INNOVACIÓN CON PROPÓSITO

AIMPLAS

ENERO 2025

Towards a new laboratory protocol for testing the delamination of PET trays

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- AIMPLAS
- Methodology
- Testing
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AIMPLAS

What is AIMPLAS?

A technology centre with more than 35 years' experience in the **plastic sector.**

More than **12,000 m²** of cutting-edge facilities

Pilot plants: 6,500 m²

Laboratories: 4,500 m²

Training: 1,000 m²

AIMPLAS

Protocol methodology

Methodology

Sample preparation

Hot washing, with caustic soda and surfactant

Verification

- *Methodology*: combined techniques from several existing protocols (washing, delamination, sink/float), **adapted to conventional lab equipment**.
- **Several parameters were considered and adjusted** to verify their effect in the delamination process.
- The developed methodology is **meant to be implemented by any qualified laboratory.**

This protocol is being developed in collaboration with **Petcore** to be incorporated in **TCEP procedures**[1]

[1]: Tray Circularity Evaluation Platform. https://www.tcep-europe.org/

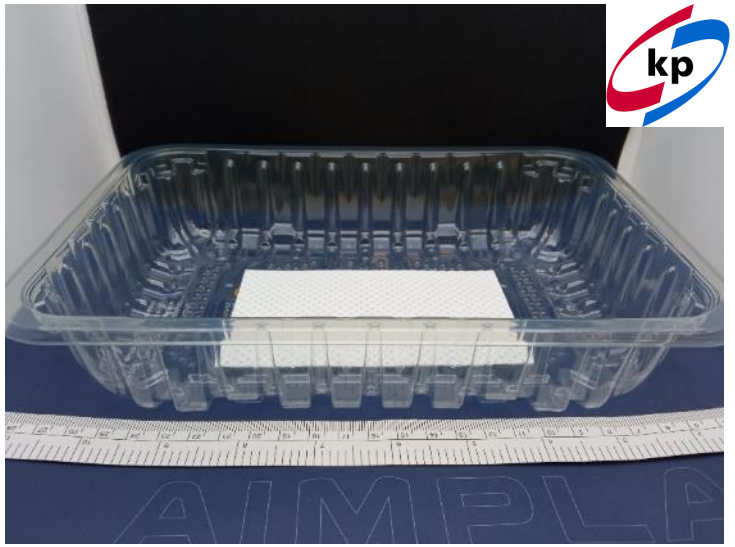
Methodology

Sample preparation

Hot washing, with caustic soda and surfactant

Verification

1. The absorbent pad was removed (left behind glue and part of fabric).
2. The tray samples were manually cut to 10-15 mm rectangles.



Methodology

Sample preparation

Hot washing, with caustic soda and surfactant

Verification

1. A vessel is filled with tap water.
2. Caustic soda and surfactant are added
3. Solution is heated under agitation
4. Flakes are added
5. Agitation at high speed is performed
6. Sample is drained and washed to remove caustic soda
7. Sample is floated to separate PET from PE
8. Individual fractions are oven dried.

Methodology

Sample preparation

Hot washing, with caustic soda and surfactant

Verification

1. Sink/float mass evaluation is performed after individual fractions are collected
2. Oven test is done on PET fraction to evaluate the remaining presence of contaminants.
3. Manual separation and quantification of remaining PE in PET.

Testing

Testing

Proof of concept

Design of Experiments

- First step: following an **existing delamination protocol,** analyse its **shortcomings** and possibilities of implementation with **standard laboratory equipment**.
- A **DoE was performed** to verify the effect of the parameters in the delamination and define the **optimal ranges.**
- From obtained results, further optimization and adaptations are being made, to ensure reproducibility.

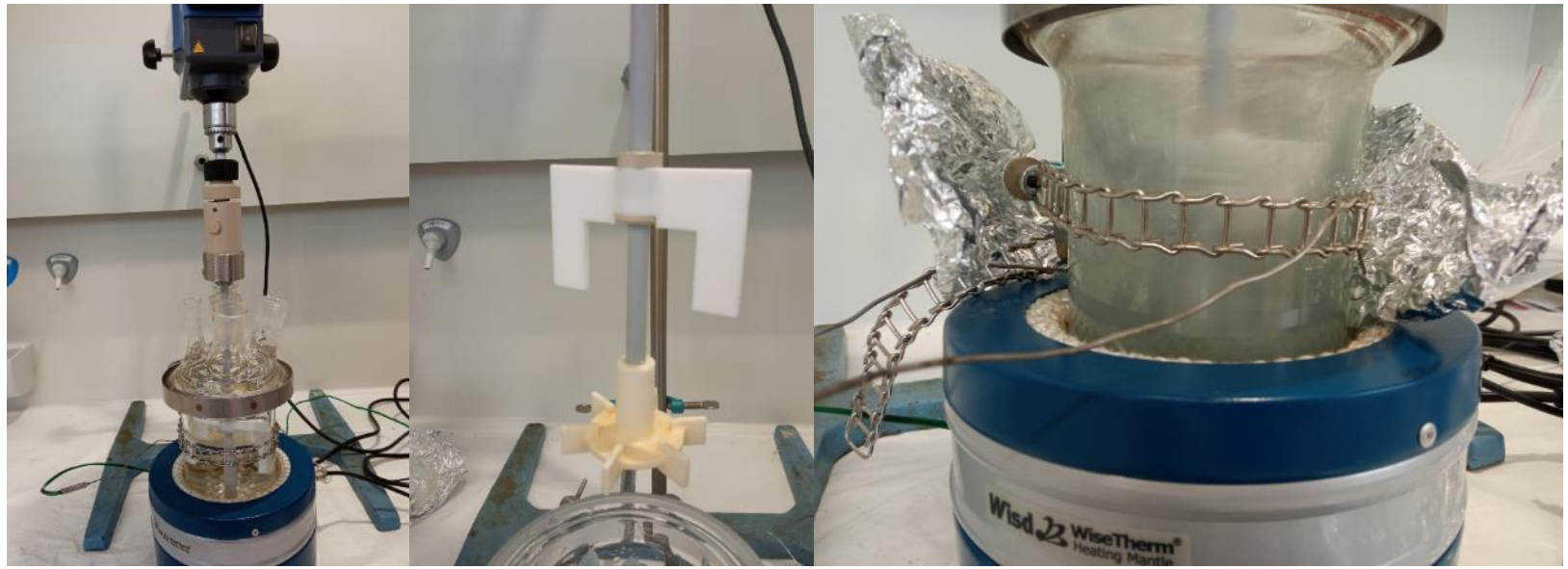
Testing

Proof of concept

Design of Experiments

Further Optimization

- Container: 1 litter vessel (1l water + 100 flakes)
- Mixing element: disc + inverted anchor
- Parameters: mid temperature, speed and time*, with NaOH.



* Liquid splashed out of the container at higher speeds, and temperature dropped.
To compensate, agitation time was increased

Testing

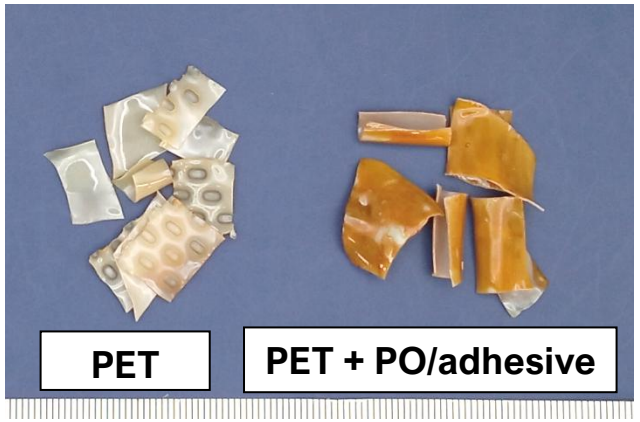
Qualitative and quantitative results:

Sink/float separation

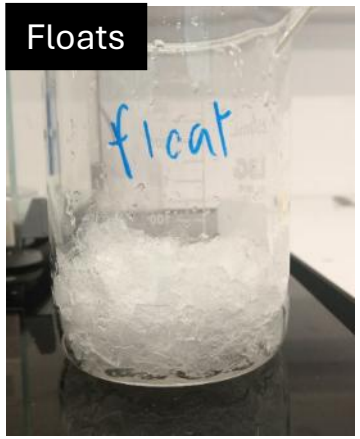
Mass evaluation

Sinks

Oven test



Floats



Weight quantification

PET = 98,6%

PE = 1,4%

PE in tray ≈ 3%

Testing

Proof of concept

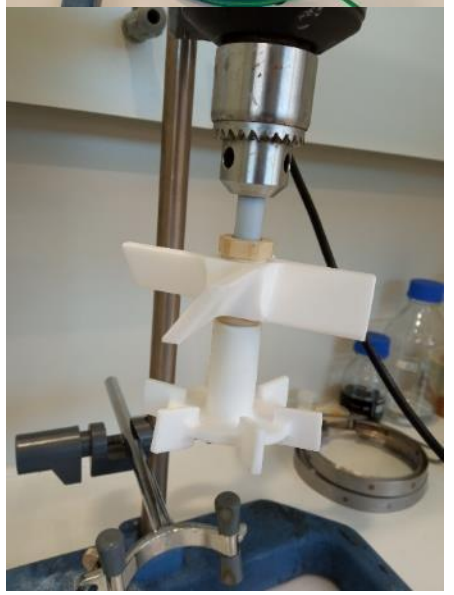
Design of Experiments

Further Optimization

- Container: 1 litter vessel (0,5l water + 50 flakes)
- Mixing element: disc + turbine
- Parameters:

Nº	Mixing	Heating	T (ºC)	V (rpm)	t (min)	NaOH(%)
0 (PoC)	D+A	R + Bl	Mid	Mid	Mid	Mid
1	D+T	Bk + Bl	High	Mid	Mid	Mid
2	D+T	Bk + Bl	High	Mid	Low	Mid
3	D+T	Bk + Bl	High	High	Mid	Mid
4	D+T	Bk + Bl	High	Mid	High	Mid
5	D+T	Bk + Bl	High	Mid	Mid	High
6	D+T	Bk + Plate	Low*	High	Mid	High

* High temperature loss; it was meant to be Mid-T but was not reached with the plate in reasonable time. Data was kept to see the effect of lower temperature.



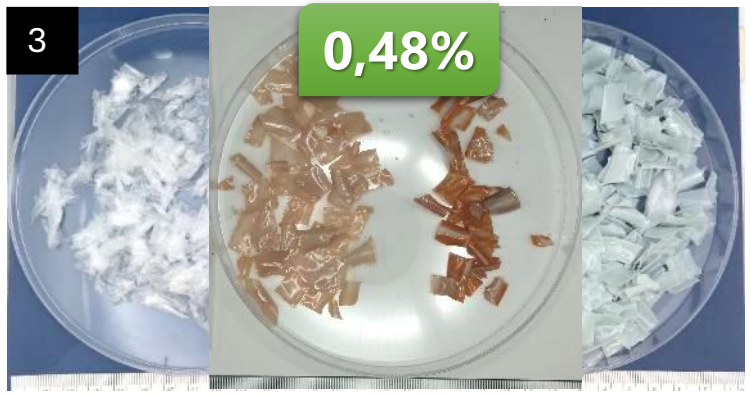
D = disc A = anchor T = turbine
R = reactor glass vessel Bk = beaker Bl = heating blanket Plate = Hot plate

Testing

Floatation separation:

