Comité d'Évaluation de la Recyclabilité des Emballages Papier-Carton

CEREC METHODOLOGY FOR ASSESSING HOUSEHOLD PACKAGING IN TERMS OF RECYCLING

CEREC (French Committee for Assessing Recyclability of Paper and Cardboard Packaging) has been offering help and advice to industrial operators (packaging manufacturers and producers) for over 15 years, to assess and improve the recyclability of their household packaging.

Set up by Citeo and REVIPAC in 2007, CEREC draws on the expertise of industrial recycling operators and technical centres, as well as its knowledge of household packaging tonnages, to assess the recyclability of paper/cardboard packaging and its potential impact on the recycling loop, and to confirm packaging as being recyclable[1].

That confirmation is reliant on the paper and cardboard packaging industry's buy-up and recycle commitment promoted by REVIPAC, which means that the products declared as recyclable by CEREC are accepted by recycling plants under the buy-up guarantee.

Drawing on its wealth of experience, CEREC offers to perform specific assessments (Notices) on packaging submitted and publishes general information and recommendations on paper/cardboard packaging recyclability on its website. As part of the paper/cardboard packaging assessment process, CEREC may deem it necessary to perform recyclability tests in addition to the technical information provided.

To issue its notices, CEREC applies a method developed hand-in-hand with the Paper Technical Centre (CTP) and set out below.

The assessment process involves up to three steps:

Step 1: The technical file provided by the applicant is analysed by CEREC experts, who check that the packaging is actually made of paper/cardboard. The experts may issue a notice directly, based on the file submitted by the applicant, previous technical notices and their own technical expertise.

Step 2 (recyclability test): If the experts are unable to issue a notice after Step 1, a recyclability test is performed in a laboratory that is able to follow the protocol drawn up by CEREC and the CTP. The recyclability test is performed on a continuous recycling line in a laboratory equipped similarly to a real-life industrial line to guarantee the robustness of the test. The recycling line is continuous to avoid the risk of intermediate sampling and non-representative results. The corrugated cardboard recycling line is used as a benchmark (includes pulpers, screens and centrifugal hydrocyclones, which are not used systematically but available if required).

Step 3 (recycling test): If an issue is flagged up during the laboratory recyclability test, a recycling test is performed to take account of the fact that a packaging item is never recycled alone but always with other household packaging from the household packaging stream,

[1] recyclable = packaging can actually be recycled
recyclability = packaging's potential to be recycled

including industrial and commercial packaging, which has different characteristics to household packaging. This test, which is technically comparable to the one described in step 2, combines the packaging being assessed with other recyclable packaging (recycled corrugated cardboard) in quantities that are representative of those found after selective collection. This condition is stricter than in real life, given that 15-20% of the selective collection stream is combined with the rest of packaging recycled by recyclers.
If the result of the recycling test shows that the issues flagged up at step 2 have disappeared, the packaging will be declared as being recyclable within the paper/cardboard household packaging stream.

Following this process involving up to three steps, a detailed notice will be issued for the packaging assessed.

To simulate an industrial recycling line in the laboratory, all the above-mentioned aspects need to be included:

- **Analyse the whole packaging system** (the specimen as a whole) without removing certain constituents (except in very specific circumstances where there is a danger of damaging the laboratory pulper). The shearing forces applied in the pulper may lead to a fragmentation of non-fibrous elements, thereby impacting the quality of the recycled material.
- **Screen all the slurry** after pulping to avoid the risk of obtaining non-representative results through sampling.
- **Simulate a complete line** by including pulping, coarse screening (holed baskets), fine screening (slotted baskets) and centrifugal cleaning for heavy particles, as well as lightweight particles, if necessary.

