Designation: E1083 – 00 (Reapproved 2017)

Standard Test Method for Sensory Evaluation of Red Pepper Heat[1]

This standard is issued under the fixed designation E1083; 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 ground red pepper[2] ranging from 10 000 to 70 000 scoville heat units.

1.2 This test method is intended as an alternative to the Scoville Heat Test, but results can be expressed in scoville heat units (SHU).

1.3 This test method does not apply for oleoresin capsicums, 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 hazards statements are given in Section 8.

2. Referenced Documents

2.1 *ASTM Publication:*[3]
STP 434 Manual on Sensory Testing Methods
2.2 *ISO Standard:*[4]
3513-1977(E) Spices and Condiments—Chilies—Determination of Scoville Index

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 a ground red pepper stronger than this. But in the event that a pepper with more than 70 000 SHU is tested, there remains the last 2 cm on the line scale.

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

3.1.3 *rinse*—to purge the oral cavity with unsalted soda crackers and 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 (SHU)*—the commonly accepted unit for expressing heat levels in capsicum products (see 2.1 and 2.2). 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. On the line scale, 5 cm.

3.1.6 *stock solution*—a standardized solution of 6.0 ppm of N-vanillyl-n-nonamide that is used to prepare other dilutions of N-vanillyl-n-nonamide (see 10.1.2).

3.1.7 *strong heat*—best defined by concept. Hotter than the 1.30 ppm N-vanillyl-n-nonamide sample. On the line scale, 15 cm.

3.1.8 *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. On the line scale, 1.25 cm.

3.1.9 *zero heat*—N-vanillyl-n-nonamide, 0 ppm. No sensory heat. On the line scale, 0 cm.

4. Summary of Test Method

4.1 Ground red pepper is steeped in hot water with polysorbate-80 for 20 min, filtered, and the filtrate diluted in room temperature water. Trained panelists 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 2 test samples.[5]

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[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] Available from the American Spice Trade Association, 580 Sylvan Ave., Englewood Cliffs, NJ 07632.

[3] Available from ASTM International Headquarters, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428–2959.

[4] Available from International Organization for Standardization (ISO), 1, ch. de la Voie-Creuse, Case postale 56, CH-1211, Geneva 20, Switzerland, http://www.iso.ch.

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

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 are followed in accordance with ASTM STP 434.

5. Significance and Use

5.1 This test provides quick and accurate ratings for the sensory heat in ground red peppers ranging from 10 000 to 70 000 scoville heat units.

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

6. Apparatus

6.1 *Two Magnetic Hot Plate Stirrers.*

6.2 *Four beakers,* 400 mL.

6.3 *One Small Beaker,* (50 to 100 mL).

6.4 *One Analytical Balance* (sensitive to 0.00 g).

6.5 *Two Volumetric Flasks,* stoppered, 1000 mL.

6.6 *One Stopwatch.*

7. Reagents and Materials

7.1 *Coffee-Type or Low Flavor Qualitative Filter Paper.*

7.2 *Medicine Cups.*

7.3 *Unsalted Soda Crackers.*

7.4 *Bottled Distilled or Deionized Water* when available, or still spring water.

7.5 *Polysorbate-80 (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.

8. Hazards

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, at random, 10 to 12 panelists. Selection should be based upon 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 I (15 min)*—Brief the randomly selected 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 (Appendix X1). 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 you prepared, evaluate them critically, concentrating and memorizing their individual sensory heat levels. Panelists rinse well between samples with crackers and water for 2 min (they are timed). After the standards have been tasted, the correct rating for each reference standard is given. Definitions for "0," "threshold," "slight," "moderate," "approaching strong," and "strong" are provided. Refer to 3.1.4 – 3.1.8.

9.5 *Session II (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 defined below:

9.5.1 Panelists are served 10-mL portions of each of 2 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 3-digit code. Two sets of samples are evaluated per sitting. The tasting procedure is described under 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 3 digit 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. Drop any panelists that cannot reproduce their judgement within 2 cm after the third training session. You should have a minimum of five panelists pass for the formal testing.

10. Procedure

10.1 *Sample Preparation:*

10.1.1 Evaluate two samples per test: (*1*) a known control (0.40 ppm dilution of N-vanillyl-n-nonamide) prepared from

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

the stock solution; and (*2*) the unknown ground red pepper. Preparation of the two samples is as follows:

10.1.2 Prepare the "stock" solution of N-vanillyl-n-nonamide by diluting 6.0 ppm N-vanillyl-n-nonamide and 200 ppm polysorbate-80 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 of N-vanillyl-n-nonamide and 20 g of polysorbate-80 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. This is the stock solution.

