Need for segregation

Polyester Staple Fibre has dyeing characteristics entirely different from those of cotton, viscose, silk, etc. Both the dyeing methods and the types of dyestuffs to be used are different.

Different brands of Polyester Staple Fibres dye differently under same conditions.

Within a brand of Polyester Staple Fibre the dyeability varies for different deniers, different merges and types.

A given type, denier and merge of polyester staple fibre may be spun with different blend ratios which again will have different dyeabilities.

It is also possible that different blend partners viz. cotton, viscose, silk etc. may be used leading to dyeing differences.

Also mills may spin the same count with different twist levels from the same polyester staple fibre.

We have, therefore, a number of permutations and combinations which can cause differential dyeing.

Any mix-up can cause costly cloth damage. Therefore, the need for segregation.

Besides the above cases which lead to differential dyeing the spinner has to reckon with the processing problems involved if cut lengths are mixed up. Some mills use 32, 38 or 40mm fibre for PC blends and 44 or 51 mm fibre for PV blends. Mix up of 51 mm fibre with 38 mm can cause serious processing problems resulting in production and quality loss.

How to achieve segregation

a. Fugitive Tinting
This is a necessary evil to achieve the segregation as mentioned under '2" above. Differences in counts, blend ratios, PSF brands, types and merges are identified by applying different shades of tinting colours to the parent mixing.
b. What are fugitive tinting colours?
As the name suggests they will flee or run away whenever we want. They are transient i.e. not permanent. Tinting colours are basically acid dyes which have no chemical affinity to polyester, cotton or viscose and can be and should be easily and completely washed off in cold water during the early stages of wet processing of the fabrics.
c. Choice of Tinting colour
An ideal tinting colour should have the following characteristics

a. It should have a good tintorial value. Minimum quantity of colour should give acceptable level of depth of shade .
b. It should be soluble in cold water.
c. It should be washable in cold water
d. It should have good light fastness.
e. It should not become fast on the fabric if the fabric is grey heat-set

d. Preparation of Tinting colour solution
The required quantity of tinting colour is made into a paste with cold water and the final volume made up with required additional cold water. If the tinting colour is not fully soluble in cold-water small quantity of Acetic acid can be used while preparing the paste. Alternatively hot water can be used for the paste preparation as well as to make up the final volume.
When using hot water for preparation of the solution, if it precipitates heavily on cooling such tinting colours should be rejected.
The final solution should be filtered through a fine cloth or mesh before use.
The concentration of tint on fibre should not exceed 0.05% of the total raw stock by weight and the tinting solution should be a 40 - 50 gpl solution .
e. Methods of applying tinting colour
The tinting solution should be applied to the fibre using a compressed air spray gun. The spray should be finely atomised and should not produce any drips.
There are basically three methods of applying the tint
Bale tinting : Here the bale covers are removed and tinting colour sprayed on all five sides of the bales uniformly
In the second method the fibre from a bale are spread on the floor and the colour applied on top layer only or in two layers.
In the third method about 10 % to 20 % of the fibres are tinted and mixed with 90 % or 80 % grey fibre uniformly before passing through the blow room. Whatever be the procedure adopted for tinting the tinted fibres should be dried thoroughly under natural conditions or under a battery of infra-red lamps.
Many mills add a small quantity of antistat in the tinting solution. This helps in better adhesion of the colour to the fibre and prevents shedding of the colour. This improves the tintorial value of the colour.
f. Which component to be tinted ?
Either Recron or the cellulosic component can be tinted.
However, tinting of Recron is the most common practice in the industry although tinting removes partially or completely the finish applied during the manufacture of the fibre.
While tinting viscose, the colour attaches to viscose tenaciously. Further, the degree of openness of viscose is much less than that of Recron. Hence, if colour is applied on a less opened mass it can lead to unopened coloured specks if blow-room and card conditions are not optimum.
In tinting cotton, mills normally used to dip 10 % to15 % of opened cotton in an open beck containing the tinting solution, squeeze it, dry it and mix with the parent mixing before passing through the blow-room. In general this method removes the natural wax off the tinted cotton and leads to higher imperfections.
g. Tinting is a necessary evil
Besides soiling the spinning machinery necessitating frequent cleaning with suitable solvents, tinting can cause

nippiness, card loading and roller lapping during spinning process.
This is especially so if:
*The tint application is not uniform
*The tint applied is excessive
*The tinted fibre is inadequately dried
In a Bombay mill processing 1.0 Den x 40 mm PSF for export counts the mills do not tint while for local counts PSF is tinted. The percentage card loading without tinting is always between nil and 1.0 for untainted PSF whereas it is around 4.0 % for tinted PSF on the same set of old Platt's SHP Cards.
3.2.Colour Coding :
If we have to avoid the necessary evil of tinting we have to adopt colour coding. Colour coding is nothing but use of different coloured cans, inter-bobbins, ring-tubes and cones/cheeses of different colours or tipped with different colours.
Most of the foreign buyers of blend yarns or fabrics from India refuse to accept tinting. Hence, the culture of colour coding for segregation finds increased acceptance in Textile Mills albeit reluctantly.

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Blending is usually done to improve the functional properties of yarn as well as fabric and to improve process performance of the fiber. Each fiber has its unique properties, but no fiber is perfect in itself, each lacking some or the other property. Blending helps to overcome the drawbacks present in one fiber by combining it with another fiber, which possess the lagging properties of the first fiber. The properties of the individual fibers combine to produce modification in the blend and produce a fabric which possess better qualities than the fabric prepared from individual fiber. Not only the change in combination of the fiber but the change in the proportions for a particular blend also produces change in the properties of the fabric. The functional properties of fabric being up to expectations, the blend proportion of different fibres is also influenced by cost aspects. Hence two, three or more fibers can be blended in various ratio to produce different varieties of fabrics possessing different properties. These factors with different properties can be utilized for different purposes/ end uses.

Blending with reference to PSF

PSF imparts to fabrics good strength,durability,easy care,
wash & wear and crease retention /recovery properties with good aesthetics. However, the comfort properties would be inferior to natural fibres due to low moisture retention. This aspect is taken care of by blending PSF with cotton or Viscose or wool.

Preparation of Mixing and overspray of additional oil

1.Cent percent PSF for draw frame blending.
It is advisable to prepare a bin mixing of at least 5 to 6 bales. Small quantities of fibre from each bale is to be taken alternatively, hand opened and spread on the floor. The mixing should be conditioned for at least eight hours. Vertical sections are to be cut for feeding on to the horizontal lattice of the blender of the blow-room.
Where bin facilities are not available five or six bales of PSF are opened and placed near the blender lattice. The opened bales are to be conditioned for at least eight hours. Small quantities of fibre from each bale alternatively are spread over the horizontal lattice.
2.Polyester and cotton for blow-room blend.
Here weighed quantities of PSF and hand opened combed cotton fleece of sliver are spread on the floor of a bin alternately one over the other. Several such layers depending on mixing size are laid to prepare a sandwich mixing. Small vertical sections are cut and the sections are hand toppled or toppled through a blender and a final mixing is laid. Some mills do two topplings either by hand or through a blender. Small vertical sections of the final mixing are cut and fed to the blow-room.
3.Polyester and Viscose for blow-room blend:
Viscose like PSF does not contain any trash or foreign matter. Both of them do not need the elaborate sequences of

beating/ opening points as required by cotton. Hence PSF/Viscose blends should preferably be made at blow room. But a note of caution. Viscose bales are highly dense and in bale form the degree of openness of Viscose is much less than that of PSF. Therefore, for blow-room blending of Viscose with PSF the former should be pre-opened through a blender with closest setting between the inclined lattice and evener roller. This will match the degree of opening of the two components which in turn will facilitate intimate blending. Further, preopening of Viscose will reduce the load on carding leading to better individualisation of fibres.

