



Various Printing Techniques of Cotton/Polyester Blended Fabrics to Enhancing its Performance Properties

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Abstract

To conserve natural resources, natural fabrics are mixed with synthetic fabrics, adding different perks to these fabrics. In the field of textile printing, learn about different printing methods and techniques and know the best way to print polyester cotton blends, and what characteristics of the blend result from cotton mixing and polyester.

Keywords: cotton/polyester fabric, printing techniques

Introduction

Undoubtedly, when a combination of different materials will produce a material that combines the advantages of the two ores, especially when the combination of fiber is natural and synthetic fiber. It is necessary to know how this mix is printed with the best possible result and know the different printing methods and their importance in our lives.

Textile printing

Textile printing is very certainly as old as civilization itself. [1] The textile sector has a significant impact on the economies of countries. [2] The use of color through dyeing and printing procedures has also played a significant part in all civilizations. [3, 4] The Coloration of fabric becomes a major process in the production of textile material. [5] Textile printing is an old art form that dates back thousands of years. [6, 7] It is one of the most diverse and significant methods of introducing colors and patterns to textile materials. [8-13] It is also the process of mixing a design concept, one or more colors, and a substrate (usually textiles) with a natural or synthetic thickener while applying a technique to correctly apply the colors. [14-28]

The main objective of printing is to create colorful patterns with sharp borders on textile fabrics

without any dye spilling beyond the design motif's borders. [29] Textile printing is defined as a regulated technique of coloring cloth in specific patterns or motifs by employing specialized printing techniques and machinery. [30, 31] It is also the process of creating a color pattern or drawing on textile materials. [32] The color is linked to the fiber in properly printed fibers to protect against washing and crocking. Localized dyeing is a term used to describe textile printing. Unlike dyeing, the dye penetrates specific regions of the substrate during printing. [33, 34]

The application of color to cloth is the primary distinction between textile dyeing and printing procedures. During the dyeing process, the cloth is immersed in a diluted dye-bath solution, and excess dye solution is squeezed out of the dye bath. On the other hand, Printing is often accomplished by applying thicker pastes containing dyes or pigments together with other auxiliary substances to a cloth surface in accordance with a color pattern. [35] The viscosity of a printing paste, in particular, is important. It controls the amount of paste transmitted to the fabric as well as the amount to which it spreads on and into the surface yarns. [35] Paste must color all visible fibers on the printed surface, so it must penetrate considerably into the yarn structure. [35]

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Classification of printing techniques

Generally, a difference is observed between printing processes and printing styles. Traditional textile printing processes can be classified into two categories: direct printing and indirect printing. [30]

Polyester Fabric

Polyester is a synthetic fabric that's usually derived from petroleum. This fabric is one of the world's most popular textiles, and it is used in thousands of different consumer and industrial applications.

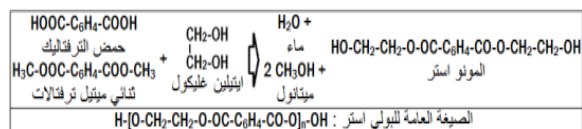
Chemically, polyester is a polymer primarily composed of compounds within the ester functional group. Most synthetic and some plant-based polyester fibers are made from ethylene, which is a constituent of petroleum that can also be derived from other sources. While some forms of polyester are biodegradable, most of them are not, and polyester production and use contribute to pollution around the world.

This type of synthetic fiber is the most important in the world of textile industries and is marketed with different brand names including terylene and dacron...

Polyester synthesis: Polyester is made across the third phase:

Esterian phase: The interaction between terephthalic acid or DMT is carried out with an excess amount of ethylene glycol at the temperature of 190-150 m and with citrus mixed with tetroxide acetate and tetroxide. It is advisable to take mitral paster for easy distillation, unlike non-volatile terephthalic acid.

