

Extractable Content of Greige and/or Prepared Textiles

Developed in 1960 by AATCC Committee RA34; reaffirmed 1968, 1972, 1975, 1988, 1989; revised 1978, 1982 (with title change), 1995, 1999; editorially revised 1987, 1993.

1. Purpose and Scope

1.1 This test method is intended for determining the amount of water, enzyme and organic-solvent extractable materials in yarn or fabric containing cellulosic fibers or blends thereof.

2. Principle

2.1 Water and enzyme soluble materials are removed from a test specimen in order by treatments in (1) hot water, and (2) an amylase solution. Oils, fats and waxes are removed by extraction with 1,1,1-trichloroethane.

3. Terminology

3.1 **extractable matter**, *n.*—nonfibrous material in or on a textile substrate, not including water, which is removable by a specified solvent or solvents as directed in a specified procedure.

4. Safety Precautions

NOTE: These safety precautions are for information purposes only. The precautions are ancillary to the testing procedures and are not intended to be all inclusive. It is the user's responsibility to use safe and proper techniques in handling materials in this test method. Manufacturers MUST be consulted for specific details such as material safety data sheets and other manufacturer's recommendations. All OSHA standards and rules must also be consulted and followed.

4.1 Good laboratory practices should be followed. Wear safety glasses in all laboratory areas.

4.2 All chemicals should be handled with care.

4.3 1,1,1-Trichloroethane can be irritating to the eyes and mucous membranes. It should only be handled in an adequately ventilated laboratory hood.

4.4 An eyewash/safety shower should be located nearby and an organic vapor respirator should be readily available for emergency use.

4.5 Exposure to chemicals used in this procedure must be controlled at or below

levels set by governmental authorities (e.g., Occupational Safety and Health Administration's [OSHA] permissible exposure limits [PEL] as found in 29 CFR 1910.1000 of January 1, 1989). In addition, the American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLVs) comprised of time weighted averages (TLV-TWA), short term exposure limits (TLV-STEL) and ceiling limits (TLV-C) are recommended as a general guide for air contaminant exposure which should be met (see 10.3).

5. Apparatus

5.1 Analytical balance with a sensitivity of 0.01 g.

5.2 Circulating air oven capable of maintaining 105-110°C (220-230°F).

5.3 Soxhlet extraction assembly.

5.4 Weighing bottles with glass covers.

5.5 Beakers, 300 mL, tall-form.

5.6 Sieve, stainless steel, 100-mesh.

5.7 Calcium chloride (CaCl₂) or equivalent desiccant.

5.8 1,1,1-Trichloroethane, (methylchloroform), extraction grade.

5.9 Bacterial amylase, *bacillus subtilis* origin, 1600-1800 B.A.U. (see AATCC Method 103).

6. Specimens

6.1 Take an approximately 10 g specimen from each sample to be analyzed. If the material is a woven fabric, it should be cut on the bias and the edges should be folded inside the specimen to avoid loss of loose fibers or yarns.

7. Procedure

7.1 **Drying Specimen.** Place the specimen in a tared weighing bottle, dry it to constant weight in the oven at 105-110°C (220-230°F), cool it in the desiccator and weigh the bottle and specimen to the nearest 0.01 g (see AATCC Method 20A, 8.1) (see 10.1 and 10.2).

7.2 **Water Soluble Materials.** Remove the dried specimen from the bottle and place it in a beaker containing 200 mL of distilled water at 82 ± 3°C (180 ± 5°F). Maintain the temperature of the water at 82 ± 3°C (180 ± 5°F) for 2 h. Then pour the water and specimen into a Buchner funnel secured in a filtration flask. Wash the specimen with two 25 mL portions of distilled water and partially dry the speci-

men by squeezing on the funnel. Return the specimen to its bottle and oven dry, cool and reweigh it. Determine the amount of water extractable matter as the difference in the specimen weights obtained in 7.1 and 7.2.

7.3 **Enzyme Extractable Material.** Remove the specimen (see 7.2) from the bottle and place it in a beaker containing 200 mL of a 2% bacterial amylase solution. Hold the solution at 74 ± 3°C (165 ± 5°F) for 1 h. Pour the solution and specimen into the sieve and rinse the specimen free of enzyme by washing with 10 successive 100 mL portions of distilled water at 82 ± 3°C (180 ± 5°F). Oven dry, cool and reweigh the specimen in the bottle. Determine the amount of enzyme extractable matter as the difference in the weights obtained in 7.2 and 7.3.

