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

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

2. Referenced Documents

2.1 *ASTM Standards:*[2]

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

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 for screening and training of oil assessors; rating and scoring samples; and data collection, handling, analysis, and interpretation.

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.

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.

6. Apparatus

6.1 *Glass Vial,* 30-mm outside diameter by 57-mm height, wide-mouth threaded top. Use amber glass for odor/flavor evaluations; clear glass for visual examination. Alternatively, use 2 oz sample cups also for odor/flavor evaluations only.

6.2 *Circulating Waterbath,* with automatic timer, thermostat, and rack.

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

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.

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

[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.

[3] *Manual on Sensory Testing Methods, ASTM MNL26*, ASTM International.

[4] *Guidelines for Selection and Training of Sensory Panel Members, ASTM STP 758*, ASTM International, 1981.

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]

9. Procedures for 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]).

9.3 *Terminology/Characteristics (See 3.1):*

9.3.1 Examples of odor, flavors, and tastes predominately characteristic of various oil types are presented in 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.

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

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

9.6 Evaluate assessors' consistency on repeated tests as recommended in STP 758.[4]

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

10.1 For information on serving containers, sample size, heating methods, sample temperature, and presentation methods, see Practice E1346.

10.2 Oils should not be held at serving temperature for more than 60 min to prevent deterioration from oxidation.

10.3 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, 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.

11. Instructions to Assessors for Odor Evaluations

11.1 Evaluate the oils for odor in the order presented from left to right.

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 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 for Flavor Evaluations

12.1 Rinse mouth well with warm filtered water (50 ± 1°C) before starting the flavor evaluation.

12.2 Taste the samples in the order presented from left to right.

12.3 Put the entire 10-mL sample of warm oil into the mouth; 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]).

[5] *Manual on Descriptive Analysis Testing, ASTM MNL 13*, ASTM, 1992.

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.

16. Keywords

16.1 descriptive testing; discriminative testing; flavor; odor; scaling; sensory analysis; taste

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

[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.

Oxidized
Definition— A general term denoting the process of oxidative deterioration of oil. Oxidized flavors or odors range widely from buttery, grassy, rancid, to painty. Not recommended as a specific odor or flavor.

Painty
Definition— An aromatic reminiscent of oils containing linolenic acid such as linseed or rapeseed (canola) oil; not noted in non-linolenic acid oils such as peanut.
Reference— Good-quality canola oil aged for four to eight days at 60°C or until a peroxide value of 10.0 is reached.
Example— Linseed oil.

Pine
Definition— An aromatic reminiscent of pine needles noted in sunflower oil.
Reference— Bleached, undeodorized sunflower oil diluted (5:95) in good-quality fresh soybean oil.
Example— Fresh pine needles cut in small pieces.

Plastic
Definition— An aromatic reminiscent of plastic containers or food stored in a plastic container.
Reference— Plastic strips from a poly(ethylene terephthalate) (PET) package stored 24 h in fresh, good-quality soybean oil.
Example— Plastic cup.

Rancid
Definition— An aromatic reminiscent of odor or flavor of highly oxidized oils containing high amounts of linoleic acid such as sunflower, cottonseed, or peanut.
Reference— Good-quality cottonseed oil aged for four days at 60°C or until a peroxide value of approximately 5.0 is reached.
Example— Potato chips fried in cottonseed oil and aged.

Reverted	
Definition—	A general term denoting the process of oil flavor reversion. During initial stages of oxidation, most oils develop flavors or odors reminiscent of odors or flavors detectable in crude oil. Each oil type would have a characteristic reverted odor or flavor. Not recommended as a specific odor or flavor.
Rubbery	
Definition—	An aromatic reminiscent of old rubber.
Reference—	0.5 ppm methyl allyl trisulfide (odor only).
Example—	Poorly processed corn oil; rubber stoppers.
Soapy	
Definition—	An aromatic reminiscent of unscented soap.
Reference—	Ivory brand unscented soap flakes.
Example—	Oxidized fat containing lauric acid, such as coconut oil.
Sulfur	
Definition—	An aromatic reminiscent of oils from seeds in the sulfur-containing vegetable family such as rapeseed (canola).
Reference—	Bleached, undeodorized canola oil diluted in good-quality canola oil (5:95).
Example—	Brussels sprouts.
Waxy	
Definition—	An aromatic reminiscent of candle wax.
Reference—	High oleic sunflower oil heated to 190°C for 30 min.
Example—	Melted paraffin.
Weedy	
Definition—	An aromatic reminiscent of freshly cut weeds.
Reference—	10 000 ppm 2-isobutylthiazole in propylene glycol.
Example—	Mixture of freshly cut green weeds.
Woody	
Definition—	An aromatic reminiscent of fresh, dry cut wood.
Reference—	Wood (oak) chips.
Example—	Peanut oil.