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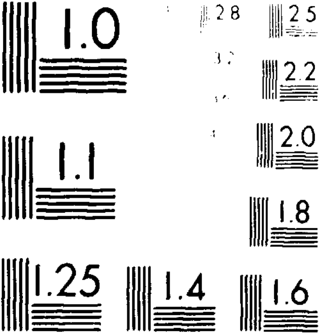
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COTTON POLYESTER BLENDS FOR PRODUCING GARMENTS USED IN TROPICAL COUNTRIES*

by

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POLYESTER-COTTON BLENDING FOR YARN MANUFACTURE

Polyester cellulosic blend fabrics were introduced into the textile industry about 22 years ago and have now become a well established facet of the industry. The blending of polyester with cellulosic fibres such as cotton, viscose and modal, produces a significant effect on a wide range of properties when compared with those of a homogeneous blend, the degree of significance varying with the blend proportions and the type of polyester fibre component used. This paper will endeavour to outline some of these aspects in the polyester-cotton blending area, which is by far the most widely used polyester cellulosic blend, confining the subject of discussion mainly to the production of yarns suitable for the manufacture of items of fabric and clothing used in tropical countries.

Some Reasons for Blending Polyester with Cotton[1]

Properties of fibres important to textile applications could be listed under - Table 1.

Physical

Electrical - resistance, 'static'.
Form - cross section.
Mechanical - strength, extensibility, elasticity, moduli, flex, fatigue resistance.
Optical - lustre.
Thermal - melting or decomposition point, contraction, setting.
Sorption - relations to water and water vapour.

Chemical

Dyeability.
Flammability.
Stability to acids, alkalis, bleaches and dry cleaning solvents.
Effect of heat - discolouration or yellowing.
Effect of storage - degradation.

Biological

Toxic or dermatalogical properties.
Resistance to bacteria, moulds and moths.

Properties of Fabric

Appearance	-	appeal, drape, handle.
Comfort	-	warmth, moisture retention, crease resistance, crease recovery.
Processing	-	behaviour in spinning, sizing, weaving, dyeing, finishing.
Stability	-	shape, shrinkage, felting, pilling.
Wear	-	abrasion resistance, resistance to soiling.

Table 1 lists the properties of fibres which are evaluated prior to general use in yarn manufacture.

Table 2 sets out a rating for polyester and cotton fibres, taking into consideration some of the properties listed in Table 1.

Table 2.

Grading:

A = Excellent

B = Average

C = Poor

	Mech. props.	Water sorption	Dyeability	Dry abrasion	Wet abrasion	Crease retention
Cotton	B-A	B-A	A	B	C-B	C
Polyester	A	C	C	D	B	A

	Static	Pilling	Softening point	Hole burning	Aesthetic properties
Cotton	A	A	A	A	B
Polyester	C	C	B	C	A

From the foregoing, it is apparent that both fibres have points of excellence in certain aspects only and by proper blending, the deficiences in one fibre can be counter balanced by the advantages of the other.

Properties of Polyester-Cotton Blends

We shall now look at some of the important advantageous properties that can be produced by the blending of these two fibres and how varying blend proportions effect these respective properties. The figures[2] 1 to 6, below, illustrating the variance in the properties caused by the variation in the proportion of the blend components is self explanatory. In figures 1 to 4, the behaviour of two fabrics of the same construction are analysed, one of the fabrics being resinated.

FIG 1. Effect of Polyester on Tear Strength.

