Review of Literature

ISSN: 2347-2723 Impact Factor : 2.0260(UIF) Volume - 4 | Issue - 5 | December - 2016

EVALUATION OF COTTON/POLYESTER CORE YARN CAMOUFLAGE FABRIC FOR MILITARY UNIFORMS USING KAWABATA SYSTEM

Prof. V. M. Patil
Principal, College of Engineering & Technology, NMKC, Jalgaon.

ABSTRACT

Low stress Mechanical properties of Fabrics obtained from different types of Cotton/ Polyester core yarns and 100% cotton yarn manufactured on Ring frame and Air Jet Spinning are compared to determine influence of core sheath ratio and spinning systems .Total six different types of core yarns are made on Ring frame and Air Jet systems under identical conditions, and the yarns are converted in to plain weave fabrics. Total Seven types of fabrics tested in Kawabata instrument and results are compared with fabrics made from 100% cotton yarn.

KEYWORDS: *Fabric, Military Uniform.*

INTRODUCTION:

We observed that stiffness increases with in increases the core % (Polyester filament).Total hand value is more where the filament % at the core material. The fabric obtained from Air jet spinning has more stiffness then the fabric obtained from Ring spinning. Cotton polyester core yarn fabric manufactured from Air jet spinning have very good total hand value ,so it is very useful in camouflage fabric for military uniforms.

Woven fabrics provide outstanding comfort qualities and have long been preferred as fabrics in many kinds of clothing. This fact combined with new technological advancements that have increased the variety of woven available, has expanded their use to approximately 50% of the apparel fabrics used in the world. Fabric properties especially bending and compression properties exert a major influence on handle and draping behaviour of apparel fabrics. Past research (1,4,5,6,8,9) focusing on the relationship between yarn and fabric flexural rigidities has shown the existence of positive correlation between two. According to P. Radhakrishnaiah(1) the bending rigidity of core yarn fabric is more then the 100% cotton yarn fabric. According to Chongwen Yu (2) Core & Blend fabric are more stiffer and less recoverable after deformation than the 100% cotton.

The purpose of our research was to determine the hand properties of woven fabric prepared from different type of core yarns and which fabrics is suitable for camouflage military uniforms. Our specific objectives were to determine the overall properties of fabrics prepared from core yarn and to identify associations that exist between 100% cotton fabrics. Our one of objectives are to compare the bending ,compression shearing and tensile behaviour of fabrics prepared from core yarn. The practical value of this research is that it will permit designers of woven fabrics to select the constructions for the best handle & other properties like tensile ,bending shearing, smoothness etc

MATERIALS AND METHODS.

We used patented staple –core spinning system (3,7) to produce the cotton polyester staple core yarn. Total three different type of core yarn prepared on ring spinning(G5/1 ring frame) under ideal condition by varying core sheet ratio. Using same core sheet ratio and materials another three core yarns are prepared on (10) murata air jet spinner MJS802.

To produce the core yarn from ring spinning the 100% cotton roving passed from back roller and different denier of polyester filament passed from front roller and produce 30 Ne core yarns from ring frame. By using same mixing and same spindles produce 100% cotton yarn of 30Ne count. The same material you process on Murata air jet spinning machine and prepared 30Ne core yarn from Air jet spinning. The twist multiple and other spinning process parameters were maintained the same for all core yarns & 100% cotton yarn. After preparing all single core yarn we double it in T. F. O. Machine under ideal conditions.

Construction particulars of the experimental fabrics are listed in table I. Fabrics were woven under normal conditions on single end warping machine and sulzer loom.

Table 1 Different types of fabrics manufactured from core yarns prepared on R/F and A/J

Construction parameter	100% cotton	70 D Nylon crimped R/F	44 D Nylon crimped R/F	30 D Nylon crimped R/F	70 D Nylon crimped A/J	44 D Nylon crimped A/J	30DNylon crimped A/J
Blend composition	100% C	40/60N/C	25/75N/C	13/87N/C	40/60N/C	25/75N/C	13/87N/C
Weave pattern	Plain	Plain	Plain	Plain	Plain	Plain	Plain
Ends/cm	27	27	27	27	27	27	27
Picks/cm	23	23	23	23	23	23	23
Warp count	30/2	30/2	30/2	30/2	30/2	30/2	30/2
Weft count	30/2	30/2	30/2	30/2	30/2	30/2	30/2
Fabric Weight,g/m2	128	128	128	128	128	128	128

