



GENERAL NOTICE 78

Impact of tethered PE caps on the regeneration of rigid PE packaging

SUMMARY

The aim of this general notice is to assess the impact on mechanical regeneration of tethered cap closure systems in the rigid PE packaging stream.

COTREP conducted regeneration tests on two different rigid PE streams:

- Rigid PE stream: this is the target stream of rigid PE packaging at sorting centres. This stream is then channelled to regeneration plants for recycling.
- "Rigid PE-Milk" stream: some regeneration plants conduct additional sorting upon receipt of the Rigid PE stream and produce a stream consisting solely of PE milk bottles, referred to in this notice as the "Rigid PE-Milk" stream. This specific stream type is aimed at developing higher added-value outlets and in particular packaging-to-packaging recycling.



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

This study assesses the impact of tethered PE caps adding "injection grade" material into the Rigid PE and Rigid PE-Milk streams, particularly when recycled material is used to manufacture bottles by extrusion blow moulding.

Given the current state of regeneration equipment and techniques available in France, tethered PE caps used as a closure system offer full compatibility in the Rigid PE stream with or without specific secondary sorting of milk bottles.

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

1. CONTEXT

Since July 2024, attached caps, known as "tethered caps", have been mandatory for all beverage bottles of up to 3 litres to meet the requirements of the Single-Use Plastics Directive. Widespread implementation of tethered caps aims to reduce environmental pollution caused by plastic caps and to improve recycling via better capture rates.

The cap is attached to the bottle through the addition of a tamper-proof ring on the bottle. This generally results in an increase in average cap weight. Improved cap capture and the addition of a tamper-proof ring therefore increase the proportion of caps in Rigid PE tonnage.

PE grades used for caps are "injection" grades with a higher melt flow rate than those used for bottle production, which are known as "extrusion grades". These grade mixes can potentially have an impact on the mechanical properties of the recycled material.

The addition of tethered caps mainly concerns milk bottles which to date make up 32% of marketed volumes of rigid PE packaging.

To allow the development of higher added-value outlets and particularly packaging-to-packaging recycling, some regeneration plants conduct additional sorting to produce a stream consisting solely of PE milk bottles, referred to in this notice as the "Rigid PE-Milk" stream. COTREP specifically wished to check the impact of tethered caps on this Rigid PE-Milk stream during regeneration to support developments underway at regeneration plants.

This notice seeks to assess the impact of tethered PE caps on mechanical regeneration of rigid PE packaging (with or without secondary sorting of milk bottles) by extrusion blow moulding and on the quality of the recycled material.

2. IMPACT ON REGENERATION

2.1. Principle and analytical criteria

In its recyclability study, COTREP assessed the impact of tethered caps on the regeneration process and quality of rPE¹ and rPE-Milk² from rigid PE household packaging.

These tests were performed on a pilot scale based on protocols defined by COTREP for recycling Rigid PE packaging. The protocols are representative of industrial practices applied by regeneration plants processing streams in France.³

Various physical-chemical criteria were measured during the test phases and compared to the values obtained for standard samples composed of:

- 100% rPE for the Rigid PE stream
- 100% rPE-Milk for the "Rigid PE-Milk" stream

The technical characteristics of the recycled material were evaluated with a view to reprocessing as bottles by extrusion blow moulding, a common application for rigid PE and the most demanding in terms of expected characteristics.

2.2. Test samples

Based on market analysis, a tethered PE cap model representative of models on the market was selected and introduced into the following standard streams:

- For the test in the Rigid PE stream:

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

The standard stream already contains an estimated 1% of caps by mass considering the market share of milk bottles (32%) and a cap capture rate of 30%.

¹ rPE means recycled material sourced from rigid PE packaging.

² rPE-Milk means recycled material sourced solely from PE milk bottles.

³ For further information, see protocols Rigid PE-1 and Rigid PE-2 on the COTREP website: www.cotrep.fr

The tethered PE cap samples (without the bottles) were introduced at proportions of 3.8% and 6% by mass to account for:

- Marketed volumes of milk bottles (32%) considering that 100% of milk bottles always have their cap still attached.
 - A peak concentration of milk bottles in rigid PE bales (50%) and the fact that 100% of milk bottles have their cap.
- For the test in the "Rigid PE-Milk" stream:

The standard stream used for the study comprises 100% rPE-Milk extruded sheets produced exclusively for the study from granulate sourced from PE milk bottles. This granulate was acquired by a regeneration plant, which conducted specific PE milk bottle sorting in a rigid PE stream sourced from French selective collection.

This standard stream already contains an estimated 3% of caps by mass.

The tethered PE cap samples (without the bottles) were introduced at a proportion of 12% by mass based on the assumption that 100% of milk bottles have a tethered PE cap.

2.3. Results

IMPACT OF TETHERED PE CAPS ON REGENERATION PROCESSES

The results are the same for both tests:

REGENERATION 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		No impact on extrusion/granulation
 EXTRUSION BLOW MOULDING		No impact on extrusion blow moulding

 Caution
  No impact

TECHNICAL CONCLUSIONS

Through tests performed by COTREP, it was possible to assess the impact of tethered PE caps used as a closure system on mechanical regeneration of rigid PE household packaging.

For the Rigid PE stream, results obtained show that the use of tethered PE caps as a closure system does not disrupt the different regeneration processes or quality of recycled material, considering a 100% cap capture rate and a concentration peak of 50% milk bottles in the rigid PE stream.

For the Rigid PE-Milk stream, results obtained show that the use of tethered PE caps as a closure system on PE milk bottles does not disrupt the different regeneration processes or quality of recycled material.

Given the current state of regeneration equipment and techniques available in France, tethered PE caps used as a closure system offer full compatibility in the Rigid PE stream with or without specific secondary sorting of milk bottles.

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