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Cotton fibres — Test method for sugar content — Spectrophotometry

Fibres de coton — Méthode d'essai pour la teneur en sucre — Spectrophotométrie

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information.

The committee responsible for this document is ISO/TC 38, *Textiles*, Subcommittee SC 23, *Fibres and yarns*.

Introduction

Cotton fibre with normal sugar content might not affect the spinning process. If the sugar content is too high, it might cause storage mildew and metamorphism. During the spinning process, it might also cause twining and breakage, and lower yarn quality and production efficiency. Spectrophotometry is used as a quantitative determination method to detect the total sugar content, and 3,5-dihydroxytoluene-sulfuric acid solution is used as the colour developer. This International Standard supplies the basic information for sugar content of cotton fibres.

Cotton fibres — Test method for sugar content — Spectrophotometry

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1 Scope

This International Standard specifies a test method to determine the total sugar content in cotton fibres. Spectrophotometry is used as a quantitative determination method, and 3,5-dihydroxytoluene-sulfuric acid solution is used as a colour developer. This International Standard is applicable to cotton fibres.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 139:2005, *Textiles — Standard atmospheres for conditioning and testing*

ISO 1130:1975, *Textile fibres — Some methods of sampling for testing*

ISO 3696:1987, *Water for analytical laboratory use — Specification and test methods*

ISO 4793:1980, *Laboratory sintered (fritted) filters — Porosity grading, classification and designation*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
percentage of sugars
percentage content of total sugars contained in cotton fibres (including reducing sugar and non-reducing sugar) in the total mass of cotton fibres under the standard atmosphere

4 Principle

Under the action of the non-ionic surfactant (fatty acid alkanolamide), sugars in cotton fibres are dissolved in an aqueous solution, then degraded into furfural derivatives in concentrated acid medium (H_2SO_4). They are later combined with 3,5-dihydroxytoluene to form an orange-yellow complex. Quantify the content of sugars in the cotton fibres by the spectrophotometric method in comparison with the calibration curve at the wavelength of 425 nm.

5 Apparatus

5.1 Spectrophotometer, with a wavelength range of 200 nm to 800 nm.

5.2 Electronic balance, selected from the following.

5.2.1 Measuring range ≥ 10 g, accurate to 0,001 g.

5.2.2 Measuring range ≥ 50 g, accurate to 0,1 g.

5.3 Water bath, capable of maintaining a constant temperature of (70 ± 2) °C.

5.4 Conical flask, of capacity 250 ml, with ground stopper or iodine flask.

5.5 Pipettes, of capacity 1 ml, 2 ml and 5 ml.

An automatic pipette system of the same accuracy as manual pipettes may be used.

5.6 Volumetric flasks, of capacity 50 ml and 100 ml.

5.7 Graduated cylinders, of capacity 100 ml and 1 000 ml.

5.8 Beakers, of capacity 100 ml and 1 000 ml.

5.9 Colorimetric tube, of capacity 25 ml.

5.10 Vacuum air pump.

5.11 Filter, made from heat resistant glass having a pore size between 40 µm and 100 µm (pore type P100 in accordance with ISO 4793:1980).

5.12 Mechanical shaker, providing rotation or movement sufficient to obtain a ready exchange of liquid between the cotton fibres and the solution used in preparing the extract.

The amplitudes of to-and-fro and rotational mechanical shaker should be set as 30 mm~70 mm and 20 mm~60 mm, respectively. A to-and–fro movement at a rate of 60 min^{-1} or a rotational frequency of 30 min^{-1} has been found satisfactory.

5.13 Cuvettes, 1 cm.

6 Reagents

6.1 Distilled water or grade 3 water, complying with ISO 3696:1987.

6.2 Sulfuric acid, analytical grade, 1,84 g/ml.

6.3 3,5-Dihydroxytoluene, analytical grade.

6.4 Fatty acid alkanolamide, technical grade.

6.5 D-fructose, analytical grade.

6.6 Reagents preparation.

6.6.1 3,5-Dihydroxytoluene/sulfuric acid solution (0,2 %).

Weigh and dissolve 0,2 g of 3,5-dihydroxytoluene with 100 g of H_2SO_4 (approximately 54 ml) in a 100 ml beaker with continuous stirring. This solution should be freshly prepared.

6.6.2 Fatty acid alkanolamide solution for determination (0,4 g/l).

Dissolve 0,4 g of fatty acid alkanolamide in 1 000 ml of water and store it in a beaker. Mix well.

6.6.3 Fatty acid alkanolamide solution for extraction (0,05 g/l).

Dilute 100 ml of the solution (prepared in 6.6.2) with water to 700 ml in a beaker. Mix well.

7 Sampling

7.1 Sample in accordance with ISO 1130:1975. Store the samples to avoid the effect of temperature and humidity.

7.2 Randomly select a test specimen, no less than 50 g, from the laboratory samples. Remove any coarse impurities and mix thoroughly.

7.3 As specified in ISO 139:2005, test the test specimen after conditioning it in the standard atmosphere no less than 48 h (or until the difference between successive weighings made at intervals of 2 h does not exceed 0,25 %).

7.4 Weigh accurately three portions of the prepared specimen (each portion should weigh 2,000 g ± 0,001 g), recorded as *m*, and reserve the residual sample for further use.

8 Procedure

8.1 Blank test

8.1.1 Pipette 1,0 ml of 0,4 g/l fatty acid alkanolamide solution (6.6.2) into a 25 ml colorimetric tube (5.9).

8.1.2 Add 2,0 ml of 3,5-dihydroxytoluene/sulfuric acid solution (6.6.1) immediately to the colorimetric tube preheated to 70 °C in a water bath (5.3), and mix them by shaking to form a mixed solution, and again keep the mixed solution at a constant temperature of 70 °C for 40 min. Remove the tube from the bath. Subsequently, add further 20 ml of the fatty acid alkanolamide solution (6.6.2) to the mixed solution, mix them by shaking the tube, immediately cool down the resultant solution to room temperature and make it up to the mark with the 0,4 g/l fatty acid alkanolamide solution (6.6.2) and allow it to stand for 5 min to form a final solution. Transfer an appropriate amount of the final solution into a 1 cm cuvette to form a blank reagent. Measure and record the absorbance of the blank reagent at a wavelength of 425 nm using a Spectrophotometer (5.1).

8.2 Calibration curve preparation

8.2.1 Standard solutions preparation

8.2.1.1 Stock standard solution

Prepare a 2,0 mg/ml stock solution of D-fructose by dissolving 0,200 g D-fructose with 100 ml water.

8.2.1.2 Standard solution

Dilute 0,5 ml, 1,0 ml, 1,5 ml, 2,0 ml, 2,5 ml, 3,0 ml, 4,0 ml, and 5,0 ml of the stock standard solution (see 8.2.1.1), with water in 50 ml volumetric flasks. These solutions contain 0,02 mg/ml, 0,04 mg/ml, 0,06 mg/ml, 0,08 mg/ml, 0,10 mg/ml, 0,12 mg/ml, 0,16 mg/ml, and 0,20 mg/ml of D-fructose, respectively.