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Various Printing Techniques of Viscose/polyester Fabric to Enhancing its Performance Properties

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Abstract

The last years of the 20th century saw significant transformations and quick advances in many spheres of life, and new technologies in the field of textile printing developed, taking the top spots in the strategic domains. All techniques for dyeing fabrics, from direct sketching to the most recent printing techniques, are included in the textile printing process. The study looks at the use of blending synthetic fibre (viscose) with polymer fibre (polyester) to produce mixed yarns. These yarns have a lot of characteristics and advantages that make them more qualified to use in producing summary fabrics and replace the significant shortage in natural fibres of cotton yarns. The majority of rayon production has shifted to emerging nations, particularly China, Indonesia, and India. As of 2016, it is unknown how common disabilities are in these industries, and worker safety continues to be an issue. Using the mechanical characteristics of fabric evaluated by FAST equipment to maximise the impact of treating textiles made of polyester, viscose, and their blends with nano silicon dioxide, not only on their performance and look but also in the production of clothing. Formability, bending rigidity, extensibility, and thickness tests are used. By adding nanosized SiO_2 particles to the surface of materials, the mechanical and durability qualities are enhanced, and the usefulness of the materials is also influenced.
Keywords: viscose/polyester fabric, Reactive Dye, Pigments, disperse and vat dyes.

Introduction

The laboratory tests on the blended yarn (65% viscose/35% polyester) yielded good results in the elongation, strength, and irregularity tests, and the produced yarn was used as a weft to create fabrics that yielded excellent results in the tests of (water absorption, shrink resistance, and elongation test). These results allow us to use these fabrics as high-quality summary fabrics. . [1]

When the viscous fabric was treated with nano silicon dioxide, it significantly outperformed other treated textiles in terms of anti-pilling behaviour. The findings of the anti-pilling were not significantly altered by washing treated materials. For treated polyester textiles compared to untreated polyester fabrics, the treatment increased the antistatic charge. The tensile strength of the treated textiles has very slightly increased. As a result of an increase in hydrogen bonding between the chains of viscose fibres, it was also discovered that the treatment increased the tear strength from 1.05 kg for untreated textiles to 1.2 kg for treated fabrics in both the warp and weft directions. [2]

With an increase in viscose percentage, it has been noticed that the fabric's ability to absorb moisture increases. [3]

Using the FAST assessment method, the correlations between the handling qualities of polyester-viscose, polyester-cotton ring, and MJS yarn fabrics, as well as yarn bulk and stiffness, have been investigated. MJS yarn textiles are often thicker and stiffer. When polyester or acrylic fibres are

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combined with cotton or viscose, [4] the synthetic component adds qualities like crease recovery, dimensional stability, tensile strength, abrasion resistance, and simple care, while the cellulosic fibres add moisture absorption. [2]

techniques for printing

Currently, eight different techniques are utilised to imprint coloured patterns on fabric:

- Block printing by hand
- Copperplate engraving for printing
- printing using cylinders, rollers, or machines
- printing stencils
- display printing
- digital printing on textiles
- Discharge Printing
- print using a heat transfer

Four general categories may be made for traditional textile printing techniques

- Direct printing is the process of printing the desired pattern using colourants that contain the dyes, thickeners, and mordants or other materials required to set the colour on the fabric.
- a mordant is printed in the appropriate pattern before the fabric is dyed; the colour only adheres where the mordant was printed.
- Resist dyeing involves printing wax or another material on fabric before it is coloured. The motifs are left uncoloured on a coloured background since the waxed areas do not receive the dye.
- Discharge printing involves printing a bleaching solution to partially or completely remove the colour from previously coloured cloth.

The last century saw a rise in the use of resist, discharge, and combination methods, which employed indigo resist to produce blue backgrounds before block-printing with various colours. Direct printing procedures are the most used type of industrial printing today.

To prepare the fabric and printing paste and to permanently fix the impression on the fabric, the printing process entails several steps, including: [5-8]

- pre-treatment of the fabric,
- preparation of colours,
- preparation of the printing paste,
- impression of the paste on the fabric using printing methods,
- drying of the fabric, fixing the printing with steam or hot air (for pigments), and post-process treatments.