Table 2 Description of test parameters tested on kawabata KES-FB3 testing machine

Test Parameter	Definition of parameter	Unit
Compression		
LC	linearity of compression curve	none
WC	Compression energy at 5kpa pressure	J/m2
RC	resilience or ratio of the energy recovered to energy spent	%
EMC	thickness compression as a % of original fabric thickness	%
TO	fabric thickness at 5Pa pressure	mm
Tensile		
EM	elongation at 5 N/cm tension	%
LT	linearity of stress strain curve	none
WT	energy to extend fabric to 5 n/cm tension	J/m2
RT	resilience or ratio of energy recovered to energy spent	%
M	observed load at 1% extension	g
Bending		
B	fabric bending stiffness at 1.0cm-1 curvature	uNm2
2HB	hysteresis at +-0.5 cm-1curveture	mN

We used the Kawabata Evaluation system for fabrics(12,13) (KES-F) to measure the mechanical properties of fabrics. Table II describes the test conditions used to measuring fabric properties. All fabric properties were evaluated on the basis of five warp and five filling tests. Yarn compression properties were evaluated on the basis of sixty compression tests ,tensile properties on the basis of twenty five test and bending property on basis of ten tests. Table III lists the property parameters evaluated under tensile bending and compression tests. The load registered by the fabrics at 1% elongation (m) was thus taken as a measure of tensile modulus. All fabrics sample were conditioned at 65 +_2% RH and 22+_10 c before the measurement

Table 3 Setting of different parameter

Parameter	Setting
Compression	
Rate of compression	
Maximum force	0.02 mm/s
Area compressed	2.0 cm2
Bending	
Rate of Bending	0.5cm-1/s
Maximum curvature	-+2.5cm-1
Sample size(L X W)	20cm X1 cm
Tensile	
Rate of extension	0.1 mm/s
Maximum tensile force	5 N/cm
Sample size (L X W)	5cm X 10 cm

RESULTS AND DISCUSSION

For making comparisons between individual fabrics ,the mean and standard deviation of KES parameters were standardise The formula is as follows:

Zi=(Xi-Mean X)/S Where Zi = the standardized value of i th fabric ,Xi = the measured value of the i th fabric. and S=standard deviation.

The standardized values were charted on physical profile diagrams ,which show the relative position of one fabric to another . In this context ,the greater the standardized value, the larger the deformation energy, resilience, linearity, hysteresis, frictional and physical properties.

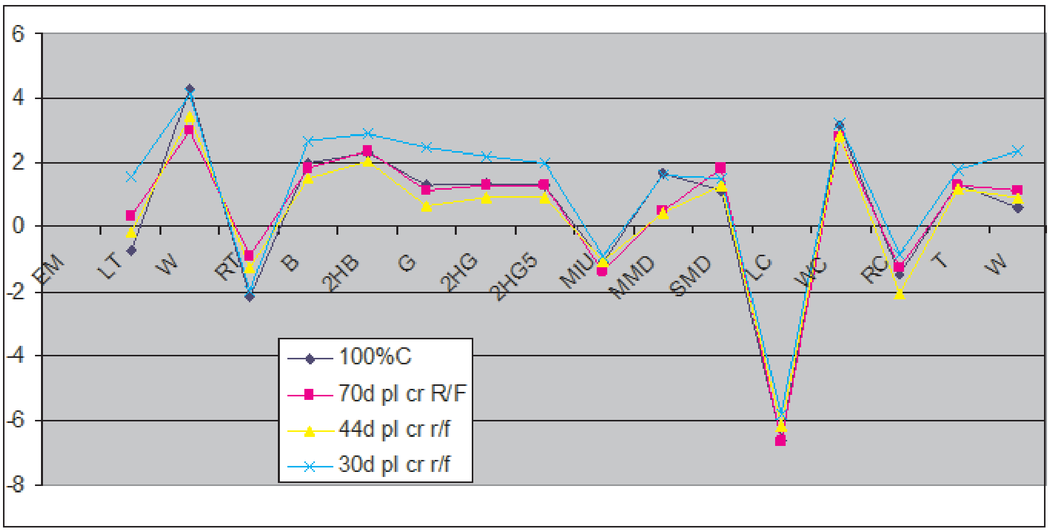
Table 4 Low stress mechanical properties

