Tinting Systems

Customized Tinting System Design

Advanced Tinting Systems – An Integrated Concept

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Paint manufacturers are facing increasing demands on product quality and performance. At the same time, they are under intense pressure from ever-tightening VOC regulations and a highly competitive market environment. The implementation of a comprehensive, Integrated Tinting System can mitigate many of these challenges and deliver a sustained competitive advantage for coatings manufacturers.

Tinting system definition

A tinting system is an efficient and accurate method of producing a large variety of colors in customer-ready containers. Tinting systems help coatings manufacturers achieve color control, shorter lead times, reduced waste, lower stocks and a great choice of shades. These systems are based on standardized components including: colorants, dispensing and mixing equipment, control software and a color formula databases designed to match the selected color marketing tools. The result is customized color delivery that meets the exact shade specified by the client.

An advanced, Integrated Tinting System is more than the sum of its parts (colorants, equipment, and software). It is a comprehensive approach to tinting system design that is customized to meet the business objectives of the individual paint manufacturer. Design of such systems requires thorough analysis of the manufacturer's current business model and future objectives. It also demands intimate technical knowledge of all tinting system components to optimize and fine tune the performance of each element.

When implementing a new or updated tinting system it is important to involve decision makers from all aspects of the coatings manufacturer's business. Too frequently, tinting decisions are considered a technical / lab assignment when the outcome impacts all aspects of the business. It is important to get input from Sales and Marketing departments as they can provide the customer perspective and evaluate opportunities to enhance color marketing programs. Input from plant and store operations are also critical to ensure a smooth transition. Purchasing, Sales, Marketing, Operations, Finance and Technical management are all essential to the successful design and implementation of an Integrated Tinting System.

New rules, new colorants

In many regions globally, new restrictions on VOC emissions have forced colorant producers to modify historical formulations to become compliant with VOC guidelines such as the EU 2010 VOC legislation which is now coming into effect.

While these changes may be deemed good for the environment, they can have a negative impact on the coating's technical performance or application characteristics. A conversion to low or no VOC colorant technology is best managed in a comprehensive way, applying the principles of Integrated Tinting System design.

Liquid Colorants are comprised of concentrated pigments or pigment mixtures, in a wetted and dispersed formulation which commonly contains additives and other raw materials that help preserve quality and enhance compatibility with the base paint material. A Colorant Set is a collection of colorants, commonly 16 or more, that when dispensed into the base paint material, combine to create the final tinted product.

With the new environmental guidelines, many additives previously used in colorants can no longer be used in future formulations. Fungicides and glycol, along with other substances, are examples of restricted raw materials that fall under the new VOC regulations. As a result, providing new colorant ranges with good storage stability, effective protection from surface drying and mold growth is becoming increasingly difficult.

The adverse effects caused by the absence of conventional colorant additives are becoming particularly noticeable when colorants remain in dispensers for prolonged periods of time. This issue can only be remedied with an optimally matched tinting system designed to serve the unique needs of the individual customer.

Declining throughput

Since their introduction in the 1970's, Point-of-Sale tinting programs have become a coatings industry standard and an essential tool to maintain market competitiveness in many parts of the world. Market penetration of on-demand tinting programs continues to expand as retailers and manufacturers seek to deliver customized color in environments ever closer to the end user. As retailers expand their number of outlets, and manufacturers decentralize tinting operations into smaller distribution centers or contractor shops, the number of dispensers in the market is rising. By contrast, the volume of colorants flowing through each individual dispenser is significantly lower (Fig. 1).

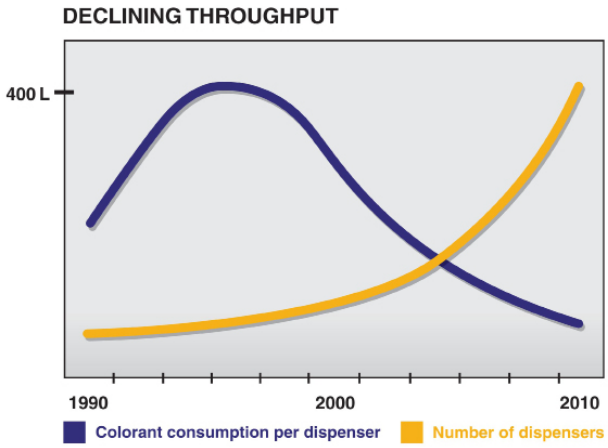

Fig.1: The number of dispensers in the market continues to increase as retailers seek to enhance their ability to deliver customized color on demand. As a result, the volume of colorant cycling through each machine is decreasing. Over time, this may adversely affect machine performance.

