Designation: D1283 – 05 (Reapproved 2013)

Standard Test Method for Alkali-Solubility of Wools[1]

This standard is issued under the fixed designation D1283; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This test method covers a chemical procedure for determination of the amount of wool substance soluble in alkali under standard conditions and is applicable to wool in scoured fiber form, or as fiber obtained from yarn or from woven or nonwoven fabric.

1.2 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

NOTE 1—This test method is applicable to other animal fibers although the level of alkali-solubility may be different from wool. With individual animal fibers, undamaged solubility should be determined before attempting to assess damage on an unknown sample.

1.3 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D123 Terminology Relating to Textiles
D1060 Practice for Core Sampling of Raw Wool in Packages for Determination of Percentage of Clean Wool Fiber Present
D1193 Specification for Reagent Water
D4845 Terminology Relating to Wool
E1 Specification for ASTM Liquid-in-Glass Thermometers
E11 Specification for Woven Wire Test Sieve Cloth and Test Sieves

3. Terminology

3.1 For all terminology relating to D13.13, Wool and Wool Felt, refer to Terminology D4845.

3.1.1 The following terms are relevant to this standard: alkali-solubility, wool.

3.2 For all other terminology related to textiles, see Terminology D123.

4. Summary of Test Method

4.1 Specimens are maintained at a stipulated constant temperature in a caustic solution for a specified period of time. The percentage of alkali-solubility is calculated from the loss in mass of the specimen.

5. Significance and Use

5.1 Alkali-solubility is an indication of the degree of damage to wool resulting from certain chemical treatments, particularly when test results on the same wool, before such treatment, are available.

5.1.1 Undamaged scoured wool has typical alkali-solubility in the range of 9 to 15 %. Fine, undamaged wool normally will exhibit higher solubility than coarse wool, because of greater surface area per unit mass of fiber.

5.2 This test method is not recommended for use on wool known to have sustained alkali damage.

5.2.1 Alkali-damaged wool has had material solubilized that ordinarily would be included in the alkali-solubility test results.

5.3 Although results in one laboratory cannot usually be verified in another laboratory, this test method is considered satisfactory for acceptance testing because it has been used extensively in the trade for this purpose and because it is the only available method for assessing damage to wool by an alkali solubility procedure. Comparative tests as directed in 5.3.1 are advisable before Test Method D1283 is used for acceptance testing.

5.3.1 In case of a dispute arising from differences in reported test results when using Test Method D1283 for acceptance testing of commercial shipments, the purchaser and the supplier should conduct comparative tests to determine if there is a statistical bias between their laboratories. Competent statistical assistance is recommended for the investigation of bias. As a minimum, the two parties should take a group of test specimens which are as homogeneous as possible and which are from a lot of material of the type in question. The test specimens should then be randomly assigned in equal numbers to each laboratory for testing. The average result from the two

[1] This test method is under the jurisdiction of ASTM Committee D13 on Textiles and is the direct responsibility of Subcommittee D13.13 on Wool and Felt.

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

laboratories should be compared using Student's t-test for unpaired data and an acceptable probability level chosen by the two parties before testing is begun. If a bias is found, either its cause must be found and corrected or the purchaser and the supplier must agree to interpret future test results in the light of the known bias.

6. Apparatus

6.1 *Test Tubes*—Glass test tubes 1.5 in. (38 mm) by 7.9 in. (200 mm) with cork stoppers.

6.2 *Constant-Temperature Bath*—A bath equipped to maintain a temperature of 65 ± 0.5° C throughout.

6.3 *Thermometer*—ASTM Aniline Point Thermometer, having a range from 25 to 105° C and conforming to the requirements for Thermometer 34C as prescribed in Specification E1.

6.4 *Weighing Bottles*—Glass bottles of approximately 30 to 35-mL capacity, fitted with ground glass covers.

6.5 *Constant-Temperature Drying Oven,* to be maintained at 105 to 110° C, preferably employing a forced draft.

6.6 *Sieves*[3]—No. 100 (150-µm) approximately 1.75 in. (45 mm) in diameter and 1.75 in. (45 mm) high.

6.7 *Hand Cards.*

6.8 *Analytical Balance*—The balance must be capable of weighing to 0.001 g.

7. Reagents and Materials

7.1 *Purity of Reagents*—Reagent grade chemicals shall be used in all tests. Unless otherwise indicated, it is intended that all reagents shall conform to the specifications of the Committee on Analytical Reagents of the American Chemical Society.[4] Other grades may be used, provided it is first ascertained that the reagent is of sufficiently high purity to permit its use without lessening the accuracy of the determination.

7.2 *Purity of Water*—Unless otherwise indicated, references to water shall be understood to mean reagent water conforming to Specification D1193.

7.3 *1,1,2 Trichloro-1,2,2 Trifluoroethane*[5]

7.4 *Hydrochloric Acid (1 + 120)*—Mix 1 volume of concentrated hydrochloric acid (HCl, sp gr 1.19) with 120 volumes of water.

7.5 *Sodium Bicarbonate Solution* (2.5 g/L)—Dissolve 2.5 g of sodium bicarbonate ($NaHCO_3$) in water and dilute to 1 L.

7.6 *Sodium Hydroxide, Standard Solution* (0.100 N)—Prepare and standardize a 0.100 *N* solution of sodium hydroxide (NaOH) in carbon dioxide-free water, kept free from access by CO_2 from the air, and dilute to 1 L.

7.7 *Working Reference Wool Samples*—Samples of undamaged scoured wool of known alkali-solubility.

8. Sampling

8.1 *Lot Sample*—As a lot sample for acceptance testing, take at random the number of shipping containers directed in an applicable material specification or other agreement between the purchaser and the supplier, such as an agreement to use Practice D1060. Consider shipping containers to be the primary sampling units.

NOTE 2—A realistic specification or other agreement between the purchaser and the supplier requires taking into account the variability between shipping containers, between laboratory samples within a shipping container, and between specimens within a laboratory sample so as to provide a sampling plan which at the specified level of the property of interest has a meaningful producer's risk, consumer's risk, acceptable quality level, and limiting quality level.

8.2 *Laboratory Sample*—As a laboratory sample for acceptance testing, take the number of subsamples from each package in the lot sample as directed in an applicable material specification or other agreement between the purchaser and the supplier, such as an agreement to use Practice D1060 if baled or bagged wool is to be tested.

8.3 *Test Specimens*—As directed in Section 9, determine the number of specimens to be tested from each subsample in the laboratory sample.

9. Number of Specimens per Subsample

9.1 *Control or Non-Critical Testing*—For routine control testing or other non-critical purpose where acceptance testing is not involved, four specimens, randomly chosen from a lot, may be tested as directed in Sections 10 and 11.

9.2 *Acceptance Testing:*

9.2.1 Take a number of specimens per subsample in the laboratory sample, such that the user may expect at the 95 % probability level that the test result for a subsample in the laboratory sample is not more than 2.0 % above or below the true average of the subsample in the laboratory sample (see Table 1). Determine the number of specimens per subsample in the laboratory sample as follows:

9.2.1.1 *Reliable Estimate of v*—When there is a reliable estimate of *v* based upon extensive past records for similar materials tested in the user's laboratory as directed in the method, calculate the required number of specimens per subsample in the laboratory sample using Eq 1:

$$n = (tv/A)^2 \quad (1)$$

where:

- n = number of specimens per subsample in the laboratory sample (rounded upward to a whole number),
- v = reliable estimate of the coefficient of variation of individual observations on similar materials in the user's laboratory under conditions of single-operator precision,
- t = the value of Student's t for two-sided limits, a 95 % probability level, and the degrees of freedom associated with the estimate of v, and
- A = 2.0 % of the average, the value of the allowable variation.

[3] Detailed requirements for these sieves are given in Specification E11.

[4] "Reagent Chemicals, American Chemical Society Specifications," Am. Chemical Soc., Washington, DC. For suggestions on the testing of reagents not listed by the American Chemical Society, see "Reagent Chemicals and Standards," by Joseph Rosin, D. Van Nostrand Co., Inc., New York, NY and the "United States Pharmacopeia."

[5] This solvent is available under various trademarks as Refrigerant-113.