As in blow room blending of PSF & Cotton, here also weighed quantities of PSF and opened viscose depending on the final blend composition are spread one over the other in a bin. The number of layers depends on the final mixing. The sandwich layer is pressed with legs to make a tight mass so that while cutting vertical layers only small tufts come out. The vertical sections cut are fed to a blender, and again another mixing is made. Vertical sections are again cut, passed through a blender and the final mixing is laid. From the final mixing vertical sections are cut and fed to the blow-room

4.Overspray of additional oil

Normally, the finish imparted to PSF during the manufacture is adequate for satisfactory processing of cent percent PSF. However, under exceptional circumstances arising from unsatisfactory atmospheric conditions or when PSF is blended with Viscose or Polynosic, overspray of additional oil is resorted to for satisfactory processing.

Overspray Oils are normally

Lubricant cum antistat

Cohesive cum antistat

Purely cohesive

Purely antistat in nature

The choice of the oil will depend on the nature of the problem encountered. Sometimes we may have to use a combination of two oils.

Whichever be the oil used it is made into an emulsion with water. The amount of oil expressed as a percentage of the total blend and the quantity of the water to be used indicated as litres per 100 Kgs. of mixing will depend on the severity of the problem and the ambient conditions.

The additional finish should be applied using a compressed air spray gun uniformly while layering during mixing preparation. Unevenly sprayed finish could cause more problems than solve them.

Unispray - An automatic overspray system

Introduction

1. All polyester / viscose spinners in this country - and sometimes spinners of 100 % polyester and polyester/cotton - do spray antistats on the polyester component. The object of the overspray is to make the blend run through textile spinning machines with the least problem of lapping, loading, fly generation, etc. The amount of overspray varies from mill to mill, within a mill between seasons, on blend composition, type and make of polyester brand and on machine speeds. Optimum quantity of overspray has to be decided by trial and error only.

2. The current practice in the mills are as under :

Polyester staple fibre and Viscose staple fibre are weighed accurately. The respective weights depends on the final blend composition and then pre-opened by passing them through a blender. They are pneumatically transported to the mixing area. First, the polyester staple is transported; it is then manually spread over an area of about 3 m x 3 m. A workman sprays antistatic oil manually with the help of a compressed air spray- gun. With this system, large drops of antistatic oil are deposited on the fibre, wetting them to an unacceptable degree and necessitating a 24 hrs. drying time. The application system partly washes off the proprietary spin finish applied by the fibre producer which adversely affects the performance of the fibre. Also the manual application of finish is not uniform at all. Some fibres will get too much finish. Some too little; this uneven distribution causes problems downstream.

Not all textile mills use compressed air to spray finish some still use sprinkling cans, while some wet brooms with finish held in a bucket and shake the broom over the fibres. Both these methods are crude and inaccurate.

Unispray - Development

1. Reliance Industries Ltd. being intimately linked with all blend spinners, was aware of the problems, and limitations of the current practice; and conceived a superior method (for which a patent has been applied) which will eliminate all the disadvantages of the current method. Reliance tied up with Intec Exports Private Ltd., Mutha Road,

Pirangoot, Pune - 412111 to develop Unispray which is being offered solely to Reliance customers.
2. The details of this system are :
The "Unispray" involves spraying the finish under very high pressure with the help of a ratio pump operating on compressed air. The finish is forced through a small nozzle resulting in fine atomisation without forming any droplets. These atomised particles are then directed on polyester and viscose fibre blends during the blending operation, using a typical blending hopper feeder.
The system delivers precisely measured amount of antistatic finish on the fibre. There is also a provision to automatically stop the spray if no fibre stock is present in the hopper of blender.
The unit has two stop motions. In case the blender is stopped, the spray unit also stops. Also, if the blender is working, but there is no fibre in the machine, then also the spray unit stops. This is to prevent spraying finish on machine parts and/or overspraying on material in the hopper.
In order to have maximum safety, the control mechanism operates on 24 Volts electric supply and the entire control mechanism is enclosed.
3. The operation of Unispray is simple and straight forward. Mills will make desired strength of spin finish and transfer it to the container. When blender is working with fibres inside, the Unispray creates a very fine mist of finish. The finish is sprayed on fibre lumps which are moving up and down on the inclined lattice of the machine. By controlling the strength of spin finish, pump pressure and nozzle size, mills can control accurately % finish oil to be put on the fibres. By a judicious choice of nozzle size, air-pressure and with the knowledge of blender production rate and total volume of finish oil to be applied, mills can automatically spray desired quantity of finish oil on the material.
4. The following advantage are claimed with Unispray :

a. Almost 100 % coverage of fibres with overspray while with conventional system only 10 to 15 % fibres are covered with overspray.
b. In the old system, overspray is not uniformly applied. There are pockets of fibres with very high quantities of overspray and then there are fibres with almost nil overspray. In the Unispray, all fibres have uniform spray.
c. The uniform overspray ensures even working of fibres in the department.
d. Since the spraying is done automatically there can be some saving in labour.

Blending stage

1. Polyester Cotton Blends
Even though PSF is traditionally blended with combed cotton at draw frame many mills, have switched over to blow room blending of the two components under the following typical Indian mill conditions:
Wide fluctuations in atmospheric conditions prevailing on the shop floor
Poor mechanical conditions of the card.
Inadequate draw-frame capacity.
2. Merits and demerits of blow room blending :
Combed cotton sliver even if it is of Suvin, brought back to blow room is soft waste. Hence, 33 % or 50 % of the mixing, depending on the blend proportion will have softer second component. This can lead to lap licking or lap splitting where calendaring pressure is not optimum particularly with old blow rooms.
Heavy lap-licking or lap splitting can result in cylinder loading and wrapping variation
The combed component is subjected to additional beating at blow room leading to nep generation
Because of the above we should attempt to card blow room blended PC laps with narrower cylinder/Flat settings of 10/12 Thou to remove the additional neps generated. Where this is not possible blow room blending of cotton and PSF may produce yarn of inferior quality
In general it is observed that for a given set of cards blow-room blending gives consistently better working and higher productivity.
Wherever, closest setting between cylinder and flats are possible with blow-room blending fibre individualisation will be better, yarn imperfections and Uster Classimat short thick faults will also be lower.
Blow-room blending quite often solves the problems of coiler choking and sliver being thrown out of the cans at cards and drawing, sometimes encountered while processing cent percent PSF particularly in old machines.

