

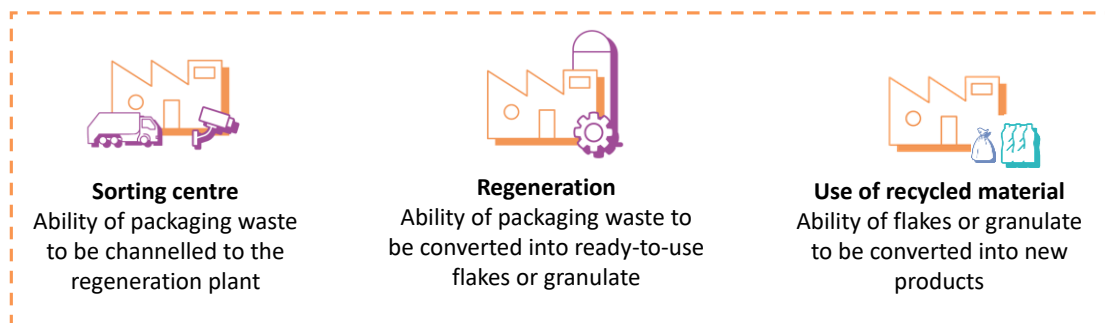



GENERAL NOTICE 58

Impact of compostable flexibles on the sorting and regeneration of flexible PE household packaging

SUMMARY

This general notice does not cover the household biowaste collection and recovery stream or the theoretical possibility of forming compostable flexible packaging bales in sorting centres. The aim of this notice is to assess the impact of compostable bags during sorting and regeneration processes for flexible PE packaging.



 Study scope

In sorting centres, compostable flexibles have a different optical signature to flexible PE packaging and the vast majority are rejected. Near infrared optical sorting technologies can separate compostable film from PE film without noticeable differences in efficiency compared with other materials. The make-up of compostable packaging does not affect sorting performance. During optical sorting processes, 100% separation performance cannot be achieved, and therefore a small quantity of compostable flexibles will be present in the flexible PE stream. COTREP tested the potential impact of these residual compostable flexibles on mechanical regeneration of flexible PE packaging.

The results show that the compostable flexible residue that arrives at regeneration plants, currently estimated at 1%, does not disrupt the flexible PE regeneration process or deteriorate the quality of the recycled material. However, once the proportion of compostable flexible residue reaches 5% – equivalent to the peak concentration level – the regeneration process is significantly disrupted. This is because the sink-float method cannot separate compostable flexibles from PE flexibles efficiently, regardless of the proportion of compostable flexibles, and the presence of these materials results in significant moisture regain during film manufacture. Further, the quality of the rPE film obtained is slightly impacted in terms of suitability for sealing with a 5% incorporation rate.

Given the quantities currently on the market and our medium-term forecasts, the residual proportion of compostable flexibles does not have a significant impact on the recycling of flexible PE. However, COTREP will monitor the peak concentration levels in bales and the development of this type of packaging on the market in view of the significant disruption to the regeneration process observed during tests with 5% compostable flexibles.

In conclusion, given its properties, compostable flexible packaging is not intended to be processed in the flexible PE packaging regeneration stream. Given the quantities currently placed on the market and the sorting and regeneration conditions used in France, compostable flexible packaging does not significantly disrupt this stream. It must nevertheless be rejected at sorting centres and is therefore not compatible with the flexible PE regeneration stream.

1. CONTEXT

Compostable flexible packaging has taken off in France since the 2015-992 law was passed to regulate the use of “fruit and vegetable” bags and films for mailing newspapers, magazines and advertisements. It is estimated that the French flexible household packaging market represented 290,000 tonnes in 2021, including 120,000 to 130,000 tonnes of PE and 15,000 to 20,000 tonnes of compostable flexible packaging.

The compostable flexible packaging on the French market is made up of different resins – starch-based plastic, PBAT/PLA, PBS or cellulose acetate.