The several types of printing include:

Direct print, discharge, resist, pigment, reactive printing, toxic print, Distributed print, Particular Print

Beginning in the late 1980s, digital textile printing was developed as a potential analogue screen printing replacement. Instead of printing dye-sublimation inks on transfer paper and then transferring them to the fabric using a heat press, it is now possible to print directly onto textile media using low-energy sublimation inks and high-energy disperse direct inks. This was made possible by the development of a dye-sublimation printer in the early 1990s. [9-12]

Polyester Fibers

Polyester Fiber Dyeing Due to their high hydrophobicity and crystallinity, polyester fibres are extremely difficult to dye using conventional dyeing techniques, unless the fibre has been altered, as in the case of modified terephthalate polyesters. Polyester fibres can be coloured using disperse dyes. Dispersion dyes can be used to colour hydrophobic fibres, such as polyester fibres, by transferring the dye from a liquid solvent (water) to the fibre. Disperse dyes are combined with water and a surface-active component to create an aqueous dispersion. Disperse dyes can leave the dye liquid because they are more substantial to the fibre than to the dye liquor.

The energy of dye molecules is increased by heat, hastening the process of dyeing textile fibres. The fibre is gently expanded by heating the dye liquid, which aids in the dye's penetration of the fibre's polymer structure. As a result, the dye molecule takes up residence in the fibre's amorphous areas. The following equilibria are produced when dyeing achieves equilibrium:

• Dye dispersed in the bath ↔ Dye dissolved in the bath.
• Dye dissolved in the bath ↔ Dye adsorbed on the fibre.
• Dye adsorbed on the fibre ↔ Dye diffused in the fibre.

printing with pigments (in a single hue) on polyester fabric (Rotary screen)

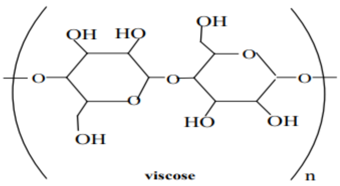
printing with pigments (in a single hue) on polyester fabric (Rotary screen) Theory: Printing is the localised application of dyes or another material that produces colour following design specifications. Polyester fabric is used a lot these days, and printing pigments are highly popular. The colour yield and fastness qualities of pigments are quite high. [13]

<u>Recipe</u>

1. Pigments: 30gm
2. Binder: 600gm
3. Fixer: 10 ml
4. Acid/CCOOH: 10 ml
5. Water (if necessary): X gm
6. Total = 1000gm

Rayon Viscose

A natural source of regenerated cellulose, such as wood and other associated agricultural products, is used to create rayon, a semi-synthetic material. Its molecules resemble those of cellulose. Viscose is another name for it. Viscose fibres and films come in a wide variety of sorts and grades. Some mimic the appearance and feel of organic materials including silk, wool, cotton, and linen. Artificial silk is a common name for the materials that imitate silk. Textiles for clothes and other uses are created using the fibre.



In contrast to other methods of producing rayon, the viscose process allows the use of wood as a source of cellulose. Viscose was formerly employed on a bigger scale than the other techniques because it is more affordable when made from woody sources of cellulose. The original viscose method, on the other hand, produces a significant volume of polluted effluent. The wastewater now has better quality and uses less water thanks to newer technologies. Up until the 1930s, rayon was solely manufactured as a filament fabric, but then techniques for using "broken waste rayon" as a staple fibre were created. [14]

preparing viscose

Primarily made from wood pulp (and occasionally bamboo pulp), viscose is chemically altered into a soluble substance. Then, after being dissolved and driven through a spinneret to create filaments, it is chemically solidified to generate fibres that are almost entirely made of cellulose. The carbon disulfide used to make the majority of rayon can significantly damage employees if the chemicals aren't handled appropriately.

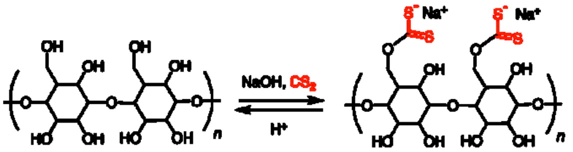
Alkali cellulose, which has the approximate formula [C6H9O4ONa]n, is created when the pulp is treated with aqueous sodium hydroxide (usually 16–19 % by mass). This process creates viscose. We permit some depolymerization of this substance. Temperature and different inorganic additions, such as metal oxides and hydroxides, have an impact on the pace of depolymerization (ripening or maturing), which also relies on temperature. Air has an impact on ripening because oxygen leads to depolymerization. After that, carbon disulfide is applied to the alkali cellulose to create sodium cellulose xanthate:

$$[C_6H_5(OH)_4{-}ONa]_n + nCS_2 \rightarrow [C_6H_5(OH)_4{-}OCS_2Na]_n$$

–

By treating the ripening solutions with a mineral acid, such as sulfuric acid, rayon fabric is created. The xanthate groups are hydrolyzed in this stage to produce new cellulose and carbon disulfide:

$$[C_6H_5(OH)_4{-}OCS_2Na]_{2n} + nH_2SO_4 \rightarrow [C_6H_5(OH)_4{-}OH]_{2n} + 2nCS_2 + nNa_2SO_4$$