Blow-room blending involves additional waste of good cotton at blow-room and card due to re-processing. The realisation of cotton component could be lower up to one percent.
Additional blow-room and carding capacities are required for blow-room blending. This will add to the cost of yarn manufacturing. There will be a marginal saving in cost because of fewer number of draw frame passages in blow room blending.
Extra space for stack mixing is required for blow-room blending.
Uniformity and intimacy of blend will be much better with blow-room blending .
3. Polyester Viscose Blends
Requirements of blow room and card operating parameters are more or less identical for Polyester and Viscose. Further, in bale form both of them are clean without any trash or other impurities. Hence, it is ideal to resort to blow room blending of PSF and Viscose

Blow Room

Since the object of blow-room is to open the compressed tufts of PSF in a bale, a blow-room sequence with two opening points preferably of the Kirschner opener type is adequate. The sequence normally is Blender/Bale opener - First Opener - Hopper Feeder - second opener - Lap end
The Kirschner beater speeds should be around 700 rpm to 850 rpm and fan speeds of 1200 - 1400 rpm are to be maintained.
Beater to pedal settings should be 8 mm for 38 mm fibre and 10mm for 51mm fibre.
To compensate for higher resilience and lower specific gravity of PSF, 1.38 compared to 1.52 of cotton, higher calendar roller pressure than that used for cotton is necessary. This is to produce sufficiently compact PSF laps free from licking
To facilitate easy withdrawal of lap spindles at the time of doffing lower rack pressure than that employed for cotton is necessary. The rack pressure employed should not be too low as to cause bulky laps.
Modern blow room lines for synthetics are provided with only one cage. In old lines having two cages and if lap licking or splitting is encountered bulk of the opened fibres should be deposited on the top cage by blanking the air-flow to the bottom cage.
The lap width should preferably be smaller than the width of carding surface by 25 mm to 30 mm to prevent folding over of lap edges leading to card loading and incidence of bunches of fibre at the edges of card web.
Linear density of the laps are to be maintained at 300 - 350 gms/metre for finer deniers and 350 - 400 gms/metre for coarser deniers.
Because of the higher bulk and resilience of PSF, lap lengths are to be reduced as compared to that of cotton. Too bulky and soft laps can get further damaged during transport and will increase the lap bit waste.

Carding

1. Recommended Speeds

Type of Card	SHP	Cross-Roll	HP	Latest HP Cards
Cylinder - rpm	200-240	250-320	350-450	450 - 550
Licker-in - rpm	550-550	600-700	800-1100	800 - 1000
Doffer - rpm	8-12	15-18	24-32	30 - 50
Flats - inches/mt	2	3	4-5	6 - 10

2. Recommended Settings
In general settings normally used for cotton are adequate with the following exceptions

Feed plate to L.I.	38 mm - 12 - 17 Thou
	44 mm - 15 - 22 Thou
	51 mm - 22 - 34 Thou with long nose feed plates

Mote-knives should be set wide to the extent of 34 Thou to prevent loss of good fibres
Licker- in under casing to licker- in setting also should be closed to minimise licker in droppings
Closer and uniform setting across the width of card between Licker-in/Cylinder and cylinder /doffer will facilitate easy transfer of fibres without loading.
Cylinder/Flat setting also should be closer and uniform for better fibre individualisation and good yarn quality. Higher cylinder speeds in the ranges mentioned above will also help in better carding.
3. Types of wires
In general low density wire population of the order of 450 to 600 for cylinder are recommended to avoid cylinder loading. However, depending upon the make of card and maintenance level in a mill we have come across use of higher density wire points for cylinder without cylinder loading even with a closer setting between cylinder and flats. Such a situation is ideal for good carding and will produce yarn with minimum imperfections and Uster classimat faults.
As far as Licker-in wires are concerned use of negative angle or zero angle wires are suggested for ease of transfer of fibres from licker-in to cylinder.
Hard point non grindable tops with low wire density for flats are generally in use for synthetics. These wires reduce flat strip waste to a minimum. High density tops normally used for cotton gives good individualisation of the fibre mass at the cost of additional flat strip waste. A happy compromise would be to use low density hard wire tops at higher flat speeds.
Doffer wires normally used for cotton are adequate for synthetics also.

Drawing

1. Speeds: Vary according to the make of drawing Old 4/4 or 3/3 drafting : 50 - 100 Metres/ Minute Semi high production) 180 - 200 Metres/Minute like LR - DO 2S) High production) 400 - 500 Metres/Minute like LR - DO/6 or Zinser) High production like) RSB ,HS, Cherry-Hera) 450 - 650 Metres / Minute
2. Settings
In general the front zone nipping distance is about 10% higher than the cut length of the fibre and back zone about 20% higher than the cut length
Narrower settings than these particularly in the front zone is employed quite often to obtain Lower U% To reduce fly liberation especially in PSF/cotton blends
3. Break Drafts
In general cent percent PSF passage after carding or the breaker passage in case of PSF/Viscose or PSF/cotton blow room blend a break draft of 1.5 to 1.7 is used. For further passages a lower break draft of around 1.3 is employed
4. Other precautions
Sliver guides or cans should be so positioned to ensure vertical withdrawal of slivers from cans.
Sliver guides behind the back rollers should be set as narrow as possible without causing overriding of slivers.
It is quite common to provide selvedge guides in the front zone to prevent shedding of fibres particularly in old draw frames
Roller clearers should be well maintained and bear against the rollers with some pressure to minimise lapping and fly liberation.
Minimum creel tension draft or even negative draft helps to reduce U% of the sliver.
Front tension drafts also should be minimum to avoid stretching
Single stop motion should be in perfect working condition to avoid blend variation in case of draw frame blending as well as to minimise count variation
Stop motion for lap ups and coiler choking should be very sensitive. Ineffective stop motions can lead to heavy lap ups which are difficult to remove resulting in downtime. Heavy lap ups can lead to fusion of PSF and hence damage to machine parts.
Both bottom metallic rollers and top rubber cots should be maintained well without any burs or roughness to avoid lapping
TOP

Wet Processing

1.Introduction

Processing of Recron polyester staple fibre blended substrates (i.e. yarns and fabrics) to get the dyed or printed finished material consists of various physico-chemical operations which are to be performed sequentially. The sequence of operations carried out on the polyester blended substrates remain essentially similar to that operative for cotton or other textiles. However, Recron polyester staple fibre due to its special attributes, warrants some materially different processes like heat-setting as well as elevation of certain operations like dyeing to high temperature or use of specialty chemicals like anti-static agent, etc.

A processor of Recron polyester staple fibre blended substrates has a choice of various alternate technologies. The final choice of sequence and unit operations is dependent on the type of substrate and also equally essentially on the infrastructure in terms of hardware available with the processor of the processing house. Many processing houses are designed to produce a certain variety or quality of the material in limited quantity and are therefore equipped with a specific type of machines; with the result they are besieged with the constraint to technology choice.

Of the various polyester staple fibre blended substrates, polyester/cellulosic blends account for more than 90% of the present production of polyester blended material. The most commonly produced blends remain to be those having either 67% polyester or 48% polyester produced by the blended yarns or by using filament weft. The cellulosic component could be either cotton or viscose or at times polynosic and some times a blend of these fibres. The processing conditions of the blends remain almost same irrespective of the cellulosic component. However blends containing cotton require slightly severe pretreatments and some times an additional step of mercerization or causticization.

2. **Pretreatments**

Recron/cellulosic blended fabrics as received in the grey room of the process house have various types of additives. Most of these additives are deliberately added at various stages so as to be helpful in the manufacture of textiles. These include spin finishes, coning oils, sizing agents and tinting colors. Having performed their useful role, the presence of these additives becomes undesirable, since they hinder the coloration and finishing of the fabrics.

