

CHI-C8-SEPPET

Label and Adhesive Separation Test for PET-based Packaging

Version 4.3 / February 2022

The CHI test method developed by cyclos-HTP for PET hot washing with label and adhesive. The results can be used to assess the recycling compatibility of adhesives or pressure-sensitive labels. The testing procedure comprises the following steps:

1. Materials

- 1.1. Sample of PET with a pressure-sensitive label and an adhesive application with unknown recycling compatibility
- 1.2. Sodium hydroxide (NaOH) for the preparation of a caustic solution
- 1.3. Surfactant (washing tenside) specified for cleaning solutions in PET recycling, selected and released by cyclos-HTP
- 1.4. Attrition cell with heating plate (see Figure 1) or a suitable kitchen stirring machine, capable of accurate heating to 80°C
- 1.5. Sieve with pore size < 2 mm
- 1.6. Buchner-funnel and equipment for vacuum filtration
- 1.7. Air drying oven, capable of heating up to 240°C
- 1.8. Desiccator
- 1.9. Optional: Photo Spectrometer with CIE L*a*b* software

2. Preparation of the samples

- 2.1. Cut the packaging sample (label/adhesive/PET) into flakes with edge lengths of approx. 10-15 mm
- 2.2. The samples before and after cutting must be documented photographically
- 2.3. Weighing: In the sample the total area of the labels should be **≥ 200 cm² per litre (= A)**; the weight of the entire packaging sample incl. PET and label should be **≥ 100 g per litre** to get a high stock density
- 2.4. Before starting the hot wash, the sample is added

3. Test procedure

- 3.1. Prepare an alkaline solution containing 1.5 % by weight of NaOH and 0.3% Surfactant (washing tenside)
- 3.2. Measure the quantity of alkaline solution (200 cm²/litre) in accordance with the quantity of the sample and in relation to the area of the sample and heat it to 80°C without sample
- 3.3. The batch with the sample is stirred at 80°C for 15 minutes with a leaf stirrer or a suitable kitchen stirring machine, this achieves higher shear forces than with a magnetic stirrer; the stirring speed is adjusted so that the flakes undergo a certain amount of shear; during this time the stirrer is switched off every minute to check whether the labels have detached from the PET; PO labels float and PET flakes sink to the bottom; the time after starting the hot wash at which this process begins is documented
- 3.4. After 15 minutes the hot wash is stopped
- 3.5. For samples with polyolefin-based label, carefully and completely skim off the label flakes and wash them once under running water; observe whether all label pieces have detached from the PET; after draining, transfer the flakes on a plate
- 3.6. If not all PO-based label pieces have detached from the PET, the test for this sample is stopped and repeated if necessary; if the result is confirmed, no recycling compatibility can be confirmed for the respective sample or the adhesive used.
- 3.7. The PET flakes are sieved, rinsed twice with approx. 200 ml of clear water and after draining transferred to a container

- 3.7.1.(optional) If the adhesive has only been detached and not dissolved, the PET flakes must be washed carefully with water:
- 3.7.2. Collect sinking PET flakes in a Buchner-funnel, filter by vacuum without paper filter and let water flow on it.
- 3.7.3. Collect sinking PET flakes in a beaker and stir vigorously by hand, carefully tilt the washing solution with floating adhesive.
- 3.8. A part of the washed and sinking PET flakes is kept for the visual comparison with the final samples after the oven roasting test
- 3.9. The PET flakes are baked ('roasted') in a preheated oven at 220°C for 60 minutes; the tray with the sample is then cooled in the desiccator.
- 3.10. The PP flakes from step 3.5 are dried for 60 minutes at 80°C; the dish with the sample is then cooled in the desiccator
- 3.11. The samples from the steps 3.8 and 3.9 are compared and documented photographically; colour changes from the original sample, especially in the case of PET, are documented.
- 3.12. By demand or to fulfil customer specifications the colour of the PET flakes can also be measured with a photo spectrometer using the CIE L*a*b* method. PET flakes from the same sample without adhesives and labels should be used as reference.

Depending on the specific task, the results can be used to assess the recycling compatibility of adhesives or pressure-sensitive labels.

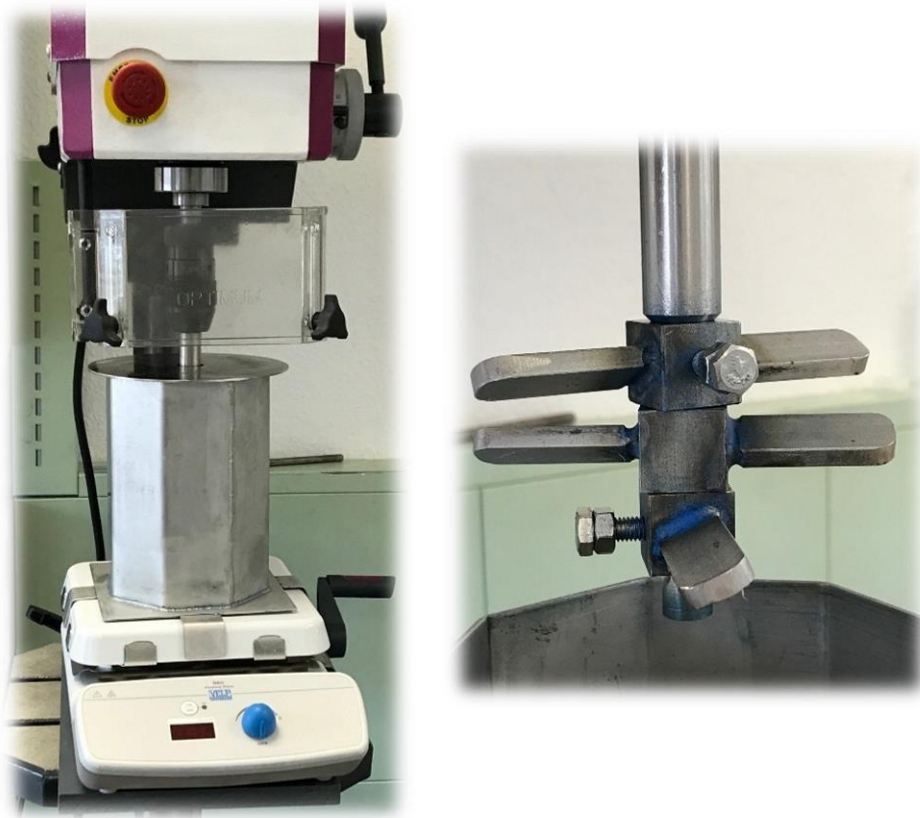


Figure 1: Attrition cell and stirrer - equipment for washing tests



Figure 2: PET sample without discolouring after roasting (test passed)



Figure 3: PET sample with discolouring by remaining adhesive

Version history:

<i>Version No.</i>	<i>Date</i>	<i>Reason/Content of revision</i>
1.0	Oct 2019	First version of test method
2.0	Feb 2020	Updated test program and parameters
3.0	Aug 2020	Updated evaluation criteria; additional parameter settings; improved photo documentation
4.0	Sep 2021	Changes of test procedure
4.2	Feb 2022	Updated photo documentation
4.3	Feb 2022	Update for washing solution