Polyester /Viscose – Economic Uniform

Source: Textile Review

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India textile market stood at 70 billon $ with the exports of 23 billion $ and domestic consumption of 47 billion $ in (1) 2009. The Indian textile and apparel industry has grown at CAGR 11% during 2005 to 2009.

However, Industry growth before 2005 is attributed to factors such as favorable government policies, economic labor availability and ample raw material availability. The current decade (2005-2015) has the growth potential mainly because of operational efficiency of Indian textile industry with backward and forward integration, manufacturing excellence, effective supply chain and diversity in product mix.

Recent volatility in cotton market over cotton supply raised cotton prices all time high. The increase in cotton price has led to price increase of VSF and PSF to an extent. However, rising petroleum prices had made Polyester prices historical high. High prices of raw materials are taking away the margins of textile manufacturers as they are not able to transfer this increase completely to end consumers. As a result manufacturers are revisiting their product mix to minimize the raw material cost as much as possible. This has led many manufacturers to switch to cotton to PSF or VSF wherever suitable.

Indian Uniform Market

The objective of this study was to develop alternate blend for uniform application with lower raw material cost and comparable functional and aesthetic attributes. Uniform market in India is worth of ₹ 12 thousands crores with the majority share of school uniform. It is growing at CAGR of 15%. The work wear uniform market has also large potential because of increasing base of MNCs.

Uniform fabrics are mainly produced in Bhilwara, Bhiwandi and Ichalkarnji hub of India. The average product blends Polyester/Cotton and Polyester Niscose blended two ply yarns in warp and weft.

The uniform fabrics are used in daily life and hence it has critical requirement of performance characteristics such as:

- Durability
- Breathability
- Hygienic Property
- Easy maintenance

Polyester /Viscose blend can bring these all attributes in uniform fabric with following superior fibre qualities:

Polyester

- Good Tenacity
- Smoothness
- Lusture
- Excellent Crease Recovery
- Ease of Maintenance

Viscose

- Excellent Moisture Absorption
- Thermal Properties
- Smoothness
- Lusture
- Soft
- Good Drape
- Color Fastness

Methodology

In this project, single yarn is being used in place of double yarn to reduce the cost of fabric while maintaining its feel and appearance. In this paper benefits and value addition of single yarn in uniform trouser fabric is compared with double yarn for loom efficiency, fabric yield, quality & cost.

Sample Preparation

Fibre: The specification of polyester and viscose fibre used for 2/40s and 20s yarn are given in Table 1. Fibres were hand opened and sandwich well in ratio of 65/35 PV.

Table 1: Specification of Polyester and Viscose

Fibre	Length (mm)	Linear Density (Denier)
Polyester	38	1.1
Viscose	38	1.2

Yarn: Fibre processed through LMW MBO and Scutcher, Card LC330A, D06 & RSB 851 and Simplex LFS 1660. Two drawing passages were given to Card slivers. Linear density of finisher sliver being adjusted to 4.92 Ktex. The yarn was made on LMW LR06 with following Ring Frame parameters:

Table 2: Ring Frame Process Parameters

Parameter	Yarn-1	Yarn-2
Count	20	2/40
Spindle Speed (RPM)	14000	16000
TM	3.2	3.4
Spacer Type (MM)	3.5	3
Traveller Used	1/0	3/0
Back-Middle Gauge	65	65
Middle-Front Gauge	44	44

For 2/40s yarn, single yarn was parallel wound on assembly winder from Peas Metler and doubled on Vijay Lakshmi TFO with 1 7.2 TPI.

Sizing & Weaving: Sizing was carried for 20s PV yarn, with single shot sizing material along with PYA & antistatic. Size recipe and process parameters are as mentioned in Table 3.

Fabric: 20s PV 65/35 and 2/40s PV 65/35 yarns were used to produce fabric. The constructions of all the fabrics are mentioning in table n0. 4.

