Designation: E1396 – 90 (Reapproved 2017)

Standard Test Method for Sensory Evaluation of Oleoresin Capsicum[1]

This standard is issued under the fixed designation E1396; 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 describes standardized procedures for the sensory evaluation of heat in oleoresin capsicums ranging from 100 000 to 1 000 000 Scoville heat units (S.H.U.).

1.2 This test method is intended as an alternative to the Scoville heat test, but results can be expressed in Scoville heat units (see ASTA Method 21.0 and ISO 3513).

1.3 This test method does not apply for ground red pepper, low heat chili peppers, or chili powder.

1.4 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this 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 precautionary statements are given in Section 8.

2. Referenced Documents

2.1 *ASTM Standards:*

E1083 Test Method for Sensory Evaluation of Red Pepper Heat[2]

2.2 *ASTA Standard:*

ASTA Method 21.0 Official Analytical Methods[3]

2.3 *ISO Standard:*

ISO 3513-1977 (E), Spices and Condiments-Chilies-Determination of Scoville Index[4]

2.4 *AOAC Method:*

Official Methods of Association of Official Analytical Chemists International (1996) 995.03 (43.1.43)

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *approaching strong heat*—*N*-vanillyl-*n*-nonamide, 1.30 ppm. This is 13.0 cm on the 15-cm line scale. It is unusual to see an oleoresin stronger than this. But in the event that a pepper with more than expected heat is tested, there remains the last 2 cm on the 15-cm line scale.

3.1.2 *moderate heat*—*N*-vanillyl-*n*-nonamide, 0.80 ppm. This is a "moderate" amount of pepper heat. It reads 10 cm on the 15-cm line scale.

3.1.3 *rinse*—to purge the oral cavity with unsalted soda crackers and 20°C spring or distilled water by slowly chewing and swallowing the cracker, followed by swirling the water around in the mouth and swallowing. This procedure is repeated as often as is natural and comfortable for the panelist.

3.1.4 *Scoville heat units (S.H.U.)*—the commonly accepted unit for expressing heat levels in capsicum products (see Test Method E1083 and ASTA Method 21.0). Scoville heat units range from 0 to 1 500 000.

3.1.5 *slight heat*—*N*-vanillyl-*n*-nonamide, 0.40 ppm. This is a "slight" amount of pepper heat. It reads 5 cm on the 15-cm line scale.

3.1.6 *strong heat*—best defined by concept. Hotter than the 1.30-ppm *N*-vanillyl-*n*-nonamide sample. It reads 15 cm on the 15-cm line scale.

3.1.7 *threshold heat*—best defined by concept rather than by a standard dilution of *N*-vanillyl-*n*-nonamide. Threshold is that point where a panelist just barely senses burn/heat. It reads 1.25 cm on the 15-cm line scale.

3.1.8 *zero heat*—*N*-vanillyl-*n*-nonamide, 0 ppm. No sensory heat. It reads 0 cm on the line scale.

4. Summary of Test Method

4.1 Oleoresin capsicum is steeped in hot water with polysorbate-80 or polysorbate-60 for 3 min, filtered, and the filtrate diluted in room temperature water. Trained panelists

[1] This test method 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] Available from American Spice Trade Association, Box 1267, Englewood Cliffs, NJ 07632.

[4] Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, http://www.ansi.org.

compare the heat in the pepper extract to a known concentration of a standard solution of synthetic capsaicin (*N*-vanillyl-*n*-nonamide) using a 15-cm line scale. The tasting procedure is timed and takes 2 min for one test sample and 9 min for two test samples.[5] This test method is a minor variation on the ground red pepper sensory method.

4.2 Panelists are screened for their accuracy and precision and trained to use the 15-cm line scale during two to three 15-min training sessions.

4.3 Standard general requirements for sensory testing follows.[4]

5. Significance and Use

5.1 This test method provides quick and accurate ratings for the sensory heat in oleoresin capsicums ranging from 100 000 to 1 000 000 Scoville heat units.

5.2 Sensory results from this test method correlate highly ($r^2 = 0.94$) with results from high pressure liquid chromatography; making the two methods substitutable.[6]

6. Apparatus

6.1 *Magnetic Hot Plate Stirrers,* two.

6.2 *Beakers,* 600-mL, four.

6.3 *Small Beaker,* 50 to 100 mL.

6.4 *Analytical Balance,* capacity greater than 300 g, sensitive to 0.01 g.