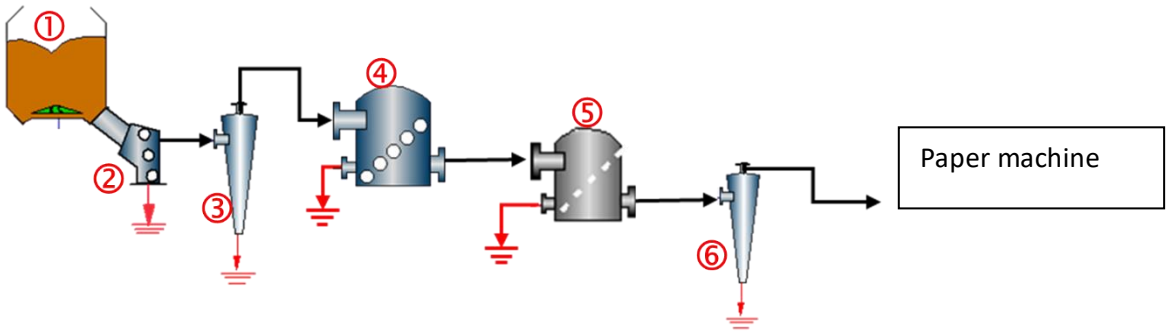
These tests serve to check that the Essential Requirements on end-of-life recovery via material recycling (standard EN 13430) are met in line with Directive 94/62/EC on Packaging and Packaging Waste.

According to standard EN 13430, those responsible for placing packaging on the market need to ensure that packaging is designed using materials or combinations of materials that are compatible with known, appropriate and industrially available recycling technologies.

APPENDIX 1: DESCRIPTION OF THE BENCHMARK INDUSTRIAL RECYCLING LINE (manufacture of paper for corrugated cardboard)

The standard industrial packaging recycling line (manufacture of paper for corrugated cardboard) used as a benchmark includes the following equipment:

- ① **Pulper** – vertical, continuous, low consistency (consistency 4-6%, temperature 40-45°C)
- ② **Pulper detrasher** (and/or ragger) to eliminate larger contaminants resulting from sorting errors (textile, wood, stones, metal wires, plastic film, bottles, etc.)
- ③ **Thick pulp cleaner** to eliminate heavy contaminants (staples, stones, sand, bolts, etc.)
- ④ **Coarse hole screening** to eliminate clumps of fibres, pieces of plastic, water-resistant paper, etc.
- ⑤ **Fine slot screening** to eliminate stickies, smaller clumps of fibre, plastic fragments, etc.
- ⑥ **Centrifugal hydrocyclone for heavy particles** to eliminate small contaminants such as sand, metal particles from metallized packaging, stickies of a specific shape and density.



Standard industrial packaging recycling line

Most of the time, this line also includes a centrifugal cleaner for lightweight particles (small particles of plastic and glue that have not been removed by the cleaner for heavy particles).

N.B. Stages 2 and 3 of the recycling line generally eliminate contaminants resulting from sorting errors (at sorting centres or during the handling of recovered paper bales) rather than from the packaging itself. These stages are therefore not reproduced in the recyclability test protocol for the laboratory.

APPENDIX: 2 DETAILS OF THE LABORATORY TEST PROTOCOLS

1) LABORATORY RECYCLABILITY TESTS: TEST PERFORMANCE CONDITIONS

N.B. The test is performed on an empty packaging item, in the knowledge that when full, it may have contained substances that compromise its recyclability.

The recyclability test has been approved by CEREC and was designed hand-in-hand with the Paper Technical Centre (CTP). Its purpose is to evaluate the extent to which the assessment criteria are met in operating conditions that are as close as possible to reality. The conditions are those found in a real-life industrial process including defibration (pulping), screening and pulp cleaning.

The specimen to be tested in its entirety passes through the continuous (machines installed as on a production line) pulping and screening (coarse and fine) stages.

a) Preparing specimens

The preparation stage is important for evaluating the packaging item as a whole as discarded by the consumer*, with all its constituent elements, which consumers may have difficulty separating from each other at consumption or sorting. The samples are reduced by hand or with scissors to a size of about 3 x 3 cm so that they are compatible with the size of the laboratory pulper. The test is performed on the packaging item as a whole. If the packaging is too large, a representative sample is taken that reflects the proportion of each constituent of the original packaging item in terms of weight.

