

The RecyClass HDPE Technical Committee investigated the impact of plasma fluorination, a plasma barrier technology, on recycling of HDPE containers. The test campaign was made on a sample representative of the market provided by Delta Engineering, as illustrated in Annex 1. Tests were carried out following the procedures described by the RecyClass Recyclability Evaluation Protocols for HDPE containers.

The sample consists in a white HDPE container (10L) internally coated with a plasma fluorination treatment to produce oxygen and solvent barrier properties. The thickness of the coating is between 60 and 150 nm. Despite the thickness of the deposit, a slight off-white colouration could be observed within the container. Such barrier treatment is mainly used for agro-chemical applications but aims also at being used for smaller packaging, for instance for cosmetic applications.

Three different laboratories, the Institut für Kunststofftechnologie und -recycling (IKTR), the CRITT Polymères and Proplast, performed in parallel the testing by following the RecyClass Recyclability Evaluation Protocol for HDPE Containers¹. For each test, the same plasma fluorination treated HDPE container was evaluated compared to a control sample corresponding to the same container but untreated. First of all, regarding the pre-treatment and especially the washing step, it is important to highlight that the coating was not washed-off and remained on the container. Afterwards, the samples behaved well during extrusion and the obtained pellets were reprocessed using injection moulding and blow moulding. Similar behaviours could be observed from the analyses made in all the laboratories, with no deviations outside of the benchmark recommendations for mechanical properties. Nevertheless, due to the presence of the coating, a discolouration of the pellets was observed, shifting from white to off-white. Indeed, the ΔE value between the pure treated bottle and the control material was equal to 9.9.

The outcome of this test campaign was that plasma fluorination is not detrimental for coloured HDPE recycling, while the colouration of the pellets will negatively impact the quality of the recyclate coming from natural HDPE containers. As this technology is today rarely used for household packaging, and due to the specificity of the HDPE resin that was used for this test campaign, the HDPE Technical Committee decided to deliver a first limited compatibility approval before to gather more data.

¹ [Recyclability Evaluation Protocol for HDPE Containers](#)

As a summary and according to the results that were obtained from the Recyclability Evaluation Protocol, the RecyClass HDPE Technical Committee defined the compatibility of the plasma fluorination technology with the HDPE recycling stream as following:

- **Limited compatible** with **coloured** HDPE recycling stream
- **Non compatible** with **natural** HDPE recycling 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.

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Annex I

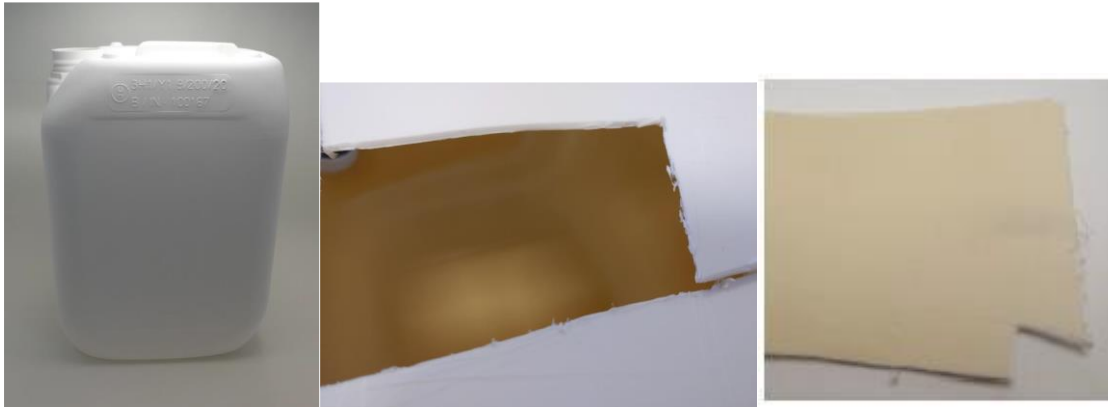


Figure 1: Plasma Fluorinated Container used for the test campaign