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COMPARATIVE STUDY OF COTTON, BAMBOO, VISCOSE AND MODAL UNION FABRIC IN TERMS OF BENDING LENGTH AND CREASE RECOVERY FOR KIDS WEAR, WOMEN WEAR AND MEN WEAR

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Abstract: The objectives of the present research work to develop the Union Fabrics for kids wear, Women's wear and Men's wear having the 100% Cotton (2/50) in warp and 100 % Bamboo (1/30), 100 % Modal (1/30), 100 % Viscose(1/30) and 100 % Cotton(1/30) in weft to improve handle properties of fabric in terms of bending length and crease recovery of union fabrics with cotton yarn as warp and yarn from regenerated fibers (Viscose, Bamboo and Modal) as weft having properties similar or better than 100% cotton. Twill weave is used as fabric structure. Bending length and crease recovery property of modal fabric was found best out of cotton, bamboo and viscose.

Index Terms - Bending length, Crease Recovery, Cotton, Viscose, Bamboo, Modal, Warp, Weft, Resiliency, Stress and Strain.

I. INTRODUCTION

found about its existence even before the birth of Christ. Currently, cotton is one of the mostly used fibers applied in a variety of products ranging from men, women and kids apparels, towels, handbags, medical and sanitary supplies, to home decor. Cotton is being admired for its virtues and is even praised as 'King Cotton' due to its cultural influence. Despite its comfort, softness, and moisture absorbing capability, cotton wrinkles very easily [6, 8]. The way people like to avoid wrinkles on their skin, they do not want it on their clothes either. To make cotton clothes wrinkle free it needs to be blended with other synthetic fibers like polyester. Manufacturing 100% wrinkle free cotton fabrics is a deceptive and complex process [1, 9]. Ironing is a tedious chore, but wearing crumpled clothing is unprofessional. That's why "wrinkle-resistant" garments have become so popular. But the current methods for making these textiles often release formaldehyde – a chemical that in large amounts is hazardous to human health – into the air and water. Formaldehyde can leak from the clothing during the manufacturing, wearing or washing of clothes, and this has risen environmental and health concerns [11, 10]. So to develop fabrics with natural, organic and regenerated fibers like bamboo, viscose, modal which improving the bending length and crease recovery properties of fabric and also overcomes challenges to raising harmful chemical and toxic generate at the time of chemical finishes to reduce wrinkle in fabrics.

MATERIALS AND EXPERIMENTAL METHODS

Three union fabrics were developed using 100%Cotton yarn as warp and 100% weft yarn made from Modal, Bamboo and Viscose fibers. In order to compare the above union fabrics with the fabrics that are widely used as kids wear, another set of fabrics were prepared using 100% cotton yarn as warp and weft.

Weaving Parameters

The specifications of weaving machine and fabrics used are as follows:

Loom: Sample power loom, over pick with Dobby

Speed (rpm): 120

Woven fabrics with the following specifications:

Table 1 Specifications of fabrics used

Warp Yarn	100% Cotton
Weft Yarn	100% Cotton, 100% Bamboo, 100% Viscose, 100% Modal
Weave	Twill weave (2/1)
EPI	84
PPI	72
Warp count	2/50 Ne
Weft count	1/30 Ne
Fabric weight	150 g/m^2

RESULTS AND DISCUSSIONS

Results and Discussions

This chapter mainly deals with results obtained on the series of testing carried out on the prepared fabric samples under study and discuss the factors that are highly influence the properties of the product.

Table 2 Comparison of yarn test values

Yarn	*Count(Ne) (actual)*	*Count strength product(CSP)*	*Twist per inch(TPI)*	*Hairiness (No. of fibers per 200m)*	*Uster Uneveness*	*No. of fibers in yarn cross-section*
Modal(1/30)	29.78	2925.88	16.12 ‘s’	13.22	0.80	598.82
Bamboo(1/30)	30.14	2293.47	16.04 ‘s’	11.20	1.19	701.58
Viscose(1/30)	28.69	2203.23	15.50 ‘s’	30.17	2.17	749.41
Cotton(1/30)	29.98	2617.96	16.08 ‘s’	18.63	1.54	761.81
Cotton(2/50)	24.38	2751.55	25.37 ‘z’	9.71	1.19	914.18

Table 3 Handle properties (Bending length and Crease recovery values) of grey and scoured fabric

Fabric types	*Bending length (cm)*				*Crease recovery (degree)*			
	Grey		Scoured		Grey		Scoured	
	Warp	Weft	Warp	Weft	Warp	Weft	Warp	Weft
Cotton-Modal	1.46	1.43	1.42	1.16	123.20	120.40	129	133
Cotton-Bamboo	1.60	1.58	1.52	1.26	118.50	116.10	121	125.50
Cotton-Viscose	2.30	1.90	1.76	1.43	98.50	100.15	103.20	104.50
Cotton-Cotton	2.99	2.77	2.23	2.13	94.00	95	96	100

Handle Properties

Bending Length

Effect of fiber type on Bending Length of grey and scoured fabrics

Table 4 Bending Length of grey and scoured fabrics

Fabric types	*Bending length (cm)*			
	Grey fabrics		Scoured fabrics	
	Warp	Weft	Warp	Weft
Cotton-Modal	1.46	1.43	1.42	1.16
Cotton-Bamboo	1.60	1.58	1.52	1.26
Cotton-Viscose	2.30	1.90	1.76	1.43
Cotton-Cotton	2.99	2.77	2.23	2.13

