Method 21.2

Sensory Evaluation of Low Heat Chilies, Red Peppers and Oleoresins

Purpose: To determine heat in capsicum spices ranging from 200 to 2500 scoville heat units for low heat chilies; 10,000 to 70,000 scoville heat units for red peppers and 100,000 to 1,000,000 for oleoresins.

A. Apparatus:

1. Magnetic hot plate stirrers.
2. Beakers, 400 mL.
3. Beaker, (50 to 100 mL).
4. Analytical balance, sensitive to 0.00 g.
5. Stopwatch.
6. Coffee-type or Low Flavor Qualitative Filter Paper.
7. Medicine Cups.
8. Rating forms (15-cm line scale anchored at 0 (none), 1.25 cm (threshold), 5 cm. (slight), 10 cm (moderate), 15 cm (strong).

B. Reagents:

1. Unsalted tops soda crackers.
2. Bottled Distilled or Deionized Water when available or still spring water.
3. Polysorbate-80 (Food Grade).
4. N-vanillyl-n-nonamide (synthetic capsaicin, see source 21.3).

C. Sample Preparation:

1. Low Heat Chilies:
   a. 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 and rate as "slight".
   b. On the day of the test, preheat the hot plate for 4 min on high heat. Combine 4.0 g of the low heat chili pepper sample and 0.04 g of polysorbate-80 in a 600 mL beaker. Dilute to 200 mL with 70°C spring or distilled water. Cover with a watch glass. Place the beaker on the preheated hot plate stirrer on medium stir speed. Heat 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 100 g of the filtrate with 100 g of 20°C spring or distilled water. Final concentration of the extracted and diluted solution is 10,000-ppm low heat chilies and 100-ppm polysorbate-80.

Method 21.2

Sensory Evaluation of Low Heat Chilies, Red Peppers and Oleoresins

2. Red Pepper:
   a. 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 and rate as "slight".
   b. On the day of the test, preheat the hot plate for 4 min on high heat. 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 in a beaker. Cover with a watchglass. Place the beaker on the preheated hot plate stirrer on medium stir speed. Heat sample 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.

3. Oleoresin Capsicum:
   a. For each test, dilute the stock solution of N-vanillyl-n-nonamide to 0.40 ppm N-vanilly-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 and rate as "slight".
   b. On the day of the test, preheat the hot plate for 4 min on high heat. Add 0.1 g of the oleoresin sample directly into 0.2 g of polysorbate-80. It is important that the oleoresin be added directly into the polysorbate-80. Heat at 200°C for 1 minute in a 600 mL beaker and then dilute to 400 mL with 70°C spring or distilled water. Cover with a watchglass. Place the beaker on the preheated 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.

Method 21.2

Sensory Evaluation of Low Heat Chilies, Red Peppers and Oleoresins

D. Procedure:

1. Preparation of Stock Solution:

   Prepare a "stock" solution of N-vanillyl-n-nonamide by weighing 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 on low setting for a minimum of 10 minutes to dissolve the N-vanillyl-n-nonamide. Quantitatively transfer the heated mixture into a 1L volumetric flask by first rinsing the beaker several times with hot (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 1L in a second 1L volumetric flask. Keep this solution stoppered and refrigerated for the duration of the test series. It will remain stable for 2 to 3 weeks but should be checked regularly for precipitation of N-vanillyl-n-nonamide. Final concentration equals 6 ppm N-vanillyl-n-nonamide, 200 ppm polysorbate-80.

2. Calibration of Panelists:
   a. Randomly select 10 to 12 panelists. Selection criteria should include availability, attitude and overall motivation of the potential panelists. Prior taste sensitivity screening is not necessary.
   b. Prepare a stock solution of N-vanillyl-n-nonamide (see Stock Solution Preparation). Dilute the stock solution to prepare the following four reference standards:
      1. N-vanillyl-n-nonamide (0 ppm) - Add none of the stock solution to 200 mL of water.
      2. N-vanillyl-n-nonamide(0.40 ppm) - Dilute 13.4 g of stock solution to 200 mL with water.
      3. N-vanillyl-n-nonamide (0.80 ppm) - Dilute 26.8 g of stock solution to 200 mL with water.
      4. N-vanillyl-n-nonamide (1.30 ppm) - Dilute 43.3 g of stock solution to 200 mL with water.