6.5 *Volumetric Flasks,* 1000-mL stoppered, two.

6.6 *Stopwatch.*

7. Reagents and Materials

7.1 *Coffee Filter Papers,* or low flavor qualitative filter paper.

7.2 *Medicine Cups.*

7.3 *Unsalted Soda Crackers,* unsalted tops.

7.4 *Water,* bottled, distilled, or deionized when available, or still spring water.

7.5 *Polysorbate-80 or Polysorbate-60,* food grade.

7.6 *Rating Forms,* 15-cm line scale anchored at 0 (none), 1.25 cm (threshold), 5 cm (slight), 10 cm (moderate), 15 cm (strong); see Appendix X1.

7.7 *N-vanillyl-n-nonamide,* available from Penta International (some restrictions apply).

8. Precautions

8.1 Pure *N*-vanillyl-*n*-nonamide will burn the eyes and skin upon direct contact. Gloves and caution must be used when handling *N*-vanillyl-*n*-nonamide in the crystalline form.

9. Calibration and Standardization of Panelists

9.1 Select ten to twelve panelists based on availability, attitude, and motivation of panelists. Screening for taste sensitivity is not necessary.

9.2 Prepare stock solution of *N*-vanillyl-*n*-nonamide (see 10.1.2).

9.3 Dilute the stock solution of *N*-vanillyl-*n*-nonamide to the following concentrations:

9.3.1 *N-vanillyl-n-nonamide, 0 ppm*—Add none of the stock solution to 200 mL of water.

9.3.2 *N-vanillyl-n-nonamide, 0.40 ppm*—Dilute 13.4 g of stock solution to 200 mL with water.

9.3.3 *N-vanillyl-n-nonamide, 0.80 ppm*—Dilute 26.8 g of the stock solution to 200 mL with water.

9.3.4 *N-vanillyl-n-nonamide, 1.30 ppm*—Dilute 43.3 g of the stock solution to 200 mL with water.

9.4 *Session 1 (15 min)*—Brief the panelists on the purpose of this test method. The purpose of the first session is to standardize their tongues and mouth to the reference standards with respect to the 15-cm line scale on the ballot (see Fig. 1). Explain to the panelists that they may use any of the infinite number of points on the line scale to describe how hot a given sample is. Panelists will taste (see 10.2.3.1 – 10.2.3.3) the coded standard dilutions prepared, evaluate them critically, concentrating and memorizing their individual sensory heat levels. Panelists rinse well between samples with unsalted soda crackers and spring or distilled water for 2 min (they are timed). After the standards have been tasted, the correct rating for each reference standard is given. A new set of labeled standard dilutions is presented to the panelists to review. Definitions for "0," "threshold," "slight," "moderate," "approaching strong," and "strong" are provided. Refer to 3.1.1, 3.1.2, 3.1.6, 3.1.7, and 3.1.8.

9.5 *Session 2 (15 min)*—This session should follow the first training session by one to two days. During this session, the panelists will be both trained and tested. Explain to the panelists how they will be evaluating the actual red pepper test samples. Explain the entire tasting procedure as follows:

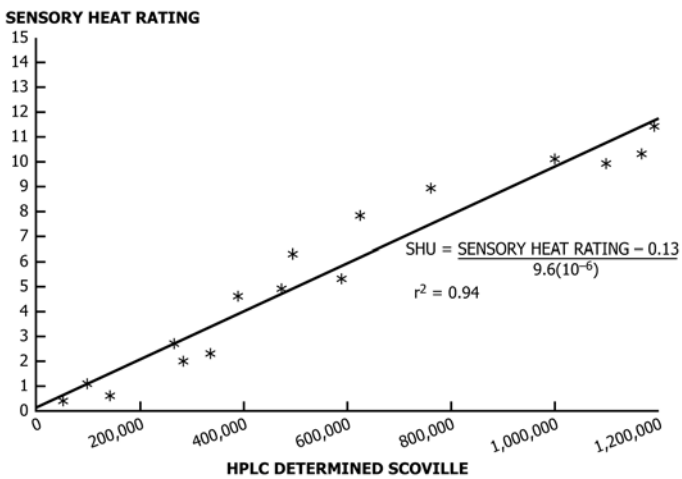

FIG. 1 Oleoresin Capsicum Heat Sensory versus HPLC

[5] Gillette, M. H., Appel, C. E., and Lego, M., "A New Method for the Sensory Evaluation of Red Pepper Heat," *Journal of Food and Science*, Vol 49, No. 4, 1984, p. 1028.