The polymerization phase is "polymerization": there is a steroid exchange reaction in which the ethylene glycol molecule is deleted at the temperature of 260m, to begin the process of polymerization to reach a molecular weight chain between 12.000-8.000. [36, 37]



Polyester fabric printing process method

1. transfer printing or sublimation printing: a design printed on a piece of paper is transferred to the fabric
2. printed with dispersed dyes: After drying, it can be fixed. [38]
 - a) High temperature and high-pressure steaming method

steaming is done in a closed steaming box with a temperature of 125-135°C for half an hour. The heating degree is close to saturation and this absorbs fiber and color paste for moisture resulting in the transfer of dispersed pigments to fiber. The fabric

temperature increases rapidly leading to coloring and the installation rate is higher. [39-41]

b) Hot melt method

The hot melt method essentially has the same mechanism and installation method as hot dyeing. Hot melt temperature 180-220°C. To prevent dye from contaminating white earth during sublimation, it also requires a higher stabilization rate. Strict control of the nature of pigments used in printing.

The consistency of printing mainly depends on the consistency of the installation, and the uniformity of the installation depends on whether the temperature and hot air flow rate sprayed on different parts of the fabric are uniform. Due to the use of the hot melt method to repair color under tight dry heat conditions, which harms fabric texture, the hot melt method is not suitable for flexible polyester fabrics and knitted polyester fabrics.

Cotton Fabric

Cotton fabric is one of the most commonly used types of fabrics in the world. This textile is chemically organic, which means that it does not contain any synthetic compounds. Cotton fabric is derived from the fibers surrounding the seeds of cotton plants, which emerge in a round, fluffy formation once the seeds mature.

One of the most important sources of robotic cotton is one F, which is widely used in ancient times. To date, it remains one of the most important natural fibers to enjoy the advantage of natural origin that has little negative effect when it comes in contact with the body, as opposed to synthetic fibers that have a negative effect, especially in terms of electrical balance and sensitivity.

Cotton structure: cotton consists of single-cell rolling bristles, and the bristles have tapered and downward open ends)

Their contact with the seed the bristles are separated from their seeds by the process of gating, their structure (with concentric layers and a central cavity known as Lumen pulp and the outer crust layer consisting of grease, pectin, and wax, and placed under the crust the primary cellulosic wall, whose fibers are intertwined in a cross, followed by the secondary wall consisting of the third cellulose layers.

Cotton fabric printing method

1. Pigment Color Printing: Printing cotton in pigment colors is characterized by not requiring subsequent washing or fumigation, it is also characterized by light stability, good washing, and weak friction stability.
2. Direct dye printing: The direct dye printing process is easy to apply as it is cheap, it is disadvantaged by its low stability. The printing process is also applied after completing the blending to start the drying phase and stabilize

- the evaporator at 102 to 105°C for 15 to 30 minutes, then we wash and rinse it in the right way.[17, 26, 37, 42, 43]
3. reactive printing of cotton textiles: reactive printing of cellulose products and eight basic stages are carried out: initial preparation, preparation of printing paste, printing, drying, hydration, installation, rinsing and washing with washing, mitigation, and final installation.
 4. For natural fabrics such as cotton, screen printing, and DTG printing are the methods that will give you the best results. If you want to try your hand at transfer printing or sublimation printing, you're going to have better results with a synthetic such as polyester. [44, 45]

Cotton & polyester blends

Polyester and cotton are censorious materials in the fabric and pieces of clothing-making ventures because each has various helpful qualities.

Poly-cotton blends are made by utilizing modern weavers and weaving machines to consolidate the two fibers; blend proportions regularly extend from 65 percent cotton and 35 percent polyester to a 50-50 blend.

While these mixes may have a few cons, the far more plentiful pros imply that poly-cotton is perfect for aesthetically-minded craftspeople who enjoy making their very own attire, costumes, and furniture covers.

Poly-cotton blends are solid, strong, and tear-safe, thanks to polyester fibers being far more versatile than cotton alone.