		100% cotton	70 D Polyester crimped R/F	44 D polyester crimped R/F	30 D Polyester crimped R/F	70 D Polyester crimped A/J	44 D polyester crimped A/J	30 D Polyester crimped A/J
LT		**0.797**	**0.778**	**0.827**	**0.877**	**0.73**	**0.736**	**0.865**
RT	**%**	**38.51**	**51.97**	**42.19**	**39.28**	**47.56**	**46.86**	**40.18**
WT	g.cm/cm^2	**11.27**	**6.04**	**8.56**	**14.81**	**9.24**	**10.66**	**15**
B	g.cm^2/cm	**0.1206**	**0.106**	**0.171**	**0.214**	**0.0842**	**0.0862**	**0.1799**
2HB	g..cm/cm	**0.1988**	**0.2024**	**0.3567**	**0.4031**	**0.1387**	**0.141**	**0.3635**
G	gf.cm.deg	**1.04**	**0.95**	**2.03**	**2.43**	**0.66**	**0.66**	**2.41**
2HG	**g/cm**	**2.94**	**2.9**	**7.01**	**8.96**	**1.89**	**1.8**	**7.96**
2HG5	**g/cm**	**4.1**	**4.01**	**7.07**	**8.25**	**2.78**	**2.81**	**7.67**
LC		0.258	0.286	0.302	0.311	0.245	0.288	0.34

WC gf.cm/cm2		0.241	0.178	0.247	0.254	0.194	0.286	0.316
RC%		31.84	38.25	39.51	41.51	38/68	36.38	41.14
MIU		**0.177**	**0.163**	**0.163**	**0.185**	**0.169**	**0.177**	**0.196**
MMD		**0.048 8**	**0.0265**	**0.0431**	**0.0465**	**0.0289**	**0.0359**	**0.0424**
SMD	**?m**	**8.98**	**16.92**	**12.92**	**12.44**	**12.14**	**10.32**	**9.24**
Fabric Thickness (To mm) at 0. 5gf/cm^2	TO	0.736	0.716	0.935	0.96	0.743	0.898	0.903
Fabric Thickness (Tm mm) 50gf/cm^2	2TO	0.355	0.438	0.568	0.571	0.421	0.426	0.496
Fabric wt. (mg/cm^2)	W	15.66	15.43	15.06	15.23	14.72	15.1	15.77
EMT	%	5.68	3.11	4.14	6.78	5.06	5.77	6.95