With the gradual extension of sorting guidelines to all packaging from 2012 to 2022, French people are required to recycle all their packaging in the selective sorting bin. This compostable packaging can therefore find its way into this collection and be sent to sorting centres, responsible for producing uniform packaging waste streams for recycling. Regarding flexible packaging, sorting centres which implement the extended sorting guidelines to all packaging produce a flexible PE stream. Other flexible packaging, including compostable packaging, is rejected and sent for energy recovery.

It is in this context that COTREP questioned the capability of sorting centres with near infrared optical sorting technologies to maintain flexible PE packaging and film bale quality, and the ability of flexible PE packaging regeneration plants to manage this compostable packaging so that it does not impact their process and/or recycled material.

This notice does not cover the household biowaste collection and recovery stream or the theoretical possibility of forming compostable flexible packaging bales in sorting centres. **It focuses on how compostable flexible packaging is processed in sorting centres and its impact on flexible PE packaging in regeneration centres.**

During the publication of this notice in June 2019, COTREP only performed tests on the recycling potential of packaging in sorting centres. COTREP has now updated its document following further tests on the impact of compostable packaging residue on flexible PE regeneration processes in 2022.

2. IMPACT ON SORTING

In sorting centres, compostable flexible packaging (like all films) is mainly channelled to the flat materials stream by a ballistic separator.

On the flat material line, near infrared optical sorting technologies are used to separate flexible PE from other packaging. In modern sorting centres, it is this stage which is used to channel compostable packaging as rejects.

COTREP conducted static and dynamic sorting tests with near infrared optical sorting technology suppliers to ensure correct recognition of the various compostable resins in relation to PE.

2.1. Test samples

COTREP worked with resin producers and packaging manufacturers to obtain the samples for its tests:

- PBAT/PLA bag sample,
- Starch bag sample (potato starch-based),
- Starch bag sample (maize and oilseed-starch based),
- PBS mailing film sample.

A cellulose acetate film sample was received after the tests were carried out and was only subjected to a static test, which was deemed sufficient for drawing conclusions.

2.2. Results of static tests

The compostable packaging was 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:

- PE has a very different signal from the 5 samples tested,
- Compostable packaging can be separated from PE films using current optical sorting machines,
- The optical sorting signal is slightly different between the various samples of compostable film tested.

Additional observations:

- The two starch-based bags have an almost identical signal,
- The cellulose acetate signal is close to the paper signal.

2.3. Results of dynamic tests

COTREP provided a pilot sorting line 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 35%), PP, composite packaging and cardboard.



All the compostable bags were mixed with this stream and together they were sorted dynamically in conditions representative of optical separation equipment operation in sorting centres. COTREP characterised the sorted PE films and rejects to identify the recycling potential of compostable packaging.

The results showed that:

- Most of the compostable packaging items were channelled as rejects,
- For this test, the residual amount of compostable film in the PE film stream is on average 0.8%,
- The produced PE stream has an average purity similar to the results obtained in sorting centres, before the manual filtering stage,
- The capture rate for PE films channelled into the dedicated stream is also similar to the results observed in sorting centres.

COTREP notes that a small amount of compostable packaging remains in the flexible PE stream sent for recycling because of the efficacy of sorting centre equipment and that most of this packaging is removed by infrared sorting technologies. **So, the make-up of compostable packaging does not affect sorting performance.**

IMPACT OF COMPOSTABLE FLEXIBLES ON OPTICAL SORTING PROCESSES

SORTING PROCESSES	IMPACT	DESCRIPTION
 OPTICAL SORTING		<i>Compostable film has a characteristic optical signature and differs greatly from flexible PE. Dynamic sorting is efficient in removing compostable packaging from the flexible PE stream.</i> ⇒ <i>No disruption to compostable flexible packaging sorting.</i>

3. IMPACT ON REGENERATION

In its recyclability study, COTREP assessed the impact of compostable flexible packaging residue, which was not totally removed by optical sorting, under mechanical flexible PE regeneration conditions.

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.

