COTREP

Comité Technique pour le Recyclage des Emballages Plastiques

Resin

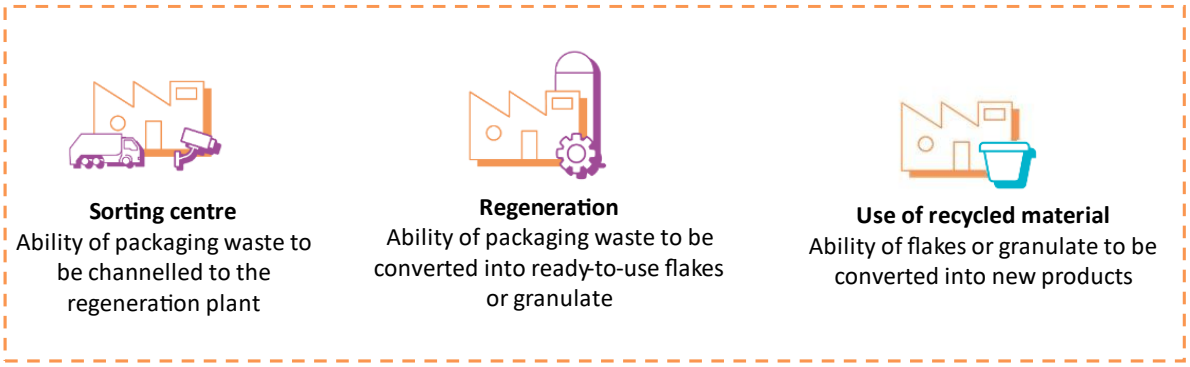
Rigid PP

GENERAL NOTICE 84

Impact of PP/COC/PP pharmaceutical blister packs on the sorting and regeneration of rigid PP packaging

SUMMARY

The aim of this general notice is to assess the sorting and mechanical regeneration potential of PP/COC/PP pharmaceutical blister packs during regeneration of rigid PP household packaging. This study solely concerns the rigid part of the blister pack (cavity tray).



Pharmaceutical blister packs are a packaging format used to package medicines. Currently, medicine blister packs are mostly made of PVC/Aluminium but this packaging is not recyclable.

Different alternatives are being developed, particularly blister packs with a rigid cavity tray made of PP/COC/PP. COC, cyclic olefin copolymer, is an amorphous thermoplastic. The COC layer provides moisture-resistant barrier properties that are sought for certain types of medicines. These types of blister pack can be produced by co-extrusion or lamination. The COC is interposed between two PP layers.

Optical sorting tests have shown that PP/COC/PP blister packs are channelled to the rigid PP stream; a certain amount of COC will therefore be present in this stream.

COTREP tested the potential impact of this packaging, and particularly COC, on regeneration of the rigid PP stream and the quality of the recycled rPP material[1] for an injection moulding application.

Regeneration tests show that incorporating 1% of PP/COC/PP pharmaceutical blister packs does not significantly disrupt the different stages of the regeneration process or the quality of regenerated material. At 4%, regeneration tests show that the presence of PP/COC/PP pharmaceutical blister packs affects the mechanical properties of regenerated material.

Given these findings, COTREP wishes to limit use of COC combined with PP solely for pharmaceutical blister packs owing to the small volume marketed, as an alternative to PVC or PVDC blister packs.

In conclusion, given the current state of the market, equipment and sorting and regeneration techniques available in France, PP/COC/PP pharmaceutical blister packs offer partial compatibility in the rigid PP stream.

COTREP may review this notice in light of developments in sorting and recycling technologies, markets, or quality requirements for recycled material.

[1] rPP means recycled material from rigid PP packaging

1. CONTEXT

Pharmaceutical blister packs are a packaging format used to package medicines. Currently, these blister packs for medicines are composed mainly of a rigid PVC cavity tray and non-peelable aluminium lidding; however this packaging is not recyclable. These items cannot be integrated into a household packaging recycling stream. In addition, the presence of PVC generally means the packaging is rejected at sorting, however, sorting errors can lead to the presence of these disruptive PVC blister packs in the various existing streams. PVDC is also added to the rigid cavity tray for medicines with greater barrier property requirements. The problems related to the sorting and regeneration of PVDC are the same as those for PVC.

An initial study revealed that to date 80% of medicine blister packs did not require high barrier properties, 10% required medium to high barrier properties and 10% very high barrier properties. Various alternatives are being developed to meet these different barrier level requirements.

Pharmaceutical blister packs with a rigid PP/COC/PP cavity tray offer an alternative with a medium to high barrier. COC, cyclic olefin copolymer, is an amorphous thermoplastic that provides moisture-resistant barrier properties sought for certain types of medicines. These types of blister pack can be produced by co-extrusion or lamination. The COC is interposed between two PP layers.

The marketed volume of PP/COC/PP pharmaceutical blister packs is estimated at under 1% of the rigid PP packaging placed on the market in France by 2030.

This notice seeks to assess the impact of PP/COC/PP pharmaceutical blister packs on sorting and mechanical regeneration of the rigid PP stream by injection moulding and on material quality.

This study solely concerns the rigid part of the blister pack (cavity tray). It does not concern its impact when combined with a lid.

2. IMPACT ON OPTICAL SORTING

COTREP assessed the impact of PP/COC/PP pharmaceutical blister packs on optical sorting.

