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Indoor air —

Part 39:
Determination of amines — Analysis of amines by (ultra-) high-performance liquid chromatography coupled to high resolution or tandem mass spectrometry

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Contents

Page

Foreword ..... **iv**
Introduction ..... **v**
1 Scope **1**
2 Normative references **1**
3 Terms and definitions **2**
4 Amines in indoor air **2**
4.1 Properties of amines 2
4.2 Origin and occurrence of amines 2
5 Analytical procedure **2**
5.1 Preparation of sample solutions 2
5.2 High-performance liquid chromatography 2
5.3 Tandem mass spectrometry 3
5.4 High resolution mass spectrometry 3
5.5 Sample sequence and external calibration 3
6 Testing of the suitability of the equipment and the instrumental analysis **3**
6.1 General 3
6.2 High-performance or ultra-performance liquid chromatography (HPLC or UHPLC) 3
6.3 Tandem mass spectrometry (MS-MS) 4
6.4 High resolution mass spectrometry (HRMS) 4
7 Reporting requirements **4**
Annex A (informative) **List of included amines** **6**
Annex B (informative) **Performance data of the analytical method** **9**
Bibliography **12**

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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).

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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 146, *Air quality*, Subcommittee SC 6, *Indoor air*.

A list of all parts in the ISO 16000 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

ISO 16000 (all parts) describe general requirements relating to the measurement of indoor air pollutants and the important conditions to be observed before or during the sampling of individual pollutants or groups of pollutants, as well as the measurements procedures themselves.

The definition of indoor environment is given by ISO 16000-1. Dwellings [living rooms, bedrooms, do-it-yourself (DIY) rooms, sport rooms and cellars, kitchens and bathrooms], workrooms or workplaces in buildings which are not subject to health and safety inspections with respect to air pollutants (e.g. offices, salesrooms), public buildings (e.g. restaurants, theatres, cinemas and other meeting rooms) and passenger cabins of motor vehicles and public transportation are among the most important types of indoor environment.

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Indoor air —

Part 39: Determination of amines — Analysis of amines by (ultra-) high-performance liquid chromatography coupled to high resolution or tandem mass spectrometry

1 Scope

This document, along with ISO 16000-38, specifies the measurement method for determining the mass concentration of primary, secondary and tertiary aliphatic and aromatic amines in indoor air using accumulated sampling and high-performance liquid chromatography (HPLC) coupled with tandem mass spectrometry (MS-MS) or high-resolution mass spectrometry (HRMS). The analytical procedure is covered by this document. The sampling procedure and the manufacturing of the samplers are covered by ISO 16000-38.

This document describes specifications for the chromatography and the mass spectroscopy for the amines. Measurement results are expressed in µg/m^3.

Although primarily intended for the measurement of amines listed in Tables A.1 and A.2, it can also be used for the measurement of other amines in indoor air. This document gives instructions and describes procedures for the inclusion of other amines.

The range of application of this document concerning the concentrations of amines in indoor air depends on the linear range of the calibration line and hence on the gas sample volume (here: from 5 l up to 100 l), the eluate volume (from 1 ml up to 5 ml), the injection volume (from 1 µl up to 10 µl) and the sensitivity of the analytical equipment (e.g. linear range from 2 pg up to 2 ng amine). The range of application can be expected to be from approximately 0,002 µg/m^3 (100 l sample) up to 2 000 µg/m^3 (5 l sample) for a common analytical equipment (e.g. Waters „TQD“) for the majority of the amines listed in Tables A.1 and A.2. The analysis of derivatives of ethanolamine is usually about 10 times more sensitive and the analysis of short-chained aliphatic amines is usually about 10 times less sensitive than the analysis of an average amine.

The performance data of the analytical method is given in Annex B, particularly in Tables B.1 and B.2.

This document can be used also for the determination of amines in water if the detection limit is sufficient.

This document does not cover the determination of isocyanates in indoor air (nor in water samples) as corresponding amines (covered by ISO 17734-1 and ISO 17734-2).

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 16000-38, *Indoor air — Part 38: Determination of amines in indoor and test chamber air — Active sampling on samplers containing phosphoric acid impregnated filters*

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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 standardisation at the following addresses:

— ISO online browsing platform: available at http://www.iso.org/obp

— IEC Electropedia: aivailable at http://www.elctropedia.org/

3.1
amines
nitrogen containing compounds with a sufficient vapor pressure (>10^{-3} Pa) and a free electron pair at the nitrogen atom which can be protonated

4 Amines in indoor air

4.1 Properties of amines

Amines are basic and polar substances.

There are primary, secondary, tertiary, and quaternary amines.

Quaternary amines are not included in this document, as they have no free electron pair and therefore have very different properties. In this document the term “amines” refers only to primary, secondary, and tertiary amines.

Not protonated amines are oxidation sensitive.

Reaction of amines with acids results in ammonium salts of the amines. The ammonium salts are not oxidation sensitive.

4.2 Origin and occurrence of amines

Amines are produced by technical chemical processes and processing and in addition by biotic or abiotic decomposition of nitrogen compounds. Besides sources of biological origin, indoor air sources of amines could be, for instance, products containing polyurethane, especially foams, e.g. in vehicle seats, mattresses, pillows, and upholstered furniture or as thermal insulation or sound absorbing material. Several amines, in particular aromatic amines, are known as harmful compounds. Furthermore, most amines have an unacceptable odour in combination with a low odour threshold.

Further sources are for example food, e.g. fish (aliphatic amines), and cigarette smoke (aromatic amines).

5 Analytical procedure

5.1 Preparation of sample solutions

ISO 16000-38 describes the procedure to get the aqueous eluate of the ammonium salts of the sampled amines. The sample solution (which contains already approximately 0,02 µmol/µl up to 0,1 µmol/µl phosphoric acid) can be used for the injection into the HPLC system without further treatment.

5.2 High-performance liquid chromatography

— stationary phase of separating column: pentafluorophenyl;

— common column dimensions: length 150 mm, inner diameter: 2,1 mm;

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