Designation: ~~E1627 – 11~~ E1627 – 19

Standard Practice for Sensory Evaluation of Edible Oils and Fats[1]

This standard is issued under the fixed designation E1627; 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 covers the recommended procedures for the sensory evaluation of edible oils and fats.

1.2 This practice covers techniques for evaluating ~~odor~~ appearance, odor, and flavor in fats and oils, for determining overall odor and flavor intensity, and the intensity of individual odors or flavors.

1.3 The techniques used in this practice are applicable to oils (liquid at room temperature) and liquified fats (solid at room temperature).

1.4 The values in SI units are to be regarded as the standard.

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~~ safety, health, and ~~health~~environmental practices and determine the applicability of regulatory limitations prior to use.~~Specific precautions are given in Section 7.~~*

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:*[2]

E1346 Practice for Bulk Sampling, Handling, and Preparing Edible Vegetable Oils for Sensory Evaluation

E1871 Guide for Serving Protocol for Sensory Evaluation of Foods and Beverages

2.2 *Other ASTM Publications:*[2]

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

ASTM Manual 26 Manual on Sensory Testing Methods

ASTM Manual 60 Physical Requirement Guidelines for Sensory Evaluation Laboratories

3. Terminology

3.1 A lexicon specific for descriptors of odors and flavors in oils and fats is included in Appendix X2.

4. Summary of Practice

4.1 This practice addresses the procedures and considerations for ~~screening~~selection and training of oil assessors; ~~rating and scoring samples; and data collection, handling, analysis, and interpretation.~~and sample handling, preparation, and evaluation.

5. Significance and Use

5.1 The application of this practice will help ensure consistency in procedures used for the sensory evaluation of edible ~~oils.~~ oils and fats.

~~5.2 This practice is designed for use by oil processors or research laboratories for evaluations by a trained, experienced sensory panel under the supervision of a sensory professional or for use by quality control and quality assurance personnel for the sensory evaluation of edible oils and fats.~~

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[1] This practice is under the jurisdiction of ASTM Committee E18 on Sensory Evaluation and is the direct responsibility of Subcommittee E18.06 on Food and Beverage Evaluation.

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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.

6. Apparatus

6.1 The following equipment should be used during sample preparation and evaluation to ensure consistent sample presentation, including temperature. (See Practice E1346.)

6.2 *Glass ~~Vial,~~ Sample Container,* ~~30-mm outside diameter by 57-mm height, wide-mouth threaded top. Use amber glass for odor/flavor evaluations;~~ use colored glass for odor/flavor evaluations to mask any color difference among samples; use clear glass for visual examination. ~~Alternatively, use 2 oz sample cups also for odor/flavor evaluations only.~~Containers should provide a uniform sample surface area, and adequate headspace, and be lidded to retain volatiles.

6.3 *Hard Plastic Threaded Caps with Liners,* liners should be food-grade, heat-resistant, and water-tolerant.

6.4 *Circulating ~~Waterbath,~~ Water Bath,* with automatic timer, thermostat, and rack.

6.5 *~~Waterbath~~ Water Bath Thermometer,* with range from 20 to ~~100°C in 1°C divisions, calibrated for 76-mm immersion, 305 mm long.~~100 °C in 1 °C divisions.

~~6.4 *Hard plastic threaded caps* with liners, or tape (PFTE pipe thread tape), to cover top of vial opening before capping with new, nonmetallic screw-type caps. Tape should completely cover vial opening or multiple strips of tape should be used.~~

~~7. Precautions~~

~~7.1 Assessors and sample servers should avoid introducing extraneous odors during testing by use of products, such as scented hand soap, hand creams, perfume, etc., or odorous writing instruments or inks. Assessors should avoid exhaling into sample vials.~~

7. Pre-Testing for Palate Cleansing

7.1 The sensory professional should conduct pre-testing to determine the length of time required between samples to overcome sensory adaptation (fatigue). This pre-testing should include any substances used to "zero" the assessor's nasal and oral cavities (for example, clear the nose and mouth of residual aromas and flavors), and a definition of clearing procedures – amount of clearing agent(s), length of use, number of times to clear, and so forth. (See Guide E1871.)

7.1.1 For example, in odor evaluations, smelling an unscented substance and/or smelling a unused, empty sample container may be used to zero the nasal passages.

