COTREP

Comité Technique pour le Recyclage des Emballages Plastiques

Resin

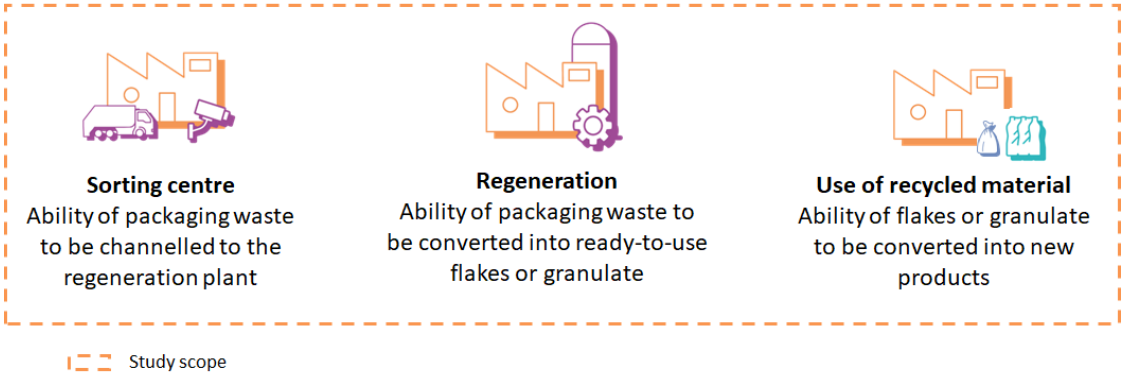
Flexible PE

GENERAL NOTICE 76

Impact of EVA on the regeneration of flexible PE household packaging

SUMMARY

The aim of this general notice is to assess the impact on mechanical regeneration of flexible PE household packaging whose structure contains one or more EVA layers.



EVA is a polymer used in combination with PE in flexible structures. It improves the flexibility and aesthetic properties of flexible PE and also offers an alternative to PVC packaging.

Results obtained from the optical sorting process show that flexible packaging including PE and EVA is detected as flexible PE at sorting centres and directed mainly to the flexible PE stream. COTREP therefore tested the impact of the presence of EVA on the regeneration of flexible PE.

The outcomes of pilot-scale regeneration tests show that certain mechanical properties of recycled PE are impacted by the presence of 5% or more PE/EVA structures in flexible PE household packaging.

Given the current state of regeneration equipment and techniques available in France, PE combined with EVA offers limited compatibility with mechanical flexible PE regeneration.

This opinion may be reviewed with regard to technological and market developments if needed.

1. CONTEXT

EVA (ethylene-vinyl acetate) is a copolymer of ethylene and vinyl acetate (VA). The proportion of VA varies from 7 to 30% depending on usage. Its mechanical properties depend directly on the quantity of VA contained. The higher the proportion of VA, the more elastic, flexible and transparent the EVA will be. Owing to its wide range of properties, EVA is used in different applications, including in household packaging.

For use in flexible household packaging, this plastic of the polyolefin family is typically blended or coextruded with PE. As it has a lower melting point than PE, it is often used in combination with PE as a sealant layer in lids for instance.

It is also used for cling film applications, flexible pouches for textiles, etc.

The tonnage of PE/EVA packaging in 2025 in France is estimated at 2,400 tonnes, with quantities of VA varying according to the structure.

This notice seeks to assess the impact of EVA in the composition of flexible PE packaging during sorting and mechanical regeneration.

2. IMPACT ON SORTING

At sorting centres, different separation stages (ballistic, aeraulic sorting, etc.) direct all flexible packaging to a near infrared optical sorting machine to separate flexible packaging from other types of packaging.

Sorting tests were therefore performed to determine whether PE-based flexible structures containing EVA are detected and correctly channelled at the optical sorting stage. COTREP conducted these static and dynamic sorting tests in partnership with the near infrared optical sorting equipment manufacturers that supply French sorting centres: Pellenc ST and Tomra.

2.1. Test samples

COTREP worked with packaging manufacturers and producers to obtain test samples that were representative of the market.

