

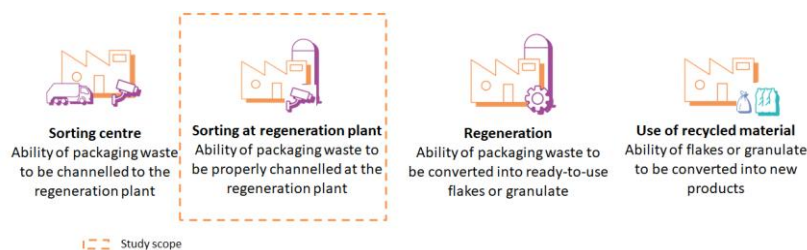


GENERAL NOTICE 82

Channelling of flexible PP/PE multilayer packaging during the sorting stage at regeneration plants

SUMMARY

The aim of this general notice is to assess the sorting potential of laminated or co-extruded flexible PP/PE multilayer packaging at regeneration plants.



The recyclability of this type of packaging poses a specific challenge: the packaging is compatible with the recycling process in the stream under development for flexible PP and PP/PE packaging but not compatible in the existing flexible PE stream. Its recyclability is therefore determined by the capability of optical sorting machines to properly direct it to the stream under development for flexible PP and PP/PE packaging at regeneration plants without disrupting the flexible PE stream.

Given that there is already a general notice (see AG69) concerning the impact of PP in the flexible PE stream on regeneration, the scope of this notice will be restricted to **the optical sorting phase at regeneration plants.**

The first static tests were conducted in partnership with the near infrared optical sorting machine manufacturers that supply to flexible packaging regeneration plants. They are designed to study the impact of packaging structure on detection. The tests determined that the factor with the most influence on the detection of PP/PE multilayer packaging is its composition, i.e. the percentages of PP and PE mass in the structure.

COTREP then used dynamic tests to check the minimum proportion of PP needed in the packaging body to ensure it was properly channelled to the flexible PP and PP/PE stream and hence ejected from the PE film regeneration stream. These dynamic tests were performed directly at a regeneration plant processing streams of flexible PE, PP and PP/PE household packaging produced from selective collection in France.

Results obtained from tests indicate that PP content in flexible PP/PE multilayer packaging should be at least 70% to ensure that PP/PE multilayer materials are properly separated from the flexible PE stream in regeneration plants.

Given the current state of equipment and sorting and regeneration techniques available in France:

- **Laminated or co-extruded flexible PP/PE multilayer packaging with a PP content greater than or equal to 70% in the packaging body offers partial compatibility in the flexible PP and PP/PE stream under development.**
- **Recommendations for the PE stream remain unchanged regarding incompatibility of PP with the PE stream.**

COTREP may review this notice with regard to technological and market developments if needed.

1. CONTEXT

Laminated or co-extruded flexible PP/PE multilayer packaging is used for its technical practicality when passed through packaging machines, particularly for savoury and sweet grocery products, coffee and deli products.

PE guarantees sealing and leak-tightness properties while PP provides the packaging's mechanical and heat resistance. The difference in melting point between PP and PE ensures clean and efficient sealing of the packaging's inner layer while maintaining outer layer integrity.

Regeneration tests for studying the impact of PP elements on the flexible PE stream have already been covered by a COTREP general notice, revealing their disruptive effect (see AG69).

Flexible PP/PE multilayer packaging poses a highly specific problem: it is not compatible in the existing flexible PE stream, but is compatible with the recycling process in the stream under development for flexible PP and PP/PE packaging. Its recyclability is therefore determined by the capability of optical sorting machines at regeneration plants to detect and direct it appropriately by ejecting it from the flexible PE stream.

This notice seeks to assess channelling of laminated or co-extruded flexible PP/PE multilayer packaging during the optical sorting phase in regeneration plants.

2. IMPACT ON SORTING IN REGENERATION PLANTS

When exiting sorting centres, a stream of flexible PE, PP and PP/PE packaging is now regenerated as a mixture. Flexible PP and PP/PE packaging is sent for chemical recycling¹ and half of flexible PE packaging is sent for mechanical recycling and the other half for chemical recycling.

When the bales arrive at the regeneration plant, additional sorting steps are therefore necessary to refine the quality of the material by removing the different contaminants and impurities, and a secondary sort is performed if the regeneration plant is seeking to recycle the flexible packaging it receives into separate PE and PP. This step depends on near infrared optical sorting technology which detects packaging according to material type. Packaging intended for the flexible PE stream is separated and channelled to mechanical regeneration while flexible PP and PP/PE multilayer packaging is separated for chemical recycling.

Initial static tests were conducted in partnership with the near infrared optical sorting machine manufacturers that supply flexible packaging regeneration plants – Pellenc ST and Tomra –, with settings similar to sorting conditions at a mechanical regeneration plant.

Dynamic tests were then performed directly at a regeneration plant processing streams of flexible PE, PP and PP/PE household packaging produced from selective collection in France to study the channelling of PP/PE multilayer packaging: either to mechanical recycling in the case of flexible PE packaging, or to chemical recycling.

2.1. Pilot-scale static sorting tests

2.1.1. Test samples and analysis criteria

To ensure representativeness of PP/PE structures available on the market, thirteen samples were selected and procured from several producers and packaging manufacturers.

The different films chosen have total thicknesses of between 50 and 95 microns and differ in terms of the thickness of their constituent PE and PP layers and the order of these layers within the structure, composed as follows:

- 6 mainly PE samples with percentages of **PE mass between 80% and 65%** (i.e. **between 20% and 35% PP content respectively**),

¹ Stream currently under development in France and to be operational during 2025

- 6 samples with similar percentages of **PE and PP mass with between 50% and 60% PE** (i.e. **between 50% and 40% PP content respectively**),
- 1 mainly PP sample with a percentage of **PP mass of 70%** and **30% PE content**.

The aim of the static test was to study the impact of these different parameters on packaging detection and look for any apparent correlations.

2.1.2. Results of static tests

The PP/PE multilayer packaging was positioned in front of the optical sorting machine sensors. The signal returned by each packaging item was analysed. Results obtained show that:

- The factor with the most influence on the detection of PP/PE multilayer packaging is its composition, i.e. the percentages of PP and PE mass in the structure.
- The PP/PE multilayer packaging consisting mainly of PE is not differentiated from PE films. The optical signature of PP for these structures is either too weak or not detected.
- Detection is random for PP/PE multilayer packaging with close percentages of PE and PP.
- PP/PE multilayer packaging consisting mainly of PP is detected as PP packaging.

2.2. Dynamic sorting tests at the regeneration plant

2.2.1. Test samples and analysis criteria

Based on the results obtained in the static tests, four samples were selected for testing by a mechanical regeneration plant processing streams of flexible PE, PP and PP/PE French household packaging:

- PP/PE multilayer – 70/30 packaging, i.e. with a **PE mass of 70%** and **PP mass of 30%**
- PP/PE multilayer – 60/40 packaging, i.e. with a **PE mass of 60%** and **PP mass of 40%**
- PP/PE multilayer – 40/60 packaging, i.e. with a **PE mass of 40%** and **PP mass of 60%**
- PP/PE multilayer – 30/70 packaging, i.e. with a **PE mass of 30%** and **PP mass of 70%**

The aim of the dynamic test was to check that the test packaging was properly detected and channelled in real-life industrial conditions.

To consider that the packaging is properly channelled, optical sorting must allow it to be distinguished and thus removed from the flexible PE stream.

2.2.2. Results of dynamic tests



The mechanical regeneration plant provided its industrial lines with a stream generated by selective collection of flexible PE, PP and PP/PE French household packaging.

The tested PP/PE multilayer samples were mixed with this stream and together it was sorted dynamically in the usual plant operating conditions.

COTREP characterised the sorted PE films and rejects to identify the recycling potential of this packaging:

STRUCTURE COMPOSITION (% BY MASS)	CHANNELLING ON SORTING AT THE REGENERATION PLANT
70% PE 30% PP	Mainly directed to the PE stream for mechanical recycling
60% PE 40% PP	Mainly directed to the PE stream for mechanical recycling
40% PE 60% PP	Mainly directed to the PE stream for mechanical recycling
30% PE 70% PP	Mainly directed to the PP stream for chemical recycling

CHANNELLING OF FLEXIBLE PP/PE MULTILAYER PACKAGING DURING THE OPTICAL SORTING STAGE IN REGENERATION PLANTS

SORTING PROCESSES	IMPACT	DESCRIPTION
 OPTICAL SORTING		<p>The detection of PP/PE multilayer films depends on their composition.</p> <ul style="list-style-type: none"> ⇒ The PP/PE multilayer films consisting mainly of PE are not correctly channelled. ⇒ The PP/PE multilayer films consisting mainly of PP are correctly channelled if their structure contains 70% or more PP.

 Caution
  No impact

To ensure that PP/PE multilayer packaging is properly separated from the flexible PE stream at regeneration plants, the proportion of PP in the flexible PP/PE multilayer packaging must be at least 70%.

TECHNICAL CONCLUSIONS

When exiting sorting centres, the stream of flexible PE, PP and PP/PE packaging is now regenerated as a mixture. Flexible PP and PP/PE packaging is sent for chemical recycling and half of flexible PE packaging is sent for mechanical recycling and the other half for chemical recycling. COTREP therefore needs to consider the requirements for the entire stream to preserve the quality of the two separate streams.

Given these circumstances, COTREP conducted tests to assess channelling of laminated or co-extruded flexible PP/PE multilayer packaging during the optical sorting phase in mechanical regeneration plants. As such, its recyclability is determined by the capability of optical sorting machines at regeneration plants to detect and direct it appropriately by ejecting it from the flexible PE stream.

Results obtained show that the channelling of these films depends on their composition.

Given the current state of equipment and sorting techniques at mechanical regeneration plants processing streams of flexible PE, PP and PP/PE French household packaging:

- **Laminated or co-extruded flexible PP/PE multilayer packaging with a PP content greater than or equal to 70% in the packaging body offers partial compatibility in the flexible PP and PP/PE stream under development.**
- **Recommendations for the PE stream remain unchanged regarding incompatibility of PP with the PE stream.**

It should be noted that this study solely concerns laminated or co-extruded flexible PP/PE multilayer packaging. COTREP may review this notice with regard to technological and market developments if needed.