Designation: D629 – 15

# Standard Test Methods for Quantitative Analysis of Textiles[1]

This standard is issued under the fixed designation D629; 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.

## INTRODUCTION

Methods D629-59 T, Quantitative Analysis of Textiles, were discontinued in 1969 because the responsible subcommittee failed to recommend their adoption as a standard after several years of publication as a tentative. The subcommittee action was based on the members' knowledge that the standard did not include several fiber types introduced to the textile trade after the method was published, and that the techniques required for their identification were lacking in the text, allowing it to become out of date. The procedures included in the text, however, are believed to be reliable for the fiber types named and the techniques described are currently being used in the trade and are referenced by other standards sponsored by Committee D-13 on Textiles. Reinstatement as a standard using the previously assigned number was requested since the listed procedures were reliable and the text considered to be the best available, though not all inclusive. Extensive editorial changes were made in various sections in 1972, and the methods were reinstated as D629-72. Editorial changes have again been made throughout the text, and statements on precision and bias and suitability for acceptance testing have been added.

The text of Methods D629-59 T was published by the American Association of Textile Chemists and Colorists in that society's Technical Manual as "Test Method 20A-1959" issued in the years 1959 through 1974. The AATCC Method was revised completely in 1975 and since published as "Test Method 20A-1975."

## 1. Scope

1.1 These test methods cover procedures for the determination of the fiber blend composition of mixtures of the fibers listed in 1.2. Procedures for quantitative estimation of the amount of moisture and certain nonfibrous materials in textiles are also described, for use in the analysis of mixtures, but these are not the primary methods for the determination of moisture content for commercial weights.

1.2 These test methods cover procedures for the following fiber types:

1.2.1 *Natural Fibers:*

1.2.1.1 *Cellulose-Base Fibers:*

Cotton
- Hemp
- Flax
- Ramie

1.2.1.2 *Protein-Base Fibers:*

Animal hairs (other than wool)
- Silk, cultivated
- Silk, Tussah
- Wool

1.2.2 *Man-Made Fibers:*

1.2.2.1 *Cellulose-Base Fibers:*

Acetate (secondary)
- Rayon, viscose or cuprammonium
- Triacetate

1.2.2.2 *Synthetic-Base Fibers:*

Acrylic
- Aramid
- Modacrylic
- Nylon 6, Nylon 6-6, others
- Olefin
- Polyester
- Spandex

1.3 These test methods include the following sections and tables:

| | Section |
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[1] These test methods are under the jurisdiction of ASTM Committee D13 on Textiles and are the direct responsibility of Subcommittee D13.51 on Conditioning, Chemical and Thermal Properties.

Current edition approved Feb. 1, 2015. Published March 2015. Originally approved in 1941. Last previous edition approved in 2008 as D629–08. DOI: 10.1520/D0629-15.

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1.4 The analytical procedures described in the test methods are applicable to the fibers listed in 1.2. The test methods are not satisfactory for the separation of mixtures containing fibers that fall within the same generic class but differ somewhat, either physically or chemically, from each other. These test methods are not satisfactory for the determination of bicomponent fibers.

NOTE 1—For other methods of analysis covering specific determinations, refer to: Test Methods D461, Test Method D584, Methods D885, Test Method D1113, Test Method D1334, and Test Method D2130. Methods for moisture are covered in Methods D885, Test Method D1576, Test Method D2462, Test Method D2495 and Test Methods D2654. For the determination of commercial weight, refer to Test Method D2494.

1.5 *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

D276 Test Methods for Identification of Fibers in Textiles

D461 Test Methods for Felt (Withdrawn 2003)[3]

D584 Test Method for Wool Content of Raw Wool—Laboratory Scale

D885 Test Methods for Tire Cords, Tire Cord Fabrics, and Industrial Filament Yarns Made from Manufactured Organic-Base Fibers

D1113 Test Method for Vegetable Matter and Other Alkali-Insoluble Impurities in Scoured Wool

D1193 Specification for Reagent Water

D1334 Test Method for Wool Content of Raw Wool—Commercial Scale

D1576 Test Method for Moisture in Wool by Oven-Drying

D1909 Standard Tables of Commercial Moisture Regains and Commercial Allowances for Textile Fibers

D2130 Test Method for Diameter of Wool and Other Animal Fibers by Microprojection

D2462 Test Method for Moisture in Wool by Distillation With Toluene

D2494 Test Method for Commercial Mass of a Shipment of Yarn or Manufactured Staple Fiber or Tow

D2495 Test Method for Moisture in Cotton by Oven-Drying

D2654 Test Method for Moisture in Textiles (Withdrawn 1998)[3]

D4920 Terminology Relating to Conditioning, Chemical, and Thermal Properties

2.2 *AATCC Method:*

20 A Test Method for Fiber Analysis: Quantitative[4]

## 3. Terminology

3.1 For definitions of textile terms used specifically in these test methods, refer to Terminology D4920.

3.2 For definitions of other generic textile terms used in these test methods, refer to Terminology D123.

## 4. Summary of Test Methods

4.1 Summaries of the specific methods used for different tests are given in the appropriate sections.

4.2 The methods for fiber analysis are grouped under three headings, as follows: Mechanical Separation or Dissection, Chemical Test Methods, and Microscopical Analysis.