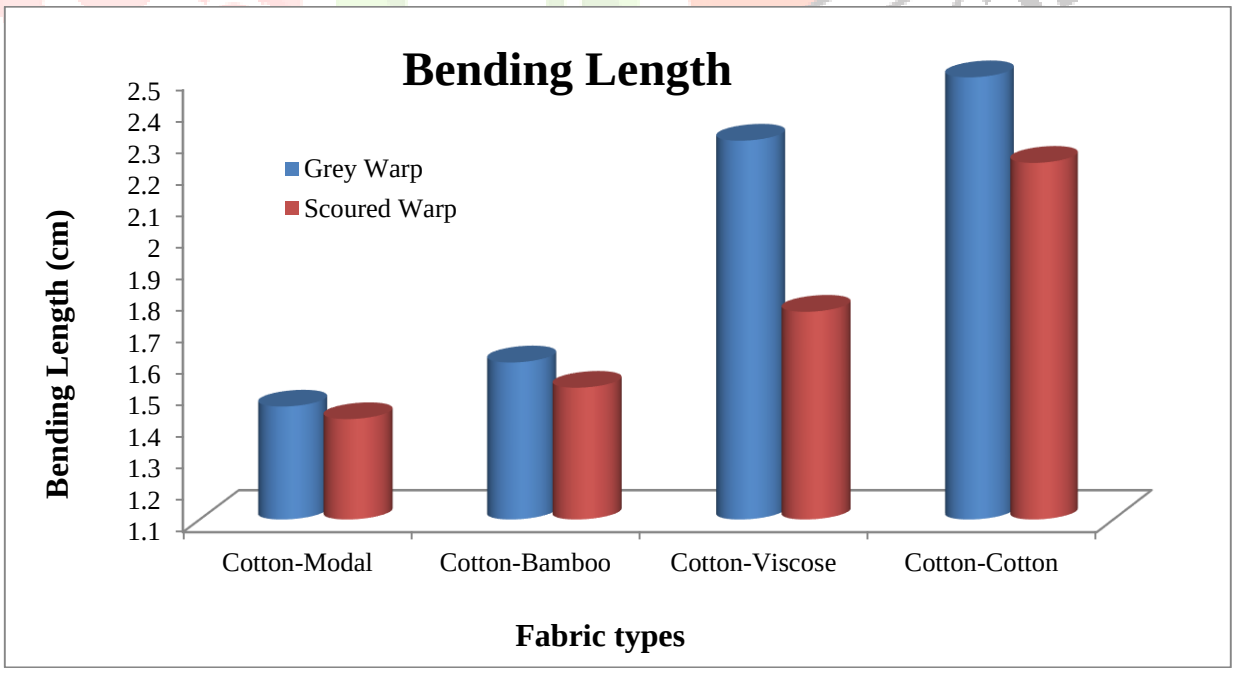

Fig.1 Bending Length (Warp way) of grey and scoured fabrics

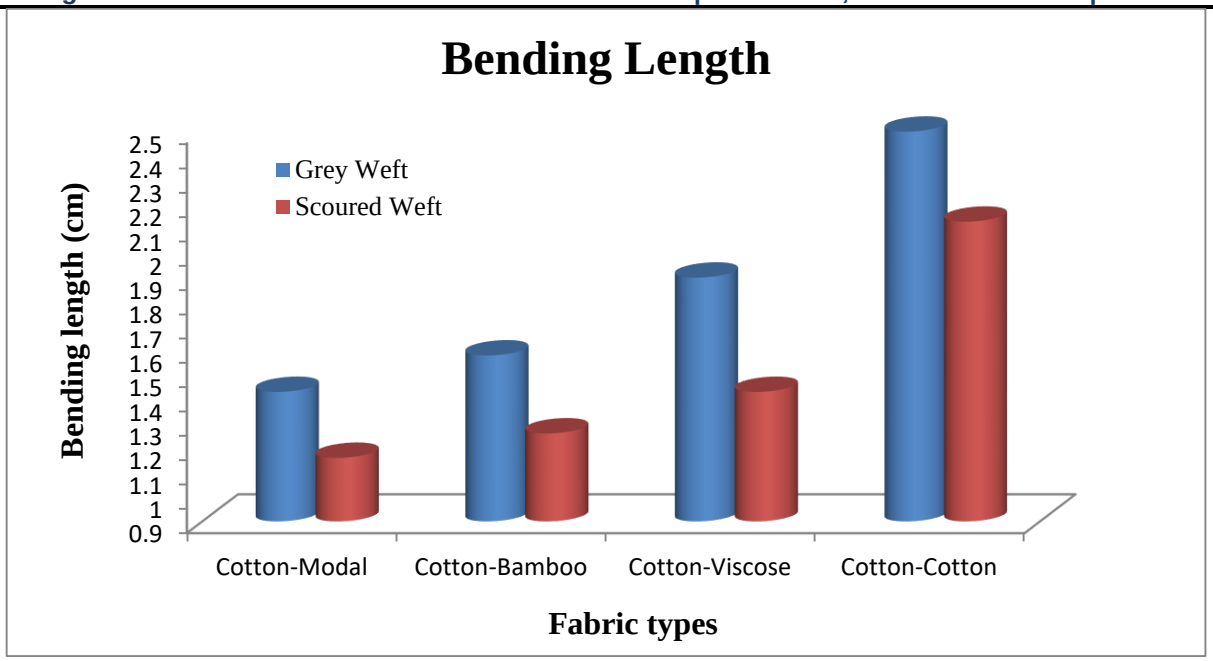

Fig.2 Bending Length (Weft way) of grey and scoured fabrics

Table 4 and Fig.1, Fig.2 depict that Cotton-Modal exhibits the lowