RecyClass

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The RecyClass Sorting Task Force (TF) investigated the effect on sorting of different non-polyethylene (non-PE) labels and sleeves with high coverage percentage, applied on High Density Polyethylene (HDPE) packaging. The test campaign was made on eight samples. RecyClass members contributed with the samples' provision as follows: ISDIN has provided the HDPE bottles, Avery Dennison the Pressure Sensitive Labels (PSL), CCL and All4Labels the sleeves and the labels. Tests were carried out following the procedures described in the RecyClass Sorting Evaluation Protocol for Plastic Packaging[1].

The samples consisted in white HDPE bottles with a volume of 200 ml. The bottle had a flat shape, in order to avoid any further sorting issues due to the rolling of the bottles on the conveyor belt. The samples' matrix was defined by the RecyClass Sorting and Decoration Task Forces. The selected samples are listed in the Table 1. Pictures of the samples are reported in Figure 1 and Figure 2.

The effect of different variables has been studied, as follows:

- *Sleeve/Label thickness:* three full body sleeves were selected. Two transparent PET-g sleeves with a thickness of 30 and 50 µm respectively, and a transparent PO-based sleeve (mainly PP-based) with a thickness of 50 µm. The thicknesses targeted for the labels were 40 and 60 µm, following the thicknesses that are usually used in the market.
- *Mass coloration*: The potential effect of use of TiO_2 to mass-colour labels and sleeves was assessed by selecting white PP-based labels, both cavitated and not cavitated, with a thickness of 60 µm and a white PET-g sleeve with a thickness of 50 µm (containing 8.5 wt% of TiO_2 based on TGA measurement).

All samples were printed with a light artwork ($L^* > 40$), representative of what can be found on the market. The labels coverage was about 70 % of the HDPE bottle, whilst the sleeves covered the whole bottle.

The tests were performed at Circpack following the RecyClass Sorting Evaluation Protocol for plastic packaging in a sorting plant operating according to state-of-the-art sorting technologies. The results of the dynamic test (full operational sorting test) are reported in Table 2.

[1] Sorting Evaluation Protocol for Plastic Packaging

The main conclusions can be summarized as follows:

- All tested labels, PET-g 30 µm & PO-based full body sleeved bottles achieved a sorting efficiency > 80% (without contaminating another mono-stream). It corresponds to full pass test according to RecyClass methodology.
- The clear/printed PET-g 50 µm (sample 2) and the white/printed 50 µm PET-g sleeve (sample 8) achieved a sorting efficiency between 70-80 % (without contaminating another mono-stream). This corresponds to 1 recyclability class deduction according to RecyClass methodology (sorting efficiency < 80 %).
- The 30 µm PET-g full body sleeve achieved a higher efficiency (94%) than the PET-g 50 µm versions, both transparent (77 %) and mass-coloured (78 %). There is evidence that the thickness of the decoration can decrease the sorting efficiency, in particular for PET sleeves.
- Proper label design (facestock material, thickness, coverage) has no or little influence on the missorting of the packaging.
- There is no clear indication that the mass-coloured decorations, coupled or not with cavitation, may hamper the detection of the underlying container.

Even though for most of the samples selected the results look promising, RecyClass reminds that:

1) Labels and sleeves applied on HDPE and PP containers, made out from a material different than the container, may decrease the efficiency or hamper the sorting of the packaging and contaminate other sorted streams.
2) Labels and sleeves applied on HPDE and PP containers, made from a material different than the container and when not complying with the current recommendations regarding coverage should be mandatory tested via the RecyClass Sorting Protocol to prove the packaging sorting and to assess the sorting efficiency of the packaging, or should be replaced by a label or sleeve facestock made of the same material as the container. This recommendation remains valid despite the good results here presented, since specific conditions (label thickness, artwork, varnishes) can affect the sorting efficiency.
3) Labels and sleeves applied on HDPE and PP containers, made out from a material different than the container are considered limited compatible in the RecyClass Design for Recycling Guidelines for HDPE and PP. As consequence, in case such a packaging fully passes the RecyClass sorting test (i.e. sorting efficiency higher than 80% and less than 10% sorted in another stream), it receives 1 penalty with the RecyClass recyclability assessment, as a non-

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preferred design, which may have a negative impact on the quality of the recyclate, if not well separated.

Furthermore, RecyClass reminds that below recommendations remain preferable when applying a label or a sleeve on HDPE and PP containers, and that in those cases a sorting test is not required to grant a RecyClass Recyclability Certification:

For HDPE containers:

- Size of non-PE surfaces on containers < 500 ml: < 50 % Coverage
- Size of non-PE surfaces on containers > 500 ml: < 70 % Coverage

For PP containers:

- Size of non-PP surfaces on containers < 500 ml: < 50 % Coverage
- Size of non-PP surfaces on containers > 500 ml: < 70 % Coverage

Companies are encouraged to utilize the current technical review as a point of reference when deviating from the above recommendations. Additionally, they are invited to conduct a RecyClass sorting test to ensure that their unique combination of sleeves and labels on HDPE and PP containers does not impede proper detection within the designated stream.

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 I

TABLE 1. SAMPLES' MATRIX

Sample (HDPE bottle)	Material	Thickness [µm]	Mass coloration (TiO_2)	Cavitation	Decoration coverage [%]	Label/sleeve weight to total packaging [wt%]
1	PET-G	30	No	No	100	3.6
2	PET-G	50	No	No	100	5.6
3	PO	50	No	No	100	4.3
4	PP	40	No	No	70	2.0
5	PP	60	No	No	70	2.6
6	PP	60	Yes	Yes	70	2.2
7	PP	60	Yes	No	70	2.7
8	PET-G	50	Yes	No	100	6.1

FIGURE 1. DESIGN FOR SAMPLES 1 - 3

FIGURE 2. DESIGN FOR SAMPLES 4 TO 7 (LEFT) AND 8 (RIGHT).

TABLE 2. RESULTS OF THE DYNAMIC TEST (FULL OPERATIONAL SORTING TEST)

Sample	PE (Rigid) [%]	Mixed Plastics [%]	Residue [%]
1	94	3	3
2	77	12	11
3	89	8	3
4	85	7	8
5	91	6	3
6	82	11	7
7	86	11	3
8	78	21	1

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