CHI-C8-PEF-0
Basic Recycling Application Compatibility Test for PE-based Flex. Packaging

Version 3.0

This CHI test method was developed by cyclos-HTP for LDPE-based flexible packaging and includes the following steps (Principle of the test method is shown in the flow chart on page 2):

1. **Materials** to be provided:
   - Flexible PE-based packaging/material structure including an unknown structure or a component with an unknown recycling compatibility, “PCK-S0“
   - Optional, reference packaging made of the same base PE grades (PE-LD or PE-LLD), “PCK-R0“
   - Commercial recyclate commonly used for the same target application in the recycling path “REF“
2. **Grinding** of the respective samples to flakes on a granulator with 5-10 mm sieve
3. **Extrusion/compounding** of grinded packaging samples on a lab-scale extruder with mono or double screw to form a recyclate; melt temperature 200-220°C.

   (A) **“CHI100”**: 100% PCK-S0

   Optional:

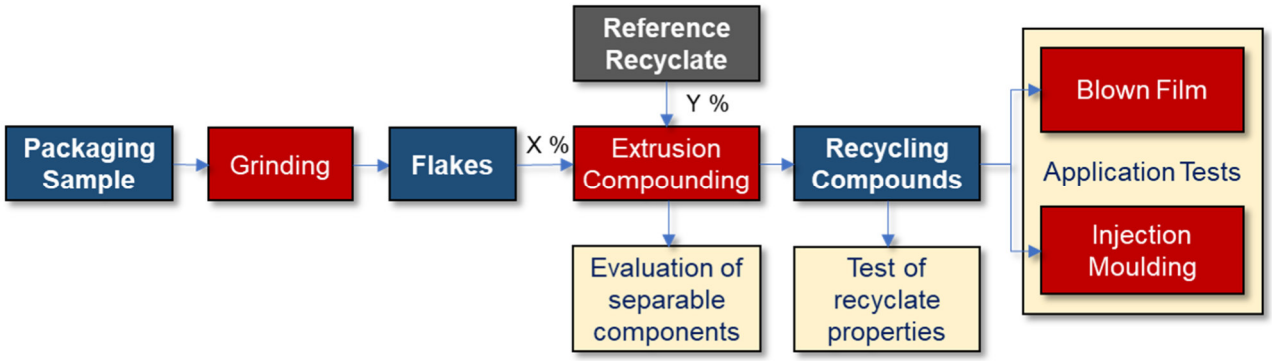
   (B) **“PE100”**: 100% PCK-R0
4. **Melt Screen** (filter with 100 µm pore size) can be used to separate heterogeneous components and to examine them qualitatively. The quantitative assessment of inhomogeneity is performed by documenting the melt pressure increase within 30 minutes after start of extrusion. Where indicated, the filtrate can be qualitatively examined to assign it to a component in the starting material.
   - Characterisation of recyclates CHI100 and REF: Thermally (DSC), viscosity (MFR); density
5. **Test specimens for Injection moulding** are prepared from the recyclates CHI100 and REF according to DIN EN ISO 3167
   - Characterisation of test specimens: Thermally (DSC), morphologically (microscopy) and mechanically by tensile testing (DIN EN ISO 527) and Notched bar impact testing (DIN EN ISO 179).
6. **Blown Films** are produced containing 50% of the recycling compounds out of steps 3/4 and 50% virgin PE-LD/LLD according to the CHI test method *CHI-C8-BFPE*.
   a. Testing of the blown film samples according to the CHI test method *CHI-C8-BFPE*.with regard to their mechanical (DIN EN ISO 527-3) and optical properties, as well as sealing properties (DIN 55529) and sealing seam tightness (CHI method).
7. **Evaluation** of all test results is carried out according to the following criteria, whereby the evaluation refers to the tested applications. The results of the samples CHI100 is compared with REF. Optional the samples PE100 and CHI100 are also compared.
   An evaluation for the applications in injection moulding and blown films is made in the following order:

   a) A significant, negative deviation of the relevant test results between **CHI100** and **REF** leads to a classification of the assessed packaging structure as "not compatible for recycling" (CAT3 according to the CHI assessment and requirement catalogue). By demand a further testing is necessary according to the CHI standard method *CHI-C8-PEF-1*.

   b) If the relevant results between **CHI100** and **REF** are in a comparable range or CHI100 is even better, the assessed packaging structure can be stated as “recycling compatible” and - under suitable conditions - “valuable material”

   c) In case of negative results of CHI100 in comparison to REF, an optional comparison of samples **CHI100** and **PE100** is used to prove whether the deviation originates from the PE base material in the sample or if the suspect component under investigation has a limited recyclability.

Principle of the test method:



Overview of test samples and evaluation criteria:

	Trial #	REF	CHI100	PE100
Recyclate blends	PCK-S0 (sample with critical material)	0%	**100%**	0%
	REF (reference PCR recycle)	**100%**	0%	0%
	PCK-R0 (reference packaging sample)	0%	0%	**100%**
Recyclate blends characterisation	DSC Tm peak [°C]			
	Fraction with high melting points (e.g. evaluation of PP contents)			
	Density [g/cm³]			
	MFR (190°C/2.16kg) [g/10min]			
Injection moulding application mechanical testing	Tensile Modulus (E_t) [Mpa]			
	Tensile Strength (σ_m) [Mpa]			
	Tensile Stress at Break (σ_b) [Mpa]			
	Elongation at Break (ε_b) [%]			
	Charpy Impact strength (acU) [kJ/m²]			
Blown film application mechanical testing	Tensile strength (MD/CD)			
	Elongation at Break (MD/CD)			
	Dart impact failure			
Blown film application sealing properties	Sealing properties on lab sealing press (sealing temperature T_s vs. time t_s)			
	Tensile testing of sealing strength			
	CHI seam tightness test			

Version history:

Version No.	*Date*	*Reason/Content of revision*
1.0	Oct 2019	First version of test method
2.0	Mar 2020	Updated test program and parameters
3.0	Sep 2021	Updated evaluation criteria; improved scheme