A simplified view of the xanthation of cellulose[

In addition to regenerating cellulose, acidification produces carbon disulfide, sulphur, and hydrogen sulphide (H2S). To get rid of any remaining acid, the thread formed from the regenerated cellulose is rinsed. Sodium sulphide solution is then added to remove the sulphur, and contaminants are bleached using sodium hypochlorite solution or hydrogen peroxide solution.

Processed cellulose made from wood pulp and plant fibres serves as the foundation for production. The pulp's cellulose concentration should range from 87 to 97 %. **[14]**

resist printing on viscose fabrics of Reactive dye:

This technique may be used for environmentally friendly resist printing on viscose materials when using a reactive dye.

Preparation of Reactive Printing Paste

Reactive printing preparation The following blows are a paste reactive dye printing recipe:

Constituent	**g/Kg**
Reactive dye	25
Thickener	350
Urea	250
Sodium carbonates	15
water	410
Total	1000

Flat screen printing, immunity, and viscose textiles.

To find the best printing recipe for white resist printing, all printing recipes (resist or reactive) were applied to the cloth using the flat screen printing technique.

First, the resist printing mixture was applied, cured at 100 degrees for four minutes, and then reactive dye was printed using a manual flat screen printing process. After that, the printed cloth is set by heating it for 10 minutes at 102 degrees. A second resist-printing paste that was individually mixed with citric acid (from 5 to 40 %) and had a consistent resist agent concentration of (from 0.4-2 %) was made for comparison. Following hot water and non-

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ionic detergent wash, cold water was used to rinse the printed materials, and they were then dried. [15]

viscose chemically reactive

It is a cellulose fibre, therefore even relatively mild acids will cause damage to it.

Viscose rayon maintains its vibrant, rich hues while having a silk-like appearance and great drape. Many of its qualities are comparable to those of cotton or other natural cellulosic fibres because of its cellulose foundation. More so than cotton, rayon is capable of absorbing moisture, is breathable, cosy to wear, and takes vibrant dyes well. Unless the fabric is created from short, low-twist yarns, neither static electricity nor pilling occurs.

In addition to having a mild dry strength and abrasion resistance, rayon is cosy and gentle against the skin. It will wrinkle because, like other cellulosic fibres, it is not robust.

Rayon may be ironed at somewhat lower temperatures than cotton. Although termites and silverfish may attack it, it often withstands insect damage. Although it will mildew, this usually won't be an issue.

One of the rayon's advantages is its adaptability and capacity to mix well with a variety of fibres, sometimes to cut costs and other times to provide sheen, softness, or absorbency and consequent comfort.

In general, bleaches do not harm rayon's fibre and it has a moderate tolerance to acids and alkalis. However, the fabric's dyes may change colour with time. Rayon will burn since it is a cellulosic fabric, although flame retardant treatments can be used.. [16-20]

The following table contrasts the properties of polyester, viscose, and cotton. [21]

material	cotton	viscose	polyester
moisture regain	good	very good	poor
thermal protection	good	very good	poor
air permeability	very good	good	poor
softness	good	very good	poor
smoothness	poor	good	very good
static dissipation	good	very good	poor
drape	good	very good	poor
lustre	poor	very good	very good
crease recovery	poor	poor	very good
uniformity	poor	very good	good
anti-pilling	good	very good	poor
wash & wear	good	poor	very good

Fabric pre-treatment

The wet processing industry's branch known as textile printing is widely employed in the fashion sector as well as for all types of materials and fibres. Generally speaking, printing is a type of dying in which only portions of the cloth are dyed rather than the complete thing. The colour is enclosed in a paste with a thickening agent, which may be a natural or synthetic polymer, to confine the colour to the design area. These polymeric materials come in a variety of forms, including starches, seaweed alginate, plant gums, and polyacrylics. Following printing, the cloth is dried, and the colour is briefly set by heat.