The prime concern of the pretreatments is to free the fabric of these impurities which may add up to 5-12% of the weight of fabric. Inadequate pretreatments may lead to defective finished product.

As much as 60-70% processing faults have been traced back to insufficient pretreatments.

The pretreatment of Recron/cellulosic blended fabrics has two objectives:

(1) the preparation of the fabrics for subsequent dyeing, and

(2) to impart maximum brightness to white fabrics with all the means available.

The higher the degree of whiteness demanded, the more difficult the task becomes. Anybody who has already had experience in this matter knows what an enormous effort is required to achieve this aim.

The main source of impurities in the polyester/cotton fabrics is with the cotton. This is the component which determines the pretreatment conditions to be employed. It is not generally known that the bleaching of the cotton component, for instance, in white fabric, not only determines the general level of whiteness, but also influences the fluorescence of the optical brightener to quite a considerable extent. In addition to having been bleached to the desired extent, it is required that such materials should be hydrophilic, dye-receptive and present a uniform appearance after dyeing. The following facts should be remembered when pre-treating Recron/cotton blends.

(1) Recron polyester staple fibre is hydrophobic by nature and remains so after pretreatments.

(2) Apart from sodium chlorite, which has a light bleaching effect, the polyester does not respond much to other bleaching agents

(3) Most of the natural as well as acquired impurities occur in the cotton.

(4) In a Recron/cotton blend, only the cotton component can acquire hydrophilic properties provided, of course, appropriate treatment is given.

Fundamentally speaking, it is always the more strongly contaminated component of the fibre mixture that determines the pretreatments to be selected.

The unit operations are performed on these fabrics according to any one of the following sequences:

(1) For White Fabrics : Desizing - Scouring - Bleaching -, Mercerizing Optical whitening and Heat-setting singeing Peroxide bleaching Drying Finishing

(2) For Dyed Fabrics Desizing - Scouring Bleaching , Mercerizing Heat-setting Dyeing Singeing , Finishing.

Mercerization is not required for Recron/viscose blends.

There is no simple answer to the question of which is the best sequence of operation; much depends on both the material itself and on the machinery available.

2.1 Singeing

Singeing is rarely carried out on the grey fabric unless it is absolutely essential. If carried on the grey fabric it tends to 'fix' the impurities like sizing agents, oils and antistatic finishes. Singeing of the polyester component results in the bead formation. These beads show up as dark spots in the exhaust-dyed fabrics. It is advisable to carry out singeing after the bleaching or dyeing operations.

In the gas singeing operation, which is generally followed in most of the modern mills, the fabric is passed over a set of gas burners in such a way that each face comes in contact with the flame twice. Burners with short, uniform flames are used for these fabrics. The fabric moves over the flame at a speed of 100- 1 25 m/min followed by a passage over a water-filled roller. For very fine fabrics, the cloth is passed over a water filled cylinder while the flame tangentially impinges on the outer surface. This is done to avoid fusion of the polyester. Singeing not only improves the surface appearance but also reduces the pilling tendency.

2.2 Desizing

Recron/cellulosic blend fabrics have a size content of 15-18% for single yarns and 6-8% if doubled yarns are used in the warp. The size generally employed is a mixture of various film-forming agents and lubricants, namely, starch, CMC, PVA, acrylic polymers, fats, tallow and wax. In order to meet the techno economic requirements most of the modern sizes contain starch and PVA or acrylic polymer

Most of the desizing operations are designed to primarily remove these ingredients of the size. Though it is generally claimed that PVA can be removed by a hot wash, in practice complete removal can only be ensured by an oxidative treatment. Earlier the mills were generally carrying out Enzymatic Desizing which is very economical, efficient and least damaging to cellulose using the following recipe:

Bacterial Enzyme 10 g/l
Common salt 10-20 g/l
Wetting Agent 1-3 g/l
Time 1-10 hours
Temperature 60-90oC

Enzymatic desizing is carried out either on a jig dyeing machine or by a pad-store method. Thorough after-wash completes the process.

Limitation of this process is enzymes are not effective on synthetic sizing materials.

Oxidative desizing methods have become popular found favour in recent times, due to their versatile nature and are preferred by many processors especially when they are not sure of the components of size. These methods have been found to be most effective for sizes having PVA and gum.

Typical recipe:
Hydrogen Peroxide (50%) 2-5 g/l
Or
Sodium persulphate 1-3 g/l
Sodium carbonate 10-20 g/l
Wetting Agent 1-3 g/l
Time 10-160min
Temperature 80-100oC
pH 10-11

Oxidative desizing can be carried out either by pad store method or on a jig dyeing machine. This method of desizing can be combined with the scouring operation.

2.3 Scouring

The scouring of the Recron/ cellulosic blends is generally carried out in the open width to avoid rope marks. A very mild scouring treatment is required for Recron/ viscose rayon blended fabrics, since these fabrics have only spin-finishes or residues of sizing components. Acceptable scouring can be achieved easily by using following recipe.

2.3.l. For Scouring of Recron/ Viscose Rayon Blends:

Sodium carbonate - 2-3% owf
Anionic detergent - 1-3 g/l
Temperature - 90- 1OOoC
Time - 1-2h

Generally jumbo-jigger is used. For light weight fabrics winch can be employed.

2.3.2. For Scouring of Recron/ Cotton Blends.

Recron/cotton blends require severe scouring conditions to remove the natural impurities of cotton. Effective removal of fats and waxes of cotton can only be achieved by boiling the fabric with a strong alkali like sodium hydroxide. Since sodium hydroxide has an adverse effect on the polyester, one has to be careful while using it. Keeping these effects of NAOH in view, the scouring of Recron/cotton fabrics can be carried on a jigger by using following recipe:

Sodium hydroxide - 5 g/l
Wetting agent - 1-3 g/l
Emulsifying agent - 1-3 g/l
Temperature - I00oC
Time - 40-50 minutes

This scouring should be followed by a thorough hot wash.

When one is required to process fairly large meter age of Recron/ cotton fabrics one can use either a Pad-roll method or a continuous method of scouring depending on the availability of the machines and production rates required. Following treatment conditions can be used.

2.3.3. For Scouring of Recron/Cotton blends by Pad roll method

Pad with: Sodium hydroxide(35%) 10-15cc/l
Wetting Agent 1-3 g/l
Scouring Agent 6-10g/l
Steam for 1-6 hours depending on the quality of the fabric and wash thoroughly.

For Scouring of Recron/ Cotton blends by Pad Steam

Pad with: Sodiumhydroxide 30 g/l
Wetting agent 1-3 g/l I
Scouring agent 6-10 g/l
Steam for 5 min at 98- 1OOoC in a steamer and wash.

2.4. Bleaching

The scoured Recron/celluiosic blended fabrics generally are adequately white. However, if the cellulosic component happens to be cotton the bleaching becomes a necessity. For goods to be sold as white or in light shades a high degree of whiteness is required. For the bleaching of Recron/cotton blends one can use either sodium hypochlorite or hydrogen peroxide or sodium chlorite.

Bleaching with hydrogen peroxide is more often practiced because of its advantages like permanent white, ease of use and possibility of combining scouring and bleaching.

