
Indoor air —

**Part 4:
Determination of formaldehyde —
Diffusive sampling method**

Air intérieur —

*Partie 4: Dosage du formaldéhyde — Méthode par échantillonnage
diffusif*



This document is a preview generated by EVS



COPYRIGHT PROTECTED DOCUMENT

© ISO 2011

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

Published in Switzerland

Contents

Page

Foreword	iv
Introduction	vi
1 Scope	1
2 Normative references	1
3 Principle	2
4 Reagents	2
5 Apparatus	3
6 Sampling	4
7 Procedure	4
7.1 Desorption and sample preparation	4
7.2 Calibration	4
7.3 HPLC analysis	5
7.4 Determination of sample concentration	6
7.5 Storage	6
7.6 Determination of desorption efficiency	6
8 Calculation	6
8.1 Mass of DNPH-formaldehyde on the filter	6
8.2 Concentration of formaldehyde in air	7
9 Precision and uncertainty of the method	7
10 Quality assurance/quality control	8
11 Test report	8
Annex A (informative) Typical designs of diffusive samplers	9
Bibliography	11

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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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.

ISO 16000-4 was prepared by Technical Committee ISO/TC 146, *Air quality*, Subcommittee SC 6, *Indoor air*.

This second edition cancels and replaces the first edition (ISO 16000-4:2004), which has been technically revised, especially 7.2.

ISO 16000 consists of the following parts, under the general title *Indoor air*:

- *Part 1: General aspects of sampling strategy*
- *Part 2: Sampling strategy for formaldehyde*
- *Part 3: Determination of formaldehyde and other carbonyl compounds in indoor air and test chamber air — Active sampling method*
- *Part 4: Determination of formaldehyde — Diffusive sampling method*
- *Part 5: Sampling strategy for volatile organic compounds (VOCs)*
- *Part 6: Determination of volatile organic compounds in indoor and test chamber air by active sampling on Tenax TA® sorbent, thermal desorption and gas chromatography using MS or MS-FID*
- *Part 7: Sampling strategy for determination of airborne asbestos fibre concentrations*
- *Part 8: Determination of local mean ages of air in buildings for characterizing ventilation conditions*
- *Part 9: Determination of the emission of volatile organic compounds from building products and furnishing — Emission test chamber method*
- *Part 10: Determination of the emission of volatile organic compounds from building products and furnishing — Emission test cell method*
- *Part 11: Determination of the emission of volatile organic compounds from building products and furnishing — Sampling, storage of samples and preparation of test specimens*
- *Part 12: Sampling strategy for polychlorinated biphenyls (PCBs), polychlorinated dibenzo-p-dioxins (PCDDs), polychlorinated dibenzofurans (PCDFs) and polycyclic aromatic hydrocarbons (PAHs)*

- *Part 13: Determination of total (gas and particle-phase) polychlorinated dioxin-like biphenyls (PCBs) and polychlorinated dibenzo-p-dioxins/dibenzofurans (PCDDs/PCDFs) — Collection on sorbent-backed filters*
- *Part 14: Determination of total (gas and particle-phase) polychlorinated dioxin-like biphenyls (PCBs) and polychlorinated dibenzo-p-dioxins/dibenzofurans (PCDDs/PCDFs) — Extraction, clean-up and analysis by high-resolution gas chromatography and mass spectrometry*
- *Part 15: Sampling strategy for nitrogen dioxide (NO₂)*
- *Part 16: Detection and enumeration of moulds — Sampling by filtration*
- *Part 17: Detection and enumeration of moulds — Culture-based method*
- *Part 18: Detection and enumeration of moulds — Sampling by impaction*
- *Part 19: Sampling strategy for moulds*
- *Part 23: Performance test for evaluating the reduction of formaldehyde concentrations by sorptive building materials*
- *Part 24: Performance test for evaluating the reduction of volatile organic compound (except formaldehyde) concentrations by sorptive building materials*
- *Part 25: Determination of the emission of semi-volatile organic compounds by building products — Micro-chamber method*
- *Part 26: Sampling strategy for carbon dioxide (CO₂)*
- *Part 28: Determination of odour emissions from building products using test chambers*