Simultaneously, companies are expanding their colorant set in the face of steadily growing demands for technical performance. Innovations in colorant technology have sparked a demand for more specialized colorant types that can help coatings manufacturers meet their customers' expectations for quality. For example, there is a notable increase in the demand for specialized high-performance pigments that are more resistant to environmental influences (e.g. PY184, PR168, PY110 or PR254). The combined effect of these two trends is a reduction in the overall consumption of each individual colorant.

As a result, colorants often linger in the dispenser longer than desired, which can cause a variety of issues including thickening of certain colorant types, mold growth, drying at the nozzle head or areas of exposure within the canister and general degradation of the product due to age. An Integrated Tinting System takes throughput of each colorant into account during the design phase. Several tactics may be implemented to increase consumption volumes of slow moving colorants. These include, but are not limited to, selecting the ideal canister size for each colorant, defining the best colorant set to achieve the client's business objectives and optimization of color formula recipes.

Product and color variety

In an effort to rise above the competition, paint manufacturers have developed a wealth of coatings formulations and products to serve the diverse needs of their customers. A tinting system must adapt to the various challenges posed by a comprehensive product portfolio ranging from silicate and silicone based paints, to latex and alkyd products.
As coatings technologies become more complex, meeting the demands of increasing product and color variety can expose the limitations of existing tinting systems.

In the long run, the only overall tinting concept with promise of success is one that is customized to meet the unique needs and special conditions of each paint manufacturer.

Farewell to universal glycol containing colorants

In an effort to become more efficient, paint companies adopted universal colorant systems for tinting a broad variety of products from water-based latex architectural coatings to solvent-borne industrial products.

Water-based Universal Colorants which are glycol containing, could be used in the majority of products, however they will not meet future environmental guidelines nor do they achieve today‘s standards for compatibility especially when technical performance requirements are stringent.

Industrial customers demand different colorant ranges and options than painters and stores for DIY enthusiasts. A stucco manufacturer, for example, has a higher demand for colors that are resistant to degradation from exposure to sunlight and weather. In addition, they need colorants whose performance does not adversely affect the water-repellent properties (lotus effect) of the base paint.

Similarly users of alkyd paints have a high demand for both brilliant and deep colors that can require a large colorant load. Introducing too much water into an alkyd product can impair workability and application characteristics of the paint. This is a common problem caused by traditional universal colorant systems after the new Deco VOC 2010 regulation was introduced, which requires the VOC content to be less than 300 grams per liter. Problems like thickening of the paints, gloss reduction and extended drying time are caused by the latest binder technologies.

Traditional tinting systems commonly consist of 16 colorants. Nowadays, modern Integrated Tinting Systems which are designed to meet evolving VOC regulations and serve a broad range of coatings technologies will likely require at least 20 to 24 different colorants. Complete systems utilizing 32 colorants in varying technologies are already established in today’s market (e.g. Western Europe).

It is no longer possible for tinting systems to function as stand-alone solutions. They must evolve into complete tinting concepts customized to meet the varying and specialized demands of the individual paint manufacturer.

Dual system or universal colorant technology: a case study

A paint manufacturer was recently faced with deciding on a strategic path for the company’s future. As a supplier of professional users, the demand for product quality was high. Their comprehensive product portfolio ranged from silicate to silicone exterior paint, a range of interior acrylic paints, yet also included some important alkyd coatings. Stucco paints represent a large share of sales and are an important mainstay of the company. The goal was to keep alkyds in the product portfolio without compromising technical performance or application characteristics.

A competitive market analysis revealed the following scenario: the majority of paint manufacturers in the European market are using either two separate tinting systems (one for water-based decorative paints and one for solvent-based industrial coatings) or a single tinting system relying solely on universal colorant technology.

The Dual System option

Typically separate or "dual" systems consist of 32 colorants (i.e. 16 colorants used for each technology). The advantage of this method is the colorants' optimal adjustment to the end product performance. Water-based products are tinted only with water-based colorants, while only solvent-based colorants are added to solvent-based coatings such as alkyd paints. As a result, the technical characteristics of the coating are only minimally impacted by the tinting process.

While separate systems provide optimal compatibility in the base paint material, the system set-up is equally important and frequently ignored in this dual technology configuration. Often, certain colorants such as violet or blue LC are used in very small amounts (Fig. 2).

The annual consumption of some colorants amounts to less than 1 liter. In these instances, aqueous VOC-free as well as alkyd colorants tend to thicken or dry up, causing costly problems in the dispensers.