2.4.1. For Bleaching with Hydrogen Peroxide in Jigger

Hydrogen Peroxide (35%) 4 g/l
Sodium Silicate 5 g/l
Sodium Carbonate to pH 10.5
EDTA 0.1

Generally there is no need for additional alkali, since the cloth remains alkaline after scouring treatment. 2 ends are given at 60oC, 2 at 80oC and 2 at boil. Typical time for this process is 45-60 minutes.

Bleaching with hydrogen peroxide can also be carried out by the Pad-store (room temperature) or on a continuous range using almost the same recipe for padding. For Pad store, fabric impregnated with chemicals is stored for 12-16 hours and then taken for a hot wash. In a continuous range, padded goods are immediately steamed for 10 minutes and then washed.

2.4.2. For Bleaching with Sodium Chlorite in Jigger

Sodium Chlorite (80%) 1-2% owf
Formic acid (85%) to pH 3-4
Sodium nitrate 1-2 g/l
Treatment at boil for 1-2 hours. After treat with sodium bisulphate (1-2%) at 70oC for 10 minutes.

2.5-Mercerization or Causticization

Since Recron polyester staple fibre is not adversely affected by concentrated sodium hydroxide at ambient temperature, the mercerization of the Recron/cotton blend does not pose any special problems except those which are inherent in the process. Caustic soda of 52-54oTw is used. One can mercerize either on a pad less chainless machine or the conventional chain mercerizing range depending on the availability of the machine and the fabric quality. In the absence of the proper machine one can achieve results by treating the fabric on a jigger with sodium hydroxide of 15% concentration. This treatment known as the causticization treatment does not improve the lustre but is effective in increasing the dye uptake of the cotton component of the blend.

In the case of Recron/viscose rayon blends a caustic treatment with NAOH of IO Tw, at room temperature in jigger or winch improves the dye sorptivity of the viscose by destroying its skin and is advisable for higher dye sorption of the reactive and direct dyes.

Mercerization or causticization treatments should preferably be given after the bleaching operation.

2.6 Heat Setting

Heat setting is done to improve dimensional stability, crease resistance, uniform dye pick up and to reduce pilling propensity.

Heat-setting of Recron/cellulosic blend fabric is carried out on a pin stenter by keeping an overfeed of 3-5%. It is essential that the fabric temperature is kept above 180'during heat-setting otherwise poor dye-uptake will result. An uneven heating of the fabric in the stenter may result in uneven dyeing. An overfeed of 3-5% is given to allow shrinkage during heat-setting which invariably occurs. Any attempt to reduce the overfeed may result in higher residual shrinkage. It is essential that the residual shrinkage in the fabric is less than 1%, which is adjudged by boiling the heat-set fabric in water for half an hour.

It is advisable to carry out heat-setting after the various preparatory processes are over. If an optical whitener is to be applied it is economical to pad the fabric with an aqueous solution or dispersion of the optical whitener before heat setting so as to fix and develop the optical brightener at high temperature.

Rapid cooling of the fabric when it is still on the chain is essential for "locking in" the heat set parametres.

3. Dyeing

The dyeing of polyester, which was considered as the most tedious process at one time has been so perfected over the time that it is one of the least trouble-some provided suitable machinery and dyes are made available to the dyer. Today, maximum effort is being put in to optimise the dyeing procedures for polyester. The particular inputs required for the successful dyeing of the polyester are:

(a) Properly formulated dyes;

(b) Theoretically perfected dyeing procedure

(c) Effective and intelligent usage of auxiliaries; and

(d) Scientifically designed equipment.

3.1 Disperse Dyes

For the dyeing of polyester fibres mostly disperse dyes are used. Pure disperse dyes are crystalline solids of low molecular weight which melt on heating (150-250'C) and sublime without decomposition. Aqueous solubility at 80'C ranges from 0.2 to 100 mg/l. Since solubility increases logarithmically with temperature, in practice all the dyes may be in solution in a dye bath at 130'C. Consequently on cooling dye may come out of solution as relatively large particles. It appears that in solution disperse dyes are molecularly dispersed over the whole range of dyeing conditions used.

Because disperse dyes are applied in the form of very fine aqueous dispersions; particle size and dispersion stability are extremely important. Ideally a commercial disperse dye is required to disperse extremely rapidly when added to water and to give a stable dispersion of very fine and uniform particle size (less than 1 micron**).** Further, the dispersion should remain stable throughout the dyeing operation up to the maximum temperature employed, and in presence of any other dye bath additives including carriers and leveling agents under certain circumstances, e.g., at temperature above 100oC and in presence of certain surface active agents, aggregation of dye particles may occur to such an extent that they become deposited on the fibre surface, lowering fastness to rubbing and washing. Some of the salient features of the disperse dyes are:

1. Essentially low molecular weight azo, anthraquinone and diphenylamine derivatives
2. High melting (> 150'C) and crystalline materials - milled with dispersing agents to produce dispersion of 0.5-2.0 micron particle size, stable in bath.
3. Essentially nonionic, although aromatic and aliphatic - NR2 NH, N HR and OH groups are present.
4. Relatively low solubility in aqueous medium under dyeing conditions, but with a solubility of at least 0.1 mg/l at 80oC.
5. Relatively great saturation level of pure dye (30-200 mg/g of fibre).
6. No chemical change involved throughout the dyeing process.

Dyeing Procedures for the Dyeing of Recron polyester staple fibre blended fabric

For dyeing of Recron/cellulosic blends the two components namely the polyester and the cellulosic part, are mostly dyed separately. Some processes have been developed to dye both the components simultaneously. However, these processes have not yet been widely commercialised.

3.3. Piece Dyeing

The polyester component of the Recron/cellulosic blend can be dyed by any one of the following methods:

a) Carrier Dyeing Method

b) High Temperature High Pressure Dyeing Method

c) Thermosol Dyeing Method

The first two are batch dyeing methods while the third method is a continuous dyeing method.

3.3.1. Carrier Dyeing Method

In the Carrier dyeing method, an additional organic compound is added to the dye bath. This organic compound, popularly known as 'Carrier' accelerates the rate of dyeing, with the result it is possible to dye polyester at boil in a jigger or in open becks. Carriers are usually aromatic compounds of various types apart from the effective substance, the majority of commercial carriers also contain emulsifiers which ensure satisfactory emulsification, or dispersion in the dye liquor, the effective substance being itself sparingly soluble in water. There are quite a number of theories on the way in which carriers act. The carriers lower the glass-transition temperature of the fibre, some carriers enhance the solubility of the dye in the bath. Lowering of the glass-transition temperature (Tg,) permits dye diffusion at lower temperature, thereby giving dyeing of adequate depth at boil. Use of excess amount of carrier, may result in large increase in dye solubility and may result in low exhaustion i.e. poor dyeing.

The carriers are expected to possess many desirable properties namely, ease of availability, low cost, non toxicity, biodegradability etc. No organic compound is endowed with all these characteristics. Hence a compromised product is used. Some of the most commonly used compounds are 0-phenylphenol, Biphenyl and Chlorobenzenes, sold under various trade names.