7.1.2 In flavor evaluations, an example clearing procedure could read "Rinse the mouth well with 50 ml warm water (50 ± 1) for 60 seconds between samples to clear mouth of residual flavors. Wait 2 minutes before tasting the next sample to prevent taste fatigue." Additional substances used to clear the mouth of residual flavors of oils could include unsalted soda crackers, or a 50:50 blend of warm water and sodium-free carbonated water (50 ± 1).

~~8. Procedures for Recruitment and Screening Assessors~~

~~8.1 For basic information on conducting sensory tests, see MNL26[3] and STP 758.[4]~~

~~8.2 For normal sensory acuity for basic tastes, see STP 758.[4]~~

~~8.3 *General Odor or Flavor Recognition Relating to Oils*—Present prospective assessors with a series of samples and a list of applicable oil descriptors specific for the type of oil to be tested (see Appendix X1). Appendix X2 contains definitions, reference standards, and examples of each descriptor. Test prospective assessors for general discrimination and the ability to describe samples and demonstrate familiarity with terms.~~

~~8.4 For general interest and availability, see STP 758.[4]~~

8. Procedures for Selecting and Training Oil Assessors

~~9.1 See STP 758[4] for information on panel training.~~

~~9.2 Determine training based upon test objective. Tests may include intensity ranking, attribute recognition, or difference tests, or a combination thereof (see MNL26[3]).~~

8.1 *~~Terminology/Characteristics (See 3.1):~~* Present prospective assessors with a series of samples and a list of applicable oil descriptors specific for the type of oil to be tested (see Appendix X1 and Appendix X2). Test prospective assessors for general discrimination and the ability to describe samples and demonstrate familiarity with terms. (See STP 758.)

8.1.1 ~~Examples~~Appendix X1 presents examples of ~~odor,~~odors, flavors, and tastes predominately characteristic of various oil ~~types are presented in~~ types. ~~Appendix X2.~~ Attributes are identified as typical of an unprocessed or partially processed oil (U), freshly processed oil (F), deteriorated oil (D), or origin unknown (X). The appendix is a general guideline based on the attributes typically identified for each oil type; however, other attributes may be noted.

8.1.2 Appendix X2 contains definitions and examples of each descriptor.

8.2 Determine assessor training based upon the chosen test method, which may include intensity ranking, attribute recognition, or difference tests, or a combination thereof (see ASTM Manual 26). Training should familiarize assessors with the relevant products, tasks, procedures, scales, attributes, references, and so forth. (See STP 758.)

8.3 Assessors and sample servers should avoid introducing extraneous odors during testing by use of products, such as scented hand soap, hand creams, perfume, etc., or odorous writing instruments or inks.

8.4 Assessors should avoid exhaling into sample vials.

8.5 Prepare training samples characteristic of various odors or flavors and various intensity levels. Use Appendix X1 and Appendix X2 as guides.

8.6 Evaluate a series of concentrations starting with easily distinguished samples and proceed to more difficult discriminations.

8.7 Evaluate assessors' consistency on repeated tests as recommended in STP 758.

9. Procedures for Oil Sample Handling, Preparation, and Presentation

9.1 For information on preparation methods for liquid oils, serving containers, sample size, heating ~~methods,~~ methods for liquid samples, sample temperature, hold time, and presentation methods, see Practice E1346.

9.2 ~~Oils should not be held at serving temperature for more than 60 min to prevent deterioration from oxidation.~~If samples are not liquid at room temperature, pre-test for the times and temperatures needed to melt the sample, and at which to hold the sample without sensory changes.

9.3 If samples are presented in pairs or other multiples, it is recommended that a method be used to maintain uniform sample temperature of the oils during testing. ~~Aluminum blocks,~~(See Practice E1346~~with recesses to hold vials, heated at a temperature of 5°C higher than the serving temperature of the oil will keep the sample at the proper serving temperature for 10 min. Molded styrene (styrofoam) blocks, with recesses to hold vials, will help minimize temperature loss. Vials should fit into the recesses or cavities in the blocks deep enough so the oil line in the vial does not extend above the top of the recess. The diameter of the aluminum block recess should not be more than 1 cm wider than the diameter of the vial to allow adequate heat transfer.~~.)

9.4 Evaluations should be conducted using best practices that minimize respondent bias and distraction. (See ASTM Manuals 26 and 60.)

10. Considerations for Appearance Evaluations

10.1 Examine the color, clarity, and thickness of the sample visually. These attributes can be evaluated against the expected appearance of the oil, based on the knowledge and experience the assessor has of that oil. If the oil is an unusual color, is not clear, or is not similar in thickness/consistency compared to the previous samples, these deviations from expected visual attributes should be noted on the assessor's ballot.