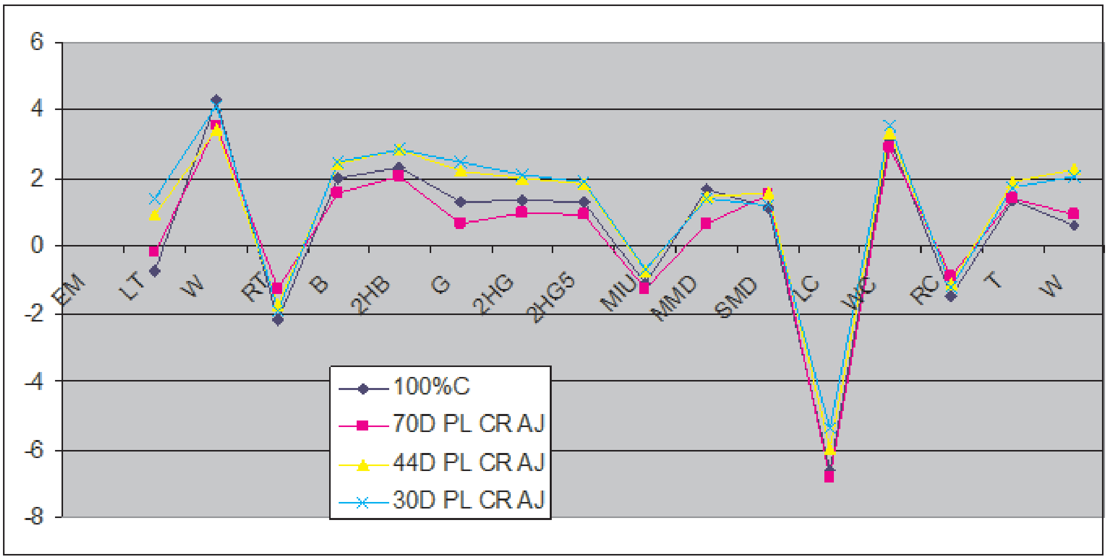
Fig. No.1

Comparison of the KES- FB3 properties of 70 denier (40/60:N/C) fabric, 44 denier (25/75:N/C) and 30 denier (13/87 N/C)manufactured from Ring frame core yarn



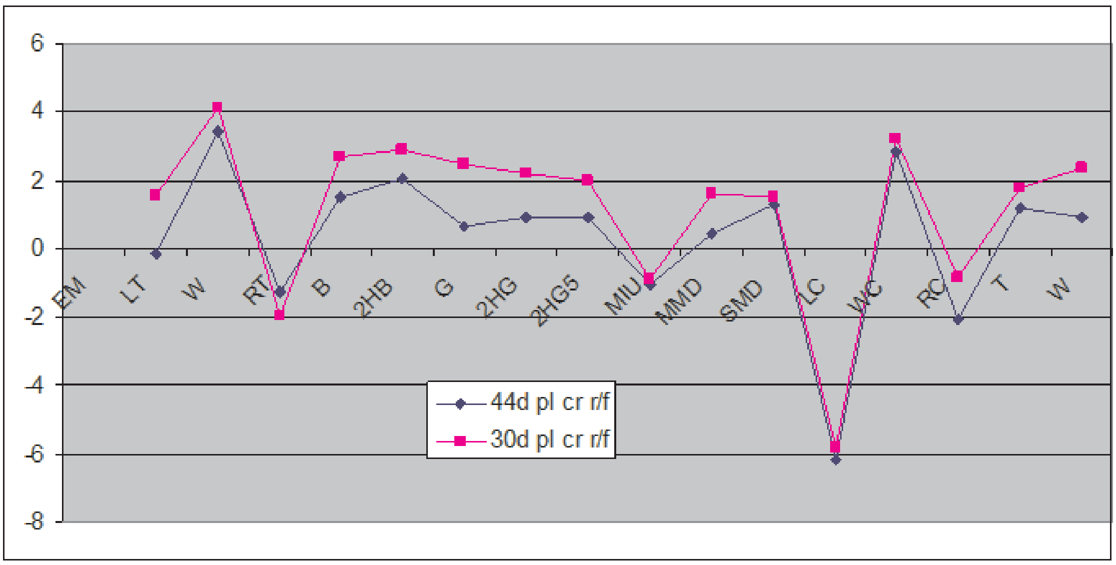
The fig.1 shows that LT,W,RT Values are more in 40/60 N/C fabric ie .linearity of load extension curve, tensile energy and tensile resilience is more as compare to 25/75 N/C, fabric bending rigidity of 40/60 N/C is more than 13/87N/C fabric but hysterias of bending movement of 13/87 N/C fabric is more. Compressibility of 40/60 N/C fabric is more i.e. the fabric will compressed easily. 40/60 N/C fabric had lower surface friction. In this fabric 40/60 N/C gives best hand value was physically lighter

Fig.No.2
Comparison of the KES- FB3 properties of 70 denier 40/60 : N/C) fabric, 44 denier (25/75:N/C) and 30 denier (13/87 N/C)manufactured from Air Jet core yarn