The dye molecules infiltrate the printed portions of the cloth during the steaming process and are also fixed under the influence of heat and moisture. The thickener and other chemicals are removed from the printed cloth after steaming. Binders and thickeners are sufficiently soft to prevent the pricey washing and drying operations, which makes the pigments special. [22]

The nano silicon dioxide treatments significantly improved

<u>Moisture Regain</u>

Regaining moisture in the cloth It has been shown that increasing the viscose fraction increases the tensile qualities of textiles made of viscose and polyester. The comparison between the measured and predicted moisture regains produced the result shown in Figure 1, which is shown. The number of water-absorbing groups grows as the viscose percentage in the fabric rises, which results in increased hydrophilicity and larger moisture regain of the fabric. The sample needs to be dried in the oven for a longer period as the viscose percentage rises. [3]

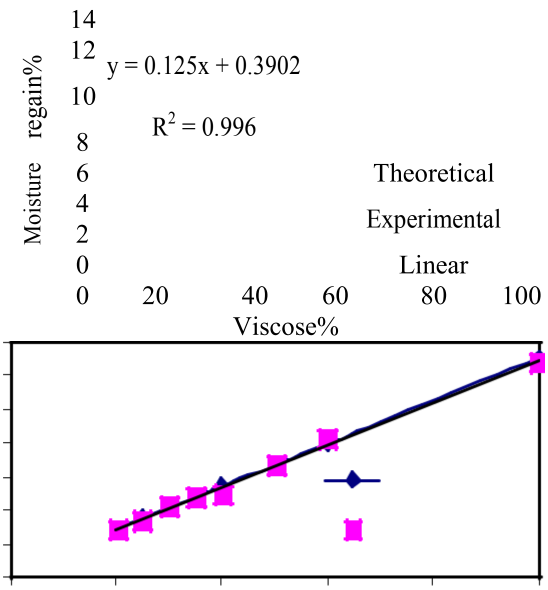


FIGURE 1. Effect of viscose proportion on moisture regain% of the fabrics [2]

Tensile strength, elongation %, roughness and tear strength

According to ASTM D 76 Standard Specification for Textile Testing Machines, the tensile qualities of viscose, polyester, and their blend textiles were assessed before and after treatment with nano silicon dioxide using an Instron Tensile Tester (USA). For samples, the average was calculated (5x 20 cm). Only for the treated and untreated viscose textiles were these tests conducted to compare changes in tensile strength and tear strength. [2]

Suitable dyes for printing on polyester and viscose blends include the following
- Disperse dye properties

- Nonionic dyes are dispersed dyes. They are therefore devoid of ionising radiation.
- They are pre-made colours that either have extremely little or no water solubility.
- They are organic colouring agents that can be used to dye hydrophobic fibres.
- Disperse dyes are used to colour synthetic fibres made of cellulose ester and acetate, polyester, nylon, and occasionally acrylic.
- When using dispersed dyes, carrier or dispersing agents are necessary.
- Disperse dyes have a light fastness value of around 4-5, which is fair to good.

Disperse dyes are divided into groups based on their chemical composition.

- Amino ketone and nitro dyes
- coloured anthraquinones
- Di-azo colours
- azo mono dyes

Preparation of print paste:

Making a thickener paste with 70 grammes of sodium alginate and 13 cups of hot water.

4 gm of dyes plus 2 gm of a dispersant

7 gm (NH_4)

1+2+3 = $2SO_4$ + 0.2 gramme $NaClO_3$ evenly stir

after treatment

To permeate the dye in the cloth and fix it, the printed fabric is steamed in the steamer for 10 minutes at 105-110°C. [23]

Reactive dye

In the clothing and textile industries, reactive dye is a frequent dye. Typically, it is an organic compound that is quite colourful. A chromophore used in reactive dye has a substituent that may easily react directly with the substrate of a fibre. A chemical bond is created between the dye and the fibre. It has excellent fastness qualities. Reactive dyes are typically used on cotton, linen, viscose, wool, and silk. [23]

Vat dyes

Typically, a reducing agent is needed to solubilize vat dyes. Sodium dithionite ($Na_2S_2O_4$), the most used reducing agent, transforms the dye into its soluble "leuco" form. The leuco dye is oxidised to a strongly coloured, insoluble condition after becoming bonded to the cloth. Even the dissolving process needs to figure out the proper quantities of caustic soda and sodium hydrosulphite to accomplish reduction. Chemical processes such as oxidation, reduction, and pH control are frequently required. Only the dye's reduced form is soluble.

