
Indoor air —

Part 20:

**Detection and enumeration of moulds
— Determination of total spore count**

Air intérieur —

*Partie 20: Détection et dénombrement des moisissures —
Détermination du nombre total de spores*



This document is a preview generated by EBS



COPYRIGHT PROTECTED DOCUMENT

© ISO 2014

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested 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 Terms and definitions.....	1
3 Principle of method.....	2
4 Apparatus and materials.....	2
5 Reagents.....	3
5.1 General.....	3
5.2 Lactophenol blue solution.....	3
6 Measurement procedure.....	3
6.1 Sampling.....	3
6.2 Direct microscopy.....	4
6.3 Calculation and expression of results.....	5
6.4 Transport and storage.....	6
7 Quality assurance.....	6
8 Calibration of flow rate, function control, and maintenance of the sampling system.....	6
9 Sampling protocol.....	6
10 Performance characteristics.....	7
Annex A (informative) Examples of impactors.....	11
Annex B (normative) Sample exchange for method validation.....	12
Bibliography.....	13

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).

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).

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

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

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 20: Detection and enumeration of moulds — Determination of total spore count*
- *Part 21: Detection and enumeration of moulds — Sampling from materials*
- *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 27: Determination of settled fibrous dust on surfaces by SEM (scanning electron microscopy) (direct method)*
- *Part 28: Determination of odour emissions from building products using test chambers*
- *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 esters*
- *Part 32: Investigation of constructions on pollutants and other injurious factors — Inspection*

The following parts are under preparation:

- *Part 33: Determination of phthalates with GC-MS*
- *Part 34: Strategies for the measurement of airborne particles (PM 2,5 fraction)*
- *Part 35: Measurement of polybrominated diphenylether, hexabromocyclododecane and hexabromobenzene*
- *Part 36: Test method for the reduction rate of airborne bacteria by air purifiers using a test chamber*

Introduction

Mould is a common name for filamentous fungi from different taxonomic groups (Ascomycota, Zygomycota, and their anamorphic states former known as Deuteromycota or fungi imperfecti). They form a mycelium and spores by which they become visible macroscopically. Most spores are in the size range of 2 µm to 10 µm, some up to 30 µm and only few up to 100 µm. Spores of some mould genera are small and become airborne very easily (e.g. *Aspergillus*, *Penicillium*) while others are bigger and/or embedded in a slime matrix (e.g. *Stachybotrys*, *Fusarium*) and less mobile.

Mould spores are widely distributed in the outdoor environment and, therefore, occur in varying concentrations also indoors. Growth of moulds in indoor environments, however, has to be considered a hygienic problem because epidemiological studies have revealed that dampness and/or mould growth in homes and health problems affecting the occupants are closely related.

Harmonized methods for sampling, detection and enumeration of moulds including standards for sampling strategies are important for comparative assessment of mould problems indoors. Before doing any measurements a plan for the measurement strategy should be made.

This part of ISO 16000 describes methods for air sampling of mould spores for subsequent microscopic analysis.

This part of ISO 16000 is based on parts of VDI 4300 Part 10.^[6]

Indoor air —

Part 20:

Detection and enumeration of moulds — Determination of total spore count

1 Scope

This part of ISO 16000 specifies requirements for sampling of moulds from air. Following the instructions given, samples are obtained for microscopy to determine the total concentration of spores.

2 Terms and definitions

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

2.1

cultivation

<air quality> growing of microorganisms on culture media

[SOURCE: ISO 16000-16:2008, 3.6]

2.2

cut-off value

particle size (aerodynamic diameter) for which the sampling efficiency is 50 %

2.3

filamentous fungus

fungus growing in the form of filaments of cells known as hyphae

[SOURCE: ISO 16000-16:2008, 3.3]

Note 1 to entry: The term “filamentous fungi” differentiates fungi with hyphal growth from yeasts.

2.4

impaction

sampling of particles suspended in air by inertial separation on a solid surface

2.5

microorganism

any microbial entity, cellular or non-cellular, capable of replication or of transferring of genetic material or entities that have lost these properties

[SOURCE: EN 13098:2000]

2.6

mould

<air quality> filamentous fungi from several taxonomic groups; namely Ascomycota, Zygomycota, and their anamorphic states former known as Deuteromycota or fungi imperfecti

[SOURCE: ISO 16000-16:2008, 3.9]

Note 1 to entry: Moulds form different types of spores depending on the taxonomic group they belong to, namely conidiospores (conidia), sporangiospores, or ascospores.