Seven Steps to Superior Color Control in the Dyehouse: The Blending of Theory and Practice, Automation and Skill

By
Eric Alho, Product Manager Textile Software
Datacolor

The globalization of manufacturing operations has created a growing world market. It also has created problems in color management for textiles, particularly in the dyehouse. Textile production for a global market now applies to a dazzling array of natural and synthetic materials. These include filaments, yarns, and threads and the many woven, knitted, knotted, and embroidered fabrics made from them, as well as nonwoven fabrics produced by mechanically or chemically bonding fibers. Reproducing color accurately and cost-effectively in all of these instances is difficult. Yet color continues to be the first, best test of quality.

Fortunately, technology continues to be developed that helps control color - from the lab, into the dyehouse and on to the production floor - even throughout the entire supply chain. This article covers the seven steps you can take to ensure efficient, cost-effective color throughout all of the critical areas of textile production and were Datacolor Products serve as suitable tools to reach this goal.

One: Be a color-matching expert
Throughout the history of colored textiles, dyers have contended with significant differences between color theory and real world practices. The unique chemical process of each dye alone challenges designers and technicians in even the most modern dyehouse, making accuracy and repeatability difficult.

Today, expert-based color technology has captured the methodology of a master dyer. Datacolor's SmartmatchÒ technology takes theoretical color predictions and adjusts them based on the experience of each system's own knowledge base. In other words, only SmartmatchÒ based color matching systems have the ability to "learn" the actual behavior of dyestuffs, processes, and substrates in a unique way that the important information is gathered from all relevant recipes and is assessed and displayed in a user friendly and understandably way.

Just some of the features and benefits you can expect from this level of advanced color technology provided with Datacolor's DCIMatch software include:

Dyestuff combinations are build up automatic, based on defined properties. That allow users to quickly select groups of dyestuffs to use in a match as well as quickly and easily browse through individual dye selections.
Formula Corrections that deliver the functionality to adjust the dye formulation in process, to correct off-shade dyeings, and to match colors on a variety of substrates.
Evaluations at the touch of button, so operators can easily and quickly choose from among various sorted formulations, including reflectance curves, on-screen color displays, strength comparisons, and L,a,b, color plots.
Selection options that quickly examine virtually all possible formulations meeting the match criteria, from single formats to multiple format displays, such as spreadsheets, in a very flexible format (e.g., shown by weight or volume and sorted by lowest formula cost or total color difference).
Laboratory and Production Corrections that reduce the number of lab trials you need to run by performing automatic additions, automatic reformulations, manual corrections, and even on-line evaluations of corrections.
New Batch and Combinatorial Corrections that eliminate batches containing unknown materials by automatically determining the contents of a batch and providing the operator with a correction to the standard.

Two: control color through to production
For maximum efficiency and control, not every aspect of the dyeing process needs to be automated. Some functions, such as loading the dyepots prior to dispensing or transferring them to dye machines, may still be most cost-effectively performed manually. Yet dyehouse automation certainly needs to go beyond color matching in order to be effective.

Next to the importance to have the color matching and production management software integrated, like available with ITMProcess software, this integration is also important in the final production stage, or quality control. Therefore, your color matching system should be fully integrated with equally advanced color QC software. An adequate color quality control package is expected to resolve differences in color assessments between the supplier and the customer. It must facilitate the documentation of all matters relating to quality, including reports, statistics, and the evaluation and archiving of data. The software also must adapt itself to the individual steps in the production process and be quick and easy to operate.Specifically, you should look for a color quality control system designed to:

· Check incoming raw materials online against easily retrieved color standards
· Configure color control screens to internal or customer specifications
· Create printouts and pass/fail reports that are individually adapted to user or to supplier / customer requirements.
· Train operators in less than an hour with "single screen" operation for virtually all functions and activities
· Communicate color data quickly and directly anywhere in the world via a new integral e-mail function.

