

The RecyClass HDPE and PP Technical Committees (TCs) investigated the impact of thermoplastic elastomer (TPE)<sup>1</sup> based on fully olefinic structure on the recyclability of HDPE and PP rigid containers. These two test campaigns were performed with samples representing 10 % of Thermoplastic Polyolefins (TPOs), PP or PE based, in HDPE and PP bottles, as illustrated in Annex 1. Tests were carried out following the procedures described by both RecyClass Recyclability Evaluation Protocols for HDPE and PP containers<sup>2</sup>.

The samples were provided by Berry and consisted of natural bottles without caps made via extrusion blow moulding (see Figure 2). The bottles are made of PP or HDPE with 10 % of TPOs with a full olefinic or aliphatic structure. The composition of the samples evaluated is the following:

- 1) 90 wt% PP / 10 wt% of TPO-PP
- 2) 90 wt% PP / 10 wt% of TPO-PE
- 3) 90 wt% HDPE / 10 wt% of TPO-PP
- 4) 90 wt% HDPE / 10 wt% of TPO-PE

The samples were tested at Institut für Kunststofftechnologie und -recycling (IKTR), a recognized testing facility, according to the RecyClass Protocols for HDPE or PP containers. The control materials used for the tests corresponded to bottles blow moulded using the same PP and HDPE grades that were the main components of the blends.

The laboratory results showed no problems during the pretreatment steps, for both PP and HDPE bottles.

In all cases, the extrusion process was not affected by the presence of the TPOs. The process was stable, without any sign of build-ups in the filter. The extruded pellets, blend A.0, A.25 and A.50, were all natural white and did not show any sign of thermal degradation. All the pellet material properties were within the benchmark recommendations.

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<sup>1</sup> For nomenclature purposes of TPEs, please refer to the ISO 18064 definition.

<sup>2</sup> [RecyClass Recyclability Evaluation Protocols](#)

Each blend was injection moulded into tensile test bars and test plates without complications. The aspect of the plates was semi-translucent and of natural white colour without inclusion or black spots. The properties of the injection moulded specimens were within the recommended benchmarks.

Concerning the conversion phase, the extruded pellets were mixed with virgin material to obtain the blends B.0, B.25 and B.50 and converted into bottles (see Figure 3). The blow moulding process could be performed without any problem. The bottles presented in all cases clear aspects without defects. The bottle dimensions and mechanical properties were within the benchmark recommendations.

On the base of these positive results, the HDPE and PP Technical Committees concluded that up to 10 wt% of TPOs is considered fully compatible with HDPE and PP container recycling. The TPOs falling in this category are defined as '100 % olefinic materials that depending on the manner they are produced can have very different properties from conventional polyolefins and do not contain blends of non-polyolefin materials, such as EPDM, etc.'

With this information, the HDPE and PP Design for Recycling Guidelines have been updated considering up to 10 % of TPOs as **fully compatible with HDPE and PP recycling**. Moreover, TPOs are considered as "valuable material" in the recyclability assessment phase.

It is important to highlight that these recommendations are given for TPOs with a full olefinic structure as targeted in this test campaign. TPOs containing blends of non-polyolefin materials, such as EPDM, etc. will be considered as not compatible with HDPE and PP recycling. These new recommendations on TPOs can be challenged through testing to show the compatibility of these elements with the RecyClass protocols.

#### ***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.

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Annex I

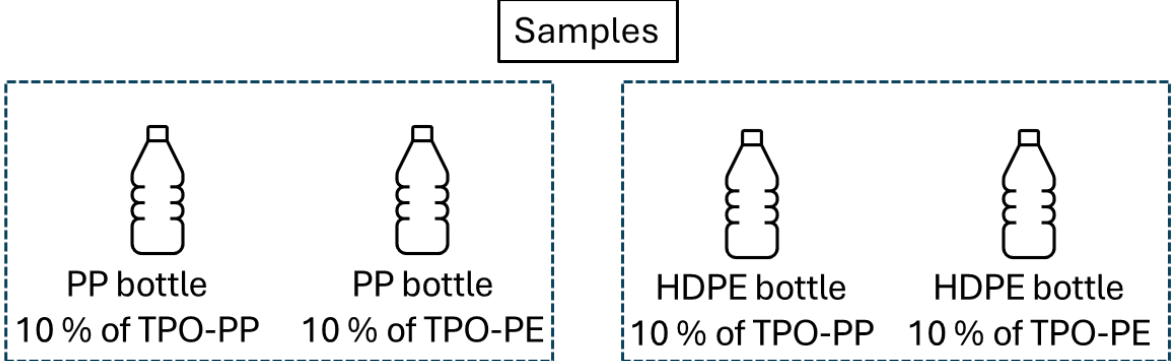


Figure 1. Schematic representation of the 4 types of bottles tested.