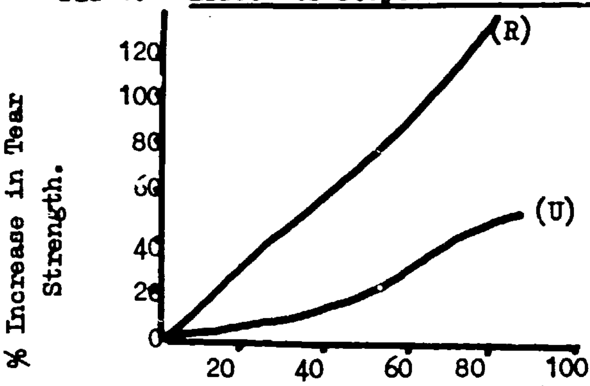
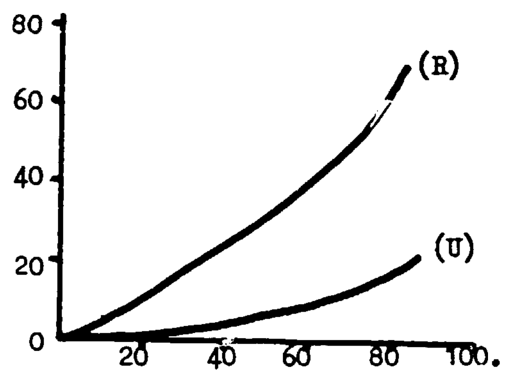


FIG 2. Effect of Poly. on Tensile Strength



% Polyester in the Blend.

FIG 3. Effect of Poly. on Crease Recovery

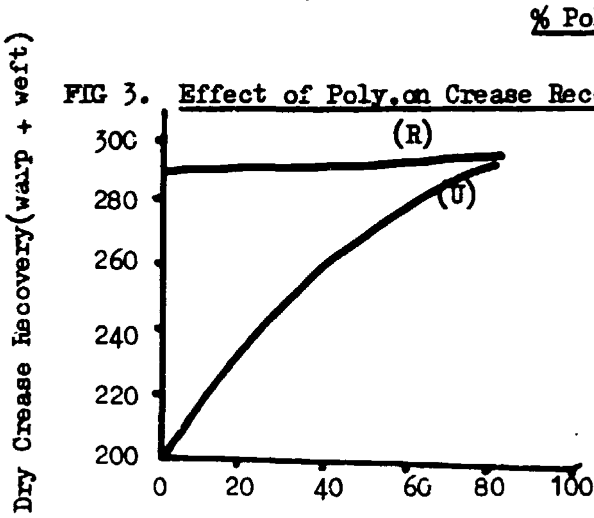
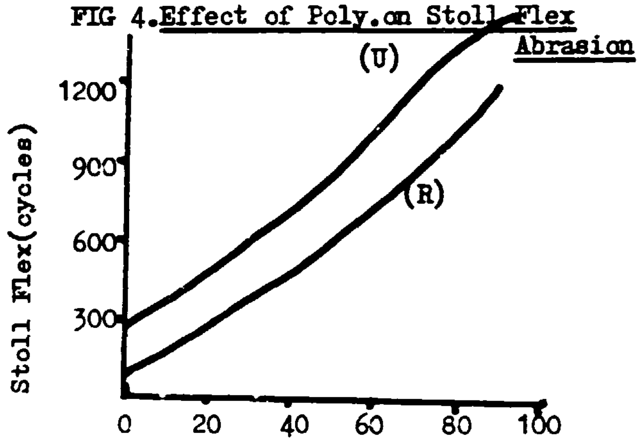


FIG 4. Effect of Poly. on Stoll Flex Abrasion



% Polyester in the Blend.

