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**Textiles — Quantitative chemical  
analysis —**

**Part 2:  
Ternary fibre mixtures**

*Textiles — Analyse chimique quantitative —*

*Partie 2: Mélanges ternaires de fibres*

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## Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

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](http://www.iso.org/directives)).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see [www.iso.org/patents](http://www.iso.org/patents)).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see [www.iso.org/iso/foreword.html](http://www.iso.org/iso/foreword.html).

This document was prepared by Technical Committee ISO/TC 38, *Textiles*, in collaboration with the European Committee for Standardization (CEN) – Technical Committee CEN/TC 248, *Textiles and textile products*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This second edition cancels and replaces the first edition (ISO 1833-2:2006), which has been technically revised.

The main changes compared to the previous edition are as follows:

- the Introduction has been deleted and relevant information have been moved to [Clause 4](#);
- [Clause 2](#) has been updated;
- the mandatory [Clause 3](#) has been added;
- in [Clause 4](#) (former Clause 3), the explanation of the 4 variants has been added;
- in [9.3](#), additional instruction in case of pre-treatment by extraction with light petroleum and water has been introduced;
- in [Table B.1](#)
  - reference to lyocell (beside viscose, cupro and/or modal) has been added;
  - additional cases: n°36 for Variant 3, n°37 and n°38 for new fibres (elastolefin, melamine), n°39 and n°40 for mixtures with elastane have been introduced;
- the Bibliography has been updated (references to parts of ISO 1833 have been removed).

A list of all parts in the ISO 1833 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at [www.iso.org/members.html](http://www.iso.org/members.html).

# Textiles — Quantitative chemical analysis —

## Part 2: Ternary fibre mixtures

### 1 Scope

This document specifies methods of quantitative analysis of various ternary mixtures of fibres.

The field of application of each method for analysing mixtures, specified in the parts of ISO 1833, indicates the fibres to which the method is applicable.

This document is applicable to mixtures of fibres with more than three components provided that the combination of test methods leads back to simple cases of fibre mixtures. [Table B.1](#) illustrates the typical ternary mixtures and their applied corresponding parts of the ISO 1833 series.

### 2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 1833-1:2020, *Textiles — Quantitative chemical analysis — Part 1: General principles of testing*  
ISO 1833-2:2020

### 3 Terms and definitions

<https://standards.iteh.ai/catalog/standards/sist/403dd79a-64e2-4a41-9596-a2b29376ce76/iso-1833-2-2020>

No terms and definitions are listed in this document.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <http://www.electropedia.org/>

### 4 Principle

After identification of the components of a mixture, the non-fibrous matter is removed by a suitable pre-treatment, and then one or more of the four variants of the process of selective solution described in this clause is applied.

Except where this presents technical difficulties, it is preferable to dissolve the major fibre component so as to obtain the minor fibre component as the final residue.

In general, the methods for quantitative chemical analysis of ternary fibre mixtures are based on the selective solution of the individual components. Four variants of this procedure are possible:

- Variant 1: Using two different test specimens, component (*a*) is dissolved from the first test specimen and component (*b*) from the second test specimen. The insoluble residues of each test specimen are weighed and the percentage of each of the two soluble components is calculated from the respective losses in mass. The percentage of the third component (*c*) is calculated by difference.
- Variant 2: Using two different test specimens, a component (*a*) is dissolved from the first test specimen, and two components (*a* and *b*) from the second test specimen. The insoluble residue of the

first test specimen is weighed and the percentage of the component (*a*) is calculated from the loss in mass. The insoluble residue of the second test specimen is weighed: it corresponds to component (*c*). The percentage of the third component (*b*) is calculated by difference.

- Variant 3: Using two different test specimens, two components (*a* and *b*) are dissolved from the first test specimen and two components (*b* and *c*) from the second test specimen. The insoluble residues correspond to the two components (*c*) and (*a*) respectively. The percentage of the third component (*b*) is calculated by difference.
- Variant 4: Using only one test specimen, after removal of one of the components, the insoluble residue formed by the two other fibres is weighed and the percentage of the soluble component is calculated from the loss in mass. One of the two fibres of the residue is dissolved, the insoluble component is weighed, and the percentage of the second soluble component is calculated from the loss in mass. If this variant is used when a test specimen is subjected to the successive action of two different solvents, correction factors shall be applied for possible losses in mass undergone by the test specimen in the two treatments.