11. ~~Instructions to Assessors~~ Considerations for Odor Evaluations

11.1 ~~Evaluate the oils for odor in the order presented from left to right.~~Follow prescribed palate-cleansing procedures before and between samples, including wait time between samples.

11.2 Pick up the vial containing the oil; hold the vial as close to base as possible.

11.3 Swirl the covered vial; lift to nose; remove the cover; sniff the headspace above the oil (use short, "bunny" sniffs); replace the cover quickly.

11.4 Sniff in the same manner—distance from nose, number of times, length of ~~time—for~~ time, and so forth—for each sample.

~~11.5 Smell back of hand before testing samples and between samples to help "zero" your nose and to prevent adaptation to oil odors.~~

~~11.6 If testing oils with weak odors, smell an empty container to facilitate adaptation to extraneous odors and to allow for better discrimination between oils.~~

12. ~~Instructions to Assessors~~ Considerations for Flavor Evaluations

12.1 ~~Rinse mouth well with warm filtered water (50 ± 1°C) before starting the flavor evaluation.~~Follow prescribed palatecleansing procedures before and between samples, including wait time between samples.

12.2 ~~Taste the samples in the order presented from left to right.~~Take enough sample into the mouth to enable thorough evaluations. Be consistent with amount taken for each sample.

12.3 ~~Put the entire 10-mL sample of warm oil into the mouth; swish~~ Swish through the mouth thoroughly; cup mouth and draw air in through mouth and exhale through nose to enhance perception of aromatics.

12.4 Expectorate the sample; do not swallow the oil.

~~12.5 Rinse the mouth well with warm water (50 ± 1°C) between samples for a predetermined amount of time to clear mouth of residual flavors.~~

~~12.6 Wait a predetermined amount of time before tasting subsequent samples to prevent taste fatigue; be consistent.~~

12.7 Additional methods to clear the mouth include unsalted soda crackers, 50:50 blend of warm water and sodium-free carbonated water (50 ± 1°C).

12.8 If residual flavors persist, repeat the procedure of rinsing and resting.

13. Procedures for Data Collection

13.1 Discrimination tests, for example, Triangle, Duo-trio, A not A, etc., are used to determine if a difference exists between two samples. Uses include qualifying alternate ingredient suppliers; confirming quality control in the plant, determining end of shelf-life; and reformulation of existing brands (see Chapter 2 of MNL26[3]).

13.2 Descriptive or scalar scoring tests are used to rate the overall intensity of a sample and to describe characteristic odors and flavors of samples. Use to find sensory differences between competitive products, aged products, new formulas, etc., and to interpret results of consumer tests and understand the effects of technical variables on product attributes (see MNL 13[5]).

13.3 Quality tests are used to rate the overall quality of a fat or oil with moderate to strong characteristic flavors such as olive or peanut oil (see MNL26[3]).

14. Data Handling

14.1 Statistical analysis of the data will depend on the type of test and test design. MNL26[3] contains statistical analysis appropriate for various sensory tests. Data handling methods for descriptive tests are presented in MNL 13.[5]

15. Data Interpretation

15.1 Action criteria will depend on the policy of the laboratory or company and will be product specific. Policies will determine the intensity levels of specific flavors that are desired or will be permitted. The intensities allowed will vary based on the attribute and its positive or negative contribution to the oil or fat. Customer complaints will validate decisions over time.

13. Keywords

13.1 descriptive testing; appearance; discriminative testing; aroma; flavor; odor; scaling;sample; sensory analysis;evaluation; tastetaste; visual

APPENDIXES

(Nonmandatory Information)

X1. VOCABULARY AND OIL ATTRIBUTES CHARACTERISTIC OF UNPROCESSED OIL (U), FRESHLY PROCESSED OIL (F), DETERIORATED OIL (D), OR ORIGIN UNIDENTIFIED (X)

TABLE X1.1 Oil Types and Attributes[A]

