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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 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 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.

Grease resistance test for paper and paperboard

1. Scope and significance

1.1 This classical method is an expanded and updated version of TAPPI UM 557 “Repellency of Paper and Board to Grease, Oil, and Waxes (Kit Test).”

1.2 Commonly known as the kit test, the method describes a procedure for testing the degree of repellency and/or the antiwicking characteristics of paper or paperboard treated with fluorochemical sizing agents (1,2).

1.3 Fluorochemical agents may impart both organophobic and hydrophobic characteristics to paper through a reduction in the surface energy of the sheet. This is done by a surface treatment of the fibers without the formation of continuous films.

1.4 This test was originally developed to allow papermakers to know when the applied fluorochemical was incorporated into the sheet and the approximate level of resistance. These were accomplished by testing production samples with a series of numbered reagents (varying in surface tension and viscosity or “aggressiveness”) held in bottles in a specially designed kit. The highest numbered solution (the most aggressive) that remained on the surface of the paper without causing failure was reported as the “kit rating” (hence the term “kit test”). This concept forms the basis for the current classical method.

1.5 Designed primarily as a surface repellency test for fluorochemical treatments, the use of this test for papers with film-like barriers or those treated with nonfluorochemical agents would have to be evaluated.

1.6 A related test is TAPPI T 454 “Turpentine Test for Voids in Glassine and Greaseproof Papers” which is more limited in terms of paper type and may detect a different failure mechanism than this method.

2. Apparatus

2.1 *Absorbent tissue or cotton*; to wipe away kit solutions at end of test.

2.2 *Balance*, capable of weighing 4000 g to within 0.1 g.

2.3 *Graduated cylinders*, glass, 100 and 500 mL; for preparing kit solutions.

2.4 *Stock bottles*, glass with foil-lined caps, glass stoppers, or polyethylene-lined caps to prevent evaporation losses; for storing kit solutions.

2.5 *Stopwatch or timer*.

2.6 *Test bottles*, with glass stoppers and glass droppers; for use during testing.

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2.7 *Testing area*, e.g., well-lit bench with dark top located in standard-conditions testing room; for conducting test(s) and rating results.

3. Reagents

3.1 *Castor oil.*

3.2 *n-heptane.*

3.3 *Toluene.*

3.4 *Kit solutions.*

3.4.1 Prepare the kit (test) solutions from the above reagents using the mixtures shown in Table 1.

CAUTION: Consult appropriate Material Safety Data Sheets and applicable safety requirements and regulations before working with n-heptane and toluene. Both are highly flammable and are reported to be health hazards. Keep away from heat and sparks and avoid prolonged or repeated breathing of vapors and contact with skin.

3.4.2 Do not measure the reagents by addition since there will be a loss of volume after mixing.

3.4.3 Weight measurements are used for castor oil as its high viscosity makes volume measurements less accurate. The density of castor oil is 0.969 g/cm³.

Table 1. Mixtures of reagents for preparing kit solutions.

<i>Kit No.</i>	<i>Castor Oil, g</i>	<i>Toluene, mL</i>	<i>n-heptane, mL</i>
1	969.0	0	0
2	872.1	50	50
3	775.2	100	100
4	678.3	150	150
5	581.4	200	200
6	484.5	250	250
7	387.6	300	300
8	290.7	350	350
9	193.8	400	400
10	96.9	450	450
11	0	500	500
12	0	450	550

3.4.4 Store the solutions in labeled stock bottles. As required, fill each test bottle with the appropriate kit number solution from the stock bottles.

3.4.5 The stock and test bottles should be tightly closed when not in use to prevent loss of solvent from evaporation (and a consequent change in the composition and properties of the solution).

3.4.6 The solutions in the test bottles should be changed regularly depending on usage. For frequent daily usage, solutions should be replaced weekly with fresh solution from the stock bottles; for less frequent usage, a monthly solution change is adequate.

NOTE 1: For certain applications, it has been reported that the upper limit of the range of kit ratings has been extended beyond 12 by continuing to adjust the proportion of toluene and n-heptane. The validity of doing this is uncertain. If done, the report should state clearly the ratio of toluene to n-heptane used to arrive at the extended kit values.

4. Safety precautions