Where a choice is possible, it is recommended to use one of the first three variants. Where chemical analysis is used, take care to choose methods prescribing solvents which dissolve only the required fibre or fibres, and leave undissolved the other fibre or fibres.

In order to reduce the possibility of error to a minimum, it is recommended that, whenever possible, chemical analysis using at least two of the four above-mentioned variants should be made.

NOTE By way of example, [Annex B](#) contains a certain number of ternary mixtures, together with methods for analysing binary mixtures which can, in principle, be used for analysing these ternary mixtures.

If the fibre mixture in a sample contains more than 3 components, where relevant, the application of combined manual separations and chemical analysis leads to decrease the number of components in sub-samples so that the given procedure in ISO 1833-1 or ISO 1833-2 can be applied.

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## 5 Reagents and apparatus

Use the apparatus and reagents described in ISO 1833-1.

## 6 Conditioning and testing atmosphere

See ISO 1833-1.

## 7 Sampling and pre-treatment of laboratory test sample

See ISO 1833-1.

## 8 Procedure

See ISO 1833-1.

## 9 Calculation and expression of results

### 9.1 General

Express the mass of each component as a percentage of the total mass of fibre present in the mixture. Calculate the result on the basis of clean dry mass, to which is applied firstly the agreed moisture regain and secondly the correction factor necessary to take account of loss of matter during pre-treatment and analysis.

## 9.2 Calculation of percentages of mass of clean dry fibres, disregarding loss of fibre mass during pre-treatment

NOTE Some examples of calculation are given in [Annex A](#).

### 9.2.1 Variant 1

[Formulae \(1\) to \(3\)](#) are applied where a component of the mixture is removed from one specimen and another component from a second specimen.

$$P_1 = \left[ \frac{d_2}{d_1} - d_2 \times \frac{r_1}{m_1} + \frac{r_2}{m_2} \times \left( 1 - \frac{d_2}{d_1} \right) \right] \times 100 \quad (1)$$

$$P_2 = \left[ \frac{d_4}{d_3} - d_4 \times \frac{r_2}{m_2} + \frac{r_1}{m_1} \times \left( 1 - \frac{d_4}{d_3} \right) \right] \times 100 \quad (2)$$

$$P_3 = 100 - (P_1 + P_2) \quad (3)$$

where

$P_1$  is the percentage of the first clean dry component (component in the first specimen soluble in the first reagent);

$P_2$  is the percentage of the second clean dry component (component in the second specimen soluble in the second reagent);

$P_3$  is the percentage of the third clean dry component (component undissolved in both specimens);

$m_1$  is the dry mass of the first specimen after pre-treatment;

$m_2$  is the dry mass of the second specimen after pre-treatment;

$r_1$  is the dry mass of the residue after removal of the first component from the first specimen in the first reagent;

$r_2$  is the dry mass of the residue after removal of the second component from the second specimen in the second reagent;

$d_1$  is the correction factor for loss in mass, in the first reagent, of the second component undissolved in the first specimen;

$d_2$  is the correction factor for loss in mass, in the first reagent, of the third component undissolved in the first specimen;

$d_3$  is the correction factor for loss in mass, in the second reagent, of the first component undissolved in the second specimen;

$d_4$  is the correction factor for loss in mass, in the second reagent, of the third component undissolved in the second specimen.

The values of  $d$  are indicated in the relevant parts of the ISO 1833 series.