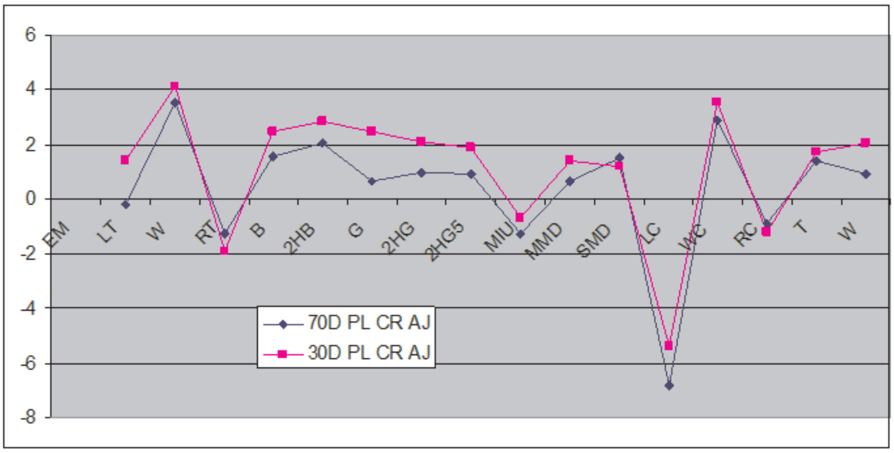
The fabric representing the polyester core cotton covered yarn is characterized by higher values for bending rigidity (B),bending hysteresis (2HB),compressive resilience(RC),tensile resilience (RT),and tensile modulus (M).The same fabric also shows slightly lower values for percentages thickness and tensile elongation (EMT).A bulky ,soft, more flexible fabric have good cover factor. In fact previous work shows(13,14,16,17) that the core yarn fabric have better cover factor then the 100% cotton fabric.

Fig. No.3
Comparison of the KES- FB3 properties of 30 denier (13/87:N/C)fabric manufactured from Ring frame core yarn and 44deniear(25/75:N/C) fabric manufactured from Ring frame core yarn



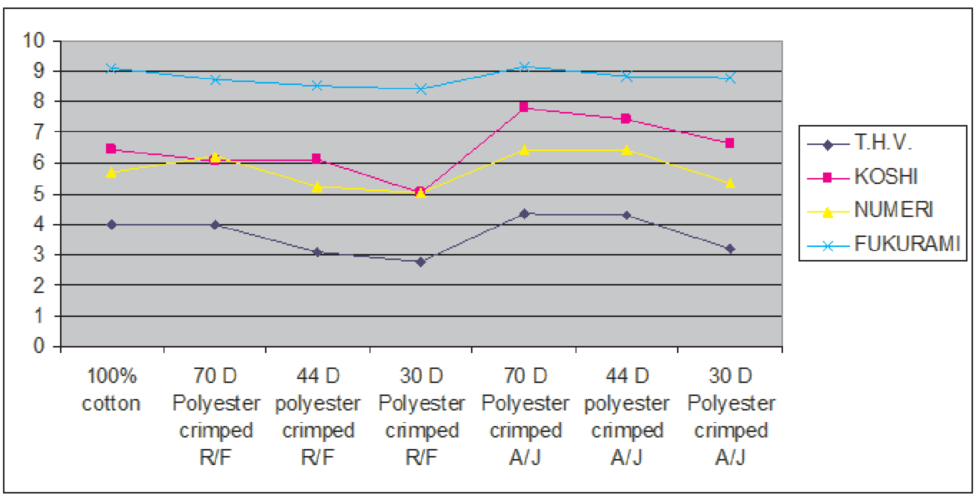
From above fig. it is observed that 30D poly. Cotton core yarn have good comfort property.

Fig.No. 4
Comparison of the KES- FB3 properties of 70 denier (40/60:N/C)fabric and 30 denier(13/87 N/C)manufactured from Air Jet core yarn



From above fig. it is observed that as core filament % decreases the Koshi value reduces ,it means that 30 Denier (13/87:N/C) fabric is smoother than 70denier (40/60:N/C) fabric and 44denier(25/75:N/C).The fabric manufactured from Air jet core yarn is more stiff then The fabric manufactured from Ring frame core yarn. In comparison with 100% cotton fabric manufactured from Ring frame yarn is stiffer then the fabric manufactured from Ring frame core yarn but it is smoother then the fabric manufactured from Air jet core yarn.