FIG 5. Effect of Poly. on Loomstate Shrinkage

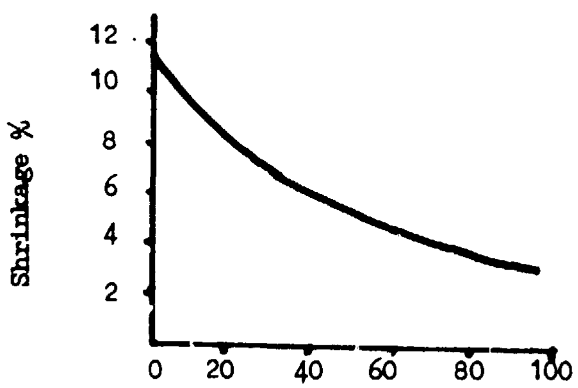
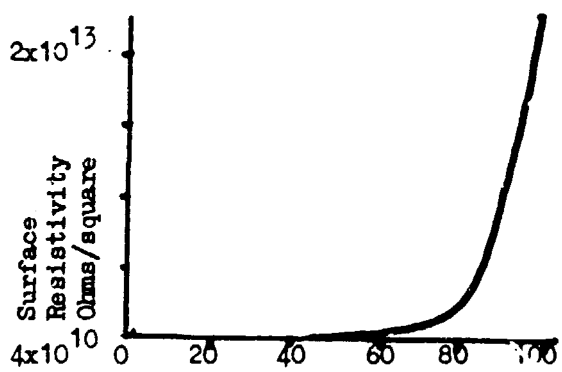


FIG 6. Effect of Poly on Surface Resistivity



% Polyester in the Blend.

(R) - Resinated.

(U) - Unresinated.

Taking figure 6 as an example, let us analyse the effect caused by the introduction of cotton, in various proportions into a polyester blend, and the manner in which static build-up, in the fabric is affected.

Garments produced from 100% polyester blends are prone to static build-up during wear. The accumulation of these static charges, causes the garment to cling to the body and in tropical countries, on a perspiring body, this could be quite objectionable.

The influence of static control, by the cotton component, is strikingly illustrated in figure 6. It is apparent that as little as 30% cotton in the blend, reduces the static to a level that the garment becomes acceptable to wear in almost any climatic conditions.

In the figures 1 to 6, it is evident that the effect of the polyester component, can be prominent only after the polyester reaches a 50% blend level in an unresinated fabric but the effect of resinating can produce the required level of prominence of the polyester component, with as low as 30% polyester in the blend. This resin finish, although producing desirable "Easy Care" properties, unfortunately affects the strength and abrasion properties adversely, although it is known that the strength and abrasion properties are still considerably higher than in 100% cellulosic materials.

Factors that Determine Optimum Blend Proportions.

Analysing figures 1 to 6 and some of the listed properties in Table 2, it is apparent that significant changes in the properties of the blend can be made by varying the blend proportions to the desired level.

For example, Pilling properties - since polyester has poor pilling properties and cotton, excellent properties, it is known that a 50% blend of cotton in the composition will make a significant difference in the level of fabric pilling.

Other changes that can be effected are fibre "form" or cross section. For instance, aesthetic appeal in the blend can be enhanced by changing the cross section of the fibre from a circular shape to a triangular, trilobal or multilobal cross section, thereby altering the angle of diffraction of light off the surface of the garment, causing a difference in eye appeal.

Change of fibre type from normal tenacity to high tenacity would vastly change the tensile properties of the yarn. Appreciable increases could also be achieved by introducing a compatible polyester component with a longer staple length and finer decitex.

The greatest area of control of the yarn parameters which determine the composition particulars of the blend, is the end product.

In this case let us consider fabrics and items of clothing suitable for use in tropical countries, the fibres preferred and the concept governing the conclusions.

Group 1.

Tropical light weight wear and fabrics : shirts, blouses, underwear, T - shirts, scarves, dress fabrics etc. and domestic items such as light curtain drapes, sheetings, pillow cases table linen etc.

Group 2.

Tropical heavier weight wear and fabrics : skirts, jackets, slacks, trousers, suitings, water-proofed raincoats, upholstery etc.

It is now necessary to examine the polyester fibres available to us.

All polyesters are petro chemical by products and the fibre is a synthetic linear polymeric ester, formed by reacting a bifunctional acid with a bifunctional alcohol.

Generic trade names like Terylene, differ slightly from say Dacron, in that one of the end groups in Terylene is an ester group, whereas it is a carboxyl group in Dacron.