The dyeing of the polyester component in the fabric is generally carried out in an enclosed jigger using following recipe:

Dye: x% owf

Dispersing agent - 1-5g/l

Carrier - 5-15g/l

Acetic acid to pH - 5-6

The dye liquor is first made up with acetic acid and the dispersing agent. After allowing the material to run for a short time at 60'C the required amount of carefully prepared carrier emulsion is added. After 10- 1 5 min. previously dispersed dye is poured in installments and after this has been distributed uniformly the temperature of the liquor is raised to the boil in 30-45 minutes. Dyeing proceeds at boil for 1 -2 hours, depending on the depth of shade required. The pH of the liquor should lie between 5 and 6 during the entire dyeing process. The material is afterwards thoroughly washed and given a reduction-clear treatment with 2 g/l sodium hydrosulphite and 2 g/l sodium hydroxide at 60-80oC for 30 min. This treatment removes the surface adhering dye and improves the rubbing fastness. The cellulosic component is then dyed with suitable dyes. If the cellulosic component is to be dyed with vat dye the reduction-clear treatment is omitted.

The carrier dyeing process has certain obvious limitations such as the additional cost of the carrier, limitation of the choice of dyes and effluent disposal problems. Residual carrier has adverse effect on the light fastness of the dyeing. Because of these limitations, other method of batch dyeing, i.e., the HT-HP method is generally preferred by the organized industry.

3.3.2.High Temperature-High Pressure Dyeing Method.

Compared with the carrier dyeing, the HT-HP process offers a number of advantages. The dyeing times are frequently shorter, the fibres are better penetrated, unevenness caused due to fluctuations in heat setting is compensated, higher colour yield with superior dyes and offers better fastness properties of the dyeing. Furthermore, faults associated with carriers, e.g., the formation of spots due to condensation of carrier, breakdown of carrier emulsion do not arise. Apart from all this, there is no need to take special precautions to remove completely residual carrier from the fibre material where inadequate removal would mean impairment of light fastness properties.

Dyeing by this method is carried out in a specially designed equipment which is capable of dyeing at temperatures above boil, obtained by creating pressure inside the dyeing vessel. The developments in dyeing machines are taking place at a fast rate. Modern machines have very rapid heating rates and high liquor circulation capacity.

In a conventional dyeing process on conventional machine , following dyeing procedure is follows;

Typical recipe:

Dye - x% owf

Dispersing agent - 1-5g/l

Leveling agent - 1-5 g/l

Acetic acid to pH - 5-6

The acetic acid and the auxiliaries are first added and then the dye to the liquor at 60oC. The material is run for a few minutes to ensure uniform distribution of the dye; thereafter the temperature of the liquor is raised to 130oC in 45-70 min keeping a uniform heating rate of 1 to 1.5oC per minute. Dyeing is continued at this temperature for 30-60 minutes to allow for diffusion and leveling by migration. The pH of the dye liquor should remain at 5 to 6 during the whole of the dyeing operation. At the end of the dyeing, liquor is cooled to 80oC in a controlled manner before draining in the case of rope dyeing of fabric qualities sensitive to crease formation. In the case of fiber and yarn dyeing , HT drains are constructed and the liquor should be preferably drained at 130'C to ensure cleaner dyeing with good rubbing fastness.

Material is rinsed and given reduction clear treatment if required.

With better understanding of the HT-HP dyeing process, developments have taken place to reduce the dyeing time by employing **rapid dyeing process** along with rapid dyeing dyes and machines. This process is based on the following principles:

a. Above the glass transition temperature (80oC) , there exists a critical temperature range (of 30oC) (which varies with dye and its concentration) where the exhaustion of dyes into fiber surface is very rapid and to the extent of 90%. Hence if rate of heating is controlled in this range, dye will go uniformly into the fiber surface and hence the long "leveling by migration" phase at high temperature is not necessary. Only small time for the dye to completely diffuse into the interior of the fiber is required which is 5-10 minutes for light shades to 20-30 minutes for dark shade.
b. Dye stuff suppliers have fine tuned their range and offering matched dyes where all the dyes used in a shade have similar exhaustion behaviour i.e.: same critical temperature range.
c. Machine suppliers have increased liquor circulation rates and heating capacities so that even heating at 1.5oC/min produces even dyeing in the critical temperature zone and beyond the critical temperature zone, heating rates of the order of 5oC/min (or more) can be employed.

Thermosol Dyeing Method:

The thermosol dyeing method was originally developed by Du Pont for the continuous dyeing of polyester fabrics by a pad-bake process. This process of dyeing has been found to give better results on the Recron/ cellulosic blend fabrics as compared to pure polyester fabrics.

The mechanism of dyeing has been a subject of study over the years. It is generally believed that heat softens the fibres and makes them more permeable to the dye molecules which diffuse into the fibre at a very high rate. Following factors affect the thermosoling process.

(a) Effective preparation of the fabric

(b) Specific properties of the dyes

(c) Auxillaries employed

(d) Thermosoling time/temperature.

The fabric should be evenly prepared and should be highly absorbent, since the time of contact between the dye-liquor and the fabric is very short. It should have no residual oil which will affect sublimation characteristics of the dye. The pH of the fabric should be 6-7 before padding.

Dye flxation is dependent on molecular size, shape, volatility and solubility of the dye in fibre. Solubility of the dye increases as molecular weight decreases but then there is danger of increased sublimation tendency. The dye should have minimum sublimation over the thermosoling temperature range. Each dye has an optimum temperature which can be obtained from the thermosoling curves which gives degree 6tTixation as a junction of time. Amount of dispersing agent in the dye also affects the extent of fixation**.** The amounts of dispersing agents act as a barrier between the dye and fibre and may reduce the sublimation temperature thereby reducing the flxation of the dye.

Migration is one of the serious problems of the thermosoling process and it is more marked in the case of blends. Migration can be inhibited by: (a) Lowering the content of dispersing agent in the dye, (b) having low pick up, (c) using better drying equipment, (d) batching impregnated fabric before drying, and (e) using thickeners. Migration is mostly reduced by adding thickeners (poly-electrolytes like sodium alginate, CMC and polyacrylic acid).

The thickeners serve dual purpose, firstly they improve the pick-up of solids and secondly they prevent the migration of the dye from the inner to the exterior zone.

Apart from antimigrants, accelerants are also added to the padding liquor to increase the dye fixation. Two types of accelerants are recommended, namely (a) Non-surfactant type (i.e. urea and caprolactum) and (b) Surfactant type (i.e. Nonionic surfactant compositions like Lyogen V, Printogen HDI and Chemigen HT4). For thermosol dyeing following recipe can be used for padding:

Dye - xg/l

Sodium Alginate - 8g/l

Accelerant - 1Og/l

Wetting agent - 2 g/l

The fixation of the padded dye can be achieved in the stenter at a temperature of 190-220'C with a contact time of 30-60 sec. The dyed fabric should be given a reduction clearing treatment.

3.4 Fibre Dyeing:

Fibre Dyeing offers several advantages over yarn and piece dyeing as fashion-oriented yarns can be spun successfully by blending dyed fibres of different shades.

Suggested processing sequence for fibre dyeing is given below:

Pretreatment (Combined with scouring) - HTHP Dyeing - Reduction Clearing - Soaping - Spin finish application - Hydro extraction - opening and drying.

