Designation: E3273 – 21

Standard Practice to Assess Microbial Decontamination of Indoor Air using an Aerobiology Chamber[1]

This standard is issued under the fixed designation E3273; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

INTRODUCTION

Indoor air normally contains a variety of microbes released from animate and inanimate sources (**1**).[2] Exposure to airborne microbes can occur either directly by inhalation or by contact with surfaces and objects where airborne particles have settled (**2**). Such exposure can lead to infections or allergic reactions, and microbial decontamination of indoor air can reduce the risk of exposure to potentially harmful microbes. While many devices for indoor air decontamination are either already on the market or under development, the continuing absence of suitable test protocols makes their claims difficult to assess. This practice gives the design, construction and operation of an economical and versatile aerobiology chamber to test technologies for a temporary reduction in the number of viable microbes in indoor air.

1. Scope

1.1 This practice is to assess technologies for microbial decontamination of indoor air using a sealed, room-sized chamber (~24 m^3) as recommended by the U.S. Environmental Protection Agency (**3**). The test microbe is aerosolized inside the chamber where a fan uniformly mixes the aerosols and keeps them airborne. Samples of the air are collected and assayed, firstly to determine the rates of physical and biological decay of the test microbe, and then to assess the air decontaminating activity of the technology under test as $\log_{10}$ or percentage reductions in viability per m^3 (**1**). The air temperature and relative humidity (RH) in the chamber are measured and recorded during each test.

1.2 The chamber can be used to assess microbial survival in indoor air as well as to test the ability of physical (for example, ultraviolet light) and chemical agents (for example, vaporized hydrogen peroxide) to inactivate representative pathogens or their surrogates in indoor air.

1.3 This practice does not cover testing of microbial contamination introduced into the chamber as a dry powder.

1.4 This practice does not cover work with human pathogenic viruses, which require additional safety and technical considerations.

1.5 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.6 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[3]

D1129 Terminology Relating to Water

D1193 Specification for Reagent Water

E2756 Terminology Relating to Antimicrobial and Antiviral Agents

E2197 Quantitative Disk Carrier Test Method for Determining Bactericidal, Virucidal, Fungicidal, Mycobactericidal, and Sporicidal Activities of Chemicals

3. Terminology

3.1 For definitions of general terms used in this practice, refer to Terminologies D1129 and E2756.

[1] This test method is under the jurisdiction of ASTM Committee E35 on Pesticides, Antimicrobials, and Alternative Control Agents and is the direct responsibility of Subcommittee E35.15 on Antimicrobial Agents.

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[2] The boldface numbers in parentheses refer to a list of references at the end of this standard.

[3] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

3.2 *Definitions:*

3.2.1 *nebulizer*—a device used to create an aerosol from a liquid.

3.2.2 *soil load, n*—a solution of one or more organic, or inorganic substances, or both, added to the suspension of the test organism to simulate the presence of body secretions, excretions, or other extraneous substances.

3.2.3 *test organism, n*—an applied inoculum of an organism that has characteristics which allow it to be readily identified.

3.2.3.1 *Discussion*—The test organism is used to simulate a transient topical microbial contaminant. It may also be referred to as a marker organism, bacterial simulant, or bacterial contaminant.

3.2.4 *test substance, n*—a formulation that incorporates antimicrobial ingredients.

3.3 *Definitions of Terms Specific to This Standard:*

3.3.1 *test device, n*—a piece of equipment meant for microbial decontamination of air using a physical or chemical process.

4. Summary of Practice

4.1 The test device is placed in the leak-free aerobiology chamber and operated either remotely or via the access gloves built into the chamber (Fig. 1); a port on one side of the chamber can be used to attach aerosol cans to release test chemicals.

4.2 Aerosols of the test microorganism are released into the chamber using a nebulizer; a fan inside it uniformly distributes the aerosols and keeps them airborne. An air sample is collected using a slit-to-agar (STA) sampler to determine the initial level of microbial contamination.

4.3 The test device is switched on or the test chemical introduced into the chamber and allowed to operate for the desired length of time. During this period, additional air samples are collected to determine the levels of viable airborne microorganisms over the test period.