A typical polyester fibre manufacturers products, that would be available for use in the textile industry for homogeneous or heterogeneous blends, would be presented in a form such as -

Deci Tex.	Length(mm).	Lustre.
1.3	35 - 43	Bright
1.7	38	Bright or optical white
1.5	40	Bright or semi dull
1.7	38(LOW PILL)	Bright or semi dull
2.7	50,58	Semi dull or bright
3.3	50,58(LOW PILL)	Semi dull
2.7	50,58	Colours
3.3	50,58	Colours

A stress-strain diagram may also be supplied, to illustrate the moduli of the fibre and in the case of the normal fibre, the diagram would look like FIG A and in the case of a low pill fibre, like FIG B, below.

FIG.A

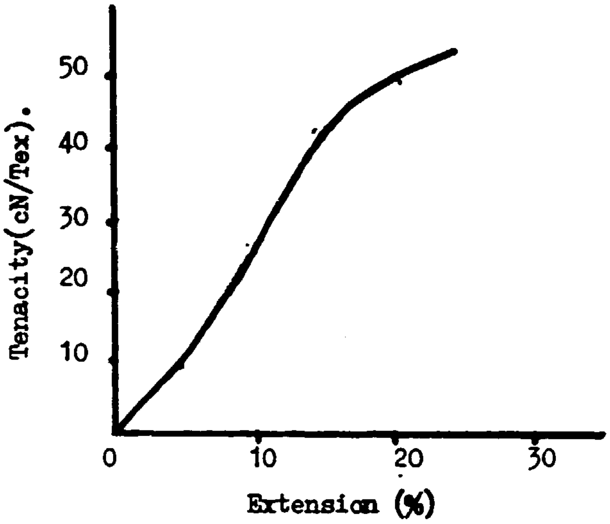
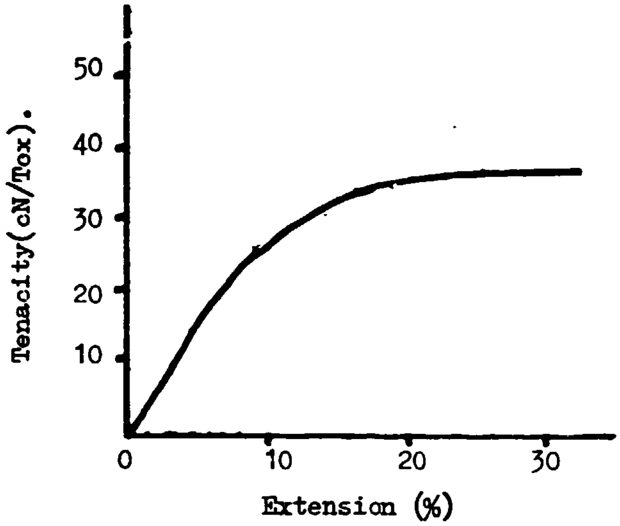


FIG.B



For producing items in group 1, fine polyester fibres will be required. Fibres of 1.3 decitex capable of spinning counts from 11.8 Tex(50sNe) to 6 Tex(100sNe) and fibres from (1.5 - 1.7) decitex with an optimum spinning count of 11.8 Tex(50sNe) will be used in the blends. Yarns spun to counts finer than 7.4 Tex(80sNe) will be used for folded yarns.

The type of fibre and degree of blend will depend on factors such as pilling, degree of crease recovery or crease retention, water adsorption, static control, dimensional stability, fineness of fabric etc. etc. Open end spun yarns as opposed to ring spun will have limits of 21 Tex(28sNe). Low pill fibres are normally used for soft handling fabrics, which are generally weft knitted.

In the main, cotton fibres break at (8 - 10)% elongation, which brings into importance the tenacity of the polyester fibre at the 10% elongation level and not at the final tenacity of the fibre, for polyester-cotton blended yarns.

