



Enhancing Gelatin Dessert Manufacturing with Instrumental Color and Haze Measurement

Introduction

Color has always been a defining quality attribute of gelatin desserts. Consumers associate specific hues with flavor, freshness, and brand identity. A bright red, green, or purple gelatin dessert sets clear expectations long before the first bite.

Historically, **instrumental color measurement alone** was sufficient to control appearance. Synthetic dyes dissolved completely in gelatin systems, producing vibrant, crystal-clear products with minimal variability. Today, as manufacturers reformulate products using **natural colorants**, appearance control has become more complex. Color alone no longer tells the full story.

Modern gelatin dessert manufacturing requires **simultaneous control of color and clarity**. Products can meet color targets yet appear cloudy, dull, or dusty—visual defects that consumers interpret as spoilage or poor quality. This is why **haze measurement is now a critical companion to color measurement** in gelatin dessert production.

Why Appearance Control Matters

Appearance is the first quality attribute evaluated by consumers. Even subtle deviations can influence purchasing decisions and brand perception.

Instrumental measurement allows manufacturers to:

- Replace subjective visual inspection with objective data
- Maintain batch-to-batch consistency
- Detect formulation or process issues early
- Communicate clearly across R&D, production, and suppliers

By measuring both **color and haze**, manufacturers gain a complete, quantifiable picture of product appearance.



Understanding Color Measurement in Gelatin Desserts

Instrumental color measurement quantifies how a sample interacts with light and reports results using standardized color spaces such as CIELAB (L^* , a^* , b^*) and color difference values (ΔE).

Color measurement supports:

- **Formulation development** - achieving target hues reliably
- **Batch release decisions** - confirming production consistency
- **Supplier qualification** - verifying incoming colorants
- **Process monitoring** - detecting drift during mixing, heating, or cooling

However, color values alone do not describe **how light passes through the product**—which is where haze becomes critical.

What Is Haze and Why It Matters

In food applications, **haze** refers to **cloudiness or turbidity** caused by light scattering from suspended particles, aggregates, or microstructures within a product.

For gelatin desserts, which consumers expect to be **clear and jewel-like**, haze fundamentally changes perceived quality. Two samples may match perfectly in color values yet look dramatically different due to differences in clarity.

Haze measurement quantifies:

- Light scattering within the product
- Loss of transparency
- Cloudiness that may not be captured by color metrics

Why Natural Colorants Introduce Haze Challenges

1. Solubility and Particle Size

Synthetic dyes are small, fully water-soluble molecules that dissolve completely, allowing light to pass through with minimal scattering.

Many natural colorants are **plant-derived extracts** that are not truly water-soluble. Pigments such as turmeric, paprika, annatto, and carotenoid-based colors often



require **emulsification or encapsulation**. These processes introduce **microscopic particles** that scatter light and increase haze.

2. Protein–Polyphenol Interactions

Gelatin is a protein-based system. Many natural colorants—especially fruit- and vegetable-derived sources—contain **polyphenols**.

When proteins and polyphenols interact, they can form **colloidal aggregates**. These aggregates scatter light and create visible cloudiness throughout the gel. This effect is similar to haze formation seen in juices or unfiltered beverages.

3. pH Sensitivity and Precipitation

Gelatin desserts are typically acidic to deliver a bright flavor profile. Some natural colorants that appear clear at neutral pH can **precipitate or become turbid** under acidic conditions, leading to haze, sedimentation, or visible specks.

Why Color Measurement Alone Is No Longer Enough

With modern formulations:

- A product can meet **CIELAB color tolerances**
- Yet still fail visually due to haze

Color measurement confirms *what color* the product is.

Haze measurement confirms *how that color is seen*.

Measuring both ensures:

- True visual correlation
- Early detection of formulation or processing issues
- Reduced consumer complaints and rejected batches

Supporting Reformulation and New Color Development

As manufacturers transition away from synthetic dyes, some legacy bright or “neon” colors cannot be reproduced cleanly using natural sources without introducing haze.

In these cases, manufacturers may:

- Optimize formulations to minimize haze
- Adjust processing conditions



- Or intentionally **redefine product appearance** to a more opaque or muted natural shade

Instrumental color and haze data allow these decisions to be **intentional, controlled, and repeatable**, rather than reactive.

