



Standard Guide for the Comparison, Detection, and Identification of the Odors of Paints, Inks, and Related Materials¹

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1. Scope

1.1 This guide is intended to provide direction in order to assist the producers and users of paints, inks, and related coatings, and others who may also be exposed, to detect, compare and identify the odors that may originate from these materials.

1.2 This guide is intended to provide references for establishing guidelines to assist in identifying and verifying the sources of odors and other related issues. Further information may be found in DS-48A (1).²

1.3 This guide is intended to assist in establishing guidelines as follows:

- (1) Comparing products for their odor characteristics,
- (2) Determining the perception threshold of odors,
- (3) Isolating and identifying the chemical nature of the odor, and
- (4) Confirming the results.

1.4 For hazard information and guidance, see the supplier's Material Safety Data Sheet.

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 and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 ASTM Standards:

- D 1292 Test Method for Odor in Water³
- D 1296 Test Method for Odor of Volatile Solvents and Diluents⁴
- D 2650 Test Method for Chemical Composition of Gases by Mass Spectrometry⁵
- D 3686 Practice for Sampling Atmospheres to Collect Organic Compound Vapors (Activated Charcoal Tube Adsorption Method)⁶

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² The boldface numbers in parentheses refer to the list at the end of this guide.

³ *Annual Book of ASTM Standards*, Vol 11.01.

⁴ *Annual Book of ASTM Standards*, Vol 06.04.

⁵ *Annual Book of ASTM Standards*, Vol 05.02.

⁶ *Annual Book of ASTM Standards*, Vol 11.03.

D 3687 Practice for Analysis of Organic Compound Vapors Collected by The Activated Charcoal Tube Adsorption Methods⁶

D 4339 Test Method for Determination of the Odor of Adhesives⁷

E 253 Terminology Relating to Sensory Evaluation of Materials and Products⁸

E 544 Practices for Referencing Suprathreshold Odor Intensity⁸

E 679 Practice for Determination of Odor and Taste Thresholds by a Forced-Choice Ascending Concentration Series Method of Limits⁸

E 769 Test Methods for Odor of Methanol, Ethanol, n-Propanol, and Isopropanol⁸

E 1207 Practice for the Sensory Evaluation of Axillary Deodorancy⁸

E 1432 Practice for Defining and Calculating Individual and Group Sensory Thresholds from Forced-Choice Data Sets of Intermediate Size⁸

E 1593 Practice for Assessing the Efficacy of Air Freshener Products in Reducing Sensorily Perceived Indoor Air Malodor Intensity⁸

3. Terminology

3.1 The definitions in Terminology E 253 are applicable to this guide.

4. Significance and Use

4.1 This guide is intended to direct the user to the appropriate existing standards and literature in order for the user to become knowledgeable of the operations that need to be done to effectively compare, detect and identify the odors of paints, inks, and related materials.

4.2 This guide directs the user to specific standards and literature sources that allow the user to accomplish the primary steps to complete the following task:

- (1) Comparing products for their odor characteristics,
- (2) Determining the perception threshold of odors,
- (3) Isolating and identifying the chemical nature of the odor, and
- (4) Confirming the results.

⁷ *Annual Book of ASTM Standards*, Vol 15.06.

⁸ *Annual Book of ASTM Standards*, Vol 15.07.

5. Hazards

5.1 Many paints, inks, and related materials contain solvents, diluents, and residual monomers that may be hazardous or toxic. For hazard information and guidance, see the supplier's Material Safety Data Sheet. Take special precautions while determining the odor of these products. The tests should be made only as frequently as is necessary for control and the evaluations should be conducted in a manner that provides the least possible amount of exposure.

5.2 Provide adequate ventilation to maintain solvent or diluent concentration below the personnel exposure limit value established for the general work area.

5.3 Other hazards may also be present: These may be, but are not limited to, flammable, combustible, corrosive, or explosive (monomers) hazards.

6. Defining the Approach

6.1 A major consideration for the accomplishment of the task being undertaken by the user of this guide is how to operate with untrained people such as paint users, plant workers, and community residents. The following resources are suggested as initial references for review (see also Practices E 769 and E 1207):

- (1) STP 682 (2)² Chapter 1, Background and Chapter 3, General Evaluation Factors,
- (2) STP 433 (3) Part I & II,
- (3) STP 434 (4) Chapter I, Part B, and
- (4) STP 1035 (5) Product Testing with Consumers for Research Guidance.

