

Recycling Compatible Packaging Test Method

1. Scope

- 1.1 The results of this test method provide an indication of whether the materials used in the construction of fiber product are likely be adequately repulped and are unlikely to contribute to runnability or product quality problems for a paper recycling facility.

2. Referenced Documents

- 2.1 RCA LRP-2 Laboratory Testing Protocol For Paper Labels Coated With Recycling Compatible Pressure Sensitive Adhesives (<https://tlmi.com/sustainability>)
- 2.2 RCA IAP-2 Determination of Adhesives in Paper Handsheets by Image Analysis (<https://tlmi.com/sustainability>)
- 2.3 CEPI recyclability laboratory test method (<https://www.cepi.org/>)
- 2.4 T 205 Forming Handsheets for Physical Tests of Pulp (<https://www.tappi.org/publications-standards/standards-methods/standardsonline/>)
- 2.5 T 275 Screening of pulp (Somerville-type equipment) (<https://www.tappi.org/publications-standards/standards-methods/standardsonline/>)
- 2.6 T 278 Pulp screening (Valley-type screening device) (<https://www.tappi.org/publications-standards/standards-methods/standardsonline/>)
- 2.7 Voluntary Standard For Repulping and Recycling Corrugated Fiberboard Treated to Improve Its Performance in the Presence of Water and Water Vapor (<https://www.fibrebox.org>)

3. Significance and Use

- 3.1 The facility age and level of capital investment ranges widely in the paper recycling industry. Some facilities are limited in types and amounts of contaminants they can remove, and others can produce high quality fiber from single stream sorting facilities. In addition, there are a wide range of products produced from recycled fiber. Given this diversity in processes and end uses, this test method was designed to represent the minimum unit operations common to all processes.
- 3.2 While packaging materials are only a small part of the recovered paper stream, the purpose of this test method is to encourage choices of materials and designs that make fiber recycling more efficient. As such, a particular product is tested by itself.
- 3.3 As has been identified in many other efforts, see TLMI – RCA LRP2, CEPI – Recyclability Test Method, and FBA – Voluntary Standard, adhesive products are of particular concern in paper recycling. An image analysis method developed by the US Postal Service, and subsequently codified by TLMI, is used to determine if the adhesives can be adequately removed by slotted screening.
- 3.4 While this test method provides results on the minimum requirements, subsequent unit operations or testing could be conducted to make other claims about a particular material. For example, one could apply flotation or high-density cleaning to test the removability of a particular contaminant, e.g., ink, metalized layers, etc. Pulp brightness or strength properties could be determined, if those properties are important for the end use.

4. Requirements

- 4.1 The products covered by this method consist of fiber product, including trays and inserts. Board or sheet materials that have not been converted to final products may also be tested using this method.

5. Equipment & Materials

5.1 Equipment

- 5.1.1 Balance capable of weighing at 20 kg with 1 g resolution
- 5.1.2 Balance capable of weighing to 300 g with 0.001 g resolution
- 5.1.3 Thermometer
- 5.1.4 Paper shredder capable of cutting into ¼" strips
- 5.1.5 Adirondack Formax Model 450H pulper, or equivalent.
- 5.1.6 Slotted screen separator/analyzer with 0.25 mm (0.010") slots. See TAPPI T 275 or TAPPI T278 for design and operation of these devices.
- 5.1.7 150 mesh screen box to collect the accepts from the slotted screening.
- 5.1.8 105°C drying oven
- 5.1.9 5-gallon plastic buckets
- 5.1.10 Stopwatch or timer
- 5.1.11 Stand mixer (Lightning Model NAR-25 or equivalent)
- 5.1.12 Sheet mold as specified in TAPPI T-205

5.2 Materials

- 5.2.1 Soft water supply, control heated to 46°C
- 5.2.2 Aluminum foil or containers for drying screening rejects

6. Paper Feed Stock Preparation

- 6.1 Determine the moisture content of a sample of the product by weighing material before and after drying to a constant weight in a 105°C oven. Note, the sample used to determine the moisture content should not be included in the materials used in the test.
- 6.2 After determining the moisture content of the material, use this value to determine the amount of material required to reach a weight of 200 g OD. For example, if the material is 5% moisture the total weight is $200/0.95 = 210.5$ g.
- 6.3 If the package weighs less than 200 g, use as many as are required to reach the desired weight.
- 6.4 If a single package weighs more than 200 g, cut pieces to reach the required weight.
- 6.5 If partial packages are required, attempt to include a prorated amount of material that contains adhesive, e.g., flap closures, laminations, etc.
- 6.6 If plastic or metal pieces are part of the selected materials and if these pieces are large enough to cause problems during shredding and pulping, they can be removed and directly included in the screen rejects.
- 6.7 As documentation, a picture shall be taken of the material.

