Designation: E460 – 21

Standard Practice for Determining Effect of Packaging on Food and Beverage Products During Storage[1]

This standard is issued under the fixed designation E460; 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 is designed to detect the changes in sensory attributes of foods and beverages stored in various packaging materials or systems, or both. It is not a practice intended to determine shelf-life.

1.2 This practice may be used for testing a wide variety of materials in association with many kinds of products. There are many ways in which a packaging material may influence a product during storage. First, the packaging material may contaminate the product with off-flavors by direct transfer of packaging component compounds to the product. Second, the packaging material may adsorb components from the product which may then be further transferred to the atmosphere, thus reducing aroma intensity in the product. Third, external contaminants may permeate the package and possibly be transferred to the product. In addition to flavor influences, packaging materials may allow color or textural changes, or both, and many other measurable sensory effects.

1.3 *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]

E1885 Test Method for Sensory Analysis—Triangle Test

E2139 Test Method for Same-Different Test

E2164 Test Method for Directional Difference Test

2.2 *Other ASTM Documents:*[2]

MNL26 Sensory Testing Methods, 3rd Edition

MNL13 Descriptive Analysis Testing for Sensory Evaluation

STP 758 Guidelines for the Selection and Training of Sensory Panel Members

3. Summary of Practice

3.1 A homogeneous lot of the product is packaged in the different ways to be considered in the test. Packaging operations must be controlled to ensure that all units are treated alike except for the differences inherent in the different packaging materials. To reduce error from test product variability a single production lot should be used. Where a single lot is not feasible a sufficient number of replicates should be used, taking care not to introduce additional variables.

3.2 Design the study to specify all appropriate storage conditions, intervals between tests, and total length of study. A sufficient number of units of each packaging treatment are stored under predetermined storage conditions to provide the necessary material for panel testing.

3.3 Periodically, samples of all treatments are withdrawn and evaluated versus a designated control by a qualified panel. Results are subjected to appropriate statistical analyses to determine whether there are significant differences among treatments.

3.4 Withdrawals are continued either through the originally planned length of storage, or until definitive results are obtained. Differences which are identified may not necessarily be detrimental to the product.

4. Significance and Use

4.1 This practice is designed to determine the effects of different packaging materials whether of construction or systems (overpack, inert atmosphere, etc.), or both. Different packaging materials may require different packaging systems and thus detectable differences may not be experimentally separable from these influences. The practice then, is limited to those situations where comparative results are meaningful. This practice should be used where experimental materials or alternate storage conditions are evaluated against a known control, for example, a soft drink in cans with experimental liners versus known liners, or potato sticks in plastic bags

[1] This practice 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.

versus coated paper bags. Accepted industry standard packages, such as glass bottles and metal cans may also be used as controls.

4.2 There are many ways in which a packaging material may influence a product during storage. First, the packaging material may contaminate the product with off-flavors/aromas by direct transfer of packaging component compounds to the product, commonly referred to as contribution or migration effect. Second, the packaging material may adsorb components from the product thus reducing flavor/aroma intensity of the product, commonly referred to as sorption or scalping effect. Third, external contaminants may permeate through the package and possibly be transferred into the product and/or compounds in the product may permeate out of the packaging, commonly referred to as permeation effect. (See Fig. 1.)

5. Design of Study

5.1 *Number of Treatments*—The number of alternate packages or systems that may be assessed is dependent upon panel capabilities. Preliminary testing should be used to determine the appropriate number of samples that can be presented during a single panel session without inducing assessor fatigue or adaptation and the number of panels that can be run within the project time frame.

5.2 *Test Product and Packaging Material:*

5.2.1 The selection of the test products is usually indicated by the interest in testing a specific packaging system.

5.2.2 The original lot of product should be homogeneous and representative of the product. When homogeneity is not possible, allocate sufficient units of the product to each packaging treatment using an appropriate statistical design.

5.2.3 Ensure that both initially and at every test interval the test products meet all required microbiological, physical, and chemical standards prior to assessor ingestion.

5.2.4 Packaging operations must be controlled to ensure that all units are treated alike except for the differences inherent in the different packaging materials.

5.3 *Storage Conditions:*

5.3.1 Determine pertinent storage conditions for each packaging system under study. Determine on the basis of prior knowledge or logical projection, those conditions to which the packaging system is most likely to be subjected. It may be advisable to conduct the test under several storage conditions appropriate to the product and its distribution and production systems, such as high and low humidity, etc. Such studies are normally run in parallel. This requires more of the test product and more panel testing time, but can greatly increase the total amount of information.

5.3.2 Extreme storage conditions may be used (often these are called accelerated storage treatments). However, results under extreme conditions must be validated against normal storage conditions. Extreme storage conditions may include a higher temperature but may also include humidity, O_2 content, light intensity, temperature cycle, and ratio of the packaging surface to the product.

5.3.3 To minimize the risk of introducing additional variables, assign experimental and control samples to all storage conditions equally. For example, if two refrigerators are needed to store all of the products, place equal amounts of experimental and control samples in each refrigerator. Consideration should also be given to the positioning of the samples in the storage locker.

5.4 *Test Intervals:*

5.4.1 Products should be tested prior to storage, at "zero time," to ensure that no inadvertent differences have arisen due to product sampling or operational errors in the packaging. If significant differences among treatments are found at this point, the cause of the difference must be investigated. Corrective steps must be taken.

5.4.2 The test intervals as well as the total time of the test will vary depending upon the product system. For example, studies of perishable food products will seldom extend for more than a week, whereas those of stable grocery products often will continue for a year or longer.

5.4.3 On the basis of available information, estimate the maximum length of storage the product will reasonably encounter under the planned storage conditions. After this time period, the terminal point of the study is reached.

5.4.4 Divide the storage time into intervals that take into account intermediate points that would lead to an early decision on the merits of the experimental packaging.

6. Test Methods

6.1 *Selection of Test Method:*

6.1.1 Select a test method appropriate for detecting differences in products. The following tests are commonly used:

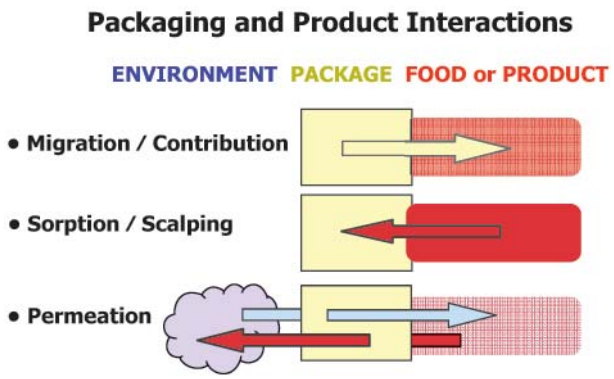

FIG. 1 Packing and Product Interactions Chart