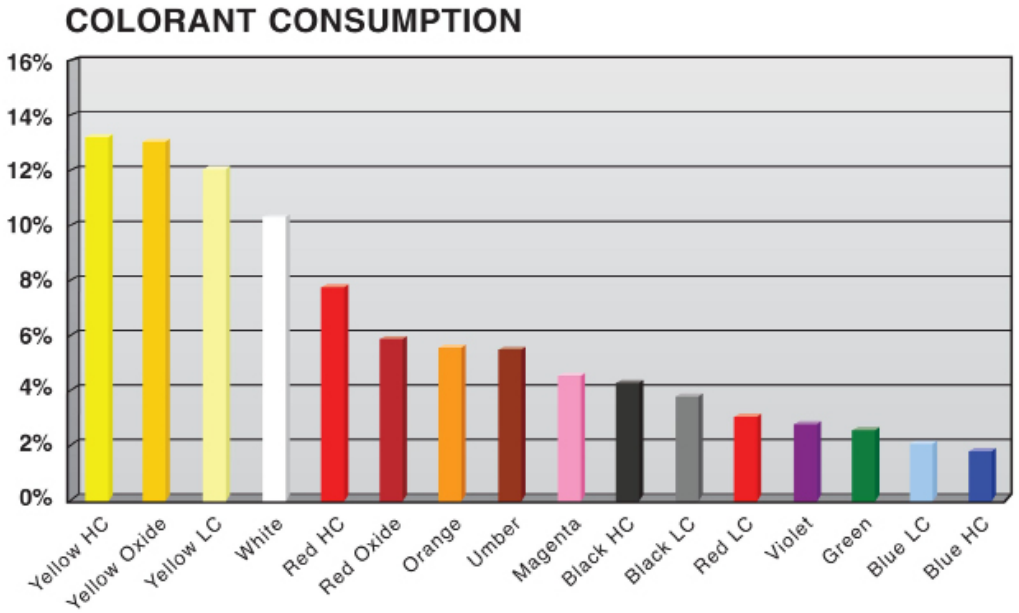

Fig. 2: The above shows the variable rates of consumption for different colorants in an average tinting system. Not all colorants are used in the same quantities. Colorants experiencing little use may degrade over time and become unusable.

Fig. 3 & 4: In order to achieve deep shades and optimal hiding, sometimes paint manufacturers must choose to add a maximum colorant load to the base paint. However, Alkyd coatings can handle only a certain amount of universal colorants because they introduce water to the formulation. Excess water can compromise the quality or application characteristics of alkyd products.

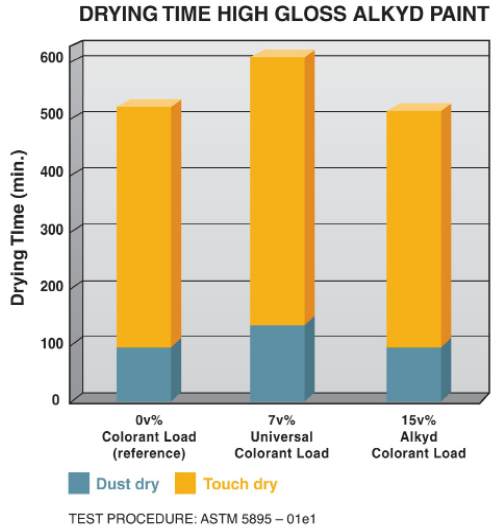

Fig. 3: In this example, 15% of the solvent-based colorant can be handled without a problem, while the addition of only 7% universal colorant will significantly reduce the gloss level of the coating.

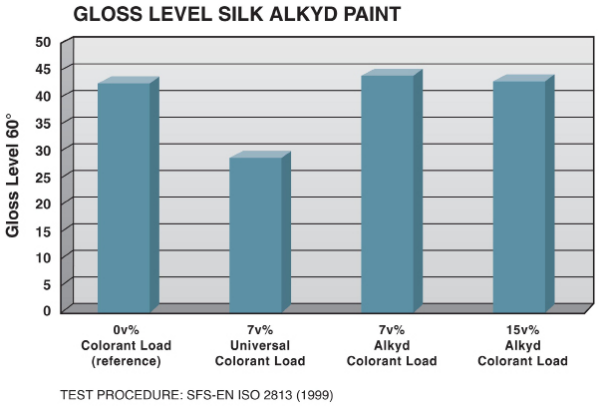

Fig. 4: Alkyd coating tinted with only 7% universal colorant requires significantly longer drying time. Professionals would not tolerate these types of variation in paint characteristics caused by the introduction of too much water into Alkyd systems.