7. Pulping

- 7.1 Shred all the material into ¼" wide strips in the paper shredder.
- 7.2 Weigh $46 \pm 2^\circ\text{C}$ soft water to bring the total weight to 2400 g, i.e., subtract the mass of fiber from 2400 g. For example, $2400 - 210.5 = 2189.5$ g of added water. This should result in a pulper consistency of 10%.
- 7.3 Add the strips to the pulper and add the water. Mix by hand to uniformly saturate the fiber. Let the fiber soak for 10 min., then use a slower speed on the pulper to begin to form a uniform mixture.
- 7.4 When the material has begun to breakdown, increase to full speed. When a somewhat uniform mass has formed (typically less than 15 seconds), stop the pulper and push material down off the pulper wall with a rubber spatula without adding water. Do not place your hands near the rotor. Measure and record the temperature on the data sheet. Restart the pulper at full speed, start the stopwatch and continue pulping for a total of 8 minutes. If a different pulper or consistency is used, the duration of pulping should be adjusted to give specific energy consumption of 25-30 W hr/kg.
- 7.5 After the pulping time, turn off the pulper. Measure and record the temperature on the data sheet.
- 7.6 Deactivate the pulper power supply.
- 7.7 Remove pulper contents and place into a 5-gallon plastic bucket.
- 7.8 Take 30 g OD pulp (300 g at 10% csc) and place in a separate bucket. This pulp will be used for making 10 handsheets according to TLMI RCA IAP-2.
- 7.9 Clean the pulper.

8. Slotted Screening

- 8.1 Prior to starting, ensure that a 10-cut screen is installed in the screen.
- 8.2 The accepts are collected and drained in a 150-mesh screen box. The rejects are any deposits left in the screening chamber and any plastic or metal removed before shredding.
- 8.3 Run a cleaning cycle to flush the system and manually adjust the screening water temperature to $46 \pm 2^\circ\text{C}$.
- 8.4 From the pulper material (step 7.7), take the remaining 170 g OD of pulp (1700 g at 10% csc). If using an automated screen, place the pulp in the tray of the screen as an even layer of pulp.
- 8.5 If using an automated screen, start and allow the program to run to completion (approximately 40 minutes). Otherwise, slowly add pulp to the screening chamber being certain to keep the consistency low to avoid overwhelming the screen. Manually, this takes 15-20 minutes. The screening time can be extended if there appears to be fiber left as rejects.
- 8.6 After screening process is complete, collect the accepts in a previously tared 5-gallon bucket.
- 8.7 Collect the rejects in a pre-weighed aluminum container for oven drying at 105°C .
- 8.8 Clean all sections of the screen unit, including the screen and under the screen.
- 8.9 After screening, dilute the accepts in the bucket by adding sufficient $46 \pm 2^\circ\text{C}$ water to

bring the total weight to 10 kg. Mix the slurry with a stand mixer for at least 5 minutes to ensure homogeneity prior to handsheet making.

- 8.10 During the formation of the test sheets for the handsheet making, the target weight is 1.2 g. The aliquot of the material in the 5-gallon bucket required to achieve this weight is used to determine the consistency of the pulp fiber. For example, if 120 g of slurry gives a 1.2 g dry sheet, the consistency is 1%. Make at least three test sheets and average the calculated consistency.
- 8.11 Make 16 handsheets according to TLMI RCA IAP-2.

9. Reporting

- 9.1 The report shall consist of the following:
 - 9.1.1 Copies of Data Log Sheets
 - 9.1.2 Pictures of the starting materials.
 - 9.1.3 Dry weight of rejects from the slotted screen.
 - 9.1.4 Using the consistency determined in 8.10 calculate the screened yield.
 - 9.1.5 Image analysis data including equipment settings, number of hand sheets analyzed, mean values for PPM, counts per square meter, PPM 95% confidence interval, average particle size, and the removal efficiency of each operation.