[6] Hoffman, P. G., Salb, M. C., and Galetto, W. G., "Separation and Quantitation of Red Pepper Heat Principles by Reverse Phase HPLC," *Journal of Agricultural and Food Chemistry*, Vol 31, No. 6, Oct. 1983, p. 1326.

9.5.1 Panelists are served 10-mL portions of each of two samples in coded medicine cups. The control (0.4-ppm *N*-vanillyl-*n*-nonamide) is always served first, coded "C." The test sample is served second, with a random two-letter code. Two sets of samples are evaluated per sitting. The tasting procedure is described in 10.2.3.

9.5.2 For this second training session, the panelists are served the "control" first, coded "C," then a test sample coded with a random two letter code. They will evaluate two sets of samples:

9.5.2.1 Control and 0.80 ppm *N*-vanillyl-*n*-nonamide.

9.5.2.2 Control and 0.40 ppm *N*-vanillyl-*n*-nonamide (the same as the control).

9.5.2.3 Do not tell the panelists what the test samples are. After learning the standard heat intensities during Session 1, they theoretically should rate the 0.80-ppm sample at "moderate" and the 0.40-ppm sample at "slight" on the line scale. A 2-cm variation from the desired response is acceptable. The panel, as a whole, should also be within 2 cm of the desired response. If not, another training session must be conducted. After the session, advise the panelists about the sample identities and the expected ratings for them. Panelists must reproduce their judgment within 2 cm of the desired response. A minimum of five panelists should pass for the formal testing. Repeat training until this is achieved (approximately three training sessions).

9.5.2.4 End the training session by giving the panelists a sample of oleoresin capsicum to acquaint panelists with the flavor of chili peppers (not present in the standards).

10. Procedure

10.1 *Sample Preparation:*

10.1.1 Sample preparation procedures are itemized in a quick reference chart (see Appendix X1).

10.1.2 Evaluate two samples per test: (*1*) a known control (0.40 ppm dilution of *N*-vanillyl-*n*-nonamide) prepared from the stock solution; and (*2*) the unknown oleoresin capsicum. Preparation of the two samples is as follows:

10.1.3 Prepare the "stock" solution of *N*-vanillyl-*n*-nonamide (6 ppm *N*-vanillyl-*n*-nonamide and 200 ppm polysorbate-80 or polysorbate-60) by diluting *N*-vanillyl-*n*-nonamide and polysorbate-80 or polysorbate-60 in spring or distilled water. Keep this solution stoppered and refrigerated for the duration of the test series. It will remain stable for 2 to 3 weeks. Check regularly for precipitation of *N*-vanillyl-*n*-nonamide. To make the stock solution, weigh 0.60 g *N*-vanillyl-*n*-nonamide and 20 g of polysorbate-80 or polysorbate-60 into a small beaker (50 mL). Heat the mixture on a hot plate (low setting) for a minimum of 10 min to dissolve *N*-vanillyl-*n*-nonamide. Quantitatively transfer the heated mixture into a 1-L volumetric flask using hot (about 70°C) spring or distilled water. Cool to room temperature. Dilute the transferred solution to 1 L using room temperature (20°C) spring or distilled water. Dilute 10 g of this solution to 1 L in a second 1-L volumetric flask. Stopper and refrigerate. Final concentrations equal 6 ppm *N*-vanillyl-*n*-nonamide, 200 ppm polysorbate-80 or polysorbate-60. This is a "stock solution."

10.1.4 For each test, dilute the stock solution of *N*-vanillyl-*n*-nonamide to 0.40 ppm *N*-vanillyl-*n*-nonamide and 13.3 ppm polysorbate-80 or polysorbate-60 in 20°C spring or distilled water by diluting 13.4 g of the stock solution to 200 mL with room temperature water. This diluted solution is referred to as the "control" for each test.

10.1.5 *Oleoresin Capsicum Samples*—On the day of the test, add 0.1 g of the oleoresin sample directly to 0.2 g of polysorbate-80 or polysorbate-60 and heated at 200°C for 1 min in a 600-mL beaker, diluted to 400 mL with 70°C spring or distilled water and place on the preheated (medium heat; 200°C) hot plate stirrer on medium stir speed for 2 min. Dilute 5 mL of the extract to 200 mL using 20°C spring or distilled water. Final concentration of the extracted and diluted solution is 6.25 ppm oleoresin and 12.5 ppm polysorbate-80 or polysorbate-60.

