

T 413 om-11

OFFICIAL STANDARD – 1926
TENTATIVE STANDARD – 1966
OFFICIAL TEST METHOD – 1980
REVISED – 1985
REVISED – 1993
REVISED – 2002
REAFFIRMED – 2006
REVISED – 2011
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Ash in wood, pulp, paper and paperboard: combustion at 900°C

1. Scope

This method for determination of ash can be applied to all types of wood, pulp, paper and paperboard.

2. Summary

2.1 A test specimen is ignited in a muffle furnace at 900°C. A separate test specimen is analyzed for the percentage moisture. The resulting weight of ash and moisture level in the sample are used to calculate the percentage ash present at 900°C on a moisture-free sample basis.

3. Significance

3.1 The ash content of the sample may consist of: (1) various residues from chemicals used in its manufacture, (2) metallic matter from piping and machinery, (3) mineral matter in the pulp from which the paper was made, and (4) filling, coating, pigmenting and/or other added materials. The amount and composition of the ash is a function of the presence or absence of any of these materials or others singly or in combination. No specific *qualitative* meaning is attached to the term “ash” as used in this Test Method. Where a further qualitative examination of the ash is desired, this method may be used in combination with TAPPI T 421 “Qualitative (Including Optical Microscopic) Analysis of Mineral Filler and Mineral Coating of Paper,” or by whatever means that is appropriate, and major components of the ash identified.

3.2 The combustion of cellulose to form volatile combustion products occurs at about 300°C. For papers or pulp containing no added fillers or coatings, ignition at either 525°C or 900°C will yield essentially identical results of a

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few tenths percent ash or less. Examples of such papers include “ashless” filter papers manufactured for chemical analysis, or dissolving grade pulps.

3.3 For samples containing fillers, coatings or pigments *which undergo negligible change in weight upon ignition of either 525°C or 900°C*, such as the oxides of silicon or titanium, and where other fillers, coatings or pigments are known to be absent, ignition at either temperature may be taken as semi-quantitative measure of the percentage of such material present in the sample.

3.4 In most cases, the ash content of paper and paperboard will contain inorganic residues from the pulp, inorganic residues from paper making chemicals, and loading or filling materials deliberately added. In such cases, the significance of the ash level determined will vary depending upon which ashing temperature is used and the identity of the materials added.

3.5 For papers containing only cellulose and calcium carbonate, ignition at 525°C will remove cellulose, and moisture, but will leave as ash the calcium carbonate essentially intact. Ignition at 900°C will convert the calcium carbonate to calcium oxide. In such cases, these methods may be used in conjunction to provide a good estimate of added calcium carbonate levels.

3.6 For papers containing cellulose and clays or materials of indefinite composition and/or variable thermal decomposition, significance of ash level may require significant confirmation regarding the materials added, qualitative analysis of the ash as described in T 421, or both, and even then care in determining data significance will be required.

3.7 The user of this Test Method must confirm that 900°C is the correct ashing method to use and the significance of results based on an understanding of the composition of the sample ash and the information desired. This method may be used in conjunction with TAPPI T 211 “Ash in Wood and Pulp, Paper and Board Combustion at 525°C” for a more comprehensive understanding of the non-cellulose materials present in the sample.

4. Definitions

4.1 *Ash*, the material remaining, calculated on the basis of the dry weight of the original sample, after the sample is ignited at the specified temperatures.

4.1.1 *Ash at 900°C*, the ash content of the sample when the ignition temperature is 900°C. (A programmable electric muffle furnace may be used, also.)

5. Apparatus

5.1 Crucibles, platinum, porcelain or silica, 50 to 100 mL, with covers.

5.2 Electric muffle furnace, suitable for maintaining a temperature of $900 \pm 25^\circ\text{C}$.

6. Sampling

6.1 Obtain a sample of wood in accordance with TAPPI T 257 “Sampling and Preparing Wood for Analysis” and TAPPI T 264 “Preparation of Wood for Chemical Analysis” or a sample of pulp in accordance with TAPPI T 210 “Weighing, Sampling, and Testing Pulp for Moisture.” Do not take cut edges or other parts of pulp where mineral contamination may have occurred.

6.2 Obtain a sample of paper or paperboard in accordance with TAPPI T 400 “Sampling and Accepting a Single Lot of Paper, Paperboard, Containerboard, or Related Product.”

7. Test specimens

7.1 Condition the sample in the atmosphere near the balance to the moisture equilibrium.

7.2 The test specimen shall consist of small pieces of the sample so selected as to be representative. The specimen weight shall be at least 1 g, moisture-free and may be increased to sufficient size to yield an ash weight of not less than 10 mg and preferably over 20 mg.

7.3 Prepare sufficient test specimens so that the Procedure, Section 9.1 may be performed at least twice for each test unit.

7.4 The test specimen shall be weighed on an analytical balance to the nearest 0.1 mg.