9.2.2 Variant 2

Formulae (4) to (6) are applied in cases where a component (*a*) is removed from the first test specimen, leaving as residue, the other two components (*b* + *c*), and the two components (*a* + *b*) are removed from the second test specimen, leaving as residue the third component (*c*).

$$P_1 = 100 - (P_2 + P_3) \tag{4}$$

$$P_2 = 100 \times \frac{d_1 r_1}{m_1} - \frac{d_1}{d_2} \times P_3 \tag{5}$$

$$P_3 = \frac{d_4 r_2}{m_2} \times 100 \tag{6}$$

where

*P*<sub>1</sub> is the percentage of the first clean dry component (component of the first specimen soluble in the first reagent);

*P*<sub>2</sub> is the percentage of the second clean dry component (component soluble, at the same time as the first component of the second specimen, in the second reagent);

*P*<sub>3</sub> is the percentage of the third clean dry component (component undissolved in both specimens);

*m*<sub>1</sub> is the dry mass of the first specimen after pre-treatment;

*m*<sub>2</sub> is the dry mass of the second specimen after pre-treatment;

*r*<sub>1</sub> is the dry mass of the residue after removal of the first component from the first specimen in the first reagent;

*r*<sub>2</sub> is the dry mass of the residue after removal of the first and second components from the second specimen in the second reagent;

*d*<sub>1</sub> is the correction factor for loss in mass in the first reagent, of the second component undissolved in the first specimen;

*d*<sub>2</sub> is the correction factor for loss in mass, in the first reagent, of the third component undissolved in the first specimen;

*d*<sub>4</sub> is the correction factor for loss in mass, in the second reagent, of the third component undissolved in the second specimen.

The values of *d* are indicated in the relevant parts of the ISO 1833 series.

9.2.3 Variant 3

Formulae (7) to (9) are applied where two components (*a* + *b*) are removed from a specimen, leaving as residue the third component (*c*), then two components (*b* + *c*) are removed from another specimen leaving as residue, the first component (*a*):

$$P_1 = \frac{d_3 r_2}{m_2} \times 100 \tag{7}$$

$$P_2 = 100 - (P_1 + P_3) \tag{8}$$



$$P_3 = \frac{d_2 r_1}{m_1} \times 100 \quad (9)$$

where

- $P_1$  is the percentage of the first clean dry component (component soluble in the first specimen in the first reagent);
- $P_2$  is the percentage of the second clean dry component (component soluble in the first specimen in the first reagent and in the second specimen soluble in the second reagent);
- $P_3$  is the percentage of the third clean dry component (component soluble in the second specimen in the second reagent);
- $m_1$  is the dry mass of the first specimen after pre-treatment;
- $m_2$  is the dry mass of the second specimen after pre-treatment;
- $r_1$  is the dry mass of the residue after removal of the first and second components from the first specimen with the first reagent;
- $r_2$  is the dry mass of the residue after removal of the second and third components from the second specimen with the second reagent;
- $d_2$  is the correction factor for loss in mass in the first reagent, of the third component undissolved in the first specimen;
- $d_3$  is the correction factor for loss in mass, in the second reagent, of the first component undissolved in the second specimen.

The values of  $d$  are indicated in the relevant parts of ISO 1833-2:2020  
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#### 9.2.4 Variant 4

Formulae (10) to (12) are applied where two components are successively removed from the mixture using the same test specimen:

$$P_1 = 100 - (P_2 + P_3) \quad (10)$$

$$P_2 = 100 \times \frac{d_1 r_1}{m} - \frac{d_1}{d_2} \times P_3 \quad (11)$$

$$P_3 = \frac{d_3 r_2}{m} \times 100 \quad (12)$$

where

- $P_1$  is the percentage of the first clean dry component (first soluble component);
- $P_2$  is the percentage of the second clean dry component (second soluble component);
- $P_3$  is the percentage of the third clean dry component (undissolved component);
- $m$  is the dry mass of the test specimen after pre-treatment;
- $r_1$  is the dry mass of the residue after removal of the first component by the first reagent;

- $r_2$  is the dry mass of the residue after removal of the first and second components by the first and second reagents;
- $d_1$  is the correction factor for loss in mass of the second component in the first reagent;
- $d_2$  is the correction factor for loss in mass of the third component in the first reagent;
- $d_3$  is the correction factor for loss in mass of the third component in the first and second reagents.

The values of  $d$  are indicated in the relevant parts of ISO 1833.