3.1. Test samples

Based on market analysis in cooperation with resin producers and packaging manufacturers, three compositions of compostable bags were selected:

- PBAT/PLA bag sample,
- Starch bag sample (potato starch-based),

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

- Starch bag sample (maize and oilseed-starch based).

These 3 types were procured from several suppliers to ensure representativeness of compostable structures available on the French market. The films were tested without any food residue.










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).

The 3 sample compostable compositions were introduced according to the distribution of structures available on the market to form a stream representative of compostable flexibles.

Tests were performed with a proportion of 1% compostable flexible (average proportion of compostable flexible residue in a bale) and 5% (proportion simulating a peak concentration level of compostable flexibles) by mass to account for the efficiency limitations of sorting techniques.

3.2. Results

IMPACT OF COMPOSTABLE FLEXIBLES ON FLEXIBLE PE REGENERATION PROCESSES

RECYCLING PROCESSES	IMPACT	DESCRIPTION
 SHREDDING		<i>Problematic when shredding certain items.</i>
 WASHING AND SPINNING		<i>No impact on washing or spinning. Note: the formation of clusters and moisture regain in batches due to the presence of compostable flakes.</i>
 FLOTATION AND DRYING		<i>The vast majority of compostable flexibles was found in the float fraction with the PE: the sink-float method cannot separate compostable flexibles from PE flexibles efficiently.</i>
 EXTRUSION/ GRANULATION		<i>A proportion of 1% compostable flexibles does not disrupt extrusion which remained stable and the granulate obtained was compliant. However, 5% compostables had a different impact on extrusion related to higher moisture content, which affected granulate quality and particularly its density.</i>
BLOW EXTRUSION		<i>Blow extrusion conditions were stable with a 1% proportion of compostable flexibles. The resulting film is compliant. However, when 5% compostable flexibles is incorporated, the granulate needs to be dried to achieve a transformable material. Compostable flexibles tend to promote moisture regain. The mechanical properties of the film are affected, particularly its suitability for sealing.</i>

 Caution
  No impact

TECHNICAL CONCLUSIONS

Through tests performed by COTREP, it was possible to assess the impact of compostable flexibles on sorting and regeneration in the flexible PE household packaging stream. Results obtained show that:

- In sorting centres, compostable flexibles have a different optical signature to flexible PE packaging and the vast majority are rejected. Near infrared optical sorting technologies can separate compostable film from PE film without noticeable differences in efficiency compared with other materials.
- During sorting processes, 100% separation performance cannot be achieved, and therefore a small quantity of compostable flexibles will be present in the flexible PE stream. This residue is estimated to be 1% in flexible PE bales leaving sorting centres. Tests performed by COTREP show that this residue does not disrupt flexible PE regeneration processes.
- However, once the proportion of compostable flexible residue reaches 5% – equivalent to the peak concentration level – the regeneration process is significantly disrupted. This is because the sink-float method cannot separate compostable flexibles from PE flexibles efficiently, regardless of the proportion of compostable flexibles, and the presence of these materials results in significant moisture regain during film manufacture. Further, the quality of the rPE film obtained is slightly impacted in terms of suitability for sealing with a 5% incorporation rate.

In light of the quantities currently on the market, medium-term marketing forecasts and existing sorting processes, the current residual proportion of compostable flexibles does not have a significant impact on the regeneration of flexible PE. However, COTREP will monitor the peak concentration levels observed in bales and the development of this type of packaging on the market. Were there to be a rise in the proportion of compostable resins in flexible PE streams, the sorting processes and related costs for disposing of rejects would be impacted. In this case, we would need to continue limiting the compostable flexible residue arriving at regeneration plants.

In conclusion, given its properties, compostable flexible packaging is not intended to be processed in the flexible PE packaging recycling stream. Given the quantities currently placed on the market and the sorting and regeneration conditions used in France, compostable flexible packaging does not significantly disrupt this stream. It must nevertheless be rejected at sorting centres and is therefore not compatible with the flexible PE regeneration stream.