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RECYCLASS TECHNICAL REVIEW

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The RecyClass Polystyrene Technical Committee (PS TC) investigated the effect of wall thickness on the air elutriation efficiency of PS packaging. The air elutriation process is a key step in each recycling process to ensure an efficient separation of flexible parts (sleeves, labels, lids, etc.) from the PS rigid parts. Since PS pots tend to have wall thicknesses between 100 and 400 µm, a potential challenge has been identified for thin wall packaging, where part of the PS material might be lost with the flexibles at the air elutriation process.

Tests were carried out following the procedures for air elutriation described in the RecyClass Recyclability Evaluation Protocol for PS Containers[1]. Six variants were assessed, as described below in Table 1. The tests were performed at AIMPLAS, in a pilot scale air elutriator equipment, using the zig-zag technology.

The materials were ground on a laboratory grinder using a 10 mm sieve. Blends of 10 % of flexible materials and 90 % of rigid pots were generated, each blend consisted of about 1 to 3 kg of material. The air elutriator was previously calibrated with samples coming from two PS recyclers, in order to have a similar set up and as the one used in real industrial conditions.

The six samples were processed with the defined conditions after the calibration of the air elutriator. In Annex I, pictures of the different fractions can be observed. Following the elutriation process, both the light and heavy fractions underwent flotation tests to separate the PET and PS materials by density, ensuring an accurate mass balance and calculation of the flexible and rigid parts in both fractions.

The test results showed the following outcomes:

- A significant amount of the material from the walls of samples 1, 2, 4, and 5 (thin wall pots) was lost in the light fraction (LF) after air elutriation, ranging from 13 % up to 45 % of the total PS material., as indicated in Table 2.
- Rigid material from samples 1, 2, 4, and 5 present in the heavy fraction after air elutriation corresponded mainly to the edge (800 – 950 µm) and bottom (~ 300 µm) of the PS pots.
- Thicker lids (≥ 50 µm) make it more difficult to efficiently separate the flexible from the rigid parts.

[1] Recyclability Evaluation Protocol for PS Containers

- Thicknesses below 150 µm tend to be separated as light fraction, meaning loss material in the process.
- Thicknesses above 450 µm showed a good separation of flexible and rigid parts, with negligible losses of PS in the light fraction.

Table 1 shows the proportion of PS present in the light fraction after air elutriation, indicating that the thin-walled pots (samples 1, 2, 4, and 5) exhibit a loss of material due to their thickness. In general, the heavy fractions were clean of flexible materials, with the exception of some lids' residues present in samples 2 and 3, due to their higher thickness.

TABLE 1. SAMPLES CHARACTERISTICS AND RESULTS.

Sample	Thickness lids [µm]	Lids material	Wall thickness PS pot [µm]	PS share in LF [%]	Total PS lost [%]
1	50	PET	100	79	39
2	50	PET	150	72	26
3	50	PET	450	0	0
4	23	PET	100	56	13
5	23	PET	150	81	45
6	23	PET	450	0	0

Based on these results, the RecyClass PS TC recommends:

- To consider the design of PS pot with walls' thickness higher than 150 µm to promote an efficient separation of flexible and rigid parts during the recycling process.
- To use thin flexible parts (≤ 23 µm), considering that these parts will be effectively and efficiently separated.

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About RecyClass

RecyClass is a non-profit, cross-industry initiative advancing recyclability, bringing transparency to the origin of plastic waste and establishing a harmonized approach toward recycled plastic calculation & traceability in Europe. RecyClass develops Recyclability Evaluation Protocols and scientific testing methods for innovative plastic packaging materials which serve as the base for the Design for Recycling Guidelines and the RecyClass Online Tool. RecyClass established Recyclability Certifications for plastic packaging, Recycling Process Certification and Recycled Plastics Traceability Certification for plastic products.