**In compliance with the method for assessing recyclability applied to all household packaging, regardless of the majority material.*

b) Pulping to break down the packaging fibres

To be as representative as possible of the energy applied in industrial pulpers, the packaging is processed in the laboratory pulper at a consistency of 3%, in water at 40°C, for 15 to 45 minutes at most (see technical appendix no. XXXX. The pulping energy influences how well the paper/cardboard packaging item breaks down into cellulose fibres at pulping. Reproducing industrial conditions as much as possible is therefore essential. The 3% consistency and the maximum pulping time of 45 minutes recreate the friction applied over a time that reflects industrial conditions and therefore the energy needed for defibration.

c) Screening (holed and slotted)

All the pulp undergoes double screening (holed and slotted) after pulping to simulate the screening baskets used in recycling plants to eliminate contaminants (other materials, adhesives, etc.), with screening performed using a screen with 5 mm holes and a screen with 0.15 mm slots.

The rejects are weighed at each screening stage and overall to check if the maximum dry solid reject criteria of 50% is met.

The final screening stage involves screening using a 0.10 mm slot screen to check whether any contaminants are left that should have been eliminated during the previous screening stages.

The rejects are weighed and visually inspected to quantify and identify them.
N.B. Laboratory screens operate under normal pressure whereas industrial screens operate under high pressure. The laboratory measurements are therefore stricter than those in real-life industrial conditions.

d) Centrifugal cleaning (hydrocyclones)

All standard packaging recycling lines are equipped with centrifugal hydrocyclones to eliminate heavy particles. They remove particles that are heavier than cellulose fibres. Most lines are also equipped with centrifugal hydrocyclones that eliminate particles lighter than cellulose fibres. The laboratory recycling line can also be equipped with a centrifugal hydrocyclone for removing lightweight particles if necessary. This stage is included if the pulp produced is still not visually homogeneous after passing through the hydrocyclone that removes heavy particles, as is often the case with packaging containing varnishes – the particles of varnish can be removed at this stage.

Including such stages depends on the composition of the packaging and the visual quality of the pulp after screening.

e) Controlling the visual quality of the pulp and performing an adhesion test: preparing handsheets

The visual quality of the recycled pulp is one of the criteria for assessing packaging recyclability. Circular handsheets with a diameter of 10 cm are produced after recycling to check the visual quality of the pulp (colour, homogeneity) and whether the handsheet comes away easily from the manufacturing equipment (adhesion test), thereby ensuring there are no remaining traces of adhesives, which could disrupt the production of recycled paper/cardboard.

This protocol is approved by the French recycling stream and provides local authorities with the guarantee that their packaging will be bought up if they have chosen the recycling stream option implemented by REVIPAC.

2) LABORATORY RECYCLING TEST: TEST PERFORMANCE CONDITIONS

If the recyclability test results are not conclusive on whether the packaging assessed is recyclable, the packaging needs to be further tested in conditions that reflect real-life industrial conditions, i.e. it needs to be recycled with other packaging.

a) Preparing specimens

The specimen is made up of two products: a sample of the packaging assessed and a sample of 100% recycled corrugated cardboard[2].

[2] The choice of corrugated cardboard is based on the benchmark industrial recycling line (paper for corrugated cardboard) and the fact that the most recycled packaging material is that made of corrugated cardboard.

Composition of the specimen: the quantity of each type of packaging should be representative of the quantity found after selective collection of household waste (see Step 3 of the methodology).

The stages of the test are the same as those of the recyclability test described in part 1 of this appendix.

APPENDIX 3: Determining the consistency and the pulping time based on the energy required.

