in-built Triggered Enzymes to Recycle Multi-layers: an Innovation for Uses in plastic-packaging

Urban Packaging Waste

Haroutioun Askanian
Clermont Auvergne INP
Haroutioun.askanian@sigma-clermont.fr

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Grant agreement: 814400

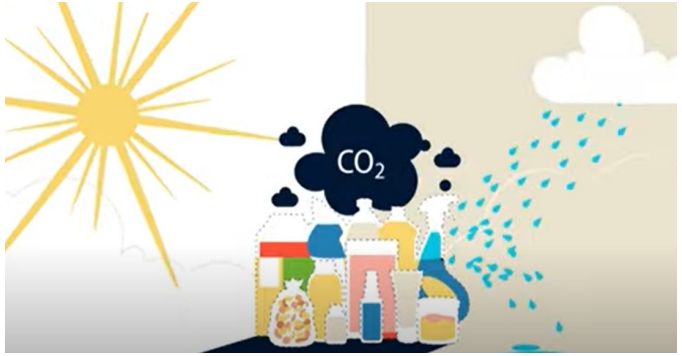
Background

From linear to circular economy

Multi-layer packaging

- **Widely used due to many properties**
- **Used for packaging of food, beverages, cosmetics, pet food, etc.**
- **Extend lifetime of goods, helping reduce food waste**

- **Due to complex structures, these materials are unrecyclable**
- **Most of plastic multi-layer packaging is incinerated or landfilled**



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14 partners : 5, 74 M€
Duration : 01/01/2019 – 31/01/2023 ➔ 31/07/2023

Objective of the project

TEMINUS addresses the challenge of unlocking recycling and reuse of flexible multi-layer and multi-compound packaging

- Range of smart enzyme-containing adhesive or tie layer polymers
- Intrinsic self-biodegradation properties
- On-demand controlled biodegradation of adhesives and tie-layers
- **Enable separation of different layers of packaging, which can then be recycled after having been collected and sorted**

Background

From linear to circular economy

Outside
BOPET/BOPA (10-15µm)
Adhesive (2µm)
LDPE (40 – 70µm)
Inside
Example 1
Adhesive lamination

Cooked foods, cheese, meat, aquatic products, pet food

Outside
OPET (10-15µm)
Adhesive (2µm)
Alu (6-9µm)
Adhesive (2µm)
LDPE (40 – 70µm)
Inside
Example 2
Adhesive lamination

Coffee, peanuts, cosmetics sachets, cosmetic tubes, pet food

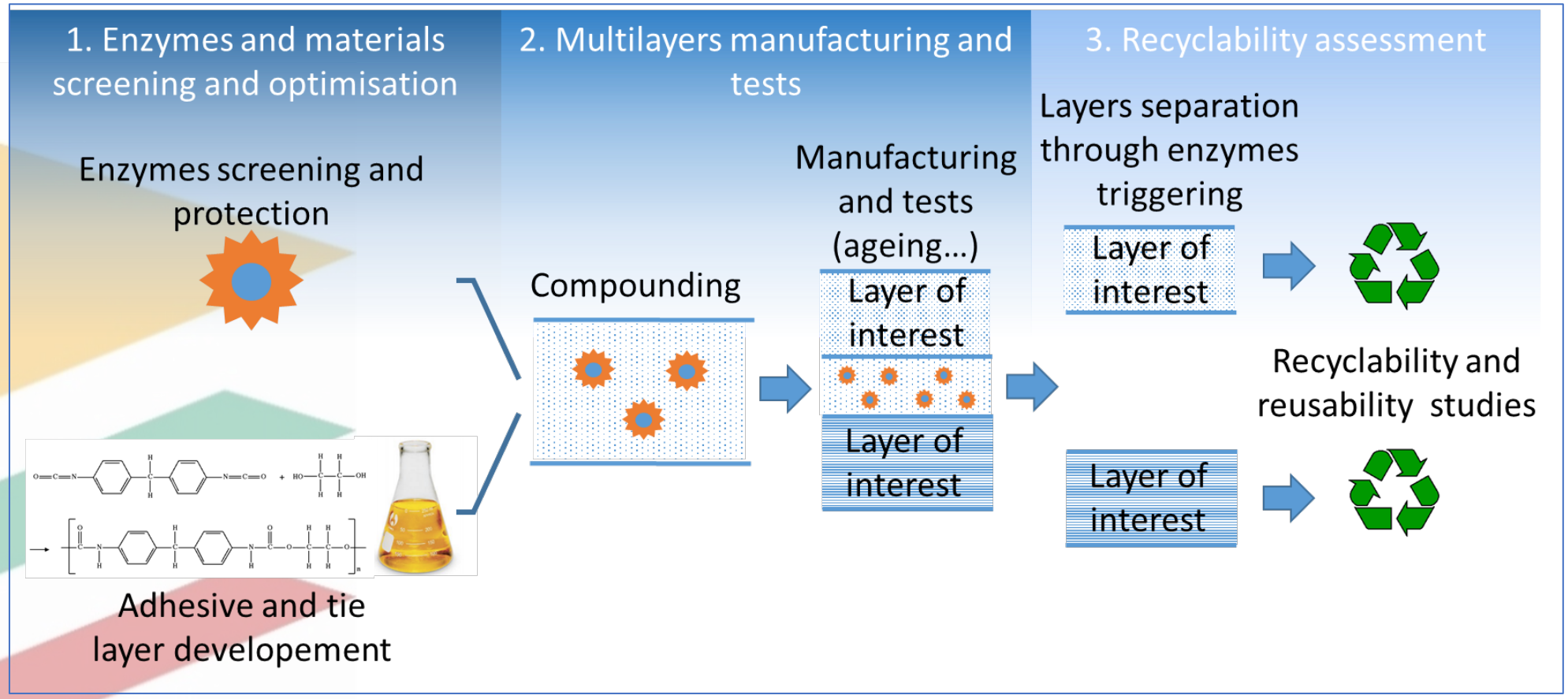
Outside
HDPE (20µm)
Tie layer (2µm)
EVOH (6-8µm)
Tie layer (2µm)
LDPE (20µm)
Inside
Example 3
Blown coextrusion

Film for vacuum packaging of fresh meat, thermoformed trays, MAP trays, cosmetic tubes, stand up pouch

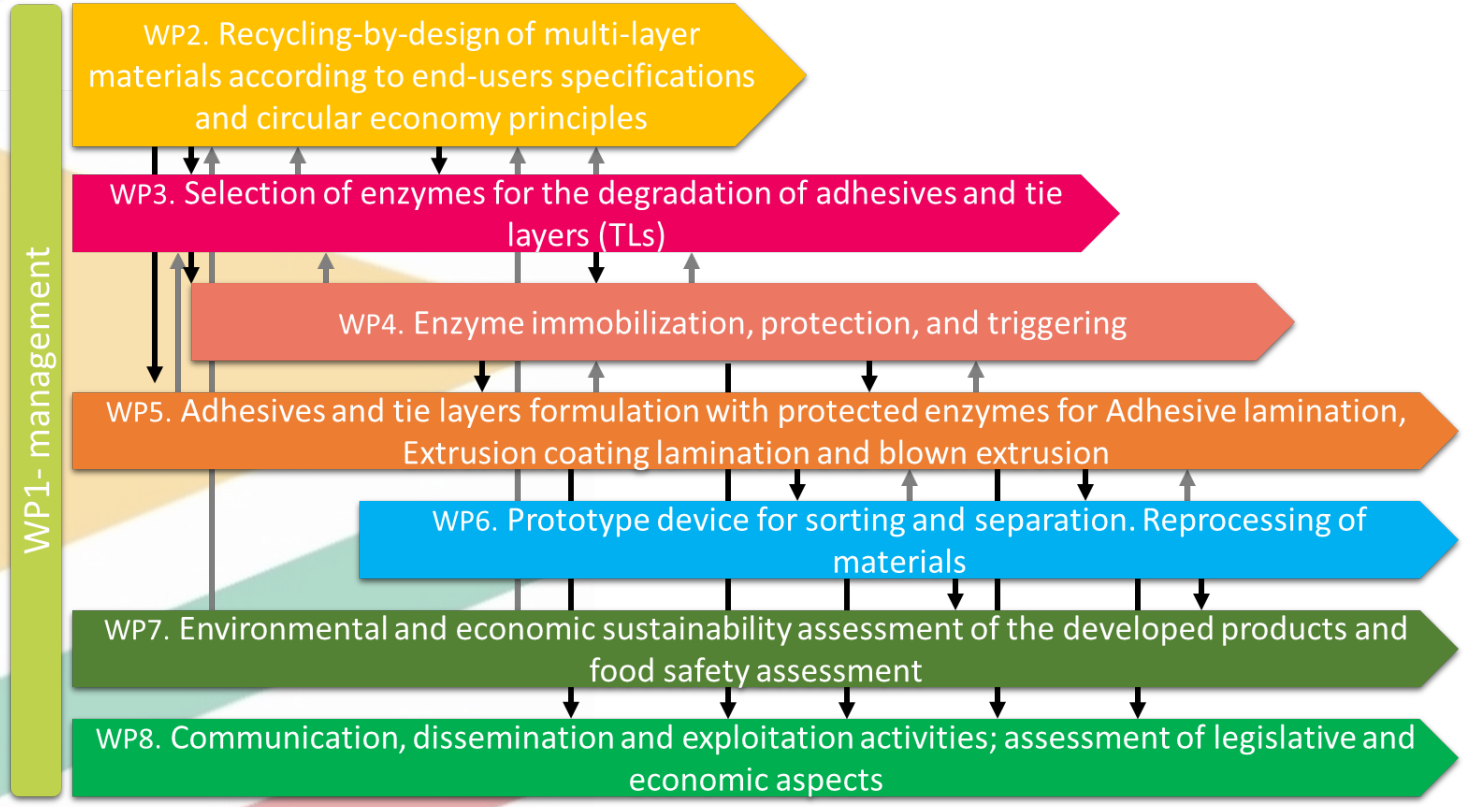
Outside
BOPET (15µm)
Adhesive (2µm)
LDPE (40µm)
Inside
Example 4
Extrusion coating lamination

Cooked foods, cheese, fish/meat, aquatic products

Description of the project



Organization of the project

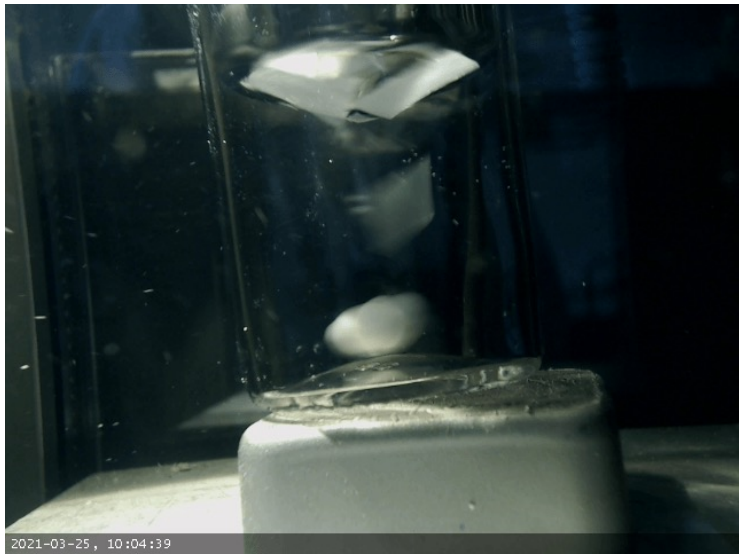


- Enzyme selection
- Improvement of enzyme thermal stability
- Demonstration of triggering
- Circular metrics / Initial LCA / Food contact
- Dissemination
  - Open research Data
  - Zenodo Terminus community https://zenodo.org/communities/terminus-h2020
  - Web : https://www.terminus-h2020.eu/
  - Social media

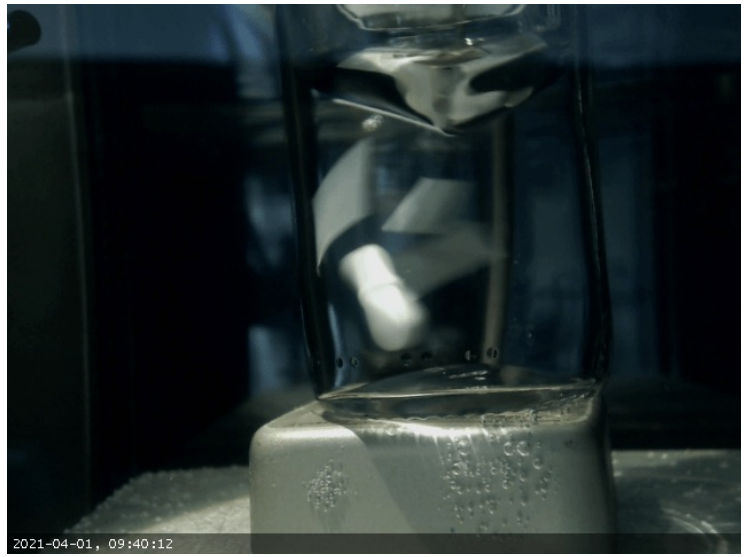
Demonstration

E-TL

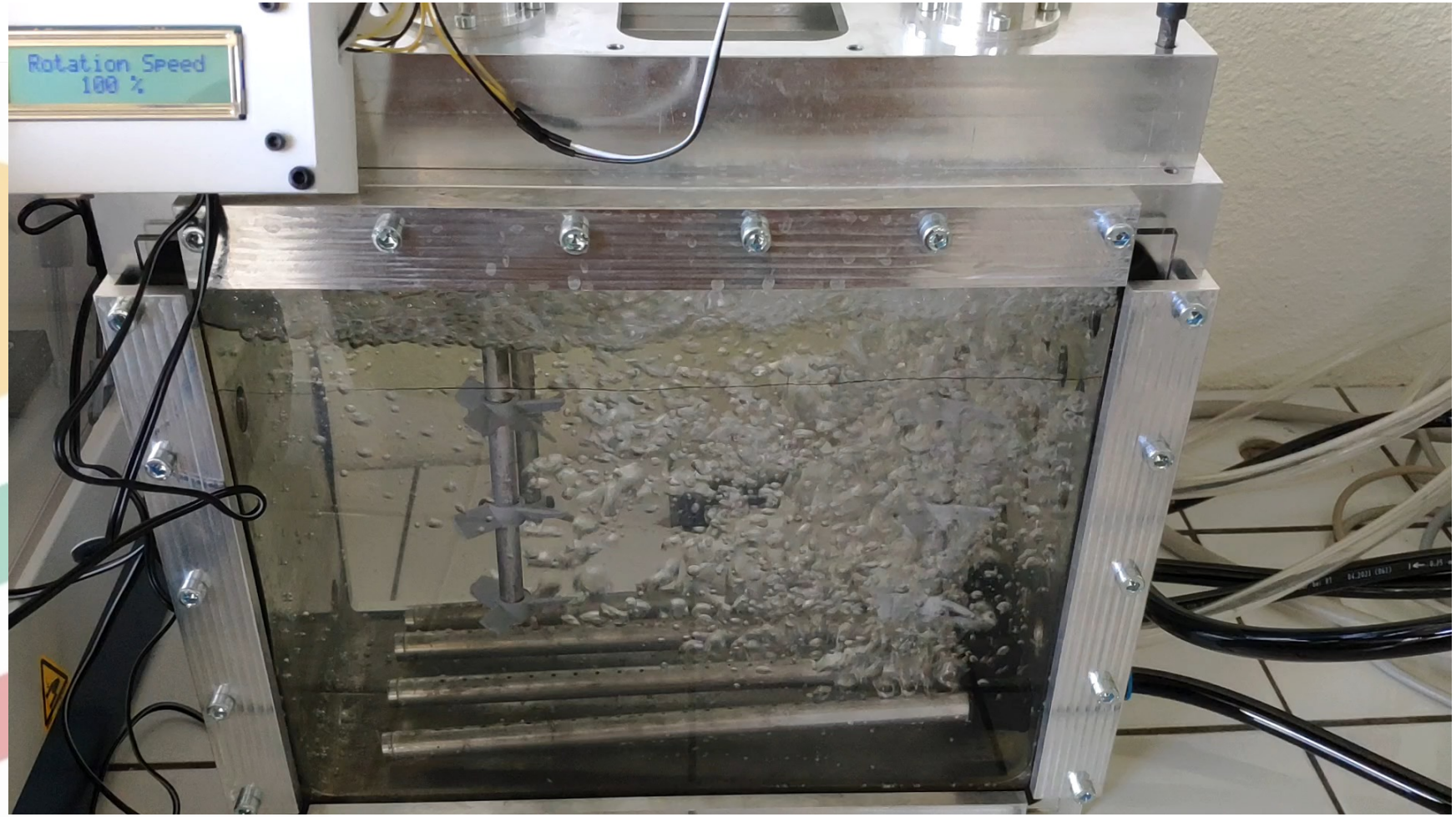
Layer1/*TL*/Layer2



PE/*TL*/PE



Design and elaboration the prototype device



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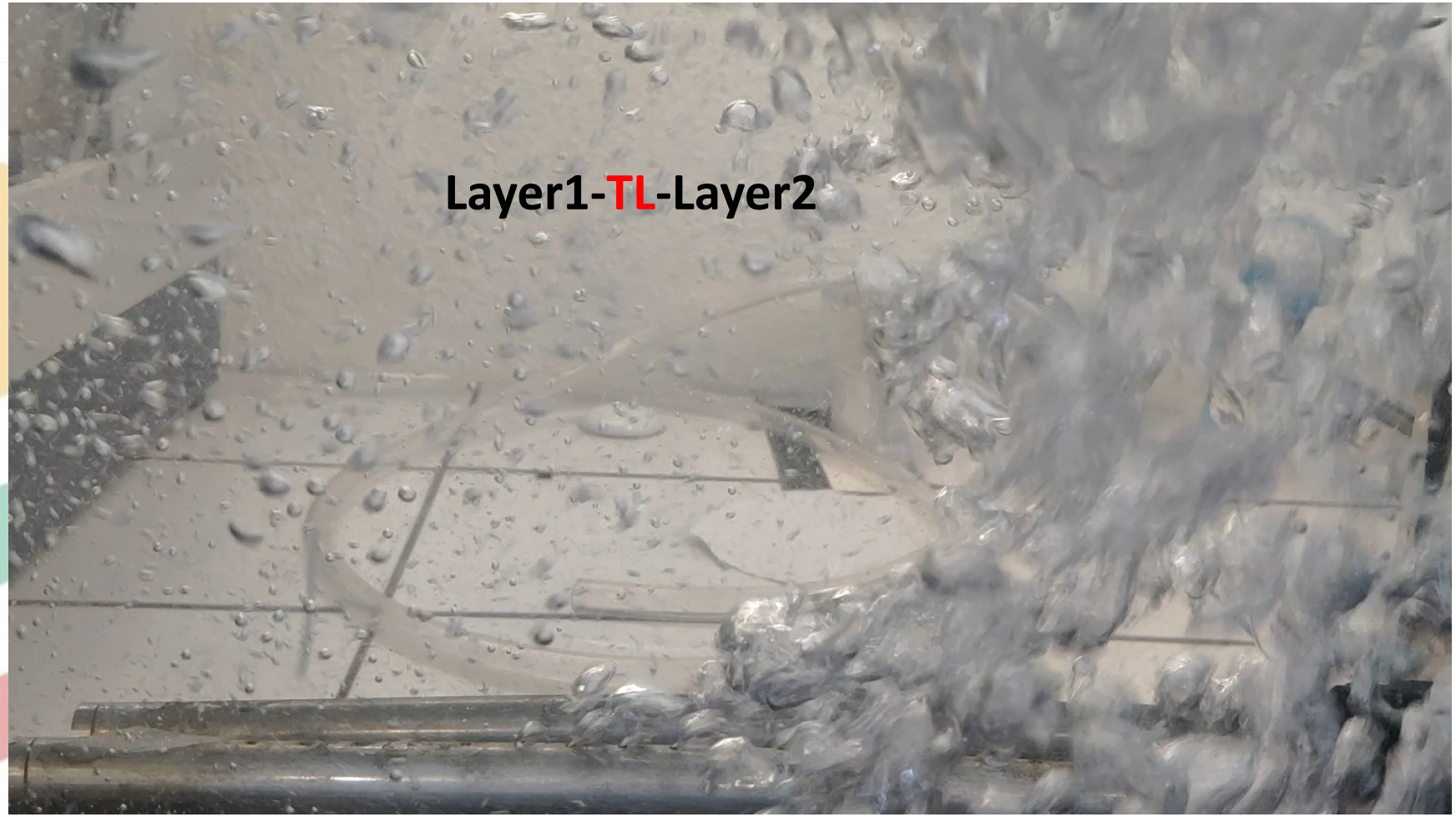

Design and elaboration the prototype device

Design and elaboration the prototype device

Layer1-2TL-Layer2

Expected final results

- 15% improvement in economic efficiency of end-of-life management
- 80% reduction of landfilling for multi-layer plastic packaging
- 55% reduction of overall plastic landfilling
- 65% decrease in the overall CO_2 footprint
- MRS: ≈ 0 ➔ ≈ 90%

Thank you for your attention!

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