



Enhancing Potato Chip Manufacturing with Spectrophotometric Color Measurement

Introduction

Potato chips are among the most popular snack foods worldwide, prized for their crisp texture, golden-brown appearance, and consistent quality. For consumers, appearance is the first indicator of freshness, flavor, and proper cooking. Even small deviations—whether chips appear too light, too dark, or uneven in color—can negatively affect perceptions of taste and quality.

Spectrophotometric color measurement offers an objective, repeatable way to monitor chip appearance throughout production. The **HunterLab Aeros spectrophotometer** provides the most effective method for this application, with best practice being to **crush chips before measurement** to account for translucency, surface irregularities, and seasoning variability. This paper explores the role of color in potato chips, the challenges of visual inspection, and how Aeros ensures consistency and brand trust.

Importance of Color in Potato Chips

- **Cooking Indicator** - Golden-yellow hues suggest proper frying; too light indicates undercooking, while too dark suggests overcooking or burnt oil.
- **Consumer Expectation** - Uniform chip color across a bag signals freshness and consistent processing.
- **Ingredient & Oil Quality** - Darker chips can indicate high sugar potatoes or degraded frying oil.
- **Seasoning Uniformity** - Even application of spices and flavors maintains brand identity and consumer satisfaction.



Challenges in Potato Chip Color Consistency

- **Surface Irregularities** - Chips vary in thickness and translucency, scattering light unpredictably.
- **Heterogeneous Samples** - Seasonings, browning, and bubbles make single-chip measurement unrepresentative.
- **Oil and Sugar Content Variability** - Natural potato variability can shift frying color outcomes.
- **Translucency of Whole Chips** - Intact potato chips allow light to pass through their thin structure, creating uneven reflectance and making color appear lighter or patchy. This translucency effect makes single-chip measurements unrepresentative, which is why **crushing chips before measurement** provides a more accurate, averaged result.
- **Human Subjectivity** - Visual inspection is prone to error, especially under inconsistent lighting.

Why Instrumental Color Measurement is Essential

Spectrophotometry provides objective **CIELAB values (L*, a*, b*)** that quantify chip color:

- **L*** - Measures lightness (critical for detecting undercooked or overcooked chips).
- **a*** - Measures red-green balance; higher a* indicates excessive browning.
- **b*** - Measures yellow-blue balance; high b* values correspond to the ideal golden-yellow hue.

By crushing chips and measuring them with Aeros:

- Results reflect the average color of multiple chips in a batch.



- Measurement accounts for translucency and surface variation.
- Standards can be created to maintain consistent golden profiles across production runs.

Recommended Solution – HunterLab Aeros

The **HunterLab Aeros** is purpose-built for heterogeneous snack foods like potato chips:

- **Best Practice: Crushed Sample Measurement** – Chips are lightly crushed and poured into the sample dish to ensure representative results.
- **Large Area Capture (27.5 in², 35 readings in 5 seconds)** – Captures broad, averaged data across the crushed sample.
- **Automatic Height Adjustment & Rotation** – Ensures repeatability regardless of pile depth.
- **Integrated Touchscreen & Software** – Provides instant pass/fail decisions and data storage.

Benefits for Potato Chip Manufacturers:

- Objective detection of undercooked or overcooked chips.
- Early identification of oil degradation or potato variability issues.
- Verification of seasoning uniformity in flavored chips.
- Reduced waste and consumer complaints, reinforcing brand consistency.

Hypothetical Case Studies Based on Real-World Examples

Case Study 1 – Detecting Under-Cooked Chips



Background

A major snack brand produces a lightly salted potato chip with a signature golden-yellow appearance.

Challenge

The **Aeros** measured higher-than-standard **L*** values in crushed chip samples, indicating a paler product. Visually, some chips appeared undercooked, with a starchy taste.

Corrective Action

- Fryer dwell time and temperature were adjusted to increase browning.
- Post-adjustment, **Aeros** confirmed chips returned to the target **L*** range.

Outcome

The issue was detected before packaging, preventing a large batch of undercooked chips from reaching consumers.

Key Takeaway

L* values provide a sensitive measure of undercooking, ensuring chips achieve their expected golden profile.

Case Study 2 - Identifying Over-Cooked Chips

Background

During production of the same chip variety, the **Aeros** detected lower-than-standard **L*** values (darker chips).

Challenge

Darkened chips suggested overcooking, potentially caused by excess fryer temperature or potato lots with higher sugar content.



Corrective Action

- Oil quality and fryer conditions were checked and recalibrated.
- Potato lots were re-screened for sugar content to reduce risk of future darkening.
- Aeros monitoring was integrated as an in-process checkpoint to catch color shifts earlier.

Outcome

Corrective action restored chips to their golden-yellow target. Consumer trust and product quality were maintained.

Key Takeaway

Continuous monitoring with Aeros allows rapid detection of overcooking and ingredient-related color deviations, reducing waste and brand risk.

Conclusion

Potato chips depend on consistent golden-brown appearance to communicate freshness, flavor, and quality. Small deviations in color can quickly erode consumer trust. Visual inspection is not reliable for heterogeneous, translucent snacks like chips, but **spectrophotometric measurement provides objective, repeatable results.**

By crushing samples and measuring them with the **HunterLab Aeros spectrophotometer**, manufacturers gain accurate, representative color data to detect undercooking, overcooking, or oil degradation. This strengthens brand identity, reduces waste, and ensures every bag of chips delivers the expected consumer experience.