Method 21.2

Sensory Evaluation of Low Heat Chilies, Red Peppers and Oleoresins

c. Training Session #1: During the first panel training session, briefly explain to the panelists the purpose of this test method. The first training session is conducted to standardize panelists using the reference standards and the 15-cm line scale on the ballot. 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 the coded standard dilutions, evaluate them critically, so as to memorize their individual sensory heat levels. Panelists should be instructed to rinse well between samples with crackers and water for 2 minutes (they are timed breaks). After the reference standards have been tasted, the correct rating for each reference standard is given. Definitions for "0", "threshold", "slight", "moderate", "approaching strong" and "strong" follow:

1. "0" heat (N-vanillyl-n-nonamide at 0 ppm) - no sensory heat and rated 0 cm on the line scale.
2. "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 pepper burn/heat. Rated at 1.25 cm on the line scale.
3. "slight" heat (N-vanillyl-n-nonamide t 0.40 ppm) Slight amount of pepper heat and rated at 5 cm on the line scale.
3. "moderate" heat (N-vanillyl-n-nonamide at 0.80 ppm) Moderate amount of pepper heat and rated at 10 cm on the line scale.
4. "approaching strong" heat (N-vanillyl-n-nonamide at 1.30 ppm) Rated at 13 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.
6. "strong" heat - best defined by concept. More pepper heat than the 1.30 ppm N-vanillyl-n-nonamide sample. On the line scale, 15 cm.

d. Training session #2: A second training 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 that they will be evaluating the actual red pepper test samples. Explain the entire tasting procedure. Panelist will be 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, and coded "C". The test sample is served second and coded with a random three digit code. Two sets of samples are evaluated per sitting. The tasting procedure is, to be used for the calibration and all tests after calibration, as follows:

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

Take entire portion of first sample (control) in mouth, hold about 5 seconds, swallow slowly.

Wait 30 seconds (timed).

Rate the first sample at "slight" (5 cm) on the ballot.

Rinse intermittently with unsalted soda cracker and 20°C spring water or distilled water during a 60 second interval (timed).
Rinse with 20°C spring water or distilled water immediately prior to second sample.
Take entire second sample (test sample) in mouth, hold for about 5 seconds and swallow slowly.
Wait 30 seconds (timed).
Rate the second sample on the line scale.
If only one test sample is to be evaluated during that session, then the panel is dismissed. Otherwise, panelists are instructed to wait 5 minutes (timed) before the next sample set.
While waiting, panelists may rinse intermittently with unsalted soda crackers and 20°C spring water or distilled water.
After 5 minutes has elapsed, the procedure will be repeated beginning with rinsing before the first sample (control) of the second set is rated again.

e. During the second training session, panelists are served 10-mL portions of each of two samples in coded medicine cups. The control (0.40 ppm N-vanillyl-n-nonamide) is always served first, coded "C". The test sample is always served with random two letter codes. They will evaluate two sets of samples:

a: control and 0.80 ppm N-vanillyl-n-nonamide.
b: control and 0.40 ppm N-vanillyl-n-nonamide (the same as control).

Panelists 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 sessions until this is achieved.

E. Calculation:

1. Sensory heat ratings are obtained by measuring the distance (in centimeters 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.

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

Method 21.2

Sensory Evaluation of Low Heat Chilies, Red Peppers and Oleoresins

3. Sensory heat ratings can be converted into Scoville Heat Units (SHU) by using the equation:

   Low Heat Chilies:
   Sensory Heat Units = (sensory heat rating - 1.3)/4.94 (10^{-3})

   Red Peppers:
   Sensory Heat Ratings = 0.199 (calculated x 10^{-3}) -0.223

   Oleoresins:
   Sensory Heat Units = (sensory heat rating - 0.13)/9.6 (10^{-6})

F. Statistics:

See References.