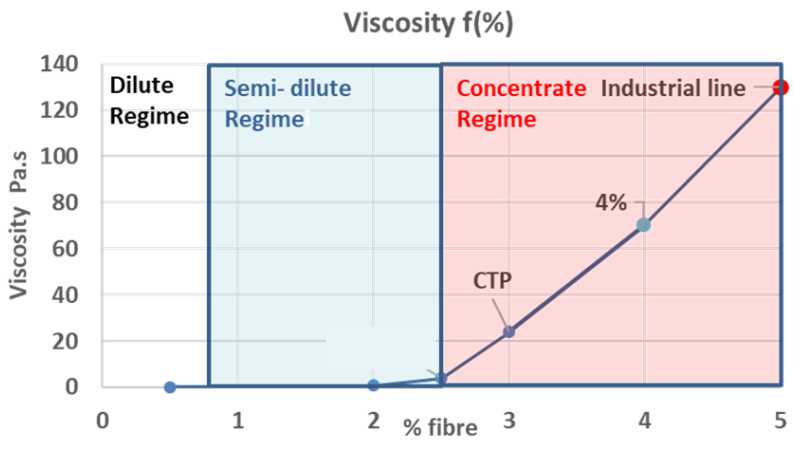
Continuous low consistency industrial pulpers operate with consistencies of about 5% (mass). Reproducing industrial pulping conditions as much as possible is therefore essential. However, laboratory pulpers are designed to work with consistencies of 1.5 to 3%. Lower consistencies lead to lower viscosities, as shown in the graph below.

The energy dissipated in a pulper is directly proportional to 'viscosity x pulping time' [references 1 to 5]. The lower the consistency (i.e. the lower the viscosity), the longer the pulping time needs to be, to compensate and maintain an equivalent energy level.

Drawing on the viscosities from the graph and the residence time in industrial pulpers (approx. 10 minutes*), we can calculate the equivalent energy (by using a viscosity with a reference of 1 for industrial pulpers at 5% as a basis)

- Equivalent energy in an industrial pulper with a residence time of 10 minutes: ~1 x 10 min. = 10
- Equivalent energy in a laboratory pulper with a consistency of 3.0%
    - Pulping time of 15 minutes: ~1/5.3 x 15 min. = 2.8
    - Pulping time of 30 minutes: ~1/5.3 x 30 min. = 5.7
    - Pulping time of 45 minutes: ~1/5.3 x 45 min. = 8.5

In the laboratory, if a product has not disintegrated within 45 minutes, it is considered as not recyclable in the paper industry sector: the energy required would be too great. In an industrial pulper, the product would be evacuated by the pulper detrasher.



Variation in viscosity according to the consistency in a pulper

*Do not confuse residence time and disintegration time. The residence time is a parameter set by the manufacturer and the paper mill. It corresponds to an average disintegration time. The disintegration time is the time required to separate the fibres and for the specimen to be in suspension.

Note: some papers are water-resistant and do not disintegrate (or only partially), even with a long pulping time. In the laboratory, the pulping time should not exceed 45 minutes.

References:

[1] Fabry B. "Etude de la rhéologie des suspensions fibreuses concentrées dans le but d'améliorer le recyclage des papiers", Ph. D. thesis , INPG Grenoble – Génie des procédés, 10 décembre 1999

[2] Fabry B., Roux J-C., Carré B. "Characterisation of friction during pulping: an interesting tool to achieve good deinking", Journal of Pulp and Paper Science vol 27 n°8, August 2001

[3] Fabry B., Roux J-C., Carré B., Duffy G. "Shear factor: a new way to characterize pulper performance",

[4] Fabry B., Roux J-C., Carré B. "Pulping; a key factor for optimising deinking", 53ème congrès ATIP, Bordeaux, October 2000

[5] Fabry B. "A new approach to characterize pulping processes for deinking", PTS-CTP Deinking symposium, 2004

APPENDIX 4: STANDARDS USED

Standards used

- ISO 5263-1: Pulps — Laboratory wet disintegration — Part 1: Disintegration of chemical pulps
- TAPPI-ANSI T275 sp-18: Screening of pulp (Somerville-type equipment)
- ISO 5269-2: 2004 Pulps — Preparation of laboratory sheets (Rapid-Köthen method)
- NF EN 13430