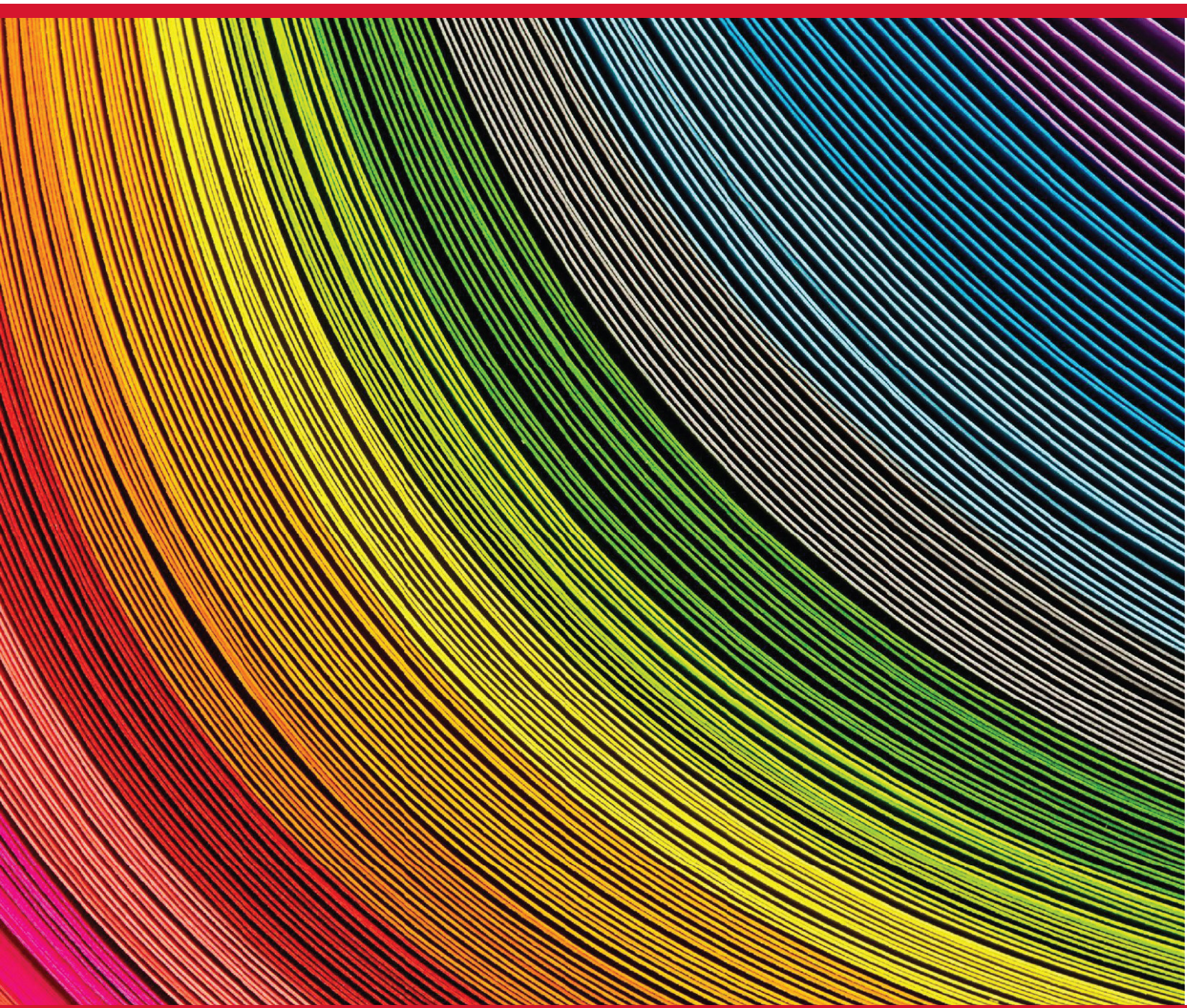




Getting Color Right in Recycled Plastics

A practical guide for quality and production managers navigating the shift to recycled material streams.

A Shifting Mandate

Recycled plastic content is no longer optional. Across Europe and North America, legislation is accelerating. The EU's Packaging and Packaging Waste Regulation is pushing mandatory recycled content thresholds for plastic packaging. Single-use plastics directives are reshaping material choices across entire product categories. In the US, extended producer responsibility laws are gaining momentum state by state. And beyond regulation, major brands have made their own commitments. Procter & Gamble and Unilever are targeting 25% recycled content, L'Oréal at 50%, and Adidas pushing toward 100%. These commitments cascade through their entire supply chains.

For quality and production managers navigating this transition, the challenge that surfaces fastest is rarely the one they anticipated. Mechanical performance, compliance documentation, and supply chain logistics all demand attention, but the problem that shows up on the production floor first, and most persistently, is color.