10.1.3 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 in 20°C spring or distilled water by diluting 13.4 g of the stock solution to 200 mL with room temperature water. Refer to this diluted solution as the control for each test.

10.1.4 *Red Pepper Samples*—On the day of the test, combine and dilute 0.25 g of the pepper sample and 0.02 g of polysorbate-80 to 100 g with 75°C spring or distilled water and place the preheated (4 min on high heat) hot plate stirrer on medium stir speed. Set the hot plate stirrer on high heat for 1.5 min, then on medium heat for 20 min of simmering (90°C) and stirring. Filter the extracted pepper using coffee or qualitative filter papers. Dilute 10 g of the filtrate to 200 g using 20°C spring or distilled water. Final concentration of the extracted and diluted solution is 125-ppm pepper and 10-ppm polysorbate-80.

10.2 *Sample Presentation:*

10.2.1 A round or conference table is preferred: use booths only if all panelists are able to be "monitored" by the panel leader. Conduct the test using all 5 to 10 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).

10.2.2 Serve panelists 10-mL portions of each sample in coded medicine cups. Always serve the control first, coded "C." Serve the test sample second, with a random 3-digit code. Evaluate two sets of samples (control and test sample) per sitting. 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) is used (Appendix X1.). A separate scale is used for each set of samples.

10.2.3 The tasting procedure is as follows:

10.2.3.1 Rinse before first sample (control) with unsalted soda cracker and 20°C spring or distilled water.

10.2.3.2 Take entire first sample (control) in mouth, hold for about 5 s, swallow slowly.

10.2.3.3 Wait 30 s (timed).

10.2.3.4 Rate first sample at "slight" on ballot.

10.2.3.5 Rinse intermittently with unsalted soda cracker and 20°C spring water during a 60-s interval (timed).

10.2.3.6 Rinse with 20°C spring water immediately prior to second sample.

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).

10.2.3.9 Rate second sample.

10.2.3.10 Panel dismissed if only one test sample is to be evaluated. If two test samples are to be evaluated:

10.2.3.11 Wait 5.0 min (timed). Rinse well with water and 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. Calculation and 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. 1, or the equation: Sensory Heat Ratings = 0.199 (calculated scoville × 10^{-3}) – 0.223.

12. Precision and Bias

12.1 *Precision:*

12.1.1 Within-laboratory (repeatability) and between-laboratory (reproducibility) standard deviations are 2.0 cm or less on the 15-cm line scale.

12.1.2 Precision data were derived from results of a collaborative test involving 14 laboratories.

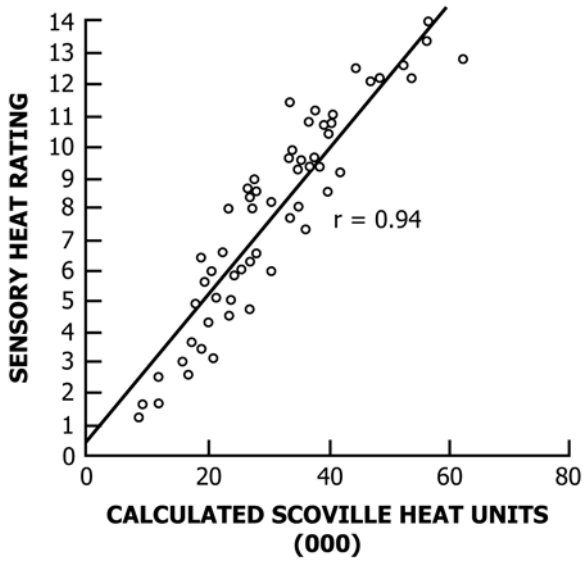


FIG. 1 Linear Relationship Between HPLC-Determined Scoville Heat Units and Sensory Heat Ratings

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. SENSORY HEAT RATING BALLOT

NAME _____

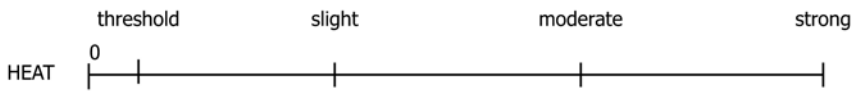
DATE _____

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).



Thank You!