	100% cotton	70 D Polyester crimped R/F	**44 D polyester crimped R/F**	30 D Polyester crimped R/F	**70 D Polyester crimped A/J**	44 D polyester crimped A/J	30 D Polyester crimped A/J
KOSHI	6.46	6.63	**7.46**	7.8	**6.09**	6.1	7.46
NUMERI	5.69	**6.13**	**5.22**	5.05	**6.44**	6.43	5.36
FUKURAMI	9.1	8.74	**8.54**	8.45	**9.15**	8.86	8.77
T.H.V.	3.97	3.97	3.09	2.8	4.37	4.29	3.18



In total hand values it is observed that THV Value is more in 70 denier (40/60:N/C)fabric manufactured from Air jet core yarn then 100% cotton and other fabrics manufactured from core yarn. Total handle value is more in fabric manufactured from Air jet core yarn then the fabric manufactured from Ring frame core yarn. 70deniear (40/60:N/C) fabric and 44denier(25/75:N/C) the fullness is more ,it means that fabric is thicker and softer then the fabric manufactured from 100% cotton fabric. Total hand value increases in 70deniear (40/60:N/C) fabric manufactured from Ring frame and Air jet core yarn because of improvement in tensile ,resilience ,bending rigidity and shearing property.

Lower LC and RC suggest that 70 denier (40/60:N/C)fabric manufactured from Ring frame core yarn is more stiffer than 30 Denier (13/87:N/C) fabric manufactured from Ring frame core yarn. Lower bending rigidity values in fabric manufactured from core yarn implies that this fabric is more flexible then 70 denier (40/60:N/C)fabric manufactured from Ring frame core yarn'.

CONCLUSION

Preferential positioning of polyester filament in the core yarn produces a softer, more flexible, more resilience and tensile fabric. As percentage of filament increases the total hand value of fabric increases but fabric become more difficult to bend. Fabric become more stiff when we prepared the fabrics from core yarn manufactured on Air jet spinning.

The polyester filament core yarn fabrics were stronger and had better abrasion resistance than cotton fabrics. Because of their unique structure ,fabrics made from the core yarns retained the softness ,absorbency ,breath ability, and other desirable properties.

REFERENCE

1) P. Radhakrishnaiahand A.P. S. Sawhney ,Low stressMechanical Behavior of Cotton/Nylon yarns and fabrics in raletion to fiber distribution within the yarn,Textile reseach journal 66(2),99-103(1996)

2) Pau-lin chenand Roger L. Baker Gary smith and Barbara,Handle of weft Knit Fabrics.,Textile research journal66(2)200-209(1998)

3) Ghosh ,T.K.Batra,S. K.,and Barker,R.L.,The Bending Behaviour of plain Woven Fabrics ,Part III:The case of Bilinear Thread Bending Behavior and the effect of set.J. Textile Inst.81,272(1990)

4) Grosberg,p.,and Kedia S.,The mechanical properties of woven fabrics ,part I:The initial load extension modulus of woven fabics,Textile Res. J. 36,71(1966)

5) Grosberg,p.,.,The mechanical properties of woven fabrics ,part II:The initial load extension modulus of woven fabics,Textile Res. J. 36,205(1966)

6) Grosberg,p.,.,The mechanical properties of woven fabrics ,part V:The initial load extension modulus of woven fabics,Textile Res. J. 36,420(1966)

7) Harper ,R.J.,and Ruppeenicker,G.F.,Woven Fabrics prepared from high tenacity cotton/Polyester core yarn ,Textile Res. J. 57,147-154(19870

8) Livsey ,R.G.and Owen ,J.D.,clothstiffness and Hystersis in bending J.Textile Inst. 55,T516(1964)

9) Oloffson,J.A.General Model of a fabrics as a Geometric Mechanical Structure J. Texile Inst.55 T541(1964)

10) M. K. Bhortakke ,T. Nishimura,and T. Matsuo,The structure of polyester/cotton bleanded Air Jet spun yarn Textile Res. J. 69(2),84-89(1999)

11) Onions,W.J.,E,and Townend,P.P.,Factors Afecting the Thickness and Compresibility of worsted Spun Yarns,J.Textile Inst.58,293(1967)

12) G.F. Ruppenicker,R.J. Harper,Jr.,A.P.S.bSawhney,K.Q.Robert.Cotton /Nylon Rip-Stop fabrics for military Uniforms.American Dyestuff Reporter 34-37 Jan.(1991)

13) Dr.Anjali Karolia and Ms. Varsha R. Shetti, Evalution of resin finished cbuf using KAWABATA System,J. Of textile Association 91-97July-Aug(1999)