Repeatedly submerging the fibre in this oxygen-free dye bath causes the decreased water-soluble form to change colour as oxygen converts it to the water-insoluble form, which is then exposed to the air. These factors make vat dyes less appropriate for home usage than fibre-reactive dyes. Indigo is an example of this group of dyes; when exposed to air, it turns from yellow in the dyebath to green and ultimately blue.

pigment printing technology, on synthetic fabrics Such as polyester, polyacrylic, viscose and their mixtures such as polyester/viscose, (60/40)

Alternatives to the commercial binders used in pigment printing technology, on synthetic textiles like polyester, polyacrylic, viscose, and their combinations like polyester/viscose, (60/40), - Pigments, thickeners, binders, and auxiliaries are all found in printing paste.

For printing on synthetic textiles like polyester, polyacrylic, viscose, and their blends like polyester/viscose and polyester/acrylic, suspension keratin has been utilised as a reasonably priced and ecologically friendly binder.

In place of the commercial binders used in pigment printing technology, which are pricy, imported from abroad, and hazardous to the environment, suspension keratin binders were created utilising naturally occurring, affordable, and renewable resources such as Egyptian wool and chicken feathers. Using chemicals and solvents that are safe for the environment, keratin suspension has been recovered from its sources. Keratin's chemical, physical, and thermal characteristics have been studied. [22]

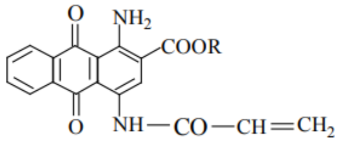
The findings show that samples printed using suspended keratin provide outcomes that are comparable to samples printed. The results of colour fastness against friction, washing, sweat, and light are satisfactory when commercial binders are used. Utilizing substances capable of creating transverse bonds can increase it. Additionally, samples printed with suspension keratin were discovered to be less stiff than ones printed using commercial binders.

Printing Method

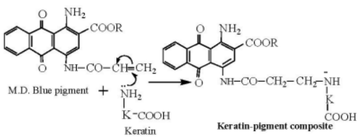
The flat screen printing technique was used to apply all printing pastes on the textiles that were chosen.

Image Fixation

Prints were air-dried before being set in an automated thermostatic oven at various temperatures (140, 150, and 160 °C) for varying lengths of time (3, 4, or 5 minutes) (Wermer Mathis Co., Switzerland).



Structure1. M.D. Blue 2G pigment.



Scheme reaction 1. Proposed reaction mechanism between M.D. Blue 2G pigment and keratin.

The printing paste was made with components capable of forming transverse bonds, and various concentrations of keratin were created and added in various amounts.

Additionally, the light output of the printed samples was tested, and the colour fastness was evaluated concerning a variety of elements, including (friction). washing-light perspiration) The printed samples' hardness was also assessed.

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Utilizing substances capable of creating transverse bonds can increase it. Furthermore, samples printed with suspension keratin were discovered to be less stiff than ones printed using commercial binders.

Compared to Egyptian wool and feathers when suspended. In textile printing, keratin suspension has been utilised as a low-cost, ecologically friendly binder.

Different concentrations of suspended-keratin-based binder (Su-KBB) were created using various keratin concentrations to achieve the ideal pigment printing conditions. Different Su-KBB concentrations were used, and the effects on colour strength and fastness qualities under various thermo-fixation temperatures and times were observed. M.D. Blue 2G, whose structural formula is presented in Structure 1 M.D. Blue 2G, was the pigment employed in this work.[22]

Data indicated that employing a 15% Su-KBB concentration in the pigment paste improved the colour strength and rubbing fastness. The findings of colour strength and rubbing fastness are equivalent between the concentrations of 10% and 15%, with just a small difference.

Viscose/Polyester blend textiles are printed using vat and dispersion dyes.

In this work, the impact of black and activated carbon mineral pigments on viscose/polyester mix textiles printed with vat/disperse dyes that have black and green hues in the NIR/Vis range was examined. Additionally, the comfort characteristics of printed materials were investigated, including air permeability, water absorption duration, bending length, crease recovery angle, and fastness of rubbing, washing, and light. **[24]**

Fabrics made of a combination of polyester and viscose were manufactured with a weight of 230 g/m2 and yarn densities of 34 and 24 per centimetre, respectively. We employed industrial activated carbon, with an average particle size of 1500 nm, and carbon black nanoparticles known commercially as "Printex V." Additional supplies from the Merck Company included acetic acid, hydrogen peroxide, potash, sodium alginate, rongalite C, nonionic soap, glycerin, cationic softener, lodigol, and sodium carbonate. Table 1.2.3.4.5 contains a list of the dyes that were used.