4.4 The plates of the recovery medium from the STA are incubated for CFU development.

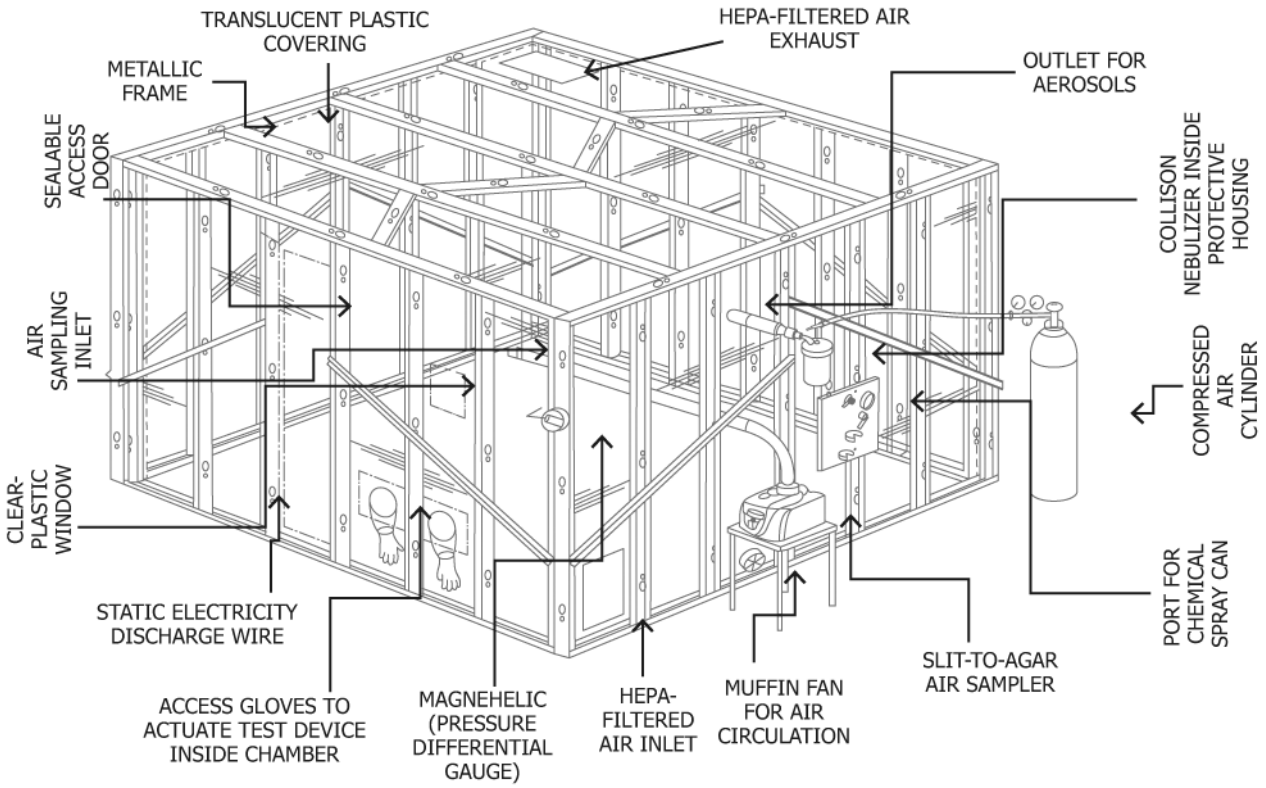
4.5 The CFU are counted to determine $\log_{10}$ or percent reductions in the viability of the test microorganism/m^3.

4.6 Between tests, the air in the chamber is flushed with fresh air to purge out any microbial and/or chemical residues in it.

5. Significance and Use

5.1 This practice is to help in the development of protocols to assess the survival, removal and/or inactivation of human pathogens or their surrogates in indoor air. It accommodates the testing of technologies based on physical (for example, UV light) and chemical agents (for example, vaporized hydrogen peroxide) or simple microbial removal by air filtration or a combination thereof.

5.2 While this practice is designed primarily for work with aerobic, mesophilic vegetative bacteria, it can be readily adapted to handle other classes of microbial pathogens or their surrogates.



(10.5 ft × 11.83 ft × 6.92 ft -860.0 ft^3 or 24.0 m^3)

FIG. 1 Aerosol Test Chamber with Essential Components