Attributes	Oil Type												
	Corn	Cotton Seed	Coconut	Fish/ Marine	MCT[B]	Olive	Palm	Peanut	Canola Rapeseed	Ricebran	Saflower	Soy	Sunflower
Bacony	...	...	U	...	...	...	X	...	...	...	...	...	...
Beany	...	...	...	...	...	...	...	...	D	...	...	D/U	...
Bitter	...	...	...	...	...	...	X	...	...	...	...	...	...
Burnt	U	...	X	...	...	...	...	X	...	X	...	U	X
Buttery	F	F	F	...	F	...	F	X	F	...	F	F	F
Cardboard	D	...	...	...	...	...	D	D	...	...	...	D	D
Corny	F	...	...	...	...	...	...	...	...	...	...	...	...
Fishy	...	...	...	U/F/D	...	...	...	...	D	...	...	D	...
Fruity	...	...	...	...	...	F	...	F	...	...	...	...	...
Grassy	X	...	...	...	...	...	...	X	D	X	X	U/D	U/D
Green	...	...	...	...	...	X	...	...	D	X	...	...	...
Hay	X	...	...	...	...	...	...	X	...	X	X	U/D	U/D
Hully	...	...	...	...	...	...	...	...	...	...	...	...	X
Nutty	F	X	X	...	X	...	X	F	...	X	...	F	...
Painty	...	...	...	...	...	...	...	...	D	...	...	D	...
Pine	...	...	...	...	...	...	...	...	...	...	...	...	U
Rancid	D	D	D	...	...	D	D	D	D	D	D	D	D
Rubbery	X	...	...	...	...	...	...	...	X	...	...	X	...
Soapy	...	...	X	...	...	...	X	...	...	...	...	...	...
Sulfur	...	...	...	...	...	...	...	...	U/D	...	...	...	...
Waxy	X	...	X	...	U	...	...	...	...	X	X	...	X
Weedy	X	...	...	...	...	...	...	X	X	X	X	X	X
Woody	...	...	...	...	...	...	...	X	...	X	X	...	X

TABLE X1.1 Oil Types and Attributes[A]

Attributes	Oil Type												
	Corn	Cotton Seed	Coconut	Fish/ Marine	MCT[B]	Olive	Palm	Peanut	Canola Rapeseed	Ricebran	Safflower	Soy	Sunflower
Bacony	...	...	U	...	...	...	X	...	...	...	...	...	...
Beany	...	...	...	...	...	...	...	...	D	...	...	D/U	...
Bitter	...	...	...	...	...	...	X	...	...	...	...	...	...
Burnt	U	...	X	...	...	...	...	X	...	X	...	U	X
Buttery	F	F	F	...	F	...	F	X	F	...	F	F	F
Cardboard	D	...	...	...	...	...	D	D	...	...	...	D	D
Corny	F	...	...	...	...	...	...	...	...	...	...	...	...
Fishy	...	...	...	U/F/D	...	...	...	...	D	...	...	D	...
Fruity	...	...	...	...	...	F	...	F	...	...	...	...	...
Grassy	X	...	...	...	...	...	...	X	D	X	X	U/D	U/D
Green	...	...	...	...	...	X	...	...	D	X	...	...	...
Hay	X	...	...	...	...	...	...	X	...	X	X	U/D	U/D
Hully	...	...	...	...	...	...	...	...	...	...	...	...	X
Nutty	F	X	X	...	X	...	X	F	...	X	...	F	...
Painty	...	...	...	...	...	...	...	...	D	...	...	D	...
Pine	...	...	...	...	...	...	...	...	...	...	...	...	U
Rancid	D	D	D	...	...	D	D	D	D	D	D	D	D
Rubbery	X	...	...	...	...	...	...	...	X	...	...	X	...
Soapy	...	...	X	...	...	...	X	...	...	...	...	...	...
Sulfur	...	...	...	...	...	...	...	...	U/D	...	...	...	...
Waxy	X	...	X	...	U	...	...	...	...	X	X	...	X
Weedy	X	...	...	...	...	...	...	X	X	X	X	X	X
Woody	...	...	...	...	...	...	...	X	...	X	X	...	X

[A] U = characteristic of unprocessed or partially processed oil.
F = characteristic of freshly processed oil.
D = characteristic of deteriorated oil.
X = unidentified origin.
Other flavors may be present from contamination, processing conditions, etc.: pumpkin, melon, watermelon, petroleum, metallic, musty.
[B] Medium chain triglycerides.