Where Color and Haze Measurement Are Applied

R&D and Formulation

- Compare color strength and clarity of candidate color systems
- Evaluate impact of pH, concentration, and stabilizers
- Optimize recipes before scale-up

Color has always been a defining quality attribute of gelatin desserts. Consumers associate bright, consistent hues with flavor, freshness, and brand identity. Historically, synthetic dyes dissolved completely in gelatin systems, producing vibrant, crystal-clear products where instrumental color measurement alone was sufficient.

As manufacturers transition to natural colorants, appearance control has become more complex. Products may still meet color targets but appear hazy, dull, or cloudy—visual cues consumers often associate with spoilage or poor quality. This shift makes clarity just as important as color, and requires instrumentation capable of measuring both reliably.

Because gelatin desserts are clear to translucent, transmission-based measurement is preferred—making Vista particularly well suited for these applications.

Why Appearance Control Matters

Appearance is the first quality attribute evaluated by consumers. Even subtle changes in clarity or brightness can impact purchase decisions and brand trust.

Instrumental measurement allows manufacturers to:

- Replace subjective visual inspection with objective data
- Maintain batch-to-batch consistency
- Detect formulation or processing issues early
- Communicate clearly across R&D, production, and suppliers



By measuring color and haze together, manufacturers gain a complete, quantitative understanding of product appearance.

Understanding Color Measurement in Gelatin Desserts

Instrumental color measurement in transmission quantifies how light passes through a gelatin product and reports results using standardized color spaces such as CIELAB (L^* , a^* , b^*) and color difference values (ΔE).

Transmission color measurement supports:

- Formulation development - achieving target hues reliably
- Batch release decisions - confirming production consistency
- Supplier qualification - verifying incoming colorants
- Process monitoring - detecting drift during mixing, heating, or cooling

Vista is designed specifically for transparent and translucent products, providing stable, repeatable transmission color data that aligns well with visual perception.

What Is Haze and Why It Matters

Haze describes cloudiness caused by light scattering from suspended particles or microstructures within a product. In gelatin desserts—where clarity is expected—haze fundamentally changes perceived quality.

Two samples may match in color values yet look dramatically different due to haze. Measuring haze alongside color ensures that appearance decisions reflect what consumers actually see.

Vista measures haze directly in transmission, making it especially effective for detecting subtle clarity changes that color metrics alone cannot capture.

Why Natural Colorants Introduce Haze Challenges

1. Solubility and Particle Size

Natural colorants are often plant-derived extracts that require emulsification or encapsulation. These processes introduce microscopic particles that scatter light and increase haze.

2. Protein-Polyphenol Interactions



Gelatin is protein-based. Many natural colorants contain polyphenols that can bind with proteins to form colloidal aggregates—creating visible cloudiness.

3. pH Sensitivity

Gelatin desserts are acidic. Some natural colorants become unstable, precipitate, or turn turbid at low pH, increasing haze even when color remains in tolerance.

Why Color Measurement Alone Is No Longer Enough

With modern formulations:

- A product can meet CIELAB color tolerances
- Yet fail visually due to haze
- Color measurement defines *what color the product is*.
- Haze measurement defines *how that color is seen*.

Vista enables both measurements in a single workflow, ensuring accurate visual correlation.

Supporting Reformulation and New Color Development

As manufacturers move away from synthetic dyes, some legacy bright colors cannot be reproduced cleanly without haze. Instrumental color and haze data help teams:

- Optimize formulations
- Adjust processing conditions
- Or intentionally redefine appearance to align with natural expectations

Vista provides the objective data needed to make these decisions confidently and consistently.

Color + Haze Measurement Workflow Using Vista

1. Ingredient & Formulation Development

- Measure CIELAB color of candidate color systems
- Measure haze to assess clarity impact
- Optimize formulation for hue and transparency

2. Pilot & Scale-Up Validation



- Track changes in color and haze with concentration, pH, and processing
- Identify haze onset before full-scale production

3. Production Quality Control

- Compare each batch to stored color + haze standards
- Detect early signs of formulation or process drift

4. Release & Shelf-Life Monitoring

- Verify finished product meets both color and clarity specifications
- Monitor haze development over time

5. Supplier & Ingredient Qualification

- Validate incoming natural colorants for both color strength and haze contribution
- Maintain consistency across suppliers and lots
- Vista's transmission-based design makes it especially effective across all these stages.

Vista Measurement Setup for Gelatin Desserts (Color + Haze)

Because gelatin desserts are clear to translucent, appearance is best evaluated using transmission measurement rather than reflectance. Transmission measurement evaluates how light passes *through* the gelatin, closely matching how consumers visually assess clarity and color. Vista is specifically designed for this application, enabling simultaneous color and haze measurement in a single, repeatable workflow.

