UM 203
ISSUED PRIOR TO 1991
REVIEWED AND RETAINED IN THE UM SET – 2010
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Freeness of pulp (Williams tester)

Scope

The Williams freeness tester provides a means of measuring freeness of stock from a beater or other refining equipment. The freeness is measured as the time (seconds) for drainage of 3 g of pulp in 1 L of water (0.3% consistency) through a wire screen.

Safety precautions

There are no particular additional safety precautions associated with this method.

Apparatus

1. *Williams freeness tester*, with a 1000-mL glass cylinder in a metal frame for holding the specimen, a screen for separating water from pulp, and a timer for measuring rate of drainage.
2. *Color-pad mold* or other sheet mold for extracting water for consistency determination (a Büchner funnel will serve the purpose).
3. *Hydraulic press* for pressing at 1379 kPa (200 psi).

Sampling and test specimens

For dried pulps, take a composite sample of at least 50 g dry and soak for 24 hours. Disintegrate the pulp using a standardized disintegrator (described in T 205 "Forming Handsheets for Physical Tests of Pulp," Appendix

Approved by a Working Group of TAPPI in accordance with the Useful Method Guidelines
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A) in 2 L of deionized or distilled water until fully dispersed. This can be checked visually by examining a very dilute sample portion of the pulp to see that no fiber bundles are present.

For slush pulps, take a representative sample equivalent to at least 10 g of dry fiber. Dilute, or concentrate, to 2 L total volume.

Using a Buchner funnel and filter flask determine the solids content (consistency) of the dispersed pulp. Apportion the remaining diluted pulp into two containers each containing 3.0 g equivalent weight of dry pulp.

Procedure

1. Stir the specimen in a small mixer with about 400-500 mL of water and adjust to a temperature of 25.5-26.5°C (78-80°F).
2. Prepare the tester to receive the diluted pulp specimen by pouring into the cylinder 500 mL of water at the same temperature. This is to prevent the pulp from striking the bare screen.
3. Pour the diluted pulp specimen into the tester cylinder, and adjust the level to 1000 mL.
4. With the timer set at zero, open the valve at the bottom of the tester.
5. Determine the freeness as the time required for the level to drop from 1000 mL to zero.
6. Because the freeness is to be on the basis of 3.0 g of moisture-free weight, remove the stock involved in the first test on each grade or furnish from the screen. Press them; dry at 105°C. As an alternate, moisture-free weight may be established as described in TAPPI T 277 "Macro Stickies Content in Pulp: The 'Pick-Up' Method," Section 6.3 (filtration on a Büchner funnel followed by oven drying).

Calculation

Calculate the individual freeness value by the following:

$$\text{Freeness } (s) = (3.0 \times t) / W$$

where:

t = drainage time, s

W = moisture-free weight of specimen, g

Determine the average freeness value in seconds and report the value to one decimal place.

Report

Report the average of the two freeness values to one decimal place and reference the use of this Useful Method (UM 203). Note any deviations to the procedure.

Precision

Based on one sample of bleached northern softwood kraft dry lap pulp at three levels of refining, the averaged coefficient of variation is 9% as determined by the TAPPI spreadsheet (downloadable at http://www.tappi.org/content/pdf/standards/useful.xls) for the determination of Repeatability for Unlike Specimens.

Keywords

Freeness, Pulps

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