

Preliminary note

Polyethylene Furanoate (PEF)

PEF is a new polyester resin offering significantly improved barrier properties compared to PET. It is possible that it will enter the market in 5 years' time, replacing composite packaging in particular. Planning for its end of life should start now.

In its trial formula, which was tested at the request of EPBP, PEF is not suitable for recycling with PET. PEF must be separated from PET at sorting centres to avoid adversely affecting PET recycling. It could initially be directed towards a **special stream for plastics requiring R&D work** with a view to creating a dedicated recycling stream.

If required, based on the tonnages marketed and R&D results, COTREP and its partners will contribute to developing a dedicated recycling stream.

COTREP has not yet tested PEF itself and has approached industrial operators with a view to performing sorting and recycling tests of this new resin in order to confirm these initial details in real-life conditions.

AN INNOVATIVE RESIN

PEF (polyethylene furanoate) is a new bio-based plastic resin that is currently being developed and is expected to enter the French market in 5 years' time. This innovation has prompted significant interest among packaging manufacturers and marketers due to:

- its barrier properties (for preserving products), which are better than those exhibited by PET. One PEF producer claims that its barrier effect is: 8-10 times superior against oxygen, 4-6 times superior against CO₂ and 2-3 times superior against water¹,
- the potential reduction in packaging weight, with mechanical and barrier properties that are superior to PET,
- transparency and transformation properties similar to PET (no need to modify industrial equipment),
- the opportunity to replace a fossil-based plastic with a bio-based plastic (made entirely from plant resources) limiting dependence on fossil fuels and impact in terms of climate change,
- the locations in which it will be produced. PEF would be synthesised in Europe.

In view of its properties, PEF could initially be used to package sensitive products requiring a gas or moisture barrier and replace current multi-material packaging (e.g. PET/PA or HDPE/EVOH composite packaging used for sparkling water or fruit juice). If its development gains momentum, PEF could subsequently compete with all rigid and flexible PET packaging.

In 2017, PEF packaging has not yet entered the European market and the PEF formula for use in packaging has not been finalised. Although it is important to start end-of-life planning for PEF, we should also refrain from drawing hasty conclusions concerning the end of life of breakthrough packaging that does not yet exist.

¹ https://www.synvina.com/wp-content/uploads/2017/06/Synvina_recycling_June2017.pdf

SORTING AND RECYCLING POTENTIAL

Please note: COTREP has not yet performed any sorting or recycling testing on PEF packaging. The analysis presented below is based on preliminary work on the recycling potential of a trial PEF formula assessed by the European PET Bottle Platform (EPBP)², which uses the same test protocol and works with the same laboratories as COTREP. Once the commercial formula of PEF is finalised, further tests should be performed to supplement this analysis. EPBP's opinion is provided as an appendix to this note.

PEF packaging can be identified at sorting centres using current optical sorting methods and thus separated from other plastics. Without optical sorting, it is impossible to distinguish between PEF and PET packaging.

All sorting centres should be equipped with optical sorting when PEF packaging enters the market and quantities of residual PEF packaging in PET bails leaving sorting centres should be kept low and manageable. The process applied by PET recyclers should ensure that any remaining PEF packaging is eliminated so that levels are considerably lower than the 2% threshold specified by EPBP.

Once the tonnage of PEF on the market begins to rise, PEF packaging could be directed towards a specific stream with a view to starting R&D work on uses of recycled PEF. As part of the polyester family, PEF could be recycled in streams similar to those used for PET, i.e. fibres, mechanical recycling as packaging, chemical recycling.

If required, based on the tonnages marketed and R&D results, PEF may be assigned a dedicated recycling stream.

CONCLUSION

Based on these initial results, COTREP shares EPBP's view that it is important to separate PEF from PET at sorting centres and, if these conditions are met, concludes that the risk of disrupting the PET stream is low. **It recommends that PEF packaging should not be marketed until sorting centres are equipped to effectively separate this new resin.**

COTREP recommends creating a dedicated recycling stream for PEF and will help achieve this goal if this material is developed for the French market.

COTREP is keen to cooperate with industrial operators on continued sorting and recycling testing of this new resin, with a view to confirming these initial results in real-life industrial conditions and laying the foundations for a PEF packaging recycling stream.

APPENDIX – PROVISIONAL EPBP OPINION ON PEF

² EPBP opinion on PEF: <http://www.epbp.org/download/319/interim-approval-synvinas-polyethylene-25-furandicarboxylate-or-pef>



Brussels, March 15th, 2017

The Technical Committee of the European PET Bottle Platform (EPBP) was requested to conduct an evaluation of the effect of Synvina's Poly(ethylene 2,5 - furandicarboxylate), or PEF, on the PET recycling stream. PEF is a polyester resin chemically similar to PET but comprising Furandicarboxylic Acid (FDCA) instead of Terephthalic Acid (PTA) in the polyester backbone. Due to its possible use as an alternative material for bottles, PEF requires a thorough assessment of the impact on PET recycling activities.

Data supplied by near-infrared (NIR) sorting equipment manufacturers demonstrates that PEF has a different near-infrared profile compared to PET, and can be distinguished and sorted by commercial NIR sorting equipment. However, sorting efficiencies will be affected by the design aspects of PEF based articles.

PEF has a higher density than PET and cannot be separated from PET by a traditional washing or sink-float step. For this reason, EPBP requests that PEF manufacturers develop a separate recycling stream for collected and sorted PEF based bottles.

For cases of no or inefficient sorting, the contamination of the rPET stream by PEF was studied using an experimental PEF grade and according to the EPBP protocol. Commercial PEF grade(s) are still under development. Data from these tests demonstrate no negative impact on haze, colour and other properties of the resulting rPET products at least up to 2% of PEF.

Based on the assessment's outcome but taking into account the variable performance of European sorting and recycling plants, the novelty of this packaging solution and its potential market penetration, EPBP has awarded interim approval to Synvina's PEF polyester resin in a test market (up to 50kt) and for an interim period, expiring 30 June 2020.

The Interim approval is awarded under the following conditions:

- A maximum allowed market penetration of 2%
- PEF-based articles are designed to allow detection and ejection by NIR sorting equipment, to minimize contamination of the PET bottle stream
- Synvina will provide EPBP with additional data on the targeted end-products, PEF commercial grade(s) and sales regions as they become available
- Synvina will continue to cooperate with EPBP in order to carry out additional tests, to be conclusive to decide if the approval can become permanent
- Synvina will work to develop a separate recycling stream for PEF based bottles when larger quantities will come to market
- **The word "interim" is quoted in any reference to the EPBP approval**

An updated technical opinion will be based on additional test data and market information supplied to the EPBP prior to any market introduction of PEF based products.