Static and dynamic optical sorting tests were performed on the premises of optical sorting equipment manufacturers Tomra and Pellenc ST. The aim was to determine whether the inner COC layer prevented the packaging from being correctly detected and channelled to the rigid PP stream.

These tests were conducted in partnership with COCET[2] in accordance with their optical sorting protocol.

2.1. Test samples

COTREP tested a PP/COC/PP blister pack structure representative of pharmaceuticals on the market containing approximately 80% mass of COC.

The blister packs were tested empty and unlidded.

2.2. Results of static optical sorting tests

The packaging was positioned beneath the optical sorting machine with near infrared (NIR) technology. The static tests were performed on the top side (cavities visible) and on the underside (liddable side). The results were as follows:

- ⇨ In all the test configurations, the samples were detected as rigid PP packaging and the presence of COC in the inner layer did not affect detection.

2.3. Results of dynamic optical sorting tests

COTREP provided test sorting lines with a rigid packaging stream from French sorting centres as a standard stream. The dynamic tests were performed on empty, unlidded blister packs. 100 samples of PP/COC/PP pharmaceutical blister packs were injected into the packaging stream from French sorting centres. The

[2] COCET: Committee for studying the behaviour of packaging in sorting centres – optical sorting protocol available on the website www.cocet.fr

machines were set to eject packaging to the rigid PP stream (target stream) based on the standard settings used in French sorting centres.

The tests revealed that PP/COC/PP pharmaceutical blister packs are mostly channelled to their target stream. Losses due to routing errors were observed; these are characteristic of small-sized packaging and unrelated to the packaging composition.

IMPACT OF PP/COC/PP BLISTER PACKS ON OPTICAL SORTING PROCESSES

OPTICAL SORTING

No impact on optical sorting; the PP/COC/PP blister packs were satisfactorily channelled to the rigid PP stream given their small size.

3. IMPACT ON REGENERATION

3.1. Principle and analytical criteria

In its recyclability study, COTREP assessed the impact of PP/COC/PP pharmaceutical blister packs on the regeneration process and quality of rPP produced from rigid PP household packaging.

The regeneration tests were performed on a pilot scale based on the protocol defined by COTREP for recycling rigid PP packaging. This protocol is representative of industrial practices applied by regeneration plants processing streams in France.[3] Use of the regenerated material was tested for injection moulding to manufacture plant pots.

Various physical-chemical criteria were measured during the test phases and compared to those of a standard sample composed of 100% rPP.

The technical characteristics of the recycled material were assessed for a plant pot application (injection moulding).

3.2. Test samples

Tests were performed on the same PP/COC/PP blister pack structure as the one used for the optical sorting tests described in section 2.1.

To isolate the issues and test solely the impact of the rigid part, or “cavity tray”, unlidded samples with a density less than 1 were chosen.

The packaging was tested without any medicine residue or other secondary elements (labels, print, etc.). These items were incorporated into the standard stream to simulate the addition of COC to the rigid PP stream.

The standard stream used for the study comprises 100% rPP extruded shredded sheets produced exclusively for the study from granulate sourced from French selective collection (rigid PP standard).

COTREP sought to assess the impact of PP/COC/PP pharmaceutical blister packs with market penetration rates of 1% and 4%. These rates respectively account for an estimation of volumes placed on the market by 2030 and conversion of the entire pharmaceutical blister pack market to this structure.

[3] For further information, see protocol Rigid PP-1 on the COTREP website: www.cotrep.fr

3.3. Results

IMPACT OF PP/COC/PP BLISTER PACKS ON RIGID PP PACKAGING REGENERATION PROCESSES

RECYCLING PROCESSES	IMPACT	*DESCRIPTION*
SHREDDING	✓	*No impact on shredding*
WASHING AND SPINNING	✓	*No impact on washing and spinning*
FLOTATION AND DRYING	✓	*No impact on flotation and drying*
EXTRUSION/ GRANULATION	!	*At a rate of 4% of PP/COC/PP blister packs, some of the granulate's mechanical properties are slightly impacted*
INJECTION MOULDING	!	*No impact during plant pot injection moulding* *Most of the mechanical properties of the pots are consistent with the standard* ➔ *The results of the squeeze test[4] reveal slightly fragile pots with a proportion of 1% and unacceptable fragility when the proportion of PP/COC/PP blister packs is 4%*

! Caution ✓ No impact

TECHNICAL CONCLUSIONS

Through tests performed by COTREP, it was possible to assess the impact of PP/COC/PP pharmaceutical blister packs on sorting and mechanical regeneration of rigid PP household packaging.

Sorting tests determined that PP/COC/PP blister packs are detected and channelled as rigid PP packaging.

Regeneration tests show that incorporating 1% of PP/COC/PP pharmaceutical blister packs does not significantly disrupt the different stages of the regeneration process or the quality of regenerated material.
At 4%, regeneration tests show that the presence of PP/COC/PP pharmaceutical blister packs affects the mechanical properties of regenerated material.
Given these findings, COTREP wishes to limit use of COC combined with PP solely for pharmaceutical blister packs owing to the small volume marketed, as an alternative to PVC or PVDC blister packs.

Given the current state of the market, equipment and sorting and regeneration techniques available in France, PP/COC/PP pharmaceutical blister packs offer partial compatibility in the rigid PP stream.

COTREP may review this notice in light of developments in sorting and recycling technologies, markets, or quality requirements for recycled material.

[4] For further information, see protocol Rigid PP-2 on the COTREP website: www.cotrep.fr