In selecting the cotton component, it is important that there is fibre compatibility. When there are significant differences in the fibre lengths and fibre densities, there will be fibre migration, with the long or fine fibres tending to migrate to the centre of the yarn and the coarser and shorter fibres to the outer layers. It has been shown that the difference in fibre fineness between the cotton and polyester fibres should not exceed .7 decitex[3]. For example, in a polyester cotton blend. a 1.7 decitex polyester fibre component should be used with cotton fibres only between 1.3 and 2.2 decitex, preferably 1.4 and 2.0 decitex. Suitable cotton staple lengths used in blends with polyester fibres for spinning respective counts are as follows -

(25.4 - 27.5)mm - counts up to 22Tex(27sNe)
(27.5 - 29.5)mm - 21 Tex to 14.8 Tex(28sNe - 40sNe)
29.5 mm and over for counts finer than 14.8 Tex (40sNe)
with a minimum of 34mm for 9.8 Tex (60sNe) yarns.

Critical cotton fibre staple lengths are governed by the maturity of the fibres, for, immature fibres are weak and produce poor spinability properties. Good maturity percentage levels, combined with low trash content are required of cotton fibres, in order to produce yarns with low nep contents and good appearance.

Spinability is also controlled by the number of fibres in the yarn cross section and it is known that there should be a minimum of 50 to 55 fibres in the cross section of the blended yarn, to make it spinable at commercially acceptable levels.

Twist factors are in general fairly standard, ranging from 3.25Ne to 3.75Ne (96 - 102.5)or decitex(S.I.units) for ring spun yarns and 3.5Ne to 4.0 Ne (105 - 120)or decitex for open end spun yarns, the twist range available being controlled by the nature of the end product. Polyester fibres with lengths more than 43 mm cannot be blended with cotton fibres for these processes because of the excessive length differences. Other fibres that should not be blended with cotton are 'Anti Flam' fibres, because it would defeat the flame proofing objective of the fibres.

Blending Techniques.

The normal area of blending is at the draw frame stage, with one pre-drawing stage of the polyester slivers and three processes of drawing with the required blend proportions of the cotton slivers. The intimacy of the fibre blend will be controlled by the properties of the polyester fibre being used and the standard number of doublings mentioned, may well be inadequate for stock dyed polyester slivers produced with multiple colours. Although this is still the traditional method of blending, the technique of blending combed cotton sliver with well opened polyester at the blending hopper in the blow room is also in vogue.

A study of this method of blending was done by S.Bandopadhyay, A.K.Sengupta and G. Ravishankar [4].

For a 50/50 blend of polyester-cotton they produced the following results:-

		Blow Room Blend		Draw Frame Blend	
Draw Frame Passages	Number of Doublings	Degree of Mix	IBI	Degree of Mix	IBI
1	6	0.678	1.48	0.47	1.92
2	36	0.764	1.42	0.63	1.50
3	216	0.811	1.38	0.75	1.36
4	1296	0.830	1.38	0.78	1.32

Basing their findings on the index of blend irregularity (IBI), they concluded that the trials proved that blending at the blow room stage will reduce the number of draw frame passages by one, which would otherwise be needed if blending commenced at the draw frames.

A further technique of blending which they considered superior to both the techniques discussed was Super Lap blending. This was done on a Whitin Super Lap machine and the results of this technique of fleece blending backed by IBI values, proved to be superior to both the blow room and draw frame methods, with the added advantage of a reduced number of passages or machines. Hence, there appears to be further room for improving this area of technology.

In conclusion, it must be borne in mind that clothing is a basic necessity and in order to satisfy the individual needs of the consumer, fabrics need to be produced with vast and varied characteristics and the diversified range of polyester-cotton garments has made this particular area of the industry a fore runner in its own right. As professionals, we should be aware of the scope that this area of the industry offers and be it technology or manufacture we should be fully alive to the multiple requirements of the consumer.

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