RecyClass

Avenue de Broqueville 12
1150 Brussels, Brussels

Phone: +32 2 786 39 08
info@recyclass.eu
www.recyclass.eu

Following previous results from RecyClass test campaign focusing on Nitrocellulose (NC) and Polyurethane (PU)-based inks, which showed the detrimental impact of NC inks on the recyclability of flexible packaging, the plastic packaging value chain was looking for solutions and alternatives to NC inks for surface printing applications. In this context, the RecyClass PO Films Technical Committee (TC) decided to investigate the impact of non-NC inks suitable for surface printing on the recyclability of PE films. This testing campaign was supported by Ticinoplast, supplier of the PE films and by the RecyClass Printing Inks WG who produced the printed samples. With the result of this test campaign, the RecyClass PO Films TC confirmed the compatibility of PU-based inks and PVB-based inks with the PE and PP flexible packaging recycling.

While NC inks are well-known for their excellent mechanical fastness properties and compatibility with heat sealing processes which make them the optimum choice for surface printing application, other inks chemistries currently used for lamination application are usually suffering from limited mechanical fastness property and stickiness which make them normally unsuitable for surface printing application. Over the past months, few new inks formulations were launched on the market to offer alternatives to NC. However, no recyclability studies were available for these new formulations. For that reason, the RecyClass PO Films TC selected 6 different ink formulations suitable for surface printing and primarily focused on PU-inks as well as acrylic (see Annex I).

Each sample was made of a 50 µm LDPE film, and a white printed layer representing about 5wt% of the total weight of the structure. Each sample contained approximately the same amount of TiO_2 pigment with a concentration of 60 wt% of the dry inks, meaning 3 wt% of the total weight of the film. Tests were conducted at Proplast according to a simplified version of the RecyClass Recyclability Evaluation Protocol for PE Films (without washing and density separation steps), with the same film basis used as control material.

During re-pelletisation, every sample showed stable extrusion pressure, and no sign of strong odour, fumes or die build-ups were observed. Therefore, unlike NC-inks, no strong volatiles release could be observed. Characterisations of the pellets showed good results with no decrease of the bulk density and stable MFI compared to control material. The pellets looked still white, highlighting the absence of strong degradation of the ink binders, with Δb^* values comprised between 4.6 and 8.5 for PU-based

inks, 6.3 for acrylic and around 9.9 for PVB-based inks respectively. As a comparison, inks containing 20% NC-binders previously showed a Δb* of about 16, under the same conditions.

Finally, no issues were faced to produce 25 µm films from these pellets. Gels analyses exhibited no significant increase of gels and film defects with the presence of the printed samples, therefore confirming the good compatibility with recycling of these new inks developed for surface printing.

As a summary and according to the results that were obtained from the Recyclability Evaluation Protocol, the RecyClass PO Films TC defined the following level of compatibility for both PE and PP flexible packaging:

- PU-based inks (for both surface and reverse printing): Fully compatible
- PVB-based inks: Fully compatible

In order to continue to improve the quality of the PE and PP flexible waste streams, the PO Films TC invites the entire plastic packaging value chain to preferably use these inks for surface printing as a replacement to NC binders. Besides, inks suppliers are invited to test with RecyClass any future ink formulation that would be developed aiming at offering new alternatives for surface printing, in particular, acrylics to confirm the first good results obtained during that test campaign. Finally, the PO Films Technical Committee emphasized that apart from the inks chemistry, it remains crucial to try to reduce the amount of ink for flexible packaging in order to enhance the quality of rPE and rPP.

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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Contact : Jean-Emile.Potaufeux@plasticsrecyclers.eu, www.recyclass.eu

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Annex I

Samples	A1	A2	B	C1	C2	D
Binder Chemistry	PU	PU	PU	PU	Acrylic	PVB
Composition	5wt% inks containing 60wt% TiO_2 pigment					

Figure 1: Composition of samples used for the test campaign.