The “Universal” option

A tinting system with only universal colorants is typically comprised of 16 colorants, depending on concentration and product variety. In this type of system, the same colorant set is used for both water-based and solvent-based products. As a result, the flow rate of each individual colorant is relatively high, even for rarely used colorants such as violet. The disadvantage to a universal system is that the colorants are water-based. This means that a certain amount of water is automatically added to the base paint material during dispensing.

In theory, small amounts of water are not problematic. However, if the intention is to produce deep shades by adding more than 5% colorant, water can begin to cause problems.

Excessive amounts of water in alkyd paint or in solvent-based coatings will compromise product quality. Gloss level, hardness, opacity and drying time may be negatively affected (Fig. 3 & 4). Professional users would not accept these technical performance drawbacks.

The Best of all worlds:
Customized, Combined System

Harnessing the advantages offered by both universal and dual system colorant technology, the paint manufacturer decided on a customized 24-colorant combined system. The new tinting system is a custom combination of the following: water-based colorants with an assortment of UV-resistant, high-performance colorants, and economical colorants for the universal and solvent-based ranges for tinting interior paints as well as coatings that require the addition of large colorant quantities. In concrete terms, the complete tinting system consists of a combination of water-based, universal, and solvent-based colorants (Fig. 5).

To optimize performance of the newly selected, combined tinting system, colorants that are only needed in small quantities for each color formula such as magenta, violet or a low concentration black, are set up as universal colorants.

It is not possible to entirely remove magenta and/or violet as they are necessary to achieve certain color shades. When set up as universal colorants, they can be used with both water-based and solvent-based systems, increasing their consumption. Since most color formulas contain only minor amounts of blue LC or violet, their impact on the performance characteristics of the final product is minimal.

Integrating rules into the color formula database ensures that only compatible colorants can be chosen with a selected product. Silicate and silicone base paints for instance, can only be tinted with water-based and universal colorants. While unlimited amounts of solvent-based colorants can be added to alkyd based products, but universal colorants may only be added in small amounts. This helps aid in defining the perfect balance between cost / performance and consumption of each individual colorant.

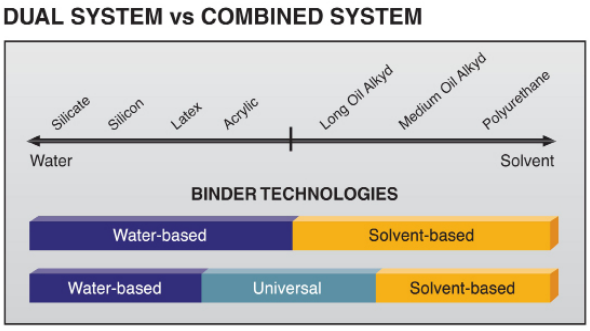

Fig. 5: Paint manufacturers are often working with two separate tinting systems – one for water-based decorative paints and one for solvent-based coatings (top bar). Customized systems comprising a selection of water-based, solvent-based colorants as well as universal colorants used for both technologies, are offering a strong alternative (bottom bar).

An Integrated concept

A completely Integrated Tinting System consists of base paints, colorants, color formulas, software, dispensers, mixers, and color marketing tools. An up-to-date integrated tinting system is more than a mere combination of these individual components. It is a balance of all items whose performance has been customized and designed to work in perfect harmony for a customers' needs.

The challenge of a comprehensive, advanced tinting system extends beyond combining the colorants and color formulas. Proper configuration of the entire tinting system, including dispensing equipment, must be considered.

Customization of a dispenser begins with an analysis of the retailer's business model and average tinted sales volume. This will determine the speed requirements to properly serve the end-user customer. Once that is determined, the dispenser type must be carefully matched to properly support the colorant technology and established set of colorants.

The behavior of the colorants over time, within the dispenser must be considered. Concentration of colorants, tendency of the pigments to thicken abrasiveness, speed of sedimentation and drying characteristics all could have a negative effect on the life time of pumps, valves or other mechanical parts. The right dispensing technology or even a combination of different technologies should be carefully considered.

COROB FIRST1 is a fully-automatic, turntable dispenser that allows for precise and repeatable on-demand tinting. Durably constructed, yet ideally positioned as an entry level machine for emerging markets or to replace manual dispensers in smaller volume retail outlets.