TABLE1 Characteristics of the used dyes during printing experiments

Commercial name	Color index (C.I.) name
Bril Green FFB	C.I. Vat Green 1
Indanthrene Golden Yellow RK	C.I. Vat Orange 1
Cibanon Red 6B	C.I. Vat Red 13
Cibanon Black 2BA	C.I. Vat Black 7
Disperse Allilon Black 2BSF	C.I. Disperse Red 145
Disperse Allilon Blue BLS	C.I. Disperse Blue 1:165
Disperse Yellow GLS	C.I. Disperse Yellow 79

TABLE 2 Disperse printing paste

	Amount of consumable materials (g)
	Green sample
Consumable materials	Sample A
Stock paste	700-800
Lodigol	20
Acetic acid	5
Disperse Blue BLS	1.34
Disperse Yellow GLS	2.66
Disperse Black 2BSF	–
Balance	x
1000	1000

TABLE 3 Reduction bath

Consumable materials	Hydro (g/L)	4
	Caustic soda (g/L)	4
	Anionic detergent (g/L)	0.5
Washing condition	Time (min)	5
	Temperature (C)	70
	L:R	1:50

TABLE 4 Vat printing paste

Consumables materials	Amount of consumables materials (g)		
	Black sample	Sample B	
Stock paste	500-600	500-600	500-600
Potassium carbonate	60	60	60
Sodium carbonate	30	30	30
Rongalit C	150	150	150
Activated carbon	0.66	–	0.66
Black carbon	0.66	–	0.66
Glycerin	13.33	13.33	13.33
Vat Green FFB	–	18.66	20.66
Vat Yellow RK	5.3	36.66	35.34
Vat Red 6B	–	3.33	3.33
Vat Black 2BAN	69.33	–	
Balance	z	Y	
Total	1000	1000	1000

TABLE 5 Oxidation bath

Consumable materials	Acetic acid 50% (mL/g)	3
	Hydrogen peroxide (mL/L)	3.5
Oxidation conditions	Time (min)	2
	Temperature (C)	60
	L: R	1:50

Due to the Bril Green FFB's chemical makeup, the green printed sample has excellent light stability (Figure 5). The black sample contains mineral pigments, yet despite this, it has a high degree of stability. **[24]**

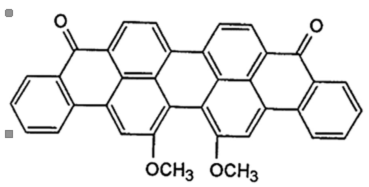

FIGURE 5 Chemical structure of the Bril Green FFB

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Methods

A natural thickening agent was added to the dispersion printing paste (ie, alginate). To create a consistent printing paste, it was vigorously stirred and agitated for 20 minutes (Table 2). The samples were then printed with the printing paste using a manual stencil. An HS 62A drier was used to dry the samples (100°C for 3 minutes). The samples were then kept in a Stenter at 185°C for 5 minutes to fix the dispersion dye. The samples were rinsed in cold water after a heat setting and then put in a reduction-clearing bath (Table 3).

The vat paste was then made using the necessary components mentioned in Table 4 to print the samples with vat dye. To create a homogenous paste, the printing paste was swirled for 20 minutes at a speed of 1000 rpm. Following that, samples were covered with the printing paste. The samples were kept in the oven for 5 minutes at 80°C. The samples were then autoclaved at 102°C for 10 minutes, washed in cold water, and stored in an oxidising solution (Table 5). The samples were then cleaned and washed in hot water. Samples were coated with Foulard 75 %, which contains 5 g/L of cationic softener and was then cured at 160°C for 3 minutes. **[24]**

The absorption time of the printed samples is longer than that of the raw samples. The thermal shrinking of the cloth after printing may be to blame for this. The fabric may develop a thin coating of printing paste ingredients from the print, making the cloth thicker and making it harder for water to penetrate the fabric. Additionally, the black sample took longer to absorb water than the green one. This is because black and activated carbon nanoparticles are present in the black sample. The water droplet's contact angle increases as a result. The nanoparticles' large surface area might be another factor. **[24]**