Furthermore, poly-cotton blends can be colored in a wide scope of hues, because they are so broadly available, tend to be far less expensive than pure cotton fabrics.

Instead of focusing on cotton vs. polyester, consider fabrics that consolidate the best highlights of the two fabrics to shape a strong, durable, breathable, financially savvy blend.

Poly/cotton mixed items will, in general, hold their shape and keep their color longer than 100 percent cotton products.

They also are more comfortable than products made exclusively of polyester. Things that blend cotton are for the most part machine washable and don't generally need to be ironed.

the best cotton/polyester blend

It can be 65/35 or equally blend, it can be the best blend if you are confused.

The blend of cotton-polyester is flexible and is used to produce anything from bedding to shirts. And, thanks to the cotton portion in the blend, compared to pure polyester products, garments made from cotton polyester are more breathable. You can get the best cotton polyester from Shaoxing Fabrics, they have a variety of fabrics

100% Cotton VS Polyester Blends: What Are the Benefits.

Polyester/cotton blends tend to be stronger than pure cotton fabrics, while also offering a wider variety of textures. While 100% cotton may not be as durable as some polyester blended fabrics, its ability to offer comfort across seasons makes garments versatile and offer convenience.

Manufacturing of the cotton polyester blend made

This fabric is manufactured by integrating natural fiber (cotton) with synthetic fiber (polyester). Fibers can be combined at either the fiber stage or the yarn stage. It is important to note that fusing them at the fiber stage can be a little pricier but it will result in a finer quality of material

These are both fine choices: the 100% cotton fabric is easier to work with, and the 50/50 blend is not far behind.

Cotton is the most widely used natural fiber used in clothing. It comes from the soft, vegetable seedpod of the cotton plant. As a fully breathable fabric, it is a great choice for hot temperatures. For most screen printers, the 100% cotton t-shirt is a dream to work with. These t-shirts cooperate with almost any ink and printing method, and they hold ink longer than other fabrics.

Polyester is a synthetic fabric, engineered for some of the qualities cotton does not offer. It is a more flexible fiber, making the fabric more tear-resistant. Polyester is cheaper to manufacture, but it is less breathable and tends to stick to perspiring skin. Screen printing on polyester fabric must be done carefully since fabrics with high polyester content are prone to dye migration. The solution to getting great prints just comes with a learning curve.

The 50/50 cotton/polyester blend has been created with both types of fibers to take advantage of the best qualities of each. A 50/50 blend is both breathable and tear-resistant. It is less expensive than 100% cotton and offers comparable comfort. The 50/50 blend prevents the fabric from shrinking, as cotton that has not been pre-shrunk is prone to doing. Screen printing on a 50/50 cotton/polyester blend t-shirt can be done using plastisol inks or water-based inks with the proper polyester-friendly additives. The major issue with screen printing on 50/50 t-shirts is the tendency of deep dyes to bleed through light inks, especially with red, orange, and dark green fabrics. It is a common and simple solution to first print a grey under base with a super low bleed ink.

Both cotton and polyester fabrics have a lot to offer in terms of comfort, durability, and breathability. The 50/50 blend is a fantastic fabric that perfectly offers the best of both. Despite its minor issues in screen printing from its polyester side, there are simple solutions to avoid such setbacks. With both fabrics approved for easy screen

printing, it is a matter of personal preference for style and comfort.

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Analysis of different printing methods for polyester/cotton fabrics

Polyester/cotton fabrics have the advantages of solid appearance, good corrosion resistance, durability, dimensional stability, easy washing, fast drying, etc., and are suitable for producing different garments. However, due to the different physical and chemical properties of polyester and cotton fibers, there are differences in the dyeing and printing properties of polyester/cotton fabrics. When printing, the difference between the two must be fully considered, and the two types of fiber can be dyed for the same color and shine. Therefore, it is very important to choose a suitable polyester/cotton canvas printing method.