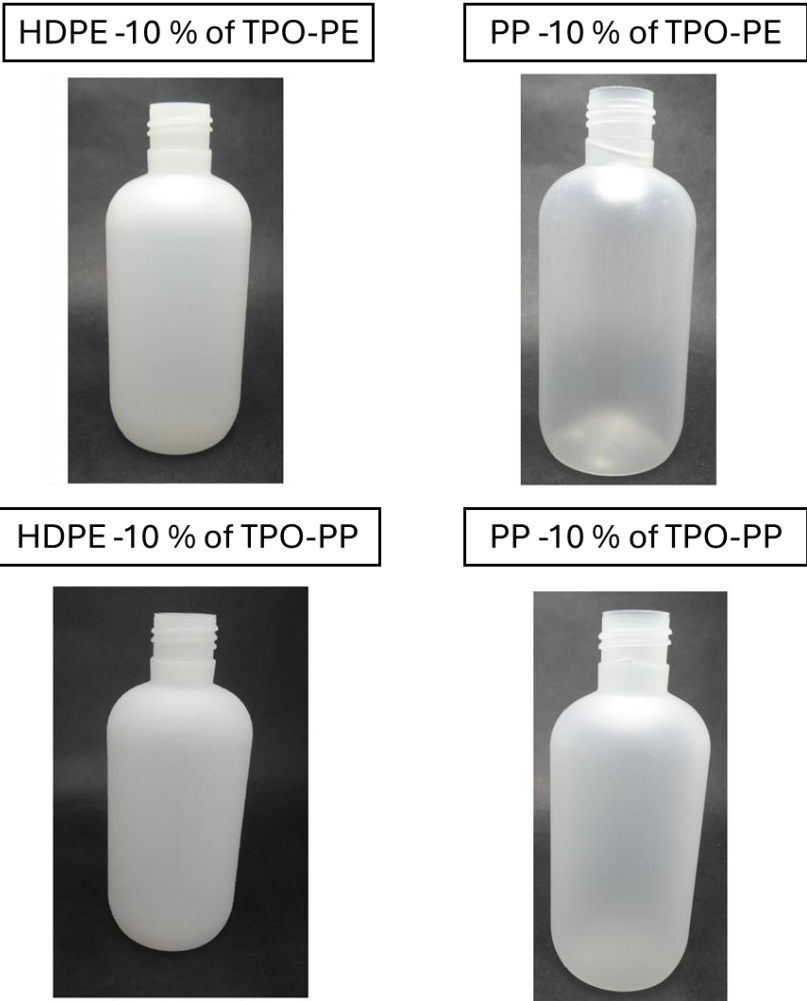


Figure 2. Pictures of the innovation bottles tested at IKTR.

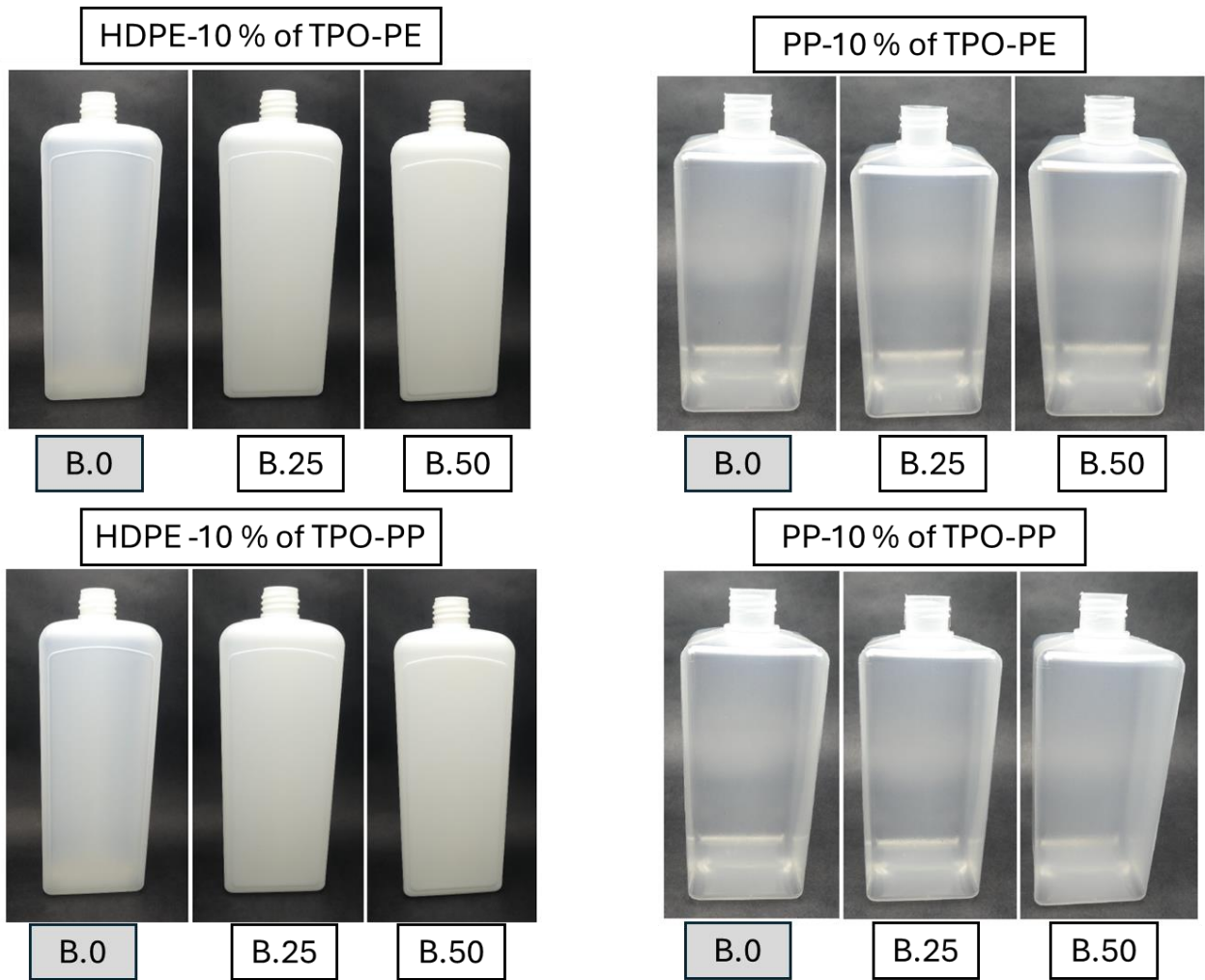


Figure 3. Pictures of the bottles B.0, B.25 and B.50.