G. Notes:

1. Use caution when handling pure N-vanillyl-n-nonamide as it will burn skin and eyes on contact.

2. This method has advantages over the Scoville Heat Test method. The Scoville Heat Test has been noted to have the following problems associated with the method: build up of heat, rapid taste fatigue, increased taste threshold, ethanol bite in the samples, lack of statistical validity, lack of reference standards, extraction time (16 hrs) poor reproducibility, and the error of central tendency.

H. References:

1. These methods have been published with American Society for Testing and Materials (ASTM).

   E1083-88
   E1395-90
   E1396-90

2. J. Food Sci. 49 (4): 1028-1033 (1984).

NOTE: This graph has been provided for information purposes only.

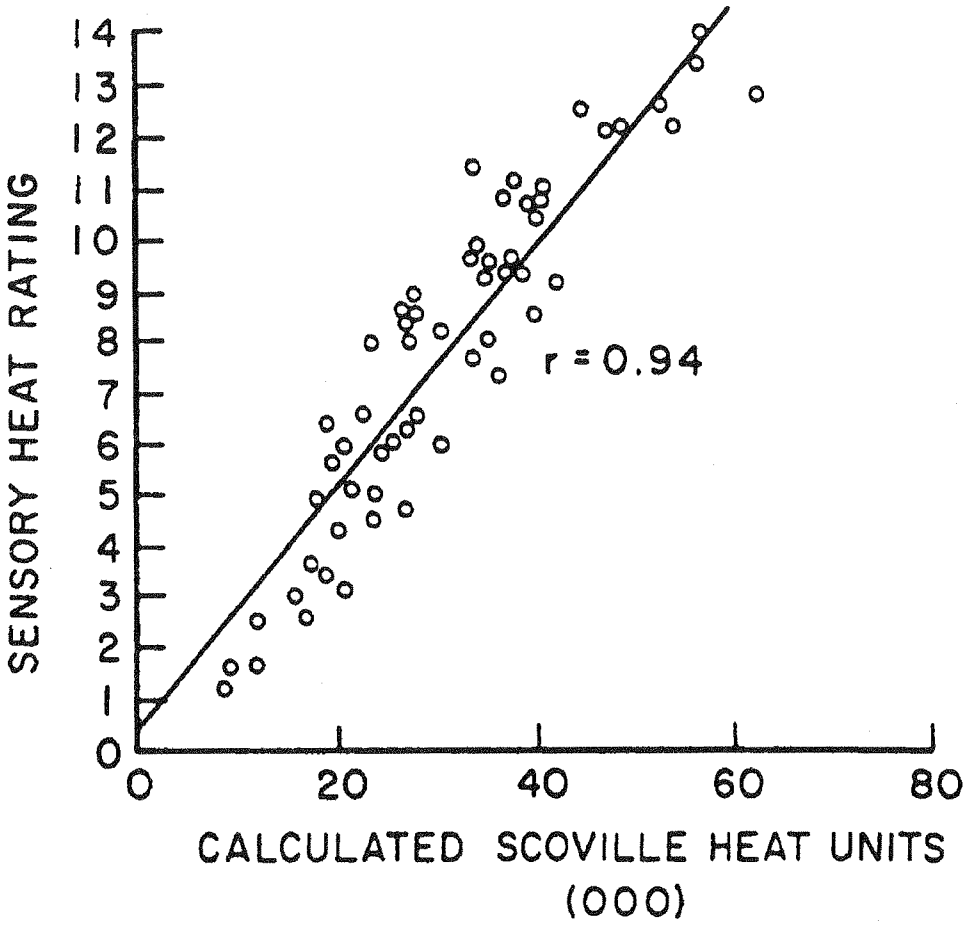

FIG. 1 Linear Relationship Between HPLC-Determined Scoville Heat Units and Sensory Heat Ratings