3.4. 1. Pretreatment:

Recron polyester staple fibre is filled in the perforated carrier of HTHP Dyeing machine with running water continuously, which allows the fibre to wet and removes the entrapped air from the dye vessel, thus allowing the vessel to be filled in fully. Packing density of the fibre in the carrier should be optimum and uniform. Too high a density will lead to problem of uneven circulation of liquor, while too low a density will lead to channeling.

It is essential to pretreat Recron polyester staple fibre loose stock to remove spin finish applied onto the fibre during manufacturing. The spin finish interferes with disperse dyes during dyeing and retards dyeing operations. The recipe for pretreatment is as follows;

Nonionic detergent 1 g/l

Sodium carbonate 1 g/l

The fibres are treated with the above chemicals for 30 minutes at 70-80oC A hot and cold wash and rinse with acetic acid is subsequently given.

3.4.2.The machine used for dyeing of loose fibres is a HTHP dyeing machine and the procedure of the dyeing is the same as that for the dyeing of fabrics.

The direction of circulation of liquor is essentially kept inside-out. After completion of the dyeing cycle, the bath is drained at high temperature; this procedure shortens the dyeing cycle, also drains oligomers, if present, and improves the fastness properties of the dyed fibres.

Reduction Clearing:

To remove the superfluous dyestuffs as well as to get better fastness properties of the dyed Recron polyester staple fibre, they are given reduction clearing treatment as mentioned previously.

3.4.4 Soaping:

After reduction clearing, the dyed fibres are given a soaping treatment for 30 minutes at 80-90'C with:

Anionic detergent 0.5-1 g/l

This should be followed by hot wash and cold rinse with acetic acid free of any alkali.

3.4.5. Spin finish application:

To compensate for the loss of spin finish during dyeing, it is imperative to apply spin finish to ensure satisfactory spinning of the fibres. This spin finish can be applied either by circulating the finish, after neutralisation, in the dye vessel or by spraying the finish on hydro extracted and dried material. It is better to combine both the methods for better processing ability One must ensure that final deposit level of spin finish is in the range of 0.12 - 0.16% depending upon the denier used.

Hydro extraction and drying:

The fibres are finally hydro extracted to remove excess water, then opened on a Wet Cotton opener and finally dried at 80- 100oC for 2-3 hours.

3.5. Yam Dyeing:

Yarns of different blends viz. Recron/ Viscose, Recron/Cotton or 100% Recron spun yams are dyed for the manufacturing of fancy fabrics. The procedure of yam dyeing is virtually the same as fibre dyeing. In this case, however, liquor is circulated both inside-out and outside-in. Dyeing is carried out in a vertical or horizontal HTHP dyeing machine.

The major problem associated with yam dyeing is shrinkage of the yarns on the cones, which if not controlled property may lead to uneven dyeing. It is, therefore, essential to shrink the yarn either by boiling it in water for one hour or alternately, by vacuum steaming before winding on perforated cones.

Once yarn is shrunk, it is again rewound on the perforated cones. The rewound cone should not be very soft; otherwise this will lead to the problem of slippage.

4. Printing

Blends of two fibres produce a multiplicity of problems for the dyer and for the printer, since the colorants must be applied in such a way that visually, it appears uniform. In printing, problems are further increased by the need to wash off excess colorant, thus introducing the risk of back staining of unprinted areas.

4.1 Direct Printing

The ideal method would be one in which a single print paste could be used over the full range of blends and produce the same satisfactory results in each case. The wide range of systems available for printing Recron/cellulosic blends have had varying degrees of success, but none has been perfect. The methods of printing can be placed in four categories.

i) Two dye (one for each fibre) two-stage fixation: disperse-vat and disperse-reactive dye combinations.
ii) Two dye one stage fixation: disperse-reactive dye combination
iv) One dye/one-stage fixation: pigments

Today only two methods, namely the 'Pigment' and 'Disperse-Reactive' methods are mostly used in India.

4.2. Pigment Printing

The pigment printing has many advantages, i.e., one can see the results immediately, no after treatment is required and pigments meet the requirements of light and wash fastness.

Couple of the serious limitations of pigment printing, which have limited the large scale use of pigments in printing are: (a) low rubbing fastness, particularly the wet rubbing and (b) modification of the handle.

Pigment printing is largely used to print small motifs on white or colored grounds. Fiber chemistry does not play any part here and the method is exactly same as that for cotton. Following printing recipe can be employed.

Pigment - x parts
Binder - y parts
Emulsion thickening - 500-700 parts
Catalyst - 1-3 parts
Urea - t parts
Total - 1000 parts

Up to 4% shade, generally 10% binder is used. Emulsion thickening is produced by emulsifying kerosene oil
or Mineral Turpentine Oil (MTO) in water (70:30). Catalysts are acid liberating salts like ammonium sulphate, ammonium chloride or mixtures of organic acids and salts. Printed fabrics are dried and the prints are fixed by curing at 150-160'C for 3-5 min. No after treatment is required.

4.5. Printing with Reactive and Disperse Dye Mixtures:

The combination of reactive and disperse dyes offers the best opportunities with respect to fastness properties as well as brilliance of colour. Basically there is only one problem in this process, i.e., keeping the white ground clean during washing, which must be very thorough to obtain high fastness levels. This process of printing is quite expensive as compared to the pigment printing, however, it is free from most of the problems associated with the latter.

In this method of printing there is a wide choice of fixation procedures. The disperse dye on the polyester fabric is either fixed by thermosoling or by HT steaming while the reactive dye can be fixed into the cellulosic component by padding the printed fabric with alkali and storing at ambient temperature or by an alkali shock method. Generally procedures which can fix both the components in single operation are preferred. Such procedures have limitations.

In one such procedure sodium bicarbonate is used. The printing recipe:

Disperse dye x parts
Reactive dye y parts
Sodium alginate (2.5% 600-700 parts
Sodium bicarbonate - 5-10parts
Urea - 50 parts
Resist salt - 10 parts
Total - 1000 parts

The printed fabrics are steamed for 30 min at 100 to 110'C to fix the reactive dye. The disperse dye can then be fixed by HT steaming or steaming at 130'C for 30-45 min or by the thermofixation process. The selection of disperse dyes is very important, only those dyes which give adequate colour yield at pH 9 -10 are used.

For two stage printing process, which gives the maximum color yield, following process may be used.

Disperse dye x parts
Reactive dye y parts
Sodium Alginate 600 parts
Resist salt 10 parts
Ammonium sulphate- 2 - 3 parts
Water z parts
Total 1000 parts

Print, dry, thermofix at 190-220'C for 60-90 sec. chemical pad with a liquor having
Sodium metasilicate - 100 parts
Sodium carbonate - 150 parts
Potassium carbonate - 50 parts
Sodium chloride - 100 parts
Water - 600 parts
Total 1000 parts
Pad, store for 12-16 hours, wash thoroughly and dry.
ICI has developed mixture of Disperse PC and Procion T dyes which can be fixed onto Recron/ cellulosic blends by a thermofixation process. These mixtures are sold as Procilene P dyes. These dyes have found maximum use in the discharge/ resist printing of polyester blends.

