COTREP

Comité Technique pour le Recyclage des Emballages Plastiques

PET
Component

General Notice

Impacts linked to residue from PET- and PE-based trays on the recycling of rigid PET packaging.

1/ CONTEXT

The extension of the sorting guidelines raises the issue of recyclability of PET trays, which account for significant tonnages.

Since 2010, CITEO has conducted a large-scale trial with its partners on the recyclability of various types of packaging that is collected as part of the extension of sorting guidelines, and particularly on PET trays.

It is important to note that preliminary studies have shown that the characteristics of PET used in trays are not always the same as those of PET used in bottles (shape, functionality, thickness, viscosity index, etc.). This may have consequences for recycling (viscosity index of recycled material, temperature resistance, colour of recycled material, etc.).

Given these circumstances, Cotrep conducted separate studies regarding:

- the recyclability of clear mono-PET trays in the clear PET bottles stream
- the recyclability of composite clear PET-PE trays in the clear PET bottles stream

A general notice was issued in 2018 on the impact of mono-PET trays on the clear PET bottles stream (AG No. 51).

This notice outlines the impact, due to sorting errors, **of PET- and PE-based trays on recycling of current clear rigid PET packaging (a stream consisting mainly of bottles)** in existing industrial conditions.

2/ PRINCIPLE AND ANALYSIS CRITERIA

Feedback suggests that it has hitherto not been possible to recycle composite trays with bottles to reproduce packaging or fibre. In this new test, COTREP is therefore seeking to simulate sorting errors or small quantities of PE on the sealing surface of sealed mono-PET trays.

The recyclability study conducted by a specialist, independent laboratory involved assessing the effect of PET- and PE-based trays on the recyclability of clear PET bottles.

These tests were performed in a laboratory using the existing procedure recognised for recycling PET as bottles. Shredded trays were mixed with 100% recycled PET flakes produced from a standard clear PET recycling stream (bottles). A series of physical-chemical criteria were measured during preparation phases and compared to a control sample made up exclusively of recycled PET flakes output from a standard clear PET stream (bottles). Having validated the study parameters, both the control and test samples were processed into sheets and bottles and their technical characteristics evaluated.

Please note:
This study gives no indication regarding the suitability of output rPET granulate for contact with food.

3/ DETAILED TEST PROCEDURE

3/1 Sample type and constitution

The selected trays were PET-PE composite trays (with 10% PE). Only trays uncontaminated by food residue and without secondary packaging elements, such as labels, glue or seals, were tested for this study.

The procedure involved a number of preparation and processing steps. These were performed on:

- a sample of PET-PE composite trays tested at different concentrations,
- a control sample consisting of recycled standard clear PET flakes (from bottles).

3/2 Performance of tests

The following procedure was applied:

1/ First, the PET-PE composite trays were shredded into flakes and washed at 85°C. These flakes were subsequently dried and aeraulic sorting was performed in order to eliminate any lighter fractions;

2/ The PET-PE composite tray flakes were then mixed with the "control" sample consisting solely of recycled standard clear PET flakes originating from bottles. The PET-PE tray flakes were mixed at concentrations of 1% and 3% in order to simulate sorting errors and residual traces of PE;

3/ The mixture of PET-PE tray flakes and recycled PET flakes was successively extruded, crystallised and underwent solid-phase polycondensation to create granulate. The same process was applied separately to the recycled PET flakes.

4/ Each batch of granulate produced was then separately mixed in equal parts with virgin PET granulate;

5/ Each of the 3 granulate mixtures was injection moulded into sheets or bottle preforms. Finally, the preforms were blow moulded to produce bottles of each test quality.

3/3 Analysis of the results: technical feasibility and measurement of physical variables

The table below shows the results **for concentrations of 1% or less PET-PE composite trays in the clear PET stream (i.e. 0.1% PE).**

Stages	Sample results
Shredding	Nothing to report
Washing and drying	Increase in fines generated
Preliminary IV analyses	IV of tray flakes 0.605 (IV of bottle flakes 0.751)
Bulk density	Higher (0.55-0.53) than the control flakes (0.25) due to the density of flakes originating from trays
Appearance of flakes	Shinier than the control; little variation in colour, not significant
Drying	Nothing to report – flakes did not stick to the equipment
Granulation	Nothing to report – no significant difference between the colour of the granulate and the control

Variation in IV on granulation	Nothing to report
Crystallisation and polycondensation	Nothing to report – the control and test samples responded in a similar manner. Good increase in IV
Acetaldehyde concentration	Nothing to report
Fluorescence	Nothing to report
Injection moulding of preforms	Nothing to report
Blow moulding of bottles	Nothing to report
Tests on bottles	Nothing to report – no significant difference with the control

An analysis of the results shows no significant difference in physical-chemical characteristics (mechanical properties, viscosity increase, thermal constants and optical parameters) between the test and control samples at concentrations of 1% PET-PE composite trays in the clear PET stream, and for both types of applications tested (sheets and bottles).

In tests of concentrations higher than 3% PET-PE composite trays in the clear PET stream, the main variation observed was yellowing, which downgrades the material. Such concentrations therefore disrupt recycling of the stream.

These tests show that up to 1% PET-PE trays may be present in the clear PET stream through sorting errors without significantly impacting regeneration. If these levels are exceeded, the end quality of recycled material is diminished.

TECHNICAL CONCLUSIONS

The study results were analysed to assess the impact of clear PET- and PE-based composite trays on the current recycling stream for clear PET bottles. They cover accidental inclusion of composite trays in PET bales due to sorting errors and inclusion of mono-PET trays with traces of PE due to sealing.

Due to sorting errors, some composite trays may indeed be mixed in with rigid mono-PET packaging and current industrial conditions enable their levels to be kept below 1% PET-PE composite trays. At these concentrations, the results of this test show that sheets and bottles offer the same mechanical, physical-chemical and colour properties as the recycled standard PET control sample.

As regards sealed mono-PET trays, Cotrep recommends using a seal of a density lower than 1 capable of separation by flotation at regeneration plants. This test shows that trace quantities (lower than 0.1%) of PE on the sealing surface will not impact the recycling of rigid PET packaging by 2022. Finally, it should be noted that the tests performed for this study were not aimed at determining how regeneration plant efficiency is impacted by trays being mixed in with bottles.