



Designation: E2609 – 08 (Reapproved 2022)

Standard Test Method for Odor or Flavor Transfer or Both from Rigid Polymeric Packaging¹

This standard is issued under the fixed designation E2609; 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 test method covers a recommended procedure for examining odor or flavor properties or both of rigid polymeric packaging closures and fillable materials.

1.2 This test method can be used for single materials or coextruded materials that are foam molded, injection molded, blow molded, compression molded, or thermoformed polymers.

1.3 The focus of this test method is the evaluation of molded polymer in terms of the transfer of package-related odors, flavors, or both, to water and other model systems (bland food simulants). Rigid packaging forms vary considerably in type, size, and shape. Thus, customizing the exact procedure for dealing with the physical requirements for individual packages is the responsibility of the user.

1.4 This test method assumes testing of the materials at a one-time point; shelf-life testing is not included.

1.5 Refer to Test Method E1870 for the evaluation of inherent odor of packaging material by confinement tests.

1.6 This test method provides sample preparation procedures and two methods of evaluation.

1.6.1 The package performance score method allows for the comparison of any molded polymer sample to another.

1.6.2 The ranking method allows for comparison of samples within the currently tested set only.

1.6.3 The preparation of samples is consistent regardless of the method of evaluation used.

1.7 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered 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

D1292 Test Method for Odor in Water

E253 Terminology Relating to Sensory Evaluation of Materials and Products

E460 Practice for Determining Effect of Packaging on Food and Beverage Products During Storage

E619 Practice for Evaluating Foreign Odors and/or Flavors from Paper Packaging

E1870 Test Method for Odor and Taste Transfer from Polymeric Packaging Film

3. Terminology

3.1 *Definitions*—For definitions of terms relating to sensory analysis, see Terminology E253.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *blow molding, v*—process of producing a hollow polymeric part by introducing air into a parisen.

3.2.2 *compression molding, v*—process of compressing polymer between two heated platens, using the heat and pressure to produce a flat sample.

3.2.3 *coextruded packaging, n*—two or more layers of resin extruded simultaneously and these layers may be different resins or the same resin.

3.2.4 *direct contact, n*—packaging material in physical contact with test medium.

¹ This test method is under the jurisdiction of ASTM Committee E18 on Sensory Evaluation and is the direct responsibility of Subcommittee E18.05 on Sensory Applications—General.

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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.

3.2.5 *foam molding*, *v*—process of producing rigid forms by expanding foam in a closed mold using steam.

3.2.6 *injection molding*, *v*—process of forcing molten polymer into a mold.

3.2.7 *monolayer packaging*, *n*—packaging consisting of a single layer of material or resin.

3.2.8 *package performance score (PPS)*, *n*—simple calculation that allows for the comparison of one rigid packaging sample to another, as long as the same battery of tests is performed on each of the samples.

3.2.8.1 *Discussion*—The PPS is calculated by summing the average intensity score for each of the tests in the battery. The PPS can be used to rate acceptability by comparing it to that of known acceptable material.

3.2.9 *thermoformed polymer*, *n*—process of heating a plastic sheet to a formable state then using air or mechanical means to shape it to the contour of a mold.

3.2.10 *rigid packaging*, *n*—polymer that holds its shape after fabrication (that is, foam molded, injection molded, blow molded, compression molded, or thermoformed polymer).

3.2.10.1 *Discussion*—Some end use applications are bottles, cups, tubs, lids, caps and closures.

4. Summary of Test Method

4.1 The potential for contamination of packaged products by transfer from the package is determined by its effect on the flavor, or odor, or both, of several substrates. Model systems, such as mineral oil, water, butter, milk chocolate, or apple juice, or combinations thereof, are possible media for transfer.

4.2 The complete procedure includes direct transfer tests that use various media and temperatures:

4.2.1 Mineral oil for odor;

4.2.2 Water for odor and flavor;

4.2.3 Other media, such as butter, milk, chocolate, apple juice, or other products intended for use in the package; and

4.2.4 Ambient and elevated temperature testing.

4.3 Mineral oil and water serve as bland simulants for fatty and aqueous food products, respectively. The actual test media used should be selected to be most representative of the product(s) that will be packaged, that is, fatty, aqueous, acidic, dry, etc., or particularly sensitive to the effects of packaging materials.

4.4 Typically, tests are conducted at ambient temperature, but additional performance information can be gained by subjecting the direct transfer tests to an elevated temperature. Temperature selection should be based on intended use and storage conditions.

4.5 An experienced panel of at least five panelists evaluates the samples. Odor and taste intensities are either ranked or rated, depending upon the evaluation approach.

4.6 Ranking evaluations are conducted by comparing intensities within a sample set (see [Appendix X3](#)). Odor and flavor notes identified by panel members are reported with a qualitative description for each sample. These identified notes may be useful for diagnostic purposes (see [X3.2](#)).

4.7 For the rating approach, a sample is given an intensity rating for odor or flavor for each test. In addition, odor and flavor notes are identified and summarized by the panelists (see [X2.2](#)). To obtain the sample package performance score (PPS), intensity ratings are averaged for each test, then summed across all tests (see [Appendix X1](#) and [Appendix X2](#)). In addition, qualitative descriptions are provided for each sample and are typically listed in order of perceived intensity.

NOTE 1—The calculation of the PPS may only be used to compare samples for which the same battery of tests has been performed (see [Appendix X2](#)).

4.8 Acceptance or rejection of a sample is determined by comparing its PPS or ranking score to that of representative packages known to be acceptable for the relevant end uses. Permissible variation from such a standard is estimated from the variance of the ratings for the representative packages.

4.9 This test method is consistent with the background information presented in Refs ([1-3](#)).³

5. Significance and Use

5.1 This test method is designed for use by a trained sensory panel experienced in using an intensity scale or rank ordering and familiar with the descriptive terminology and references associated with the packaging materials. Data analysis and interpretation should be conducted by a trained and experienced sensory professional. See Refs ([3](#), [4](#)) for discussions on panelist screening and training.

5.2 This test method should be considered as a screening technique for suppliers and end-users to use in assessing the odor or flavor impact or both of rigid packaging. The application of this test method will result in a PPS or rank data. The determination for suitability of a package for a particular end-use should be based on a set of predetermined criteria including the PPS or rank score. Information obtained from the transfer tests can also be used to evaluate the origin of any transferred tastes or odors.

6. Testing Facilities and Personnel

6.1 All testing should be carried out in a location that is odor-free, quiet, temperature-controlled, and not used for chemical experimentation. Folding tables, about 6 ft in length are convenient for sample preparation and testing. Freestanding, open metal shelves are useful for storing test equipment. Pegboards permit the storage of glassware so that air can circulate freely yet dust is kept to a minimum. Glasses should not be inverted on solid shelves as they can pick up and trap odor from shelving. For a general discourse on testing facilities, see Refs ([2](#), [5](#), [6](#)).

6.2 Staff and panelists should take precautions to eliminate extraneous odors, such as from personal-care products, smoke, food products, etc.

6.3 This test method is intended for use by trained panels under leadership of a sensory professional. For discussions on training panelists, see Refs ([3-5](#), [7-10](#)).

³ The boldface numbers in parentheses refer to the list of references at the end of this standard.