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Procedure til prøvning af luftfiltres antibakterielle effekt efter kontaminering med en bakteriel bioaerosol

Procedure for testing the antibacterial effect of the air filter after contamination through a bacterial bioaerosol

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Procedure for testing the antibacterial effect of the air filter after contamination through a bacterial bioaerosol

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Foreword

This CEN Workshop Agreement (CWA 18309:2025) has been developed in accordance with the CEN-CENELEC Guide 29 “CEN/CENELEC Workshop Agreements – A rapid way to standardization” and with the relevant provisions of CEN/CENELEC Internal Regulations - Part 2. It was approved by the Workshop CEN/WS “Evaluating Antimicrobial Coatings: From Air Filtration Efficiency to Antiviral Mechanism and Ecotoxicology”, the secretariat of which is held by UNE (Spanish Association for Standardization) consisting of representatives of interested parties on 2025-07-29, the constitution of which was supported by CEN following the public call for participation made on 2025-06-16. However, this CEN Workshop Agreement does not necessarily include all relevant stakeholders.

The final text of this CEN Workshop Agreement was provided to CEN for publication on 2025-12-15.

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The following organizations and individuals developed and approved this CEN Workshop Agreement:

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Introduction

Indoor air quality (IAQ) is a critical factor in ensuring public health, particularly in environments like hospitals, transportation systems, and workplaces. Antimicrobial air filtration technologies have attracted significant attention as a solution to reduce microbial transmission through HVAC (Heating, Ventilation, and Air Conditioning) or HEPA (High-Efficiency Particulate Air) systems.

Despite the growing availability of filters with antimicrobial treatments, there is currently no standards for evaluating their antibacterial performance under realistic airborne exposure. Most existing test methods focus on surface or water-based applications and do not reflect the aerosol contamination typically encountered in HVAC or HEPA systems.

This CEN Workshop Agreement outlines a methodology to evaluate antibacterial performance under realistic HVAC or HEPA bioaerosol conditions. During the process, a bioaerosol containing a high concentration of a specific bacterial strain is nebulized onto the filter, which is placed inside a filter holder for a defined period. The method employs both qualitative and quantitative analysis to assess bacterial survival on filter surfaces. The qualitative assessment consists of visually evaluating bacterial growth on agar plates in contact with contaminated filter specimens after incubation. The quantitative approach entails counting the colony-forming units (CFU) from a nutrient broth in which the contaminated filter has been immersed and subsequently incubated. Both approaches include the comparison with a control air filter without antimicrobial agents tested in the same way.

This document has been based on the knowledge generated in the EU-funded research project NANOBLOC, which received funding from the European Union’s Horizon Europe research and innovation programme under grant agreement No. 101057597.

1 Scope

This document defines a standardized method for assessing the antibacterial effectiveness of air filtration media after exposure to a bacterial bioaerosol. The procedure includes the controlled generation and delivery of a bacterial aerosol, its contact with the test filter surface, and the subsequent evaluation of bacterial viability using both qualitative and quantitative approaches.

This method is applicable to various types of air filters, including but not limited to HEPA filters, HVAC filters, coated filters, and filters treated with antimicrobial agents. It establishes validation criteria for controls, inoculum quality, and test conditions to ensure reproducibility and comparability of results across laboratories and applications.

This procedure is specifically designed for air filters treated with antibacterial agents to confer antimicrobial properties. Untreated specimens of the same type and production batch shall be used as control specimens to assess the relative antibacterial performance under identical test conditions.

The method is intended for use in research, quality control, and product development. It may also be used to facilitate conformity assessment procedures and regulatory compliance, where relevant and applicable.

2 Normative references

There are no normative references in this document.

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 http://www.iso.org/obp/

— IEC Electropedia: available at http://www.electropedia.org/

3.1
antibacterial activity
ability of a material or substance to inhibit or reduce the growth of bacteria, either on its surface or in surrounding media

3.2
HEPA filter (High-Efficiency Particulate Air filter)
type of air filter capable of removing at least 99,95% of airborne particles of 0,3 microns in diameter, according to EN 1822 classification

3.3
HVAC (Heating, Ventilation and Air Conditioning systems)
type of environmental control system designed to regulate indoor temperature, humidity, and air quality through integrated heating, ventilation, and air conditioning components

3.4
filters treated with antimicrobial agents
air filter that has been modified through any process intended to incorporate one or more antibacterial agents in order to confer antimicrobial properties

3.5
untreated specimen
test specimen that does not contain any antimicrobial agent. It serves as a baseline to compare the performance of treated specimens

3.6
bioaerosol
suspension of airborne particles that contains or is derived from living organisms, including bacteria, viruses, fungi, or their fragments

Note 1 to entry: In this context, it refers specifically to a bacterial aerosol used for contamination testing

3.7
McFarland standard
turbidity standard used to estimate the concentration of microbial colonies in suspension

Note 1 to entry: A 5 McFarland standard corresponds to approximately $1{,}5 \times 10^9$ CFU/mL.

3.8
CFU (Colony Forming Unit)
unit used to estimate the number of viable bacteria or fungal cells in a specimen

Note 1 to entry: One CFU is typically assumed to arise from a single organism capable of forming a colony under specific conditions.

3.9
qualitative analysis
visual or observational assessment used to determine the presence or absence of bacterial growth, typically on a nutrient agar surface in contact with a test material

3.10
quantitative analysis
measurement-based evaluation of antibacterial activity, typically involving serial dilutions, plating on agar, and counting of CFUs

3.11
vortex mixing
laboratory method used to resuspend cells or dislodge surface-bound bacteria by rapid agitation of a liquid in a tube