RecyClass – Plastic Future is Circular

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ANNEX 1

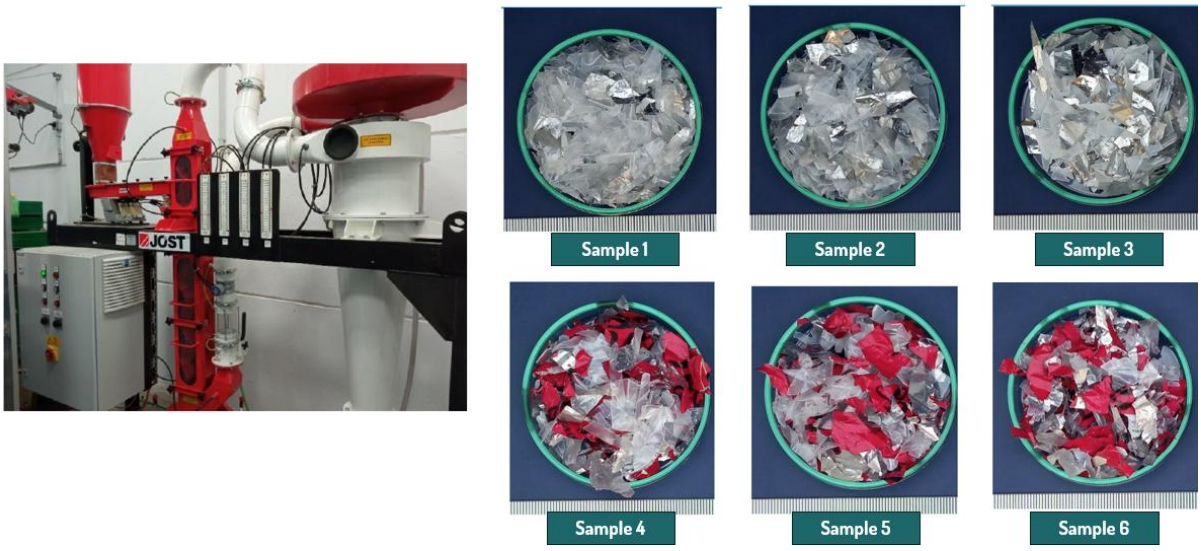

FIGURE 1. AIR ELUTRIATION EQUIPMENT AND BLENDS USED FOR THE TRIALS.

FIGURE 2. HEAVY FRACTIONS OBTAINED AFTER AIR ELUTRIATION.

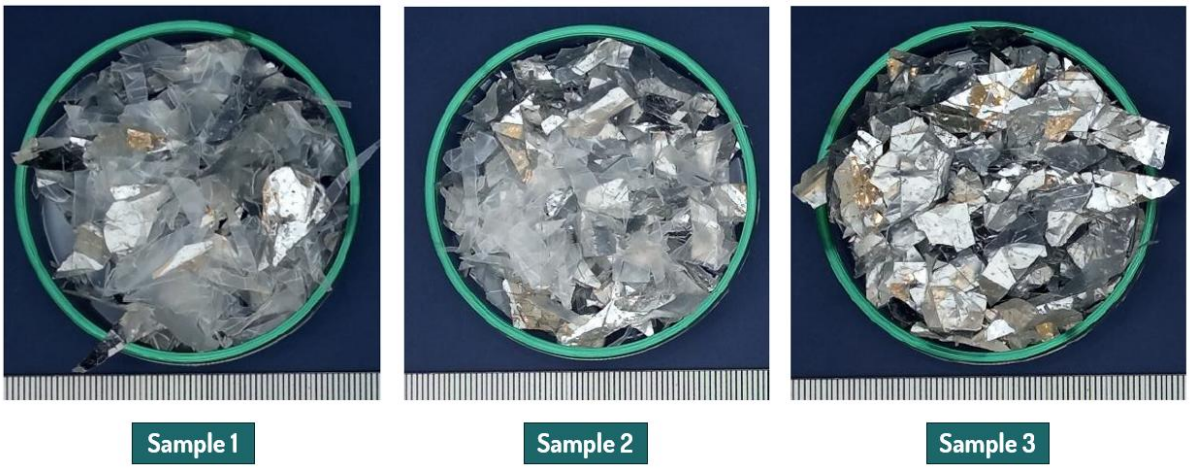

FIGURE 3. LIGHT FRACTIONS OF SAMPLES 1, 2 AND 3 (LEFT TO RIGHT) AFTER AIR ELUTRIATION.

FIGURE 4. LIGHT FRACTIONS OF SAMPLES 4, 5 AND 6 (LEFT TO RIGHT) AFTER AIR ELUTRIATION.

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