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WORKING GROUP
CHAIR _____ Chris Czyryca _____

SUBJECT
CATEGORY _____ Physical Properties _____

RELATED
METHODS _____ See "Additional Information" _____

CAUTION:

This Test Method may include safety precautions which are believed to be appropriate at the time of publication of the method. The intent of these is to alert the user of the method to safety issues related to such use. The user is responsible for determining that the safety precautions are complete and are appropriate to their use of the method, and for ensuring that suitable safety practices have not changed since publication of the method. 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 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 method, the user must 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.

Castor-Oil Penetration Test for Paper

(Ten-year review of Classical Method T 462 cm-16)

1. Scope

This Classical Method is used to measure the absorbency rate of paper for printing inks having an oil vehicle. It is normally used only for easily permeable papers such as news, book, and mimeograph (1,2); however, it can be helpful for any paper where the absorbency of an oil based vehicle is important.

2. Significance

A correlation has been established between the results of this test and the printing quality of uncoated papers using printing inks having an oil vehicle. The oil absorbency of paper is related to the air permeability, basis weight, caliper, and internal structure of the paper.

3. Summary

The test is performed by measuring the time required for a drop of castor oil to produce a uniform translucent spot on the under side of the test specimen by permeation through the specimen.

NOTE 1: The viscosity of USP castor oil has been found to vary somewhat. Accordingly, a standard viscosity oil should be used.

4. Apparatus

4.1 *Viewing box* (Fig. 1), containing: an open front; a top of smooth nonmetallic sheet material, with a 20-mm diameter hole for observing the specimen; a ground-glass partition parallel with the front of the box to prevent excessive heat from affecting the test results; a 25-W electric bulb placed in back of the partition for illuminating the specimen; and an adjustable mirror near the bottom and centered on the observation hole in the top of the box.

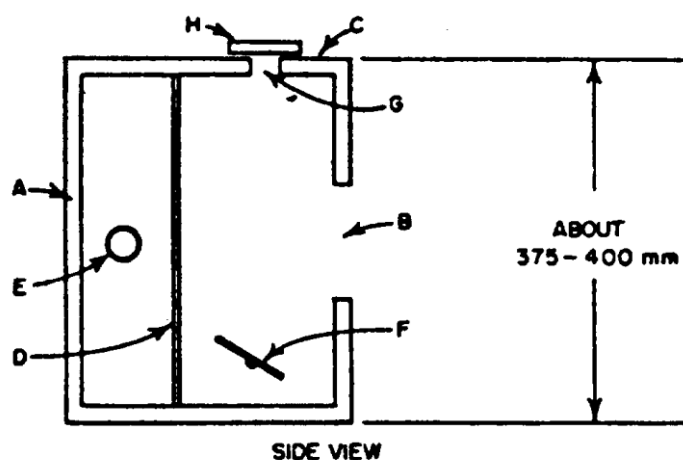


Fig. 1 Apparatus for castor oil permeation test of paper. A = box; B = open front in box; C = top, smooth, nonmetallic sheet material; D = partition, ground-glass; E = electric bulb, 25-W; F = adjustable mirror; G = hole, 20 mm diameter, in top of box for observation of specimen; H = test specimen.

4.2 *Separatory funnel or buret*, precision bore class A, with a tip of such diameter that 25 drops of distilled water delivered at $23^{\circ} \pm 1^{\circ}\text{C}$ will have a volume of 1 mL. The funnel or buret should be suspended with the end of the tip approximately 45 mm above the test specimen.

4.3 *Small bottle cap*, with black interior, having its diameter in excess of 20 mm.

4.4 *Timer*, stopwatch or electric timer.

5. Reagents and materials

Castor oil, USP, the temperature of which is maintained at $23^{\circ} \pm 1^{\circ}\text{C}$ and has a specific gravity of 0.95 to 0.97 at 25°C .

6. Test specimen

Obtain a sample of the paper in accordance with TAPPI T 400 "Sampling and Accepting a Single Lot of Paper, Paperboard, Fiberboard, or Related Product." From each test unit of the sample cut at least ten square test specimens each about 50 mm on a side. Identify five of the specimens on the wire side and the other five on the top or felt side.

7. Conditioning

Precondition, condition, and test the specimens in an atmosphere in accordance with TAPPI T 402 "Standard Conditioning and Testing Atmospheres for Paper, Board, Pulp Handsheets, and Related Products."

8. Procedure

Center a specimen over the hole in the top of the box. Suspend the funnel or buret with the tip approximately 45 mm above the test specimen center. Place a little oil in the funnel or buret and slowly open the cock until one drop of oil falls from the funnel or buret upon the specimen. Simultaneously, start the timer and close the cock. Cover the oil drop with the bottle cap to provide sharper determination of the end point. Observe the underside of the paper in the mirror and

measure the time interval from the instant of contact until the spot of oil reaches a uniform and maximum translucency. (End point appearance will differ depending upon the amount of high refractive index pigment present in the paper being tested.) Record the diameter of the spot, in millimeters, at the completion of each test. Make five test determinations on each side of the paper.

9. Report

For each side of the paper, report the maximum, minimum, and average time of penetration for the five tests, to the nearest second, as well as the average diameter of the five spots at completion of the tests, in millimeters. State the type of oil used in the test.

10. Precision

10.1 The precision is affected by the type of paper, its formation, and other factors. The precision attained with one class of papers may not be applicable to others.

10.2 Repeatability (within a laboratory): mimeograph papers = 20%; groundwood papers = 12%.

11. Keywords

Paper, Castor oil, Oil penetration tests, Absorptivity, Oil absorption, Porosity, Ink, Penetration

12. Additional Information

12.1 Effective date of issue: To Be Assigned.

12.2 Related methods: ASTM D 780 "Printing Ink Permeation of Paper (Castor Oil Test)," American Society for Testing and Materials, this Classical Method is technically equivalent to ASTM D 780; TAPPI T 454 "Turpentine Test for Grease Resistance of Paper" and TAPPI T 559 "Grease Resistance Test for Paper and Paperboard."

12.3 Precision data added in 1972.

12.4 Revisions in this method have been made in reference to apparatus and procedure. Additional information on precision has been added.

12.5 The 2006 revision harmonized the TAPPI and ASTM procedures and the specification of the castor oil. During this revision the method was voted as Classical.

References

1. Reed, E.O., "Resistance of Printing Papers," *Paper Trade J.* **86** (12):54 (1928); *Tech. Assoc. Papers* **11**(2):144, 239 (1928).
2. Wehmhoff, B.L., "Evaluation of the Printing Quality of Paper," *Paper Trade J.* **100**(6):41(1935); *Tech. Assoc. Papers* **81**(55):337(1935).

Your comments and suggestions on this procedure are earnestly requested and should be sent to the TAPPI Standards Department.