The following parts are under preparation:

- *Part 21: Detection and enumeration of moulds — Sampling from materials*
- *Part 27: Determination of settled fibrous dust on surfaces by SEM (scanning electron microscopy) (direct method)*
- *Part 29: Test methods for VOC detectors*
- *Part 30: Sensory testing of indoor air*
- *Part 31: Measurement of flame retardants and plasticizers based on organophosphorus compounds — Phosphoric acid ester*
- *Part 32: Investigation of constructions on pollutants and other injurious factors — Inspections*

Introduction

Formaldehyde has a high potential toxicity, and therefore, its determination is of interest as an indoor air pollutant. Formaldehyde is an irritant that may cause allergic reactions and other health issues.

Formaldehyde is the simplest carbonyl compound, with one carbon, one oxygen and two hydrogen atoms. In its monomolecular state, it is a colourless, pungent, reactive gas. It has been used in the production of urea-formaldehyde resins, adhesives and insulating foams. Emissions from particle (chip) board and wall insulation are the major sources of formaldehyde in indoor air.

This part of ISO 16000 is intended to be used for characterizing indoor air following the sampling strategy for formaldehyde specified in ISO 16000-2. ISO 16000-1 gives general requirements for 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.

An active formaldehyde measurement procedure (reference method) is specified in ISO 16000-3.

Aspects of the determination (sampling and analysis) and the sampling strategy of specific pollutants or groups of pollutants are specified in the other parts of ISO 16000.

ISO 16017^[6]^[7] and ISO 12219^[1]–^[5] also focus on volatile organic compound (VOC) measurements.

Indoor air —

Part 4:

Determination of formaldehyde — Diffusive sampling method

WARNING — Persons using this part of ISO 16000 should be familiar with normal laboratory practice. This part of ISO 16000 does not purport to address all of the safety problems, if any, associated with its use. It is the responsibility of the user to establish appropriate safety and health practices and to ensure compliance with any national regulatory conditions.

1 Scope

This part of ISO 16000 specifies a determination of formaldehyde in indoor air using a diffusive sampler with solvent desorption and high performance liquid chromatography (HPLC).

The test method is applicable to the measurement of formaldehyde¹⁾ in indoor air over the range from 0,001 mg/m³ to 1,0 mg/m³ for a sampling period of between 24 h and 72 h. For sampling periods of 24 h, the applicable concentration range is 0,003 mg/m³ to 1 mg/m³, and for 72 h it is 0,001 mg/m³ to 0,33 mg/m³.

NOTE Confirmed samplers with respect to measurement sensitivity and precision can apply to short-term sampling (less than 24 h).

The method is suitable for measurements in atmospheres with conventional indoor air relative humidity and for monitoring at air velocities as low as 0,02 m/s. The chromatographic step in the method is designed to eliminate potential interferences, including those due to the presence of other carbonyl compounds. The sampling method gives a time-weighted average result.

NOTE There are several diffusive samplers with various designs and shapes commercially available. They are all based on the reaction of 2,4-dinitrophenylhydrazine with formaldehyde. They are not specifically described in this part of ISO 16000 to avoid any impression that ISO favours one model over another.

2 Normative references

The following referenced documents are indispensable for the application 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 16000-2, *Indoor air — Part 2: Sampling strategy for formaldehyde*

ISO 16000-3:2011, *Indoor air — Part 3: Determination of formaldehyde and other carbonyl compounds in indoor air and test chamber air — Active sampling method*

ISO/IEC 17025, *General requirements for the competence of testing and calibration laboratories*

EN 13528-2, *Ambient air quality — Diffusive samplers for the determination of concentrations of gases and vapours — Requirements and test methods — Part 2: Specific requirements and test methods*

1) Instead of systematic IUPAC nomenclature, traditional names are used in this part of ISO 16000, e.g. “formaldehyde” is used instead of “methanal”.