

T 203 cm-09

TENTATIVE STANDARD – 1931
OFFICIAL STANDARD – 1932
REVISED – 1974
OFFICIAL TEST METHOD – 1983
REVISED – 1988
CORRECTED – 1992
REVISED – 1993
CLASSICAL METHOD – 1999
REAFFIRMED – 2009
© 2009 TAPPI

The information and data contained in this document were prepared by a technical committee of the Association. The committee and the Association assume no liability or responsibility in connection with the use of such information or data, including but not limited to any liability or responsibility under patent, copyright, or trade secret laws. The user is responsible for determining that this document is the most recent edition published.

CAUTION:

This method may require the use, disposal, or both, of chemicals which may present serious health hazards to humans. Procedures for the handling of such substances are set forth on Material Safety Data Sheets which must be developed by all manufacturers and importers of potentially hazardous chemicals and maintained by all distributors of potentially hazardous chemicals. Prior to the use of this test method, the user should determine whether any of the chemicals to be used or disposed of are potentially hazardous and, if so, must follow strictly the procedures specified by both the manufacturer, as well as local, state, and federal authorities for safe use and disposal of these chemicals.

Alpha-, beta- and gamma-cellulose in pulp

1. Scope

This method for determination of alpha-, beta- and gamma-cellulose can be applied to bleached or delignified pulps only. Unbleached and semi-bleached pulps must be delignified before testing.

2. Summary

Pulp is extracted consecutively with 17.5% and 9.45% sodium hydroxide solutions at 25°C. The soluble fraction, consisting of beta- and gamma-celluloses, is determined volumetrically by oxidation with potassium dichromate, and the alpha-cellulose, as an insoluble fraction, is derived by difference (see Note 6).

3. Significance

3.1 Separation of the cellulose in pulp into alpha-, beta- and gamma-cellulose fractions is an empirical procedure, originally devised by Cross and Bevan (1) around 1900, and has been widely used to evaluate pulps for various purposes, such as aging characteristics and response to refining operations. In a modified form, the method was adopted first as a TAPPI tentative standard in 1931 (2).

3.2 In general, the alpha-cellulose indicates undegraded, higher-molecular-weight cellulose content in pulp; the beta-cellulose indicates that of a degraded cellulose, and the gamma-cellulose consists mainly of hemicellulose (3, 4).

4. Definitions

Alpha-cellulose is the pulp fraction resistant to 17.5% and 9.45% sodium hydroxide solution under conditions of the test. Beta-cellulose is the soluble fraction which is reprecipitated on acidification of the solution; gamma-cellulose is that fraction remaining in the solution.

Approved by the Standard-Specific Interest Group for this test method



Documents

Document Sharing Hub

5. Apparatus

5.1 *Pulp dispersion apparatus* (Fig. 1)¹, consisting of a variable speed motor and a stainless steel stirrer with a shell. The speed of the motor and the angle of the blades should be adjusted so that no air is drawn into the pulp suspension during stirring.

5.2 *Constant temperature bath*, to maintain a temperature of $25^{\circ}\text{C} \pm 0.2^{\circ}\text{C}$.

5.3 *Timer*, stop watch or electric timer.

5.4 *Filtering funnel or crucible*, 50 or 100 mL, with a fritted glass disk of coarse (40 to 60 mm) porosity.

5.5 *Other glassware*: beakers, tall-form, 300-mL; pipets, 10, 25, 50, and 75 mL; buret 50-mL; flasks, 250- and 300-mL; filtering flasks, 250-mL; graduated cylinders, 25-, 50-, and 100-mL; glass stirring rods.

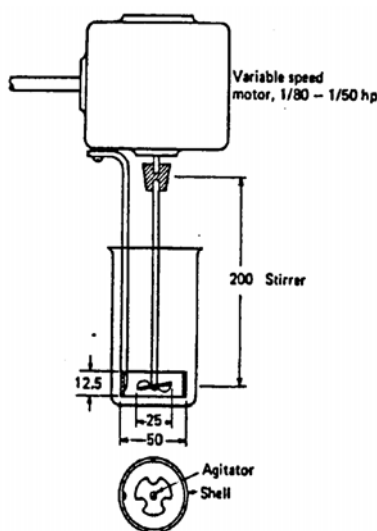


Fig. 1. Pulp dispersion apparatus (dimensions are in mm).

6. Reagents

6.1 *Sodium hydroxide solution*, 17.5% NaOH by weight, $5.21 \pm 0.005N$, carbonate free. Prepare a concentrated (about 50%) NaOH solution and let stand until the suspended carbonates have settled. Then decant the clear solution, dilute with CO_2 -free (recently boiled) distilled water, and adjust the normality as specified to $5.21 \pm 0.005N$.

6.2 *Potassium dichromate solution*, 0.5N. Dissolve 24.52 g of $\text{K}_2\text{Cr}_2\text{O}_7$ in water and dilute to 1000 mL.

6.3 *Ferrous ammonium sulfate solution*, 0.1N. Dissolve 40.5 g of $\text{Fe}(\text{NH}_4)_2(\text{SO}_4)_2 \cdot 6\text{H}_2\text{O}$ in water, add 10 mL of concentrated H_2SO_4 , and dilute to 1000 mL. The solution is not stable and the exact normality should be determined daily by titration with 0.100N potassium dichromate standard solution.

6.4 *Phenanthroline - ferrous sulfate*. Dissolve 1.5 g of 1, 10-phenanthroline monohydrate, $\text{C}_{12}\text{H}_8\text{N}_2 \cdot \text{H}_2\text{O}$ and 0.7 g of $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$ in 100 mL of water. The indicator solution is also available commercially as "Ferrioin."

6.5 *Sulfuric acid*, concentrated H_2SO_4 , 96 to 98%, sp gr 1.84.

6.6 *Sulfuric acid*, 3N. Add 83.5 mL of concentrated H_2SO_4 to an excess of water and dilute to 1000 mL.

¹ Names of suppliers of testing equipment and materials for this method may be found on the Test Equipment Suppliers list, available as part of the CD or printed set of Standards, or on the TAPPI website general Standards page.