All the fabrics were manufactured on Tsudakoma loom with 600 RPM. Loom efficiency was 80 % for both the fabrics. Wet processing: Single yarn PV fabrics were desized in formulation of Desizing Enzyme (1 gpl), Wetting agent (1 gpl), Glauber Salt (1 gpl), at 80°C

Table 3: Sizing Parameters

Process	Parameter	Value
Size Ingredients	Water	290 Kg
		(83.29%)
	One-shot sizing	50Kg
		(14.36%)
	Binder (PVA)	08 Kg
		(02.30%)
	Antistatic	0.2 Kg
		(0.06%)
Size Recipe	Initial Stirring (min)	30
	Temperature (*C*)	140
	Pressure (kg/cm')	2.2
	Cooking Time (min)	50
Process Parameters	Viscosity (Sec)	10
	RF Index	11
	Positive Feed	0
	No of Immersions	2
	Pressure (Kg/cm^2)	
	1st Immersion roller	1
	2nd Immersion roller	1
	Gear combination	23/24
	Temperature (OC)	
	Saw Box	75
	1st drying zone	110
	2nd drying zone	90
	3rd drying zone	75
	4th drying zone	70
	Moisture %	4.5
	Waxing	Yes
	Tension at winding(KN)	0.1
	Stretch %	0.1

for 45 to 60min and boil wash was given at 90°C for 20 min. in Jet dyeing machine. After boil wash, fabric was dried on Stenter machine at 150°C. Heat setting was carried out for

both single and double yarn PV fabrics on Stenter at 190°C with contact time of 40 sec. In case of double yarn PV fabric, it was followed by washing with Wetting agent (1 gpl) at 70°C for 10 min.

Table 4: Fabric Parameters

SN	Warp Count & Blend	Weft Count & Blend	EPIxPPI	Weave
1	2/40 PV	2/40 PV	72x56	Plain
	65/35	65/35		
2	2/40 PV	20 PV	72 x56	Plain
	65/35	65/35		
3	20 PV	20 PV	72 x 56	Plain
	65/35	65/35		
4	2/40 PV	2/40 PV	84x64	2/1 Twill
	65/35	65/35		
5	2/40 PV	20 PV	84x64	2/1 Twill
	65/35	65/35		
6	20 PV	20 PV	84x64	2/1 Twill
	65/35	65/35		

Dyeing of the fabric was carried out in Jet dyeing machine where polyester was dyed with disperse dye and viscose with reactive dyes. After dyeing, the sample drying was carried out in Stenter at 150°C and followed by singing process.

Finishing: All fabrics were subjected to finishing treatment. The typical finish formulation used was: Softener as per requirement (20-40gpl), Binder as per requirement (10 to 20gpl), Acid (0.5gpl) followed by drying at 150°C. Mechanical finishing was carried out on Sanforising machine with Belt pressure of 2-3 Kg at speed of 13-15 mpm.

Test Results

All the samples of Yarns & Fabrics were tested at NABL accredited lab of TRADC.

Yarn Quality: Yarn strength is tested on lea strength tester of MAG according 05-1315:1977), Rkm and on Uster Tansorapid (ISO: 2062-1993) Yarn imperfection and hairiness on UT-4 050 16549-2004).

Table 5: Yarn Quality Parameter

Count	2/40s PV65/35	20s PV65/35
Fibre	P:1.1X38	P: 1.1 X38
	V: 1.2X38	V: 1.2X38
Blend	65:35	65:35
Av. Count	20.3	20
CSP	4967	4890
RKm	28.4	28.0
RKm CV%	6.3	7.8
Elongation	12.9	12.7
Elongation CV%	4.4	5.3
U%	7.6	8.1
CVm%	9.57	10.16
Thin (-50%)	0	0
Thick (+50%)	2.8	2.5
Neps (+200%)	3.5	5.8
Total Imp/Km	6.3	8.3
Hairiness (H)	6.94	6.88
Sh	1.77	1.37

Table 6 a: Fabric Quality Parameters (Plain Weave)