10.2 *Sample Presentation:*

10.2.1 A round or conference table is preferred, but booths may be used as long as all panelists are able to be "monitored" by the panel leader. Conduct the test with all five to ten trained panelists simultaneously as the process is timed by the panel leader (if a panelist misses a panel, he/she must also be timed during his/her "make-up" test). Red lights are recommended to mask color differences.

10.2.2 Serve panelists 10-mL portions of each sample in coded medicine cups. Serving temperature should be at room temperature and equal for all samples. The control is always served first, coded "C." The test sample is served second, with a random two-digit code. Evaluate two sets of samples (control and test sample) per sitting. Use a 15-cm line scale anchored at 0 cm (0 heat), 1.25 cm (threshold heat), 5.0 cm (slight heat), 10.0 cm (moderate heat), and 15 cm (strong heat) (see X1.2). Use a separate scale for each set of samples. Order of presentation of the sample sets should be balanced to avoid position bias.

10.2.3 The testing procedure is as follows:

10.2.3.1 Rinse before first sample (control) with unsalted soda cracker and 20°C spring or distilled water, or both. Allow 15 s between rinsing and sampling.

10.2.3.2 Evaluating left to right, take entire first sample (control) in mouth, hold for about 5 s, swallow slowly.

10.2.3.3 Wait 30 s (timed) from initial intake keeping mouth closed.

10.2.3.4 Rate first sample at "slight" on ballot.

10.2.3.5 Alternately rinse with 20°C spring or distilled water and chew on an unsalted soda cracker during a 60-s interval (timed).

10.2.3.6 Rinse with 20°C spring water immediately prior to second sample. Allow 15 s between rinsing and sampling.

10.2.3.7 Take entire second sample (test sample) in mouth, hold for about 5 s, swallow slowly.

10.2.3.8 Wait 30 s (timed), keeping mouth closed.

10.2.3.9 Rate second sample.

10.2.3.10 Panel dismissed if only one test sample is to be evaluated.

10.2.3.11 If two test samples are to be evaluated, wait 5 min (timed). Rinse well with spring or distilled water and unsalted crackers during this time.

10.2.3.12 Repeat 10.2.3.1 – 10.2.3.9 for the second set of samples.

10.2.4 Note that the control is rated before each test sample.

11. Interpretation of Results

11.1 Sensory heat ratings are obtained by measuring the distance (in centimetres to the first decimal place) from the left hand side of the scale (0) to the mark placed on the ballot for each sample. Values range from 0.0 to 15.0, as the scale is 15 cm long.

11.2 Individual panelist ratings are averaged to generate a panel mean.

11.3 Sensory heat ratings can be converted into Scoville heat units by using Fig. 2, or the equation:

$$S.H.U. = (\text{sensory heat rating} - 0.13)/9.6\,(10^{-6})$$

NAME _____
DATE _____

RED PEPPER HEAT

CODES = _____ _____

Please taste the samples from left to right and rate the pepper heat by intersecting the horizontal line scale with a vertical line labeled with the sample code. Rinse before and between samples with crackers and water.
WAIT 90 seconds between samples (you will be timed).

FIG. 2 Sensory Heat Rating Ballot

12. Precision and Bias

12.1 *Precision:*

12.1.1 Within-laboratory (repeatability) average standard deviation is 0.9 cm on the 15-cm line scale. Between-laboratory (reproducibility) average standard deviation is 1.7 cm on the 15-cm line scale.

12.1.2 Precision data derived from results of a collaborative test involving twelve laboratories.

12.2 *Bias*—This test method corrects for psychological bias by coding of the test samples, use of an internal reference ("control") for each test, by training of the panelists, and by timed rinsing between samples.

APPENDIX

(Nonmandatory Information)

X1. PROCEDURE SUMMARY FOR SAMPLE PREPARATION OLEORESIN CAPSICUM

X1.1 Weigh 0.2 g of polysorbate-80 in 600-mL beaker.

X1.2 Add 0.1 g of sample directly to the polysorbate-80.

X1.3 Heat on stir plate set at 200°C for 1 min.

X1.4 Add 70°C spring water to make 400 g.

X1.5 Heat and stir on stir plate for 2 min.

X1.6 Dilute 5 g of solution to 200 g with 20°C spring water.

X1.7 Specific step-by-step procedures are described in 10.1.