7.4 **Oils, Fats and Waxes.** Place the dried specimen (see 7.3) in a fresh thimble in the Soxhlet extractor and extract 12-16 times with 1,1,1-trichloroethane. Remove the thimble from the extractor and evaporate the major portion of the 1,1,1-trichloroethane remaining on the specimen in a hood. Remove the specimen from the thimble and return it to the bottle. Oven dry, cool and reweigh the specimen and bottle. Determine the amount of solvent extracted material as the difference in the specimen weights obtained in 7.3 and 7.4.

8. Calculations

8.1 Calculate the material extracted from each specimen by water, enzyme and solvent, to the nearest 0.1%, using the following equation:

$$E = [(B-A)/I] (100)$$

where:

E = the material extracted by water, enzyme solution or organic solvent, %,

B = the mass of the specimen before the particular extraction, g,

A = the mass of the specimen after the particular extraction, g, and

I = the mass of the oven-dried specimen before the first extraction, g.

8.1.1 If the extractable material for any of the three extractions is less than 0.2%, record the value for that extraction as "less than 0.2%."

8.2 Determine the total extractables for each sample as the sum of the three extractables for that sample. Those values

reported as “less than 0.2%” are arbitrarily added in as 0.1%.

9. Precision and Bias

9.1 Interlaboratory Study. A limited study of the test method was performed in 1996, with three participating laboratories, using two testing operators in each, and two specimens per operator. Six fabrics ranging from 0.4%-9.5% total extractables by weight were included in the study. This is the best and only data set derived to date for determining precision of the test method. Users of the test method should take this limited basis into account in making any critical comparisons.

9.2 Precision. Residual variances of the fabrics were found to be uniform and were grouped by the analysis program into a single category, allowing use of a single critical difference table (see 9.2.2) for all fabrics in the study. When comparing two averages of the same fabric, under any of the three precisions stated, a difference equal to, or greater than, the table value is considered to be statistically significant on a probability of 95%.

9.2.1 Components of Variance. Six components of variance computed by the analysis program are shown both as vari-

Table I—Components of Variance

Component	Symbol	Variance	sd
Fabric	V(F)	12.2021	3.493
Laboratory	V(L)	0.0236	0.154
FxL Interaction	V(FL)	0	-
Operator (within labs)	V(O.L)	0.0077	0.088
FxO(L) Interaction	V(FO.L)	0.0112	0.106
Residual	V	0.0305	0.175

ances and as standard deviations (see Table I).

The unit for standard deviation is percent (by weight). The unit for variance is the square of percent (by weight).

9.2.2 Critical Differences. Precision for this test method is stated as critical differences (see Table II).

Since comparisons involving multiple fabrics are not usually made, these critical differences are not included. The values in Table I may be used to calculate these differences, if needed.

9.3 Bias. Extractable content of greige textiles, or of prepared textiles, can be defined only in terms of a test method. There is no independent referee method that derives a value by which bias may be determined. As a means of estimating extractable content of textiles, this test method has no known bias.

Table II—Critical Differences for Two Averages for the Conditions Noted, 95% Probability Level, % Total Extracted

Number of Test Results in Each Average	Single-Fabric Comparisons		
	Single-Operator Precision	Within-Laboratory Precision	Between-Laboratory Precision
1	0.48	0.54	0.69
2	0.34	0.42	0.60
4	0.24	0.34	0.55
8	0.17	0.30	0.52

10. Notes

10.1 It has been found that with constant atmospheric conditions, this weight is reproducible to the nearest milligram. However, normal humidity variations will cause differences of as much as 0.01 g for a specimen which is dried and weighed and redried in the oven without any other treatment. This factor is the limit to the accuracy of the following steps.

10.2 Synthetic fibers sensitive to drying conditions in 7.1 will not yield accurate data by this test method.

10.3 Available from Publications Office, ACGIH, Kemper Woods Center, 1330 Kemper Meadow Dr., Cincinnati OH 45240; tel: 513/742-2020.