The porosity that exists on the fabric's surface is filled during the printing process. As a result, air permeability is reduced. In general, the printed samples' rubbing and light fastness were excellent. Another important factor was the printed samples' washing resistance. The printed samples also had less elongation at break, rupture force, and bending length. In addition, the printed samples' water absorption time and angle of crease recovery were longer than those of the raw sample. The primary cause of this modification is the fabric's thermal shrinkage during the printing process. **[24]**

The effects of Dyeing and Printing of Polyester / Viscose Yarns Blends for Clothing use

alterations to the tensile strength of mixed suiting textiles caused by the dyeing and printing procedures (65 % polyester: 35 % viscose) The results obtained demonstrated adverse impacts of dying and printing processes on the tensile strength of the textiles produced. Additionally, dyeing and printing techniques had a favourable impact on the elasticity of the textiles that were created. It was discovered that the strength of the printed fabric was superior to the coloured cloth along the warp direction. Additionally, it was discovered that the strength of the coloured cloth was superior to the printed fabric along the weft direction. It was discovered that the printed cloth elongated more in the warp direction than the coloured fabric did.

Bulk - A (dyeing processes)

The dyeing procedure is divided into two steps:

a) Viscose portion dyeing (35 %)

The viscose fibres were coloured using dispersed dyes. 2 % blue dye, 0.8 % black dye, 0.008 % red dye, and 1cc/L acetic acid made up the formula. Agent dispersed in 1 cc/L The death temperature was 130°C, and the liquor-to-water ratio was 1:7. The dyeing process took 30 minutes, and the cloth was supplied to the machine in a rope shape [25]

b) Polyester portion dyeing (65 %)

The polyester fibres were coloured using insoluble vat dyes. The formula included sodium hydro-sulphate (12 g/L), caustic soda (8 g/L), reduction material, and 1 % dark blue colour. The ratio of alcohol was 1:3. The cloth was put into a jigger dyeing machine in an open form. The therapy lasted 45 minutes, with the temperature set at 60°C. The cloth was then given an oxidising treatment using 10 ml/L hydrogen peroxide (H_2O_2) at a temperature of 50°C following the draining of the dyeing liquid. Ten minutes were spent on the therapy [25]

Batch-B (processes involving printing):

The printing procedures were completed in the following two stages:

a) Fabric Dyeing Background

For a colourful backdrop, a dispersed dye was used to dye the cloth (batch B). The formula contained 0.189 % blue dye, 0.0079 % red dye, 1cc/L of acetic acid, 1cc/L of a dispersing agent, and a 1:7 liquor ratio. The cloth was inserted into a rope form while the liquor was transported to the jet colouring equipment. For 30 minutes, the temperature was changed to 130°C. The cloth was run through the centre machine to remove shrinkage and prepare it for the next operations because it was in a rope shape. [25]

b) Printing Processes

On the cloth, pigments were utilised for printing. The paste's ingredients were softener, fixing agent, emulsifier, 50 g/Kg pigment dye, poly acetate (ammonia salt), 1g/Kg, PH8, 150 g/Kg binder acetate base, and poly acetate (ammonia salt). The fabric was run through a flat printing machine to print the desired design, then through a drying calendar attached to the flat printing machine to finish drying the fabric at a temperature of 130 °C. The fabric was then taken to a stenter machine for colour fixation at 180 °C for a period of 1-2 minutes. The printed cloth was finished by being submerged in a bath with a 10 g/L softener to create a smooth surface. The cloth was subsequently dried by passing through a stenter machine to get its ultimate width (150 cm). [25]

Effect of Dyeing

The coloured fabric's mean tensile strength in the warp direction was 141.66 kgf, and its extension percentage was 37.97. However, the mean tensile strength and extension % in the weft direction, respectively, were 112.02 Kgf and 22.47. It can be seen that after dyeing the cloth, the tensile strength reduced by 13.1% while the extension rose by 13.1% when compared to the findings obtained in the warp direction for grey fabric. The tensile strength decreased by 2.7 % and the extension rose by 0.4 %, respectively, when testing was done in the weft direction, according to the data. It was anticipated that the yarn's tenacity would somewhat diminish following the colouring procedure. This decrease in toughness resulted from the fact that during reductive washing with NaOH, particularly viscose fibres and partially PES fibres suffer minor damage. [25]

Effect of Printing

The printed sample's mean tensile strength was 151.19 kgf in the warp direction and 36.77 kgf in the weft direction, whereas these values were 109.54 kgf and 22.75 kgf, respectively.

According to these findings, the tensile strength reduces by 7.3 % and the extension rises by 9.6 % for warp direction compared to the findings for the grey sample. However, in the weft direction, there was a 4.8 % loss in tensile strength and a 1.7 % rise in extension.

