Designation: D7706 – 17 (Reapproved 2023)

Standard Practice for Rapid Screening of VOC Emissions from Products Using Micro-Scale Chambers[1]

This standard is issued under the fixed designation D7706; 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.

1. Scope

1.1 This practice describes a micro-scale chamber apparatus and associated procedures for rapidly screening materials and products for their vapor-phase emissions of volatile organic compounds (VOCs) including formaldehyde and other carbonyl compounds. It is intended to complement, not replace reference methods for measuring chemical emissions for example, small-scale chamber tests (Guide D5116) and emission cell tests (Practice D7143).

1.2 This practice is suitable for use in and outside of laboratories, in manufacturing sites and in field locations with access to electrical power.

1.3 Compatible material/product types that may be tested in the micro-scale chamber apparatus include rigid materials, dried or cured paints and coatings, compressible products, and small, irregularly-shaped components such as polymer beads.

1.4 This practice describes tests to correlate emission results obtained from the micro-scale chamber with results obtained from VOC emission reference methods (for example, Guide D5116, Test Method D6007, Practice D7143, and ISO 16000-9 and ISO 16000-10).

1.5 The micro-scale chamber apparatus operates at moderately elevated temperatures, 30 °C to 60 °C, to eliminate the need for cooling, to reduce test times, boost emission rates, and enhance analytical signals for routine emission screening, and to facilitate screening of semi-volatile VOC (SVOC) emissions such as emissions of some phthalate esters and other plasticizers.

1.6 Gas sample collection and chemical analysis are dependent upon the nature of the VOCs targeted and are beyond the scope of this practice. However, the procedures described in Test Method D7339, Practice D6196 and ISO 16000-6 for analysis of VOCs and in Test Method D5197 and ISO 16000-3 for analysis of formaldehyde and other carbonyl compounds are applicable to this practice.

1.7 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.8 *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.*

1.9 *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:*[2]

D1356 Terminology Relating to Sampling and Analysis of Atmospheres

D1914 Practice for Conversion Units and Factors Relating to Sampling and Analysis of Atmospheres

D5116 Guide for Small-Scale Environmental Chamber Determinations of Organic Emissions from Indoor Materials/Products

D5197 Test Method for Determination of Formaldehyde and Other Carbonyl Compounds in Air (Active Sampler Methodology)

D5337 Practice for Setting and Verifying the Flow Rate of Personal Sampling Pumps

D6007 Test Method for Determining Formaldehyde Concentrations in Air from Wood Products Using a Small-Scale Chamber

D6196 Practice for Choosing Sorbents, Sampling Parameters and Thermal Desorption Analytical Conditions for Monitoring Volatile Organic Chemicals in Air

D7143 Practice for Emission Cells for the Determination of Volatile Organic Emissions from Indoor Materials/Products

[1] This practice is under the jurisdiction of ASTM Committee D22 on Air Quality and is the direct responsibility of Subcommittee D22.05 on Indoor Air.

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[2] 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.

D7339 Test Method for Determination of Volatile Organic Compounds Emitted from Carpet using a Specific Sorbent Tube and Thermal Desorption / Gas Chromatography

2.2 *ISO Standards:*[3]

ISO 16000-3 Determination of formaldehyde and other carbonyl compounds – Active sampling method

ISO 16000-6 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/FID

ISO 16000-9 Indoor air—Part 9: Determination of the emission of volatile organic compounds – Emission test chamber method

ISO 16000-10 Indoor air—Part 10: Determination of the emission of volatile organic compounds – Emission test cell method

2.3 *Other Standard:*[4]

U.S. EPA Method TO-17 Determination of volatile organic compounds in ambient air using active sampling onto sorbent tubes

3. Terminology

3.1 *Definitions*—For definitions and terms commonly used for sampling and analysis of atmospheres, refer to Terminology D1356. For definitions and terms commonly used when testing materials and products for VOC emissions, refer to Guide D5116. For an explanation of general units, symbols and conversion factors, refer to Practice D1914.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *micro-scale test chamber, n*—an environmental test chamber ranging in volume from a few milliliters to about 250 mL and designed to operate at moderately elevated temperatures that is used to measure vapor-phase organic emissions from small specimens of solid materials and products.

3.2.2 *control level, n*—a user-defined acceptance criterion for a micro-scale chamber test, for example, presence or absence of a target compound and/or a concentration or emission rate of a target compound, typically used in production quality control to indicate that the tested product sample likely will meet the corresponding acceptance criterion for a reference test.

4. Principles

4.1 Micro-scale test chambers operate under the same mass transfer principles as conventional small-scale test chambers and cells for measuring emissions of VOCs including formaldehyde and other carbonyl compounds from materials and products (see Guide D5116 and Practice D7143).

4.2 Clean gas (dry nitrogen or air) is supplied to a micro-scale chamber and passes over the exposed surface of the test specimen before reaching the exhaust point. The gas flow rate and temperature within the micro-scale chamber are controlled. As the gas passes over the test specimen, emitted compounds are swept away from the surface.

4.3 After the test specimen has equilibrated in the micro-scale chamber (typically for 20 min to 40 min), a sampling device is connected to the outlet for collection of vapor-phase compounds exiting the chamber.

5. Summary of Practice

5.1 Micro-scale chambers can be used for rapid screening and quality control of VOC emissions from many materials and products. Compatible sources include (with examples): rigid materials (plastics, wood-based panels, hard surface flooring), compressible materials (textiles, foams, polymer sheeting), irregularly-shaped materials (polymer components, carpet), and wet-applied products in dried or cured form (for example, paints, coatings, adhesives, caulks, sealants).

5.2 Representative test specimens are prepared from material/product samples and are placed directly into micro-scale chambers. For samples that are heterogeneous, it is necessary to prepare and test replicate specimens. In some cases, it may be necessary to precondition samples or specimens prior to testing.

5.3 Micro-scale chambers typically are used for measuring area-specific emissions from surfaces. They also can be used to determine mass-, length- or unit-specific emission rates from variously shaped test specimens.

5.4 Chamber bodies are held at moderately elevated temperatures of 30 °C to 60 °C and typically are supplied with a controlled flow of clean, dry gas, either nitrogen or air.

5.5 Specific operating procedures are developed for each type of material or product. The key parameters of equilibration time, chamber temperature and inlet gas flow rate are optimized in an iterative process starting from typical conditions and then confirmed by the analysis of replicate specimens.

5.6 Gas samples for VOCs are collected at the exhaust of the micro-scale chamber. For ease of use, the entire gas flow exiting the chamber typically passes through the sampling device.

5.7 A number of gas sampling and analytical methods are compatible with micro-scale chambers. VOCs may be collected on sorbent tubes and analyzed by thermal desorption—gas chromatography (GC) with mass spectrometry (MS) and/or flame ionization detection (FID) to identify and quantify compounds as described in Test Method D7339, Practice D6196, ISO 16000-6 and U.S. EPA Method TO-17. Formaldehyde and other carbonyl compounds may be sampled and analyzed as described in Test Method D5197 and ISO 16000-3. Other analytical techniques such as direct-reading instruments may be used if applicable.

5.8 This practice describes tests that are used to correlate emission results obtained from micro-scale chambers to reference results from conventional emission test chambers and cells (that is, Guide D5116, Test Method D6007, Practice D7143). This relationship is then developed and validated to establish a ‘control’ level to evaluate whether the sample is

[3] Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, http://www.ansi.org.

[4] Available from United States Environmental Protection Agency (EPA), William Jefferson Clinton Bldg., 1200 Pennsylvania Ave., NW, Washington, DC 20460, http://www.epa.gov.