



GENERAL NOTICE 75

Impact of oriented PE on the regeneration of flexible PE household packaging

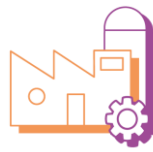
SUMMARY

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 oriented PE layers.



Sorting centre

Ability of packaging waste to be channelled to the regeneration plant




Regeneration

Ability of packaging waste to be converted into ready-to-use flakes or granulate



Use of recycled material

Ability of flakes or granulate to be converted into new products

 Study scope

The advantage of oriented PE lies in its ability to replace complex structures that are not compatible with the recycling of flexible PE, such as PET/PE or PP/PE structures. The outcomes of pilot-scale regeneration tests show that oriented PE does not affect the mechanical flexible PE regeneration process or impair the mechanical properties of the recycled material at proportions of up to 18% in flexible PE tonnage. The recycled material is slightly impacted in terms of suitability for sealing but does not pose a significant risk for end use.

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

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

1. CONTEXT

The development of mechanical recycling of flexible PE prompted resin producers and packaging manufacturers to innovate by offering oriented PE (OPE)-based structures. The new OPE films can replace complex structures such as PP/PE and PET/PE, etc. which are not compatible with mechanical recycling of flexible PE.

The principle of orientation post extrusion can improve film properties such as puncture resistance, transparency or rigidity. A distinction is made between MDO (Machine Direction Orientation) which orients the chains in the machine direction only and the tenter frame biaxial orientation (TF-BOPE) process which first orients in the machine direction and then in the transverse direction.

To enable efficient implementation of films during orientation, new PE grades have been developed by resin producers. These new grades have higher densities (LLDPE, HDPE, MDPE, etc.) than the LDPE grades typically present in flexible PE household packaging tonnage, which can impact the properties of recycled material. COTREP wanted to assess the impact of these new PEs in the flexible PE household packaging stream to enable regeneration plants to plan for the change in tonnage.

OPE films are often used in packaging that requires barrier properties. Due to their rigidity, OPE films can be combined with most barriers including metallisation, EVOH and SiOx. OPE films do not account for the whole packaging item as they are also used in combination with a sealant film to produce pouches or bags.

The marketing potential of packaging requiring an OPE film in 2030 is estimated to be 28,000 tonnes. The OPE contained in packaging accounts for 50% of the packaging structure weight at most. The percentage of OPE in flexible PE household packaging tonnage is estimated to be roughly 10% in 2030.

This notice seeks to assess the impact of new grades of chain-oriented PE on mechanical flexible PE household regeneration and the quality of the recycled material. The OPEs assessed in this notice are those produced using the MDO and tenter frame biaxial orientation (TF-BOPE) process.

2. IMPACT ON PILOT SCALE REGENERATION

2.1. Principle and analytical criteria

In its mechanical regeneration study, COTREP assessed the impact of MDOPE and BOPE film 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.

2.2. Test samples

Tests were performed on several OPE (MDOPE and BOPE) films representative of those available on the market. They were tested without any combined sealant layer or barriers.

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 5%, 10% and 18% OPE film by mass to account, respectively, for marketing in 2023, marketing potential in 2030 and a peak concentration in bales.

2.3. Results

IMPACT OF OPE ON FLEXIBLE PE REGENERATION PROCESSES

RECYCLING PROCESSES	IMPACT	DESCRIPTION
 SHREDDING		<i>No impact on shredding</i>
 WASHING AND SPINNING		<i>No impact on washing and spinning</i>
 FLOTATION AND DRYING		<i>No impact on flotation or drying</i>

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

RECYCLING PROCESSES	IMPACT	DESCRIPTION
 EXTRUSION/ GRANULATION		<i>No impact on extrusion/granulation</i>
BLOW EXTRUSION		<i>No impact during film manufacture. The mechanical properties of the film obtained are compliant, but with a slight impact on suitability for sealing.</i>



Caution



No impact

TECHNICAL CONCLUSIONS

Through tests performed by COTREP, it was possible to assess the impact of oriented PE (OPE) films on mechanical regeneration of flexible PE packaging.

Results obtained show that the presence of oriented PE up to a proportion of 18% does not disrupt the different stages of the regeneration process.

The mechanical properties of the films up to a proportion of 18% are comparable to the standard but certain properties, such as suitability for sealing, may be slightly impacted, without them representing a risk for end use.

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.

Given the current state of equipment and techniques used in France, oriented PE such as MDOPE and BOPE used in flexible PE structures offers **partial compatibility** in the flexible PE stream. This opinion may be reviewed with regard to technological and market developments if needed.