CONCLUSIONS

The laboratory tests on the blended yarn (65% viscose/35% polyester) yielded good results in the elongation, strength, and irregularity tests, and the produced yarn was used as a weft to create fabrics that yielded excellent results in the tests of (water absorption, shrink resistance, and elongation test). These results allow us to use these fabrics as high-quality summary fabrics.

The findings show that samples printed using suspended keratin provide outcomes that are comparable to samples printed. The results of colour fastness against friction, washing, sweat, and light are satisfactory when commercial binders are used. Utilizing substances capable of creating transverse bonds can increase it. Additionally, samples printed with suspension keratin were discovered to be less stiff than ones printed using commercial binders.

For affordable and ecologically friendly binding when printing on synthetic textiles, suspension keratin has been employed. As an alternative to the commercial binders used in pigment printing technology, materials including polyester, polyacrylic, viscose, and their combinations, such as polyester/viscose and polyester/acrylic,

In the current work, a viscose/polyester fabric was printed using vat dyes and dispersion dyes, and activated carbon nanoparticles were added to the print paste, which had a substantial impact on the number of colour components and the decrease of IR reflection. Sample B, which contains no black and no activated carbon nanoparticles, is the formulation that produces the monochromatic NATO green the best. It also contrasts with the reference sample's hue the least. Additionally, compared to the standard sample, the black-printed sample exhibits a superior IR reflection and a more tolerable E.

Greater angles in the printed samples compared to the raw samples suggest that the printed samples are more resistant to bending and creasing. gives the wearer more comfort as a result.

From the results obtained in this work:

According to the findings of this study, wet treatment methods, such as dyeing and printing, increase the fabric's extensibility. (Printed fabric strength at the weft direction was less than that of dyed fabric owing to the passing of printed fabric across Stenter machine several times.) Printed fabric strength at warp direction was larger than that of dyed fabric due to the presence of a printing thickener at the fabric surface. Due to the impact of wet procedures, printed fabric elongation in the warp direction was larger than that of dyed fabric. Due to the repeated transit of printed fabric over the Stenter machine, the extensibility of printed fabric in the weft direction was lower than that of coloured fabric. [25]

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تقنيات الطباعة المختلفة لأقمشة الفسكوز / البوليستر لتحسين خصائص أدائها

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الملخص

شهدت السنوات الأخيرة من القرن 20 تحولات كبيرة وتقدما سريعا في العديد من مجالات الحياة ، والتقنيات الجديدة في مجال طباعة المنسوجات المتقدمة ، مع احتلال المراكز الأولى في المجالات الاستراتيجية. يتم تضمين جميع تقنيات صباغة الأقمشة ، من الرسم المباشر إلى أحدث تقنيات الطباعة ، في عملية طباعة المنسوجات. تبحث الدراسة في استخدام مزج ألياف اصطناعية (vizose) مع ألياف بوليمر (بوليستر) لإنتاج خيوط مختلطة. تتمتع هذه الخيوط بالكثير من الخصائص والمزايا التي تجعلها أكثر تأهيلا للاستخدام في إنتاج الأقمشة الموجزة وتحل محل النقص الكبير في الألياف الطبيعية للخيوط القطنية. تحولت غالبية إنتاج الحرير الصناعي إلى الدول الناشئة ، وخاصة الصين وإندونيسيا والهند. اعتبارا من عام 2016 ، من غير المعروف مدى شيوع الإعاقات في هذه الصناعات ، ولا تزال سلامة العمال تمثل مشكلة. استخدام الخصائص الميكانيكية للنسيج التي تم تقييمها بواسطة معدات FAST لزيادة تأثير معالجة المنسوجات المصنوعة من البوليستر والفسكوز وخلطاتها مع ثاني أكسيد السيليكون النانوي ، ليس فقط على أدائها ومظهرها ولكن أيضا في إنتاج الملابس. يتم استخدام اختبارات القابلية للتشكيل وصلابة الانحناء والقابلية للتمدد والسماكة. من خلال إضافة جزيئات SiO_2 ذات الحجم النانوي إلى سطح المواد ، يتم تعزيز الصفات الميكانيكية والمتانة ، كما تتأثر فائدة المواد.

الكلمات الرئيسية: نسيج الفسكوز / البوليستر صبغة تفاعلية ، أصباغ ، أصباغ التشتت والحوض، الخيوط المخلوطة