Particulars		Norms			
Warp Count & Blend			2/40s	2/40s	20s
Weft Count & Blend			2/40s	20s	20s
Finished EPI X PPI		.+/-3%	80X64	80X64	76X60
Greige					
GSM	gm/m^2	.+/-5%	166.2	169.4	185.6
Finished					
GSM	gm/m^2	.+/-5%	197.3	202.6	218.7
Greige					
Width	cm	.+/-1 cm	159.3	160.6	157.4
Finished					
Width	cm	.+/-lcm	148.5	148.5	143.1
Tearing Strength					
Warp	Newtons 9.6 N		>62.7	>62.7	57.82
Weft	Newtons 9.6 N		48	57.8	39.6
Dimensional Stability					
Warp	%	<2.5%	-1.7	-2.5	-1.6
Weft	%	<2.5%	-0.9	-0.7	0

Table 6 b: Fabric Quality Parameters (Twill Weave)

Particulars	**Norms**				
Warp Count			2/40s	2/40s	20s
Weft Count			2/40s	20s	20s
Finished EPI X PPI		.+/-3%	96X70	96X72	94X72
Greige					
GSM	gm/m^2	.+/-5%	190.5	199.2	212.4
Finished					
GSM	gm/m^2	.+/-5%	244.1	237.9	241.6
Greige					
Width	cm	.+/-lcm	158.8	159	159
Finished					
Width	cm	.+/-lcm	143.2	145	144.6
Tearing Strength					
Warp	Newtons 9.6 N		61.96	>62.7	>62.7
Weft	Newtons 9.6 N		60.8	>62.7	>62.7
Dimensional Stability					
Warp	%	<2.5%	-1.3	-2.2	-2.1
Weft	%	<2.5%	0	-1.3	0

Fabric Quality: The fabrics were tested for EPI & PPI (IS 1963-1981), GSM (IS 1964-2001), Finish Fabric Width (IS 1299-1984), Shrinkage (IS 1954-1990) and Tearing Strength (IS 6489-1993). Fabric quality results are mentioned in table 6a&b.

Yarn, Greige & Finish fabric has been work out for all product produce with single and double ply PV yarn to study the cost benefits.

Table 7: Costing (2)

Sort no	**Twill**		
Warp Count	2/40s PV	2/40s PV	20sPV
Warp Yarn Price ₹/ Kg	236	236	192
Weft Count	2/40s PV	20sPV	20sPV
Weft Yarn Price ₹/ Kg	236	192	192
Weaving conversion cost			
(@ 0.20 ₹/ Pick)	12.8	12.8	12.8
Sizing Cost in ₹/ Kg	-	-	20
Grey conversion cost	13.05	13.05	14.5
Grey fabric cost ₹/mtrs	69.7	64.4	60.6
Total Processing cost			
In ₹/mtrs	12	12	14.5
Total fabric price ₹/mtrs	81.69	76.41	75.08

Sort no	Twill		
Warp Count	2/40s PV	2/40s PV	20sPV
Warp Yarn Price ₹/ Kg	236	236	192
Weft Count	2/40s PV	20sPV	20sPV
Weft Yarn Price ₹/ Kg	236	192	192
Weaving conversion cost			
(@ 0.20 ₹/ Pick)	9.6	9.6	9.6
Sizing Cost in ₹/ Kg	-	-	20
Grey conversion cost	9.81	9.81	11
Grey fabric cost ₹/mtrs	57	52.6	49.4
Total Processing cost			
in₹/mtrs	12	12	14.5
Total fabric price ₹/mtrs	69.01	64.61	63.9

Results & Discussion

- While comparing quality of both the double and the single yarn, no significant difference was observed. Total imperfection of single yarn was slightly higher in comparison with double yarn.
- In final fabric, all test parameters are well within norms in 20s PV sample as compared to 2/40s PV.
- Loom efficiency of 20s PV 65:35 yarn was satisfactory.
- Feel wise the 20s poly viscose plain fabric is denser and fuller as compare with 2/40s poly viscose 65:35 fabric.
- Fabric made up of single ply is approx. ₹ 6 per mtrs. economical than double ply.

Conclusion

This project highlights the cost benefit of using single ply yarn in PV uniform in place of double yarn.

References

(1) Source: Techno pack Study: Indian Textile & Apparel Industry: Brightest Future Ever
(2) Weaving and processing cost are as per TRADC calculation and that may differ from Market costing.

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