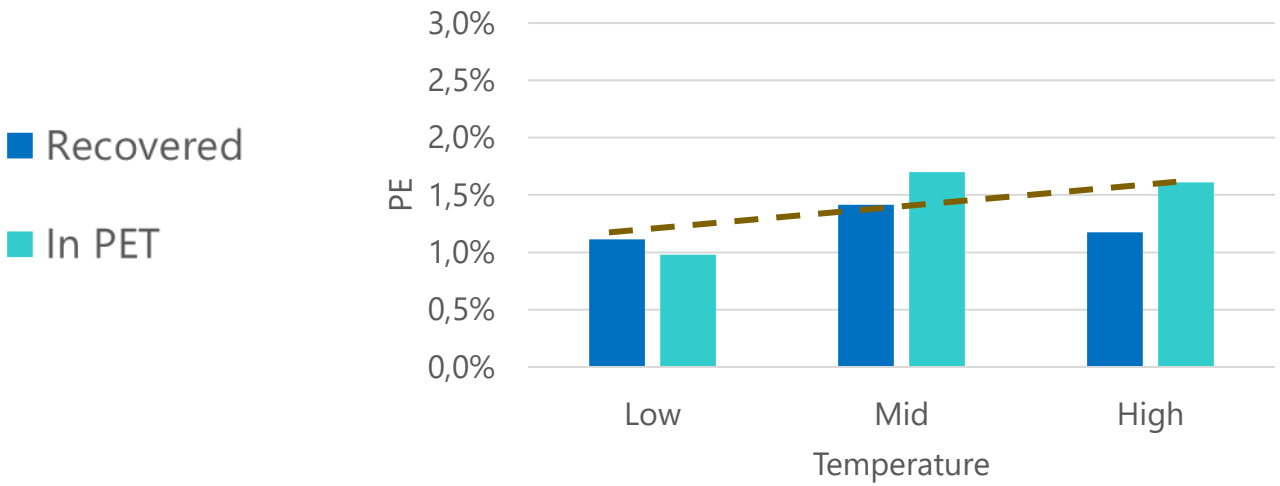
Testing

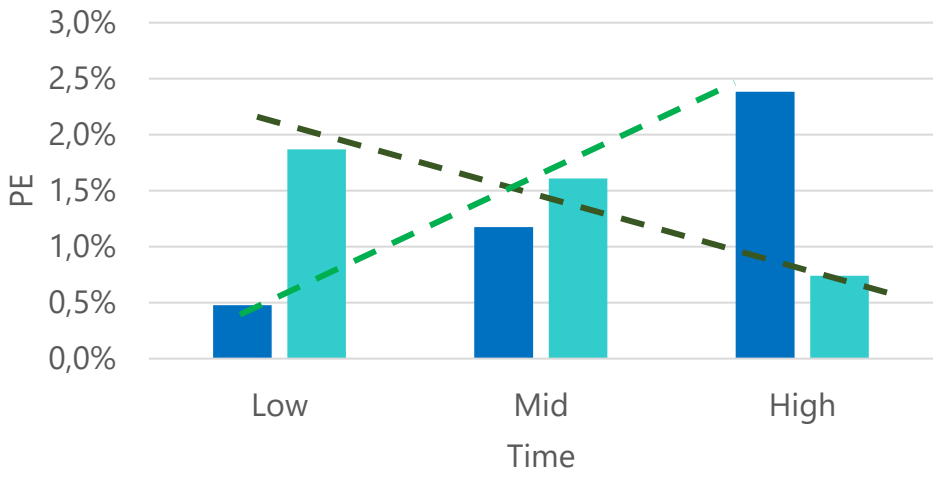
PE remaining in PET (oven test)

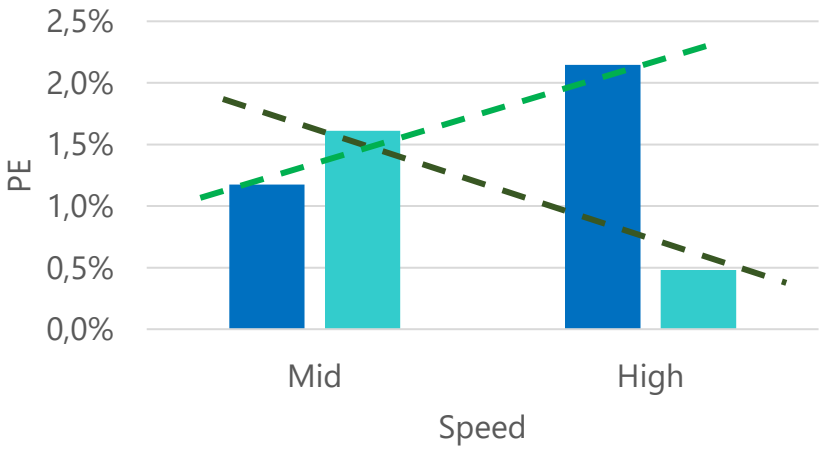


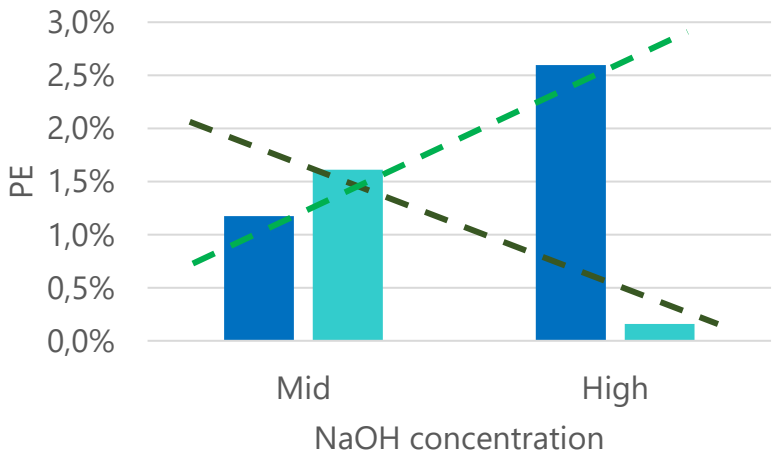
Testing

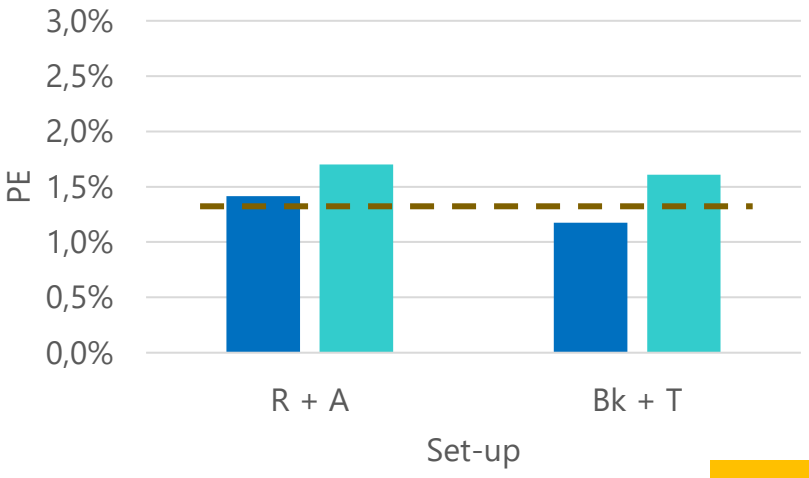
Qualitative and quantitative results:











Concluding remarks: towards further optimization

Concluding remarks

Process remarks

- Important effect of agitation speed and time: expected due to higher shear.
- Some effect of NaOH content.
- No important effect of temperature (above mid value).
- No important effect of set-up (with heating blanket).

Other remarks

- Difficulty to float all separated material (some gets trap with sinking fraction)
- Evaluation methods seems insufficient/inaccurate, but all gives similar result.

Final process

Sample preparation

Hot washing, with caustic soda and surfactant

Verification

1. A vessel is filled with tap water.
2. Caustic soda and surfactant are added.
3. Solution is heated under agitation.
4. Flakes are added.
5. Agitation at high speed is performed
6. Sample is drained and washed to remove caustic soda
7. Sample is floated to separate PET from PE
8. Individual fractions are oven dried.

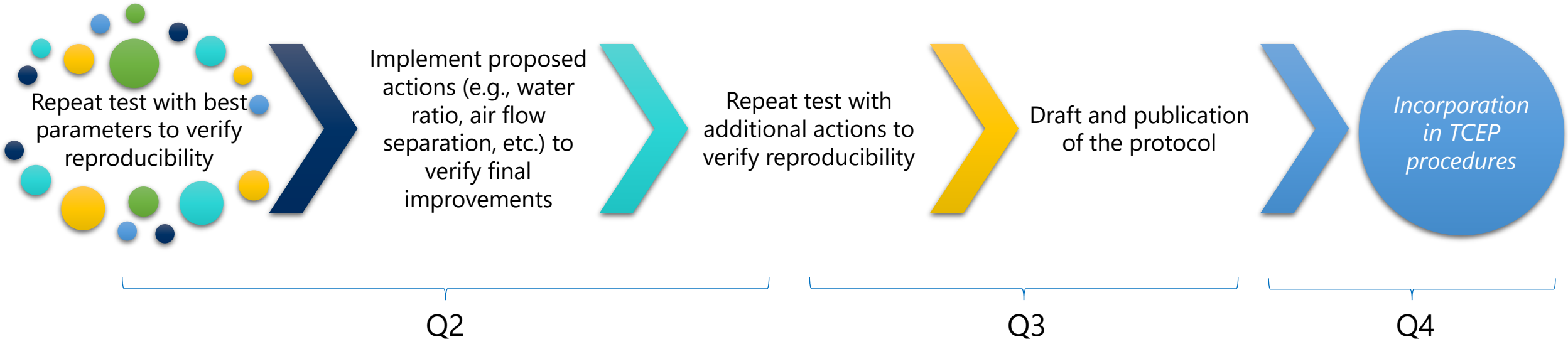
Water ratio reduced to increase shear

NaOH at high concentration

Maximum agitation allowed by the system

Additional separation after drying (air flow) to separate all delaminated PE.

Next steps


Repeat test with best parameters to verify reproducibility
Implement proposed actions (e.g., water ratio, air flow separation, etc.) to verify final improvements
Repeat test with additional actions to verify reproducibility
Draft and publication of the protocol
Incorporation in TCEP procedures
Q2
Q3
Q4

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