Three: fully integrate your color systems
In fact, with recent just-in-time demands, the textile industry needs to be assured of a seamless operation that reduces dye as well as chemical and labor costs for the lab and throughout the entire production process. As mentioned, this doesn't need to include automating every aspect of dye production, but certainly must include key areas. Whatever systems you put in place must work together. A good color matching system, for example, must work with related systems, from laboratory dispensing and textile production management to color quality control and color communication.

Effective color control and color management begins with accurate and repeatable color measurement and data analysis. There are a variety of computerized systems on the market, all engineered with the idea of improving communication, quality, productivity, and profitability. But if the system you choose doesn't allow integration with the complete range of color management conditions, then you can not be assured of an absolutely accurate manufacturing processes that produces less wasteful overall.

Four: target accurate color on any fabric
This is important because the coloration process starts with a target color that is defined and needs to be reproduced onto a certain fabric. Today, there are excellent advances in laboratory dyeing and finishing and washfastness testing. Datacolor's latest machines have been designed with three goals in mind:

· To duplicate the production dyeing process on a small scale in the laboratory.
· To dye small samples that are representative of the color and material which will be produced in production.
· To reduce the time and staff required for developing production formulas.

For all three goals, correlation is the key; the correlation between the formula developed in the lab and the formula used in production. To ensure correlation between the lab and production, Datacolor developed the Spectradye Plus, an infrared exhaust laboratory-dyeing machine with a fully automated dosing system. With the addition of the dosing carousal, time-consuming manual dosing has become a thing of the past in the textile industry. Auxiliaries can be automatically dosed into the dyeing beaker via peristaltic pump during the dying cycle. Pumps are available with multiple dose capacity: linear, progressive and degressive.

The newest designs even duplicate the "rock and dye" motion of the production process, which guarantees better correlation between your lab and production formulas. The most advanced units accommodate multiple concentrations of each auxiliary for the full range of shades, pale, medium and dark.

Five: eliminate errors in the lab
Rapidly changing fashion trends have changed life in the textile laboratory forever. The need to produce smaller lots in a wider range of colors and fabrics translates into a requirement for extra speed, throughput, and accuracy in today's

most successful lab environments. Some of the most tedious and time-consuming routines traditionally have been necessary to achieve desired results.

Today's demanding lab environment requires superior accuracy and overall improved reproducibility in order to support textile dyeing and finishing operations. The latest laboratory dispensing and solution maker products offer the versatility and performance necessary to handle a wide range of laboratory testing, reporting, and dispensing. This includes everything from the calculation of precise dye dilutions to comprehensive reporting facilities for guaranteed traceability.

Solution making is a critical process in the textile lab. If the starting dye-solutions are inaccurately and inconsistently prepared, then the final formulas will be incorrect and unrepeatable, as well. This is true however good the methods of generating the recipes are, or however accurate the dispensing methodology. Consider for a moment the number of problems associated with using traditional manual methods of preparing solutions:

· Errors can occur when manually calculating the amount of dyestuff, auxiliary and water required when making up solutions.
· Manually weighing out the precise amount of the required dye takes time and skill, and the risk of mistakes in a busy production environment is high.
· Manually dispensing auxiliaries and water accurately is very time consuming.
· Variations in the temperature of water used can affect the stability and accuracy of solutions for certain dyestuffs.
· Inaccuracies in the amount of auxiliary added in solutions can affect the stability and reliability of solutions for certain dyestuffs.

The latest range of AutoLab solution maker systems are designed to eliminate or significantly reduce all of these problems, increasing the speed and accuracy of solution preparation.

Similarly, perfect stock solutions require perfect dispensing. The most recent AutoLab laboratory dispensers totally eliminate such potential errors as unsuitable dye-strength, inaccurate additions of auxiliaries in the dye bath, and inconsistent liquor ratios. Also, these dispensers employ superior agitation and tube cleaning for consistent and accurate recipe dispensing.

The latest systems automate that portion of the process most affected by human error, freeing skilled technicians to concentrate on other, cost-effective areas. Consider the potential errors associated with traditional manual methods of dispensing that can be eliminated:

· Incorrectly calculating the amount of solution
· Incorrectly selecting the most suitable solution strength
· Pipetting the wrong dyestuff
· Pipetting the wrong amount of dyestuff
· Contamination from dirty pipettes
· Adding the incorrect amounts of water, resulting in inconsistent liquid ratios
· Inaccurate adding of auxiliaries in the dye bath
· Disorganization and mismanagement of recipes and their subsequent correction
· Long and laborious work of lab staff
· Large amount of manual paperwork, encouraging errors

Designed for fast operation, increased throughput, and high accuracy, current laboratory dispensers are available in a versatile product range. The very latest advancement in the dispensing suite the AutoLab 100Plus has the capability of dispensing three recipes at the same time, therefore substantially increasing throughput. Also, with the optional conveyor system available for the 100Plus, up to 100 recipes can be continually dispensed, one after the other, without the need for human intervention. With a faster speed of operation, but with the consistent accuracy and repeatability of other models, efficiency in the laboratory can be improved even further.

Six: do more, but make it easier
Fully automated shouldn't equate to "hard to use." Even the most complex technology - color matching, dyeing and dispensing to color quality control - should be seamlessly integrated into normal textile production routines for continuous improvement without any special effort from the operators. The entire system should be configurable to the various levels of experience among users, delivering into their hands point-and-click control over multiple color management and control operations.

The most advanced systems use a flexible, graphically "friendly" Windows® environment. This platform not only allows easy customization of screens and printouts, but also provides the ability to add important recipe information, like the auxiliaries needed for dyeing, to a recipe in the simplest way possible. Users of different computing and laboratory experience levels should be able to operate the systems - from multi-tasking capabilities for recipe, dispensing, and solution making - without deep background knowledge.

Seven: communicate color throughout the chain
Describing color has always been a subjective and expensive process for all parties involved in the production of textiles, particularly in the dyehouse. Datacolor's Colorite system is already well introduced to serve as a communication tool for colors, so that each one involved in the coloration process is talking the same language about the specified color target. There are also new advances in color technology available, which utilize the power of the Internet to control color with accuracy never before possible. In the process, these advances also yield many other benefits - shortened time to market, costs reductions that cascade throughout the supply chain, and an overall improvement in color quality.

This new web-based color control system utilizes Internet access, compatible PCs, color management software, carefully calibrated computer monitors, and a color-measuring instrument such as a spectrophotometer. All of the elements must be state-of-the-art to ensure the system functions at optimal levels for all color matching and quality control activities.

The software and the measuring instrument, for example, should work together to deliver the best possible objective data about the color in numerical elements that can be more easily communicated than subjective terms like "warmer, softer, lighter." This is true of any color management cycle. The key to providing superior color communication in an electronic medium, however, is precise on-screen color reproduction. This necessitates a high degree of monitor calibration and the right color control software designed specifically for this medium.

Once the on-screen color is created, the software then, in turn, automatically computes the right colorimetric data. This is the digital "signature" of that color - and includes the standard colorimetry parameters such as reflectance and L,a,b data. The system accepts measurements from a spectrophotometer in the form of colorimetric data, and instantly transforms that data into visual color on the screen for evaluation or adjustment.

The resulting digital sampling with ColoriteÒ brings an ability to create and visualize color electronically. It avoids the arduous and often costly traditional method of mailing colored samples back and forth between sites for approval. Digital sampling technology breaks new ground across all industries, but is particularly important in dyehouse applications where accurate color reproduction is critical to the delivery of a quality product.

In the fast-moving textile market, few dyehouses can afford to conduct "experiments." There are increasing demands on work carried out in the laboratory, in the dyehouse, and on the produciton line. Only systems that are proven for working together throughout these critical process can form a powerful cost-effective tool for the entire industry.

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