7. Odor Comparisons

7.1 Test Method D 1296 covers a comparative procedure for observing the characteristic and residual odors of volatile organic solvents and diluents to determine their odor acceptability. However, this test method might be suitable for other materials if modified. Practice E 679 is an example of a standard practice for determining the odor acceptability of several specific compounds; Test Method D 4339 is used to determine the odor of a formulated product (adhesives).

7.1.1 Annex A1 of Test Method D 1292 provides a suggested system for classifying odors.

7.1.2 A general reference for odor character profiles is given in DS 61 (6).

8. Determining Odor Perception Threshold

8.1 The first step is to determine at what concentration in the atmosphere a product's odor is perceptible or at what concentration a specific odor is detectable over the product's base odor. Because perception threshold can vary with the individual, a sufficiently large number of observers is necessary. (See STP 434 (2) Chapter I, Section B Test Subjects, 1b Number of Panel Members.)

8.2 Practice E 679 is used to determine the threshold while Practice E 544 is used to calibrate the threshold versus

1-butanol to define the concentration reference.

8.3 By defining the odor threshold, the investigator is able to confirm that a difference in odor exists when comparing one product to another product as used as a control. The presence of a different odor is likely to result in a significantly lower perception threshold. Practice E 1432 is used to define and calculate individual and group sensory thresholds

9. Isolation and Identification of the Chemical Nature of the Odor

9.1 *Isolation*—Gas Chromatography (GC) and Mass Spectrometry techniques such as those contained in Practices D 3686, D 3687 and Test Method D 2650 can be used to separate and identify the volatile fractions of the product, some of which are prime contributors to the product's odor.

9.1.1 Construction requirements for tests chambers are specified in STP 433 (3) part II, "Concentration of Odor Vapors in Test Chambers" and in Practice E 1593, Appendix X1.3.

9.1.2 A sample can also be captured by trapping the odor using carbon adsorption of a gas stream above the vapor space of a container of the product.

9.2 *Identification*—While the above methods are capable of separating and identifying the volatile components, they do not establish which compounds contribute to the odor. Each separated component needs to be evaluated by a trained sensory panel using odor profiling methods such as those outlined in MNL 13 (7) to determine what fraction or fractions contribute to the odor. The component, or components, suspected of causing differences in odor can be compared to referenced materials in DS 48A (1). Preparative GC may be needed to provide an identified fraction of sufficient size for further fractionation, identification, and odor profiling.

10. Confirming the Results

10.1 The product odor must be confirmed by using the conclusions of the isolation and identification effort to reconstitute the odor using the identified components and concentration. This reconstituted odor concentrate is then evaluated by a trained sensory panel using the above methods, to confirm its similarity to the product under investigation.

11. Follow Up Action

11.1 Upon confirmation by Section 10, efforts should be made to reduce or eliminate the main odor contributors from use, open storage, or open handling. If 10.1 does not produce a positive confirmation, then the investigator must look for surfaces, objects, etc. that could absorb or chemically alter the objectionable components in the handling, transport, and storage phase of the investigation.

12. Keywords

12.1 evaluation panel; odor; odor threshold; sensory evaluation

REFERENCES

- (1) Fazzalari, F.A., ed., *DS 48A Compilation of Odor and Taste Threshold Values Data*, ASTM, 1978.
- (2) Schaefer, E. E., ed., *Manual on Consumer Sensory Evaluation*, ASTM STP 682, ASTM, 1979.
- (3) *Basic Principles of Sensory Evaluation*, ASTM STP 433, Committee E-18, ASTM, 1968.
- (4) *Manual on Sensory Testing Methods*, ASTM STP 434, ASTM, 1968.
- (5) Wu, L. S., ed., *Product Testing with Consumers for Research Guidance*, ASTM STP 1035, ASTM, 1989.
- (6) Dravnieks, A., compiler *DS 61 Atlas of Odor Character Profiles*, ASTM, 1985.
- (7) Hootman, R.C., ed., *MNL 13 Manual on Descriptive Analysis Testing for Sensory Evaluation*, ASTM, 1992.

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