

Color Measurement of Potato Skin

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Background

The method was developed in-house, based on the information that was learned by M. Hansen at the HunterLab Seminar in Reston, Virginia, 2003

Scope

Range:

Lightness: 0-100

Chroma: 0-80

Hue: 0-360° angle

Accuracy: Determine with HunterLab Green Tile

	Actual	Average \pm standard deviation (n=38)
Lightness	50.93	50.87 \pm 0.05
Chroma	29.70	29.71 \pm 0.11
Hue	153.37	153.32 \pm 0.07

Duplicate Precision: Relative standard deviation of duplicate Green Tile readings made on the same day, N =38

Lightness: Average relative standard deviation = 0.04% (std deviation = 0.03)

Chroma: Average relative standard deviation = 0.13% (std deviation = 0.13)

Hue: Average relative standard deviation = 0.02% (std deviation = 0.02)

Day-to-day Precision: Relative standard deviation of Green Tile readings over 38 separate days.

Lightness: 0.9%

Chroma: 0.38%

Hue: 0.05%

Purpose

The original project requiring this method was concerned with the physiological changes in tubers during long-term storage. Pigment composition of tubers degrades

during storage. Moisture loss, texture, firmness, disease, and other factors also affect quality and consumer acceptance of stored tubers.

This method monitors the skin color of potato tubers by generating a color profile of the tuber surface. Color measurement is a critical objective quality parameter that can be used for many applications such as the analyses of physiological changes, quality changes as a result of storage conditions over period of time, the maturity of potato variety, tuber size, disease and other factors.

Procedure

A. Equipment

HunterLab ColorQuest 45°/0

B. Sample Analysis

1. Allow an hour or two for the potatoes to adjust to room temperature.
2. Randomly choose 20 small tubers for each sample.
3. Peel the outer surface of the tubers at approximately 1mm thickness.
4. Place peels in the sample dish with the skin facing downward.
5. Arrange peels so that no light can pass through the sample dish. This may require filling the sample dish $\frac{3}{4}$ full.
6. Center the sample dish over the reflectance port.
7. Place the white tile on top of the sample dish and read the sample by pressing the Read Sample on the Toolbar.
8. Fill in the sample identification table and click on OK.
9. Empty sample dish onto paper towel and mix peels thoroughly.
10. Clean sample dish in between samples.
11. Repeat steps 4-8 two more times, for a total of three measurements.
12. Proceed to the next sample.
13. After all the samples have been analyzed, save the L, a, and b values in Excel spreadsheet.
 - a. Highlight the data.
 - b. From the Edit menu, copy and paste to an Excel spreadsheet.
14. From the Master Color Data active view, convert CIELab color scale to CIELCh.
 - a. Double click on Active View and configure the display data.
 - i. Color Scale: CIELCh
 - ii. Illuminant : D65
 - iii. Observer : 10°
 - iv. Click on OK.
 - b. Highlight C and h° data.
 - c. From the Edit menu, copy, paste, and save to the same Excel spreadsheet in B.13b.

C. Instruments Parameters

1. Turn on the power by plugging the power supply box into a wall receptacle.
Allow the lamp to warm up for about an hour.
2. Turn on the computer and monitor.
3. Enter any password to log on the computer.
4. Double click on HunterLab Universal Software icon.
 - a. Choose Master Color Data as the display to configure.
 - b. Configure the software to read the specified color scale, illuminant, and an observer.
 - i. Color Scale: CIELab
 - ii. Illuminant: D65
 - iii. Observer: 10°
 - c. Click on OK.

**** NOTE:** To ensure colorimetric integrity, never touch the surface of the tiles during calibration or operation. Use a small amount of isopropanol solution on Kimwipes tissue to clean the tiles when become soiled. Place the tiles in the box provided at the end of operation.

D. Sample Calculations

This method measures the skin color of a tuber surface under proper illumination and viewing conditions. The CIE system of lightness, chroma, and hue is used for the description of the color. Chroma and hue angle equations are derived from CIE L, a, and b values, so therefore:

1. $C \text{ (chroma)} = (a^2 + b^2)^{1/2}$
2. $h^\circ \text{ (hue angle)} = \arctan b/a$

The C and h° values are calculated by the ColorQuest software in B15. Take the average values of the readings (L,C and h) for each sample.

E. Calibration

Perform calibration at the beginning of each day.

1. Double click on the CAL/Standardize button on the toolbar and follow the prompts for the standardization sequence.
2. Place the black tile in the reflectance port and click OK.
3. Place the white standard tile in the reflectance port and click OK.
4. The computer will inform you when the instrument is fully standardized.

F. Quality Control

1. Use the Green Tile as a reference sample. The first sample read and the last sample read each day should be the Green Tile.
 - a. Double click on Active View and configure the data display.
 - i. Color scale: XYZ
 - ii. Illuminant: D65
 - iii. Observer: 10°
 - iv. Click on OK.
 - b. Place the Green Tile on the port
 - c. Press Read Sample button on the toolbar. Leave the Green Tile on the port when asked for the white tile. Click on OK.
 - d. Leave the Green Tile on the port when asked for the black tile. Click on OK.
 - e. Fill in the identification table and click on OK.
 - f. Record the X, Y, Z values in the instrument log book.
2. Accuracy Check must meet the FSTC specifications:
 - a. $X = 13.60 \pm 0.06$
 - b. $Y = 19.16 \pm 0.08$
 - c. $Z = 14.23 \pm 0.06$
3. Reproducibility Check: Calculate the difference between the two measurements taken at the beginning and end of the day. For each parameter (X, Y, Z), the difference between the two measurements must not exceed 0.05.

G. Sample Disposal

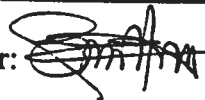
After analyses are finished, the tubers can be stored in the walk-in cooler in Room 165 for two weeks.

H. Data Reporting

Report the average of L,C and h° raw sample data and QC data in a spreadsheet.

APPROVAL

Writer:



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Manager:



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