~~[A] U = characteristic of unprocessed or partially processed oil~~
~~F = characteristic of freshly processed oil~~
~~D = characteristic of deteriorated oil.~~
~~X = unidentified origin.~~
~~Other flavors may be present from contamination, processing conditions, etc.: pumpkin, melon, watermelon, petroleum, metallic, musty.~~
~~[B] Medium chain triglycerides.~~

X2. LEXICON FOR FATS AND OILS

~~Bacon~~
~~*Definition*~~ — ~~An aromatic reminiscent of smoked bacon.~~
~~*Reference*~~ — ~~Crude undeodorized coconut oil heated to 38°C.~~
~~*Example*~~ — ~~Fried smoked pork bacon.~~
~~Beany~~
~~*Definition*~~ — ~~An aromatic characteristic of raw soybeans.~~
~~*Reference*~~ — ~~Crude soybean oil diluted in fresh soybean oil (5:95).~~
~~*Example*~~ — ~~Ground lima beans (dry mixed with water (2:98 ratio).~~
~~Bitter~~
~~*Definition*~~ — ~~A basic taste simulated by such substances as quinine and caffeine.~~
~~*Reference*~~ — ~~0.2 % caffeine in water.~~
~~*Example*~~ — ~~Tonic water.~~
~~Bland~~
~~*Definition*~~ — ~~No aromatics or taste factors perceptible.~~
~~*Example*~~ — ~~Mineral oil.~~
~~Burnt~~
~~*Definition*~~ — ~~An aromatic reminiscent of burnt popcorn or grains.~~
~~*Reference*~~ — ~~Crude, unprocessed corn oil.~~
~~*Example*~~ — ~~Air-popped popcorn.~~
~~Buttery~~
~~*Definition*~~ — ~~An aromatic reminiscent of fresh, sweet, unsalted butter.~~
~~*Reference*~~ — ~~Fresh, sweet, unsalted butter diluted in good quality soybean oil (1:99).~~
~~*Example*~~ — ~~Freshly processed unsalted butter.~~

Cardboard	
Definition	An aromatic associated with the odor of wet cardboard or paper.
Reference	Wet one cup unsalted, dry-roasted vacuum-packed peanuts with distilled water; place wet nuts on tray to air-dry for 24 h.
Example	Wet cardboard.
Corny	
Definition	An aromatic of steeped ground corn.
Reference	Crude corn oil diluted in fresh corn oil (5:95).
Example	Raw corn: non-heat treated corn; cooked corn: heated or boiled corn; and, toasted corn: heated enough to caramelize sugars.
Fishy	
Definition	An aromatic reminiscent of cod liver oil.
Reference	Cod liver oil diluted in good-quality soybean oil (1:99).
Example	Odor from canola (rapeseed) oil heated at 190°C.
Fruity	
Definition	An aromatic reminiscent of ripe fruit.
Reference	2 ppm ethyl acetate.
Example	Olive oil.
Grassy	
Definition	An aromatic reminiscent of the green character of mowed grass.
Reference	Crude soybean oil from non-heat-treated soybeans diluted in good-quality soybean oil (5:95).
Example	Fresh cut grass.
Green	
Definition	An aromatic associated with unprocessed immature fruits or grains.
Reference	5 ppm cis-3-hexenol in water.
Example	Raw immature soybeans.
Hay	
Definition	An aromatic reminiscent of dried grass character of air-dried grain or vegetation.
Reference	Crude soybean oil from heat-treated beans diluted in good-quality soybean oil (5:95).
Example	Dried alfalfa.
Hully	
Definition	An aromatic associated with the outer protective coating of a grain or oilseed.
Reference	Raw steeped peanut hulls.
Example	Sunflower hulls (confectionery type).
Hydrogenated	
Definition	An aromatic reminiscent of the sweet paraffin-like odor of crayons.
Reference	10 % undeodorized hydrogenated soybean oil (iodine value = 90–110) in good-quality soybean oil.
Example	All vegetable solid shortening.
Light-struck	
Definition	Mixture of aromatics characteristic of light-sensitive oils such as soybean that are exposed to fluorescent light or sunlight.
Reference	Good-quality soybean oil exposed to fluorescent light (100 footcandles for one week or 800 footcandles for 4 h).
Melon	
Definition	An aromatic reminiscent of watermelon rind.
Reference	0.002 ppm 2,6-nonadienal in good-quality soybean oil (odor only).
Example	Soybean oil processed with phosphoric acid; watermelon rind.
Metallic	
Definition	An aromatic associated with metal coins.
Reference	0.01 % ferrous sulfate diluted in distilled, filtered water.
Example	Copper pennies soaked in filtered water for 12 h; soybean oil processed without citric acid.
Musty	
Definition	An aromatic reminiscent of odor of a moldy or damp cellar or room.
Reference	25 ppb methyl isoborenol.
Example	Damp cloth stored in a plastic bag.
Nutty	
Definition	An aromatic reminiscent of fresh, sweet nutmeats.
Reference	Freshly ground English walnuts.
Example	Freshly processed peanut oil.