1) Pigment printing

Dye printing is a printing method that anchors the paint to the surface of the cloth by making a bond material. It is a traditional printing method for polyester/cotton fabrics. The specific process flow is:

Pre-treatment → thermal setting → floor color dyeing or polyester whitening → printing → baking → heat adjustment → tensile (cotton whitening, adding purifier). [52]

The advantages of pigment printing are simple preparation of color paste, short operation, full chromatogram, good gloss, good reproduction, and low cost. However, pigment printing also has many shortcomings, such as poor hand sensation, easy production of printing defects, low friction stability, and so on. In the increasingly fierce and demanding textile market, current problems of dye printing severely restricted its application and development on polyester/cotton fabrics. To improve this method: by using ultraviolet treatment. [53-60]

The Effects of UV Pretreatment on the Color Strength Values of Pigment Printed Fabric

To study the influence of pretreatment time, UV pretreatments were carried out for 60 and 120 min. The data for two different pigments (Orange K-R and Blue K-BG) showed that the best K/S values were obtained when the cotton/polyester blend fabrics were pretreated for 60 min. This can be attributed to the increasing number of polar groups owing to UV photo-oxidation and roughness on the surface due to the physical etching. Further, an increase in UV exposure time led to a decline in the K/S values of the printed fabrics. Because the concentration of active species accumulating on the fiber surface is

increased and at the same time the collision between the active species lowers the modification effect. Meanwhile, at higher exposure time, the voids become too open to get diffusion of pigment, due to which the printing paste equilibrium may face desorption resulting in low color depth. The color strength of UV-pretreated cotton fabric is higher than that of UV-pretreated polyester fabric. The photo-oxidation of the cotton fiber surface leads to an increase in the polarity and the surface energy of the cellulose molecules by inducing new functional groups such as -OH, -C = O, and -COOH. [61] Hence, it can enhance the adhesion forces between the cotton fiber surface and the binder. On the other hand, after UV pretreatment, the formation of cracks in the fiber surface can contribute to trapping pigment in the fiber. Furthermore, the formation of cracks and grooves increases the surface area, and therefore pigment attachment is improved by a larger surface area. [61]

2) Disperse/Tinctures Vat Same Size Printing

Dispersion/Dye Vat Printing The same size is suitable for printing medium and dark colors and polyester/cotton printing products requiring high color fastness nowadays, this process is mainly used in printing anti-infrared military camouflage clothing the common process flow is:

Printing drying baking filler reduction solution fumigation washing with cold water washing oxidized water soap washing with hot water washing with cold water washing the cold acid equation drying and drying.

When polyester/cotton fabrics are printed with dispersed dyes and bowls in the same pulp printing process, the printing process can be used only in two stages, i.e., the polyester component is printed with sporadic dyes and then the cotton ingredient is printed with dyes container. Two-stage printing of polyester/ cotton fabrics with dispersion dye/bowl has the advantages of clear and bright patterns, color fading, no staining, etc., but the printing process is longer, and steam reduction is prone to insufficient reduction and dark color.

3) Disperse/Reaction Printing Dye

Sporadic/reactive dye printing is mainly used for dark printing on polyester/cotton fabrics. The process essentially involves a two-stage and one-phase method.

The two-stage printing process of dispersed/reactive pigment shall be as follows:

White cloth printing → drying and baking (190 ~ 200°C, 1 ~ 3 minutes) → alkaline pulp printing → steaming (102 ~ 105°C, 5 minutes) → washing with cold water ← hot water washing (about 50°C) → soap (or cleaning reduced, 70-80°C) → washing with water → drying

The process has the advantages of energy saving, environmental protection, color stability, and high production efficiency, but the process is long, the color is not easy to control, and the fabric pattern is easy to penetrate when rolling lotion.

The single-phase printing of reactive/ reactive dye is the process of adding all the dyes and auxiliary materials needed for printing in the printing paste and then printing, installation, and washing. It is especially suitable for printing medium and dark colors of polyester/cotton fabrics. Advantages of full chromatogram, pure shade, bright color, short process flow, simple operation. The main disadvantage is that scattered dyes facilitate the smearing of cotton fibers. Scattered dyes and auxiliary materials should be inspected and used before printing.

4) Discharge printing on polyester/cotton blends.

Discharge and resist printing styles are methods used by textile printers, to obtain effects difficult to achieve by direct printing. On the printing of polyester/cellulosic blends, the introduction of discharge or resist effects is severely limited by the chemical nature of the dyes, The discharge effect is obtained by adding, to the printing paste discharging agent capable of discharging the ground color of the used dischargeable dyes. The colored discharge is obtained by adding, to the paste, some dyes stable to the discharging agent fixed places where the ground dye is destroyed. [4, 62, 63]

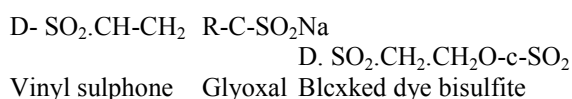
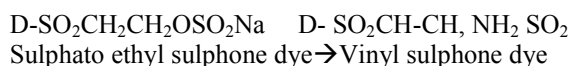
5) White discharge printing

It has long been known that disperse dyes can be dissociated, not only by reducing agents but also by alkalis. This feature has been used in printing polyester/cotton blends. to produce better white grounds and to remove as much disperse dye as possible from the cellulosic. A few numbers of Samaron dyes containing heterocyclic compounds can be dissociated by alkali, and can be used for this White discharge printing on polyester/cotton fabrics can then be affected by destroying the ground reactive and dispersed dyes by printing pastes containing reducing agents and alkali and steaming.

6) Resist printing

Resist, or reserve printing is another method parallel to discharge and the results are often indistinguishable. The resist style, however, has the advantage that dyes of great chemical stability which are resistant to discharging effects, can be resisted to give prints of high fastness levels and a clear white. It has been reported, that discharge-resists on cellulosic fibers with reactive dyes have been growing steadily and became more popular in the past few years. This technique gives crisp outlines, which were previously unobtainable with any discharge printing technique, and a wide range of vinyl sulphone (Remazol) dyes is available for this method. [4]

The fixation of vinyl sulphone-type reactive dyes can be prevented by the addition of sulfites or thiosulphates White and colored resist pastes can be prepared by adding glyoxal-bisulfite product to the standard vinyl sulphonic print stock in printing the resist paste, the reactive vinyl sulphone groups Of the Remazol dye, generated by alkali, will be blocked by the glyoxal bisulfite product and become no more reactive to cellulose according to the following equations:



In the meantime, the dispersed dye in the ground color is discharged or destroyed under the combined effect Of alkali and the reducing agent in the printing paste.

Conflicts of interest

There are no conflicts to declare

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There is no fund to declare

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تقنيات الطباعة المختلفة لأقمشة مخاليط القطن / البوليستر لتحسين خصائص أدائها

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الملخص

للحفاظ على الموارد الطبيعية، يتم خلط الأقمشة الطبيعية بالأقمشة الاصطناعية، مما يضيف امتيازات مختلفة إلى هذه الأقمشة. في مجال طباعة المنسوجات، تعرف على طرق وتقنيات الطباعة المختلفة وتعرف على أفضل طريقة لطباعة مزيج القطن البوليستر، وما هي خصائص المزيج الناتج عن خلط القطن والبوليستر. مما لا شك فيه، عندما ينتج مزيج من المواد المختلفة مادة تجمع بين مزايا الخام، خاصة عندما يكون مزيج الألياف طبيعيًا وأليافًا صناعية. من الضروري معرفة كيفية طباعة هذا المزيج بأفضل نتيجة ممكنة ومعرفة طرق الطباعة المختلفة وأهميتها في حياتنا.

الكلمات الرئيسية: نسيج القطن / البوليستر تقنيات الطباعة