2.2. Results of static tests

The PE/EVA packaging items were positioned in front of the optical sorting machine sensors. The signal from each packaging item was compared with the PE signal and the results obtained show that:

- Packaging combining PE and EVA is detected as PE packaging,
- EVA does not have a different optical signature to PE,
- This packaging cannot be separated from PE films using current NIR optical sorting machines.

2.3. Results of dynamic tests

COTREP provided pilot sorting lines with a packaging stream from French sorting centres. This packaging stream was collected at the ballistic sorting outlet stage, before optical sorting. It was made up of flexible PE packaging (approximately 15%), PP, composite packaging and cardboard.

The composite PE/EVA packaging was mixed with this stream and together it was sorted dynamically in conditions representative of optical separation equipment operation in French sorting centres. COTREP characterised the sorted PE films and rejects to identify the recycling potential of this packaging.

The results showed that 92% of the PE/EVA test packaging is directed to the PE stream. They hence confirm the importance of assessing the impact of the inclusion of EVA on the regeneration of flexible PE packaging.

IMPACT OF FLEXIBLE PE/EVA PACKAGING ON OPTICAL SORTING PROCESSES

SORTING PROCESSES	IMPACT	*DESCRIPTION*
 **OPTICAL SORTING**		*PE/EVA films have a similar optical signature to flexible PE.* ⇨ *Dynamic sorting directs this packaging to the flexible PE stream.* ⇨ *Need to examine the impact on regeneration of EVA in the flexible PE stream.*

3. IMPACT ON REGENERATION

3.1. Principle and analytical criteria

In its mechanical regeneration study, COTREP assessed the impact of EVA on the regeneration process and quality of recycled PE (rPE) produced from flexible household packaging.

These tests were performed on a pilot scale based on protocols defined by COTREP for recycling flexible PE packaging. The protocols are representative of industrial practices applied by regeneration plants processing streams in France.[1] Various physical-chemical criteria were measured during the test phases and compared to those of a standard sample composed of 100% rPE.

3.2. Test samples

To ensure representativeness of PE/EVA structures available on the market, four different samples were selected and procured from several suppliers. The different films chosen differ in EVA and VA quantities depending on use. The aim of the test was to verify the impact of these quantities on regeneration potential and determine any upper limits on the proportion of EVA and VA quantities in the stream.

A 100% rPE film was produced exclusively as the standard film for the study from granulate sourced from a regeneration process using packaging waste generated by the French selective collection system (flexible PE standard). Tests were performed with 1%, 2% and 5% PE/EVA film by mass to account, respectively, for marketing in 2023, marketing potential in 2025 and a peak concentration in bales.

3.3. Results

IMPACT OF EVA ON FLEXIBLE PE 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 or drying*
EXTRUSION/ GRANULATION	!	*The properties of granulate vary slightly if PE/EVA exceeds 5%*
BLOW EXTRUSION	!	*The mechanical properties of the film obtained deteriorate if PE/EVA exceeds 5%* ⇨ *Impact on elongation at break and tensile stress* ⇨ *Impact on suitability for sealing*

! Caution ✓ No impact

[1] *For further information, see protocols Flexible PE-1 and Flexible PE-2 on the COTREP website: www.cotrep.fr*

TECHNICAL CONCLUSIONS

Through tests performed by COTREP, it was possible to assess the impact of EVA on sorting and mechanical regeneration of flexible PE packaging.

Results obtained show that:

- In sorting centres, flexible PE/EVA packaging has a similar optical signature to flexible PE packaging. Near infrared optical sorting technologies direct PE/EVA films mainly to the flexible PE packaging stream with good performance in terms of capture rates.

- The mechanical properties of recycled PE are affected if PE/EVA structures exceed 5% in the flexible PE packaging stream. This is particularly true for the traction properties and suitability for sealing of the films produced.

It should be noted that the appearance of the films produced was not assessed in this test. A further study may be performed to supplement this notice.

In conclusion, given the current state of equipment and techniques used in France, EVA has **limited compatibility** with flexible PE streams regardless of the quantity of EVA and VA included in the packaging. This opinion may be reviewed with regard to technological and market developments if needed.