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Textiles — Qualitative and quantitative proteomic analysis of some animal hair fibres —

Part 2: Peptide detection using MALDI-TOF MS

Textiles — Analyse protéomique qualitative et quantitative de certaines fibres animales —

Partie 2: Détection des peptides par MALDI-TOF MS

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Foreword

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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.

This document was prepared by Technical Committee ISO/TC 38, *Textiles*.

A list of all parts in the ISO 20418 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.

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Introduction

Animal hair fibres have been used for fabrics or furs. In general, fibres from different animals show distinct colours and morphologies, and in most cases can be distinguished to the species level under microscopic observation. In the textile industries, the identification and quantification of animal hair fibres are very important to guarantee the quality of textile products. Currently, the only practical way to identify animal hair fibres is the microscopic method. However, microscopic identification of animal species from hair fibres can be difficult in certain cases of highly processed fibres or ambiguous samples. Thus, microscopists in testing laboratories require vast experience and a high skill level.

In order to overcome the difficulties of the microscope method, some novel objective methods such as DNA method have been developed to identify animal hair fibres. This method is very sensitive and can be used for qualitative analysis. However, it has been reported that the quantitative analysis of some highly processed samples remains difficult with the DNA method.

It is well known that animal hairs are mostly composed of proteins, and that the amino acid sequences of these proteins are slightly different among different animal species. In the early 2000s, mass spectrometry (MS) was shown to be a very useful method for identifying protein structures. MS of the small peptides obtained by enzyme digestion of proteins can be used to clarify the differences in amino acid sequences among proteins. A particularly efficient qualitative and quantitative method was developed using matrix-assisted laser desorption/ionization-time of flight (MALDI-TOF) MS in 2014. The method has been shown to be useful even for highly processed samples and is applicable to various types of animal hairs such as goat (cashmere or mohair), wool and yak.

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Textiles — Qualitative and quantitative proteomic analysis of some animal hair fibres —

Part 2:
Peptide detection using MALDI-TOF MS

1 Scope

This document specifies a qualitative and quantitative procedure to determine the composition of animal hair fibre blends by MALDI-TOF MS.

The composition of non-animal hair fibres can be measured by methods described in the ISO 1833 series. Both results are then combined to determine the whole composition of fibres.

The method is based on a preliminary identification, by light microscopy, of all fibres in a blend on the basis of their morphology, according to ISO/TR 11827. In case fibres of the same animal species are present (e.g. blends of cashmere and mohair), the method is not applicable and the quantitative analysis can be performed using microscopical analysis (e.g. as described in ISO 17751 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 3696, *Water for analytical laboratory use — Specification and test methods*

3 Terms and definitions

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

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/

3.1
animal hair fibre
type of keratin fibre for textile use: wool, cashmere and yak

EXAMPLE Some animal hair fibres come from camel, alpaca, and angora rabbit.

[SOURCE: ISO 20418-1:2018, 3.1, modified — examples of animal hair fibres have been added.]

3.2
protein
polymers of amino acids that play many critical roles in the body

3.3
peptide
small *proteins* (3.2) consisting of approximately less than 50 amino acids

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3.4
buffer solution
solution used to keep pH at a desirable value of the reaction solution

3.5
marker
m/z of animal species specific monoisotopic peak used for identification and quantification

Note 1 to entry: See (Clause 4) for an explanation of *m/z*.

4 Abbreviated terms

SDS-PAGE	sodium dodecyl sulfate-polyacrylamide gel electrophoresis, a method used to separate proteins according to their molecular size
MALDI	matrix-assisted laser desorption/ionization, a soft ionization method for mass spectrometry
TOF MS	time of flight mass spectrometry, a type of mass spectrometry based on the time difference of ions to reach the target plate according to molecular mass
m/z	dimensionless quantity formed by dividing the ratio of the mass of an ion to the unified atomic mass unit, by its charge number (regardless of sign)

5 Principle

Proteins in animal hair fibres are extracted using SDS/dithiothreitol (DTT)/phosphate buffer. The extracted proteins are partially purified using SDS-PAGE. The proteins in the gel are enzymatically digested by trypsin. The ratios of animal species-specific peptides are analysed by MALDI-TOF MS. The percent composition of each animal hair fibre is calculated using the calibration curve.

6 Reagents

All reagents shall be of high enough quality suitable for biochemical analysis. Some of the media are available on the market.

6.1 Water, Grade 3 quality as specified in ISO 3696.

6.2 Sodium dihydrogen phosphate dihydrate, 99 % or higher in purity.

6.3 Disodium hydrogen phosphate, 99 % or higher in purity.

6.4 Sodium dihydrogen phosphate solution (0,2 mol/l).

— sodium dihydrogen phosphate dihydrate 31,2 g

Make up to 1 l by dissolving in water.

6.5 Disodium hydrogen phosphate solution (0,2 mol/l).

— disodium hydrogen phosphate 28,4 g

Make up to 1 l by dissolving in water.

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