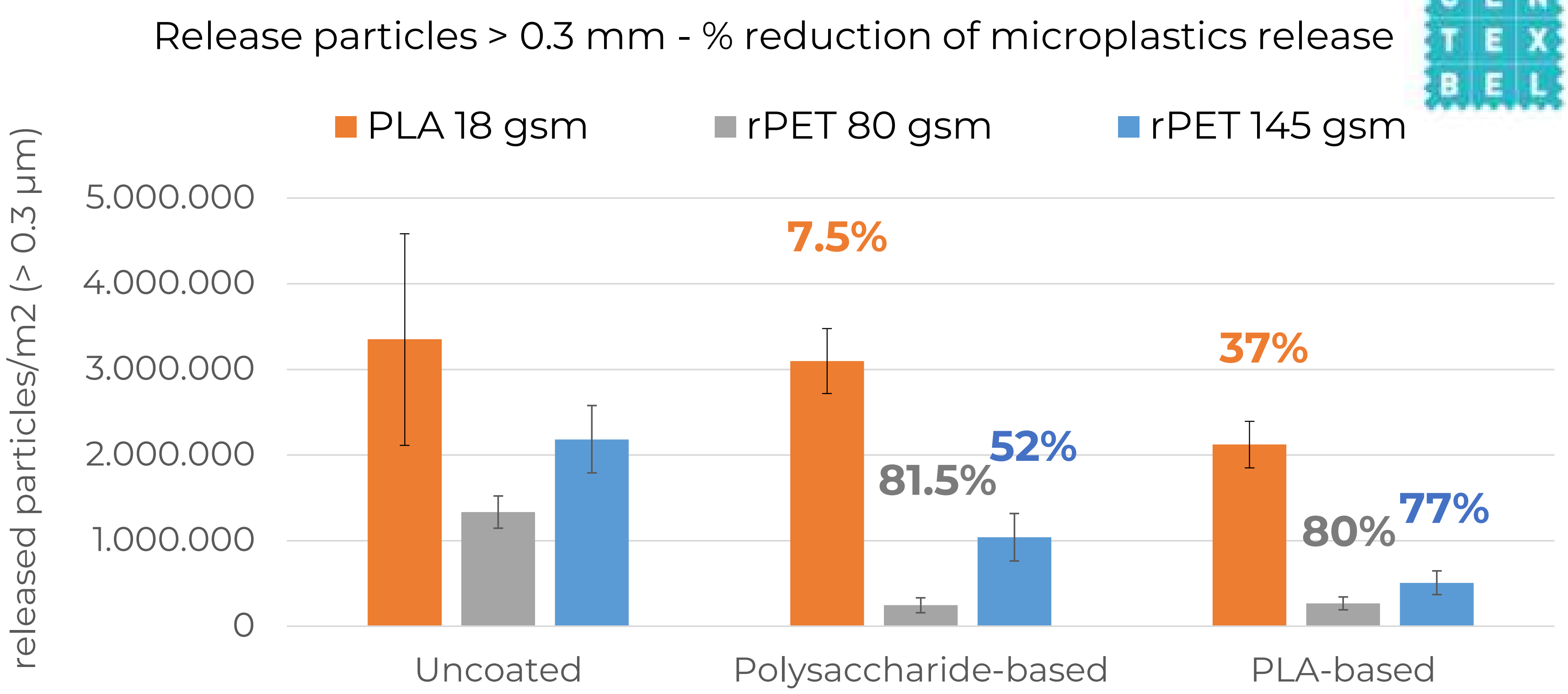
rPET 80 gsm

rPET 145 gsm

This project is funded by the Horizon 2020 Framework Programme of the European Union under Grant Agreement Number **952983**

Finish coatings to reduce microplastics

Characterization of finish coatings – Linting test



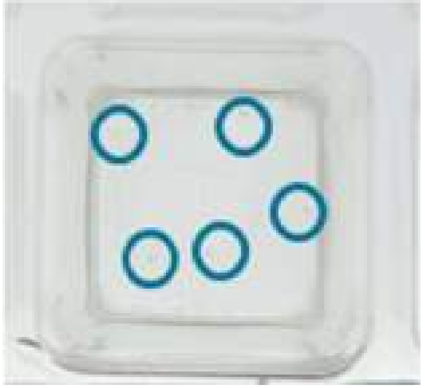
✓ All coatings passed abrasion resistance and colour fastness tests

This project is funded by the Horizon 2020 Framework Programme of the European Union under Grant Agreement Number **952983**