Wherever possible,  $d_3$  should be determined in advance by experimental methods.

**9.3 Calculation of the percentage of each component with adjustment by agreed moisture regains and, where appropriate, by correction factors for losses in mass during pre- treatment operations**

$$A=1+\frac{a_1+b_1}{100} \quad B=1+\frac{a_2+b_2}{100} \quad C=1+\frac{a_3+b_3}{100} \tag{13}$$

hence

$$P_{1A} = \frac{P_1 A}{P_1 A + P_2 B + P_3 C} \times 100 \tag{14}$$

$$P_{2A} = \frac{P_2 B}{P_1 A + P_2 B + P_3 C} \times 100 \tag{15}$$

$$P_{3A} = \frac{P_3 C}{P_1 A + P_2 B + P_3 C} \times 100 \tag{16}$$

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or

$$P_{3A} = 100 - (P_{1A} + P_{2A}) \tag{17}$$

where

- $P_{1A}$  is the percentage of the first clean dry component, including moisture content and loss in mass during pre-treatment;
- $P_{2A}$  is the percentage of the second clean dry component, including moisture content and loss in mass during pre-treatment;
- $P_{3A}$  is the percentage of the third clean dry component, including moisture content and loss in mass during pre-treatment;
- $P_1$  is the percentage of the first clean dry component obtained by one of the formulae given in 9.2;
- $P_2$  is the percentage of the second clean dry component obtained by one of the formulae given in 9.2;
- $P_3$  is the percentage of the third clean dry component obtained by one of the formulae given in 9.2;
- $a_1$  is the agreed moisture regain of the first component;
- $a_2$  is the agreed moisture regain of the second component;

- $a_3$  is the agreed moisture regain of the third component;
- $b_1$  is the percentage of loss in mass during pre-treatment of the first component;
- $b_2$  is the percentage of loss in mass during pre-treatment of the second component;
- $b_3$  is the percentage of loss in mass during pre-treatment of the third component.

Where a pre-treatment is used, the values of  $b_1$ ,  $b_2$  and  $b_3$  should be determined if possible, by submitting each of the pure fibre components to the pre-treatment applied in the analysis. Pure fibres are those free from all non-fibrous material except that which they normally contain (either naturally or because of the manufacturing process) in the state (unbleached, bleached) in which they are found in the material to be analysed.

Where no pre-treated separate fibre components used in the manufacture of the material to be analysed are available, average values of  $b_1$ ,  $b_2$  and  $b_3$  as obtained from tests performed on clean fibres similar to those in the mixture under examination should be used. If pre-treatment by extraction with light petroleum and water is applied, correction factors  $b_1$ ,  $b_2$  and  $b_3$  may generally be ignored, except in the case of unbleached cotton, unbleached flax (or linen) and unbleached hemp where the loss due to pre-treatment is usually accepted as 4 % and in the case of polypropylene as 1 %.

In the case of other fibres, usually, no allowance is made in the calculation for the loss during pre-treatment. However, any significant mass loss should be taken into consideration.

NOTE Some examples of calculations are given in [Annex A](#).

## 9.4 Calculation of the quantitative analysis by manual separation

### 9.4.1 General

Express the mass of each component fibre as a percentage of the total mass of the fibre in the mixture. Calculate the result on the basis of clean dry mass to which are applied the agreed moisture regain and the correction factor necessary to take account of loss of mass during pre-treatment operations.

### 9.4.2 Calculation of the percentage mass of clean dry fibre disregarding loss in fibre mass during pre-treatment

$$P_1 = \frac{100m_1}{m_1 + m_2 + m_3} = \frac{100}{1 + \frac{m_2 + m_3}{m_1}} \quad (18)$$

$$P_2 = \frac{100m_2}{m_1 + m_2 + m_3} = \frac{100}{1 + \frac{m_1 + m_3}{m_2}} \quad (19)$$

$$P_3 = 100 - (P_1 + P_2) \quad (20)$$

where

- $P_1$  is the percentage of the first clean dry component;
- $P_2$  is the percentage of the second clean dry component;
- $P_3$  is the percentage of the third clean dry component;