NOTE 2—It is assumed that the analyst knows from qualitative tests (as directed in Test Methods D276) what fibers are present and, therefore, which method of analysis is applicable. The choice of method will depend upon the nature of the material to be analyzed and, in some cases, on the accuracy required.

## 5. Significance and Use

5.1 Qualitative and quantitative fiber identification is actively pursued by committee RA24 (Fiber Identification) of AATCC and presented in AATCC Test Methods 20 and 20A. Since precision and bias development is also part of the AATCC test methods, both AATCC and ASTM D13 have agreed that new development will take place in RA24.

[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.

[3] The last approved version of this historical standard is referenced on www.astm.org.

[4] AATCC Technical Manual, available from the American Association of Textile Chemists and Colorists, P.O. Box 12215, Triangle Park, NC 27709, www.aatcc.org.

However, because there is valuable information still present in the ASTM standards, D13.51 has agreed Test MethodsD276 and D629 will be maintained as active standards by ASTM.

5.2 Test Methods D629 for the determination of quantitative analysis of textiles may be used for acceptance testing of commercial shipments but caution is advised since information on between-laboratory precision is lacking. Comparative tests as directed in 5.2.1 or in Standard Tables D1909 may be advisable.

5.2.1 In case of a dispute arising from differences in reported test results using Test Methods D629 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 specimen should then be randomly assigned in equal numbers to each laboratory for testing. The average results from the two laboratories should be compared using Student's *t*-test and an acceptable probability level chosen by the two parties before the testing began. If a bias is found, either its cause must be found and corrected or the purchaser and supplier must agree to interpret future test results in the light of the known bias.

5.3 The effects of the various reagents used in the chemical methods on the residual fibers in a blend depend upon the history of the fibers and, unless otherwise stated, are generally too small or too uncertain to warrant the application of correction factors.

5.4 Fiber composition is generally expressed either on the oven-dry mass of the original sample or the oven-dry mass of the clean fiber after the removal of nonfibrous materials. If nonfibrous materials are not first removed from the textile before the fiber analysis is carried out, or if the treatments described in Section 8 are incapable of removing them, any such materials present will increase the percentage of the fiber constituent with which they are removed during the analysis, assuming they are soluble in the solvent used.

5.5 The analytical methods are intended primarily for the separation of binary mixtures of fibers. These procedures may also be used for the analysis of mixtures containing more than two types of fibers by selecting the best combination of methods to use (Table 1). Since a sequence of solvents on a given fiber may produce different results than the expected results from a single solvent, it is advisable to determine the results of such sequential effects when testing multiple fiber blends. It is sometimes more convenient to separate mechanically the yarns in a textile which are of similar types, and then use the appropriate chemical method to analyze each of the components. Table 2 shows the solubilities of the various fibers in different chemical reagents.

**TABLE 1 Chemical Methods for Analysis of Fiber Mixtures[A]**

| | Wool | Spandex | Silk | Rayon | Polyester | Olefin | Nylon | Mod-acrylic | Cellulosic, Natural | Aramid | Acrylic | Triacetate |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Acetate | 1 | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | | 1 | 1 |
| Triacetate | 3 | | (5) | (7[5])[B] | 9 | 3[9] | (5) | 9 | (5) | | 3 | |
| Acrylic | (6) | | (6) | (7[5]) | 10 | (8) | 10 | 10 | (5[7]) | | | |
| Aramid | (6) | | | | | | | | | | | |
| Cellulosic, Natural | (6)[5] | (10) | (6) | (4) | 5 | 5 | (3) | (2) | | | | |
| Modacrylic | 2 | 2 | 2 | 2 | 2 | 2 | 2 | | | | | |
| Nylon | 3 | (10) | (6) | 3 | 9 | (8) | | | | | | |
| Olefin | (6) | | (6) | (7[5]) | 8 | | | | | | | |
| Polyester | (6) | (10) | (6) | (7) | | | | | | | | |
| Rayon | 5 | | (6) | | | | | | | | | |
| Silk | | 6 | | | | | | | | | | |
| Spandex | (6) | | | | | | | | | | | |

[A]Key to Methods and Reagents:
Method No. 1—80 % acetone(cold)
Method No. 2— *N*-Butyrolactone
Method No. 3—90 % formic acid
Method No. 4—59.5 % sulfuric acid
Method No. 5—70 % sulfuric acid
Method No. 6—Sodium hypochlorite solution
Method No. 7—Curpammonia solution
Method No. 8—Hot xylene
Method No. 9—90 % formic acid
Method No. 10—N,N-dimethylacetamide

[B]Each analytical method is identified by a number and where possible, two methods of analysis are provided for each binary mixture of fibers. The number or numbers inside parentheses refers to the method that dissolves the fiber shown at the top of the diagram. The number or numbers outside the parentheses indicates the method that dissolves the fiber listed at the left side of the diagram. Where two methods are listed for a specific binary mixture, the non-superscript method number represents the method of choice.