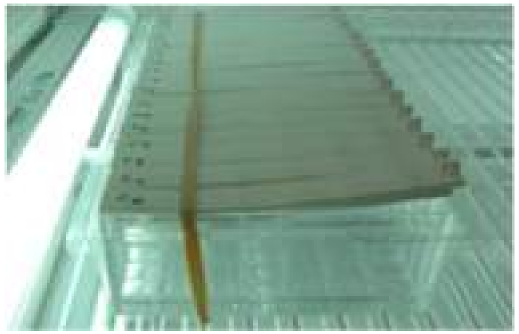
Finish coatings to reduce microplastics

Characterization of finish coatings – Ecotoxicology

SUBSTRATE	FINISH COATING	DAPHNIA IN VITRO TEST	ALGAE IN VITRO TEST	MESOCOSM
PLA 18 gsm	PLA-based	Non-Toxic	Non-Toxic	Non-Toxic
PLA 18 gsm	Polysaccharide-based	Non-Toxic	Non-Toxic	Non-Toxic
rPET 80 gsm	PLA-based	Non-Toxic	Non-Toxic	Non-Toxic
rPET 80 gsm	Polysaccharide-based	Non-Toxic	Non-Toxic	Non-Toxic
rPET 145 gsm	PLA-based	Non-Toxic	Non-Toxic	Non-Toxic
rPET 145 gsm	Polysaccharide-based	Toxic	Non-Toxic	Non-prioritized



In vitro test with Daphnia



In vitro test with *Algae*

Mesocosm test

This project is funded by the Horizon 2020 Framework Programme of the European Union under Grant Agreement Number **952983**

Contents

- PRESERVE EU-Project
- ITENE and its role in PRESERVE
- Finish coatings to reduce microplastics
- **Scale up and validation**

This project is funded by the Horizon 2020 Framework Programme of the European Union under Grant Agreement Number **952983**

Scale up and validation

Selection of coatings after lab scale development

SUBSTRATE	FINISH COATING	DRY WEIGHT (g/m2)	% REDUCTION OF MICROPLASTICS RELEASE	DAPHNIA IN VITRO TEST	ALGAE IN VITRO TEST	MESOCOSM
PLA 18 gsm	PLA-based	3.50 ± 0.25	37%	Non-Toxic	Non-Toxic	Non-Toxic
PLA 18 gsm	Polysaccharide-based	2.83 ± 0.15	7.5%	Non-Toxic	Non-Toxic	Non-Toxic
rPET 80 gsm	PLA-based	11.58 ± 0.87	80%	Non-Toxic	Non-Toxic	Non-Toxic
rPET 80 gsm	Polysaccharide-based	5.67 ± 0.46	81.5%	Non-Toxic	Non-Toxic	Non-Toxic
rPET 145 gsm	PLA-based	7.53 ± 0.59	77%	Non-Toxic	Non-Toxic	Non-Toxic
rPET 145 gsm	Polysaccharide-based	5.33 ± 0.40	52%	Toxic	Non-Toxic	Non-prioritized

This project is funded by the Horizon 2020 Framework Programme of the European Union under Grant Agreement Number **952983**

Scale up and validation

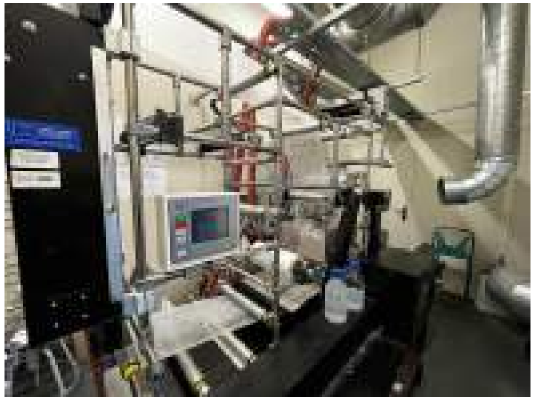
rPET 145 gsm - PLA-based finish coating

All coatings passed abrasion resistance and colour fastness tests
(*) %Microplastics release reduction - Particles >0,3 µm (#/m2)

SCALE	SUBSTRATE	FINISH COATING	DRY WEIGHT (G/M2)	% REDUCTION OF MICROPLASTICS RELEASE (*)	DAPHNIA IN VITRO TEST	ALGAE IN VITRO TEST	MESOCOSM
LAB	rPET 145 gsm	PLA-based	7.53	77%	Non-Toxic	Non-Toxic	Non-Toxic
PILOT	rPET 145 gsm	PLA-based	5.60	88%	Non-Toxic	Non-Toxic	Non-Toxic

- Viscosity Ford cup n°4: 14
- Gravure application:
  - ✓ Anilox: 59 LCM (19 cm^3/m^2).
  - ✓ Drying temperature: 1st oven 60°C - 2nd oven 30°C.
  - ✓ Speed: ≈ 8 m/min.