COROB FLEX520 features patented LENTEQ piston pump technology, proven to accurately handle and dispense troublesome colorant types including problematic low and NO VOC technologies. Smart design allows for low maintenance costs and the bi-directional turntable speeds dispensing time.

Further, it is important to select the optimal canister sizes and determine suitable stirring and recirculation needs for each individual colorant. This will help to ensure that the colorant remains fresh in the canister which will help minimize maintenance interventions.

Equipment specialists often place too much emphasis on quantifying the “Minimum Accurate Dispense” capabilities of their products, especially when pastel colors and small container sizes pose a challenge for the paint retailer. These figures are often unreliable; factors such as drying in the nozzle tips and the freshness of the colorant within the canisters have a profound effect on the actual minimum dispense that is achievable at the retail level.

Repeatable, accurate results are best achieved by combining a slightly larger dispense size with a well selected colorant set which may include some lower concentrations of key colorants to achieve the a light or pastel color range, even in sample size containers. In addition, proper color formulation plays a vital role in achieving successful and repeatable results.

The formula of color

Creating an accurate formula database is a critical part of Integrated Tinting System performance. The correct color formula rules ensure that:

- The appropriate colorants are selected to achieve desired performance characteristics (e.g. UV-resistant colorants are used with exterior products)
- The overall formulation cost is considered and minimized
- Colorant consumption between all single colorants is optimized, meaning each single colorant should achieve a reasonable turnover to overcome technical problems

Through this process, a small selection of the color formulas may turn out to be more expensive than they previously were. However, the overall improved performance of the system will balance this out in the end. Maintenance costs and down times will be minimized as throughput of slow moving colorants is improved. Lower total cost of ownership and superior tinting system performance are the ultimate objective of Integrated Tinting solutions.

Responsible service

Service is a key part of the tinting process that should not be overlooked. As Integrated Tinting Systems are designed to fine tune all tinting components, it is important that the service provider be well versed in both the mechanics of the equipment and the characteristics of the colorant set. True tinting system support is best provided by a global network of trained specialists in colorants and system technology, who are able to modify existing systems and provide consultative assistance in case of problems. Choosing a partner who is responsible for the performance of all components of an Integrated Tinting System is a true competitive advantage.

Consultative Services

The article illustrates the complexity of designing a truly Integrated Tinting System which fine tunes the performance of each component so that it works in harmony with the overall system. Even more important are the strategic business decisions made throughout the design phase that create a sustainable competitive advantage for the paint manufacturer. As with any investment, a certain amount of compromise is necessary when designing advanced tinting systems. Only by working with a partner, capable of understanding all aspects of tinting system design, can you be assured that your business priorities will be achieved. Once implemented, only a supplier with comprehensive capabilities will be responsible for the long-term functionality of the complete Integrated Tinting System.

A quick recap

Integrated Tinting Systems are customer-specific solutions designed to fine tune all of the individual elements of a complete tinting system. An integrated tinting system must be viewed as a whole to see its true value; all parts are designed to work in harmony with each other.

- Stringent legal and technical standards, as well as competitive pressures, are forcing paint manufacturers to optimize their tinting processes.
- As a result of new VOC guidelines, many additives can no longer be used in future colorant production. It is becoming more difficult to find colorant additives that offer good storage stability and protection against surface drying as well as mold growth.
- Demands on colorant quality, consistency and technical innovation are steadily rising.
- Tinting systems must not limit a paint manufacturer's ability to offer a broad range of product technologies in the market place.
- Tinting trends show that on demand tinting is moving closer to the end-user. Penetration of dispensers in increasing at the expense of colorant throughput.
- Combined tinting systems can help overcome this challenge as they use a customized colorant set combining water-based, solvent-based, and universal colorants to satisfy the tinting needs of the customers' product portfolio.
- Colorants in an advanced tinting system that are used only in small amounts within formulations are set up as universal colorants to increase their flow rate and prevent drying.
- All components of an Integrated Tinting System should be perfectly matched: colorants, color formulas, dispensing and mixing equipment, software, color marketing service and support.

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About CPS Color

Headquartered in Vantaa, Finland, CPS Color is the world's leading supplier of advanced color solutions for the global paints and coatings industry. CPS Color offers complete tinting solutions: CPSCOLOR™ colorants (liquid pigments), COROB™ dispensing and mixing/shaking equipment, software, color marketing tools, customer support and service. CPS Color Group has a global organization employing 900 color professionals with operations on six continents. The Group's 2010 turnover amounted to 181 million Euros. CPS Color is owned by Nordic Capital Fund VI.

For further information, please visit: www.cpscolor.com