4.6 Carbonized Polyester Printing

4.6.1 In the carbonization process the cellulosic component of the Recron/ cellulosic blend is dissolved by treating the fabric with 70% sulfuric acid along with small quantities of sulphamic- acid and urea, with the result one gets I 00% polyester fabric with very soft handle. It is advisable to use Recron rich blends to avoid the problem of slippage. To produce the carbonized Recron prints initially the cloth is printed with the disperse dyes.
Disperse dye - x parts
Ammonium sulphate (or citric acid) - 3-5 parts
Sodium chlorate - 1 -2 parts
Thickening (guar gum) 600-700 parts
Water - y parts
Total - 1000 parts
Print**,** dry and fix by steaming at 130C for 30-45 min. The fabric is then be washed, reduction cleared and carbonized. The carbonization process can be carried out either by a batch process in a jigger or by a pad-batch method. In the jigger the fabrics are treated for 30-40 min (2-4ends) at room temperature. The fabric is then washed and neutralized. A mild bleaching treatment may be given to improve the whiteness of the prints.

4.6.2. Brasso or Cut-out Style: This style involves localised dissolution of the cellulosic component at printed portion by printing the Recron/cellulosic fabric with acid liberating salts. The fabric is initially printed with
Aluminium Sulphate - 200 parts
Water. - 100-200 parts
Citric acid - 20-30 parts
Wetting Agent(acid stable) - 10-20 parts
Glycerine - 50-70 parts
British gum (1: 1) - x parts
Total - 1000 parts
Print, dry, bake at 130-145'C for 3 to 5 min. The goods are then thoroughly washed on a winch to remove the degraded cellulosic component. Bleaching may be carried out to get better whiteness.

4.7. Discharge and Resist Styles of Printing

It is very difficult to discharge the disperse dye once it is fixed, therefore, most of the discharge printing, of the Recron/cellulosic fabric is carried out on a padded unfixed ground
(a) Pad with Disperse-Reactive dye mixture and print with vat dye.
(b) Padding with Prociline PC dyes and printing with alkaline paste.

5.Finishing

While water absorption and the ability to transport moisture characterize cellulosic fibres (these properties provide wear comfort and low electrostatic charge.) the polyester fibre provides the durability and the easy-care properties to the fabric. Finishing operations are carried out to upgrade the properties of the fabric. In the case of white goods, the finishing of Recron/cellulosic blends generally proceeds in two steps in order to impart optimum easy care properties to both components. First of all, the Recron fibre is heat-set, subsequently the cellulosic fibre is resin finished. If the flash curing process is used, and the temperature is sufficiently high, heat-setting and cross-linking can be carried out in one step. The heat-setting of the Recron polyester staple fibre blended fabrics is carried out by the process described earlier. However, for the cross-linking of the cellulosic component only certain kinds of agents can be used, since whiteness of the fabric is to be maintained. The cross linking agent has an effect on the polyester fibre only in that polycondensates deposit on the fibre and can give the material a fuller handle.
With the Recron/cellulosic dyed materials, the Recron fibre is usually pre-set. When resin finishing the cellulosic component, the finishing agents may influence the fastness properties of the dyed Recron component. This, of course, also applies similarly to the catalyst and the curing conditions, the additives, softening agents, non-slip and

water repelling agents as well as to anti-soiling and antistats.
The rubbing and the wet fastness properties of polyester fibres that have been dyed with disperse dyes can be adversely affected.

5.1 Wash-and-Wear Finish

With Recron/cellulosic fibre fabrics, it is often necessary to bring the wash-and -wear properties of the cellulosic component on a level with those of the Recron polyester staple fibre component by resin finishing. The principle of this is that the tendency of the cellulosic fibre to crease, either in the dry or wet state is diminished. Cyclic urea methylol compounds are mainly employed, along with softeners, for this purpose.

Recipe:

Resin - 40-80g/l
Polyethylene Emulsion- 20-30g/l
Magnesium chloride - 8-12 g/l
Optical brightener (for white goods)- xg/l
Pad to a liquor pick-up of 60%, dry and cure for 5 min. at- 150'C or 30 sec. at 21O'C. Sometimes 1-2% silicon emulsion is also added to get a soft feel. Resins with built in catalysts are also available whereby $MgCl_2$ is not required.

5.2 Anti-pillng finish

Pilling is an unpleasant phenomenon usually associated with spun yarn fabrics, especially when they contain polyester. Fibres are released from the yam by bending and abrasion, and they combine together at the surface of the material to form knots known as pills.
Resin finishing reduces the Pilling tendency. However, following treatment can impart anti-pilling.
Anionic polyacrylate - 20-50 g/l
Silicic acid product 20-60 g/l
Nonionic softner 2-4 g/l
Pad and dry in the stenter.

5.3 Non-slip Finish

Recron/cellulosic blends when carbonized give a very loose structure, with the result the fabric becomes prone to 'slip'. This tendency to slip can be reduced by giving treatment with colloidal silicic acid solution along with acrylates film forming compounds as discussed above.

Recipe

Anionic polyacrylate- 10-30 g/l
Silicic acid product. - 40-100 g/l
Softener - 2g/l
Apply by padding and dry in the usual manner.

5.4 Soil-Release Finish

Durable press fabrics containing polyester fibres are known to show tendency to retain stains and also attract soil from the wash liquor during washing. This is due to hydrophobic nature of these fabrics. Various soil-release agents have been developed. These are described as durable film forming polymers containing polymer groups which are capable of hydrogen bonding with water.
These finishes are applied by a pad-cure process along with the resin

5.5 Antistatic Finishing

During spinning, weaving and finishing, textile fibres, yarns and fabrics are subjected to friction. Static electricity is thus generated on the fibre. Polyester fibre has low conduction hence it accumulates static electricity. Static electricity gives rise to a number of problems. For instance, the operator at the delivery end of a stenter may get electric shocks because of static electricity. Garments made of polyester fibres attract soil during normal wear and also have a tendency to cling to the body of the wearer.
Non-durable antistatic agents are usually hygroscopic surface-active materials, closely allied in composi6on to softeners and wetting agents. A permanent antistatic finish can be given by using a combination of a cationic and an anionic compound.
Cationic quaternary ammonium compound - 3-4%
Acetic acid (30%) - 0.5-1 cc/l
Treat the fabric with the above composition for 10-20 min at 70'C (in a jigger). Then add
(anionic alkyl sulphate) - 1.6-2.2%
Continue treatment for another 10-20 min. Dry and cure if required.

Water-Repellent Finish

Water repellency or durable shower proofing is an important finishing process. It is usually applied to fabrics for outerwear where an excellent wash fastness is expected. Also, often internal resin treatment is required to be given to the same fabric. Both finishes can be combined.

A typical recipe

Dimethyl Dihydroxy Ethylene Urea - 40-60 g/l
Ziroconium salt-containing wax emulsion - 60 g/l
Reactive Softener - 60 g/l
Magnesium chloride. - l0 g/l
Pad, dry and cure at 150oC for 5 min.

5.7 Optical Whitening

The optical whitening agents are chemical compounds which absorb light in the UV region and emit in the visible region thereby making the fabric look white as well as bright. The optical whitening agents suitable for the polyester component are insoluble in water and generally supplied in the paste form. It can be applied by the HTHP method. In the popular method for long runs, the fabric is treated with 5-20 g/l agent and thermofixed at 180-2000C for 30-60 secs. One can combine heat- setting and the optical whitening . However, it can be also applied in along with finishing as described in Sec. 5.1.