Why Color Becomes a Problem

Getting consistent color from recycled material is fundamentally different from working with virgin resin, and the gap is wider than most manufacturers expect until they experience it firsthand.

The core issue is feedstock variability. Recycled material does not arrive as a neutral, predictable starting point. It carries a color history accumulated from its previous life, including residual pigments, UV exposure, heat, and repeated processing cycles, that shifts from lot to lot. When feedstock comes from separately collected, well-sorted sources like clear PET bottles, the variation is relatively manageable. But when it comes from mixed post-consumer waste, you have almost every color imaginable combined together. Since sorting by color adds time and cost to an already tight margin, most recycled streams end up as a mixed, muted base. Practitioners in the field describe this as "50 shades of grey."

The consequence for color management is significant. In a color matching exercise conducted across nearly 2,000 shades from the NCS color catalog, a transparent virgin material could match approximately 1,857 colors, around 95% of the full gamut. The same exercise using a mid-grey opaque post-consumer recycled material could match only 759. That is more than half the available color space eliminated simply by changing the substrate.

This is not a reason to stop using recycled content. It is a reason to approach color management differently, with the right tools, the right process, and realistic expectations set at every level of the supply chain.

Where It Hits the Business

Color problems in recycled plastics do not stay in the lab. They cascade through production in ways that are often underestimated until they show up in the numbers.

Color recipes developed for virgin materials cannot simply be transferred to recycled substrates. The optical properties of the base material are different, which means formulas need to be redeveloped from scratch. And because recycled feedstock can shift lot to lot, those formulas may need adjustment again with the next delivery. Every adjustment cycle means more sampling, more lab time, more material consumed, and longer timelines before production can run.

Brand color approvals become considerably more complex. A color that passes against one incoming lot may not pass against the next, pushing teams through repeated approval cycles and delaying schedules. Scrap and rework rates increase. And for lighter shades, pastels, and precise brand colors, development cycles can stretch significantly, sometimes with no guaranteed outcome depending on what the feedstock contains.



There is also a subtler source of measurement error that compounds these challenges: Thermochromism.

When a sample is measured fresh off the production line while still holding heat, the color reading can differ meaningfully from the same part measured after cooling. Color molecules change their structure with temperature shifts. It is a reversible effect, but one that leads teams to make unnecessary adjustments based on inaccurate data, adding cost and time to an already demanding process.

The manufacturers who manage this best are the ones who stop trying to apply virgin-material standards and processes to recycled-content production, and instead build their color programs around what recycled substrates actually require.

What the Best Operations Do Differently

Across the plastics industry, the operations that consistently achieve color accuracy with recycled content share a common set of practices, regardless of whether they are masterbatchers, compounders, or converters.

The foundation is incoming material control. As one supply chain manager with over 25 years in the plastics industry put it during a recent industry discussion: companies that underestimate how much feedstock variability impacts downstream processing tend to assume recycled resin is a direct drop-in replacement, and that assumption is where things go wrong. The most effective operations develop formal color specifications for recycled feedstock, define acceptable LAB values and physical testing criteria, and require suppliers to meet them contractually with certificates of analysis on every lot. Compliance is verified through objective spectrophotometric measurement at receiving, not visual assessment, so that out-of-range material is identified before it reaches the line.

The next layer is smarter formulation. With recycled substrates, the base resin is never optically neutral. Its color contribution must be characterized and factored into every recipe. Operations that do this systematically, working with their compounders to understand each incoming material's optical properties and build formulation strategies around them, achieve meaningfully better first-time match rates and fewer correction cycles. In documented case studies using post-consumer recycled substrates, this approach delivered a Delta E of 0.54 on a green shampoo cap after just one correction, down from a first-shot Delta E of nearly 2.0, and a close blue match from a dark grey PCR substrate in a single correction step.

Finally, systematic quality monitoring turns reactive firefighting into a proactive process. Defining color standards appropriate for recycled content, setting tolerances that reflect the reality of the substrate rather than virgin-material expectations, and tracking batch performance over time gives production teams the visibility to catch deviations early, before they become rejections.



Enabling Each Stage of the Process

Getting color right in recycled plastics requires precision at every stage, from the moment incoming material arrives to the final approval that releases a batch for shipment. The right measurement and software tools do not replace the practices described above; they make those practices consistent, scalable, and less dependent on individual judgment.

Spectro 1000 and Spectro 700 – Benchtop Spectrophotometers for Precision Measurement

Objective, repeatable color measurement is the starting point for everything else. The [Spectro 1000](#) delivers the highest precision in Datacolor's fleet of benchtop spectrophotometers, designed for high efficiency and confidence in both color formulation and quality control. The [Spectro 700](#) offers the same commitment to accuracy for operations requiring a versatile high-performance benchtop instrument.

Both instruments include sample temperature measurement capability, a feature that becomes particularly important in recycled plastics production, where thermochromism can introduce meaningful measurement error if samples are evaluated directly off the line.

By monitoring and accounting for sample temperature, teams avoid making formula adjustments based on readings that do not reflect the material's true color, eliminating a common and often invisible source of rework.



Spectro P300 – Portable Spectrophotometer for Production Floor Quality Control

For quality checks beyond the lab, at receiving, on the production floor, or across multiple locations, the [Spectro P300](#) is engineered for portable advanced color precision in critical quality evaluations.

It brings objective, instrument-based color measurement to wherever decisions need to be made, reducing reliance on visual judgment and creating a consistent, documented record of color performance across the operation.



Colibri ColorMatch — Formulation Software Built for Variable Substrates

[Colibri ColorMatch](#) uses advanced multilux technology in its color and opacity matching algorithm, resulting in higher first-time match rates, fewer correction steps, and optimized pigment load. For recycled plastics specifically, the software characterizes the optical properties of the recycled base resin and incorporates that data directly into the formulation calculation, rather than treating the substrate as neutral.

A virtual mix feature allows formulators to model blends of virgin and recycled material digitally, determining the optimal ratio without physically producing samples for every possible combination, saving significant time and material. A dedicated recolor function handles variable PCR streams where feedstock consistency cannot be guaranteed batch to batch. And the software's correction algorithm is specifically designed to compensate for lot-to-lot differences in incoming material, making it possible to recover an existing formula efficiently when the feedstock shifts rather than starting the development process over.

[Colibri ColorMatch](#) communicates seamlessly with [Colibri ColorQuality](#), offering one connected platform to manage color from formulation through to production approval.

Colibri ColorQuality — Quality Control Across Batches and Facilities

Once colors are formulated and approved, maintaining consistency across production runs and locations is the ongoing challenge. [Colibri ColorQuality](#) enables manufacturers to define color standards, set tolerances, monitor batch performance, and communicate color data across the supply chain systematically and objectively, replacing the reactive decision-making that characterizes operations without a structured quality process.

For operations working with recycled content, where batch-to-batch variation is an inherent reality, this kind of continuous monitoring builds confidence at every level: with suppliers who need clear specifications, with brand customers who need reliable approvals, and with internal teams who need to know when to act and when a result is within acceptable range.

The Knowledge Factor

Technology is only as effective as the people using it. One of the most underappreciated challenges in recycled plastics color management is the knowledge gap within production teams.

Color expertise is rarely formally taught. Most practitioners learn through experience, often guided by a veteran colorist over many years. As that generation retires, companies risk losing institutional knowledge that is difficult to replace quickly, and in the meantime they may own color management software that nobody fully knows how to use.

Datacolor's free [Color Science Essentials](#) video series offers a practical, accessible foundation in color science and measurement for anyone on your team who works with color.

For teams that want to go further, Datacolor offers [eLearning courses](#) and on-site training tailored to specific industries and workflows, giving teams enough understanding to use digital tools confidently, question results intelligently, and make better decisions faster. In a recycled content environment, where every unnecessary iteration has a measurable cost, that foundation makes a direct difference.



Younger team members are often keen to adopt digital tools, but without the foundational understanding to interpret results critically, the tools underperform.

The strongest operations are those where experienced practitioners and digitally literate newer team members work together, each bringing something the other lacks.

Looking Forward

The regulatory pressure driving recycled content adoption is not going to ease. If anything, the next five to ten years will see mandates tighten and enforcement strengthen across major markets. For quality and production managers, that means color management for recycled plastics is not a temporary challenge to work around. It is a core competency to build now, before the pressure intensifies further.

The trajectory of the industry is encouraging. Sorting technology is improving rapidly, with AI-assisted optical systems enabling finer separation of polymer types and colors at the recovery stage. Chemical recycling is scaling, promising feedstocks that are far more consistent and color-neutral than physical recycling can currently deliver.

And as more manufacturers invest in proper color measurement and formulation infrastructure, the supply chain as a whole becomes more capable of delivering the color quality that brands and consumers expect from recycled content.

The companies that build those capabilities today will be the ones best positioned to meet tomorrow's demands, with less rework, faster approvals, and stronger relationships across their supply chains.



Ready to assess where your color process stands?

Every recycled plastics operation is dealing with a different feedstock, different color targets, and different constraints. Our color experts work with manufacturers to identify exactly where measurement and formulation gaps are creating the most cost, and what it would take to close them.

If that conversation is useful to you, we are ready to have it.

Talk to a Datacolor [color expert](#) or explore our [Plastics Industry Guide](#)