This project is funded by the Horizon 2020 Framework Programme of the European Union under Grant Agreement Number **952983**

Scale up and validation

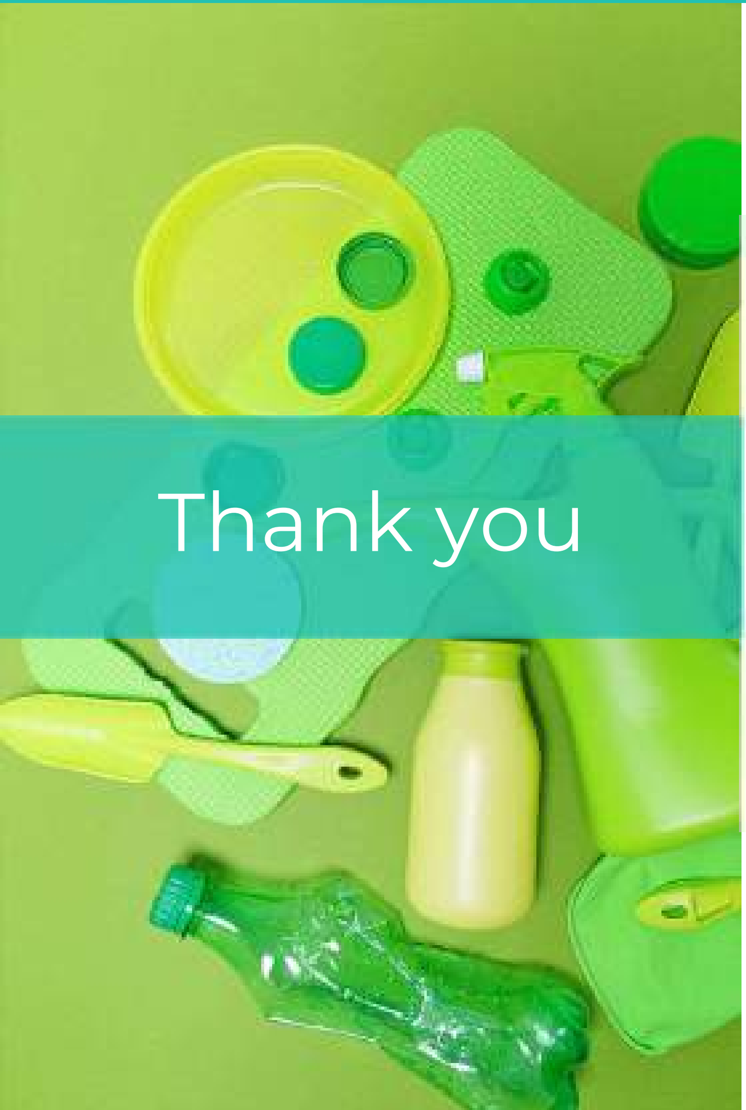
Upcoming tasks: PLA-based finish coating – rPLA shopping bag validation

Nonwoven based on r-PLA from PRESERVE activities

Non-woven shopping bag target demonstrator

Application and characterization of coated shopping bag

This project is funded by the Horizon 2020 Framework Programme of the European Union under Grant Agreement Number **952983**



Thank you

IRIS
Hochschule Albstadt-Sigmaringen
Albstadt-Sigmaringen University
CENTEXBEL
Fraunhofer
AIMPLAS
PLASTICS TECHNOLOGY CENTRE
ITENE
NEXT TECHNOLOGY TECNOTESSILE
ALMA MATER STUDIORUM UNIVERSITÀ DI BOLOGNA
ISDIN
PLANET BIOPLASTICS srl
Bostik
smart adhesives
CARBIOLICE
SÜDPACK
Graphic Packaging
INTERNATIONAL
SIBO
group
OWS
ROMEI REPLASTICS
DENIMX
SMART UPCYCLING
Kneia
Crowdhelix
european bioplastics
DANONE
ONE PLANET. ONE HEALTH
FERRERO

This project is funded by the Horizon 2020 Framework Programme of the European Union under Grant Agreement Number **952983**

teresa.calvo@itene.com