Recommended Measurement Mode

- Measurement Type: Transmission
- Metrics:
 - Color: CIELAB (L*, a*, b*), ΔE
 - Clarity: Haze (%)
 - Illuminant / Observer: D65 / 10° (typical for food and beverage applications)



Sample Preparation Guidelines

To ensure repeatable and meaningful results:

- Prepare samples at consistent thickness using molds or sample cells
- Ensure samples are bubble-free and fully set before measurement
- Allow samples to equilibrate to room temperature
- Avoid surface condensation or moisture on sample holders

Consistency in sample preparation is critical, as thickness and trapped air can influence both color and haze readings.

Cell and Holder Selection

- Use clear, optically consistent sample cells designed for transmission
- Maintain consistent path length across measurements
- Clean cells thoroughly between samples to avoid residue that can introduce artificial haze

Vista's transmission optics are optimized to minimize stray light and improve sensitivity to subtle haze changes.

Establishing Color and Haze Standards

For effective quality control:

- Measure and store a golden sample that meets both color and clarity expectations
- Define acceptable tolerances for:
 - CIELAB (L^* , a^* , b^*)
 - ΔE (color difference)
 - Haze (%)
- Use these combined standards for batch approval, not color alone

This approach ensures that products passing QC match both hue and transparency expectations.

Routine Quality Control Workflow



Vista supports rapid, repeatable checks during production:

1. Measure finished batch for color and haze
2. Compare results to stored standards
3. Flag deviations early for corrective action
4. Trend data over time to identify process drift

By capturing both attributes at once, Vista reduces ambiguity in pass/fail decisions.

Shelf-Life and Stability Monitoring

Vista is well suited for tracking appearance changes over time:

- Monitor haze development due to aggregation or precipitation
- Detect slow clarity loss not visible immediately after production
- Correlate appearance changes with formulation, pH, or storage conditions

This is especially valuable when evaluating natural color systems with long-term stability concerns.

Example Color and Haze Tolerance Ranges for Gelatin Desserts

(Actual tolerances should be determined through product testing, visual correlation, and consumer acceptance studies.)

Color Tolerances (Transmission Measurement)

- $\Delta E^* \leq 1.0$ (typical target for visually critical, brand-defining flavors)
- $\Delta E^* \leq 1.5$ (common production tolerance where minor variation is acceptable)
- $\Delta E^* \leq 2.0$ (upper limit where differences may begin to be noticeable, depending on color and clarity)

Note: In clear products, color differences can appear more noticeable than in opaque foods, especially when haze is low.

Haze Tolerances (Transmission Measurement)

- Haze $\leq 1.0\%$ (Crystal-clear appearance; typical for premium or legacy clear gelatin products)



- Haze $\leq 2.0\%$ (Slight softening of clarity; generally acceptable for products with natural colorants)
- Haze $\leq 3.0\%$ (Noticeable cloudiness; may be acceptable only if aligned with intentional product appearance)
- Haze $> 3.0\%$ (High risk of consumer perception issues (cloudy, dusty, or spoiled appearance))

Combined Color + Haze Acceptance Example

A batch may be considered acceptable when both conditions are met:

- $\Delta E^* \leq 1.5$
- Haze $\leq 2.0\%$

This prevents situations where a product passes color but fails visually due to excessive haze.

R&D vs Production Guidance

- R&D / Reformulation: Use tighter limits to understand formulation sensitivity and optimize clarity
- Production / QC: Apply validated tolerances based on visual panels and consumer expectations

Key Reminders

- Color defines the hue. Haze defines the clarity. Consumers judge both simultaneously.
- Effective tolerance setting links numbers to what people see.

By establishing color and haze tolerances together—and validating them visually—manufacturers ensure data-driven decisions that protect clarity, color, and consumer trust.

Conclusion

For gelatin desserts, transmission-based color and haze measurement is essential. Vista provides a practical, objective way to quantify both attributes—supporting formulation, quality control, and long-term appearance stability in products where clarity is just as important as color.



As gelatin dessert formulations evolve, appearance control must evolve with them. Color alone is no longer sufficient. Consumers judge quality based on both hue and clarity, particularly in products expected to be bright and transparent.

By combining transmission color measurement and haze measurement, Vista provides a complete, objective view of appearance—helping manufacturers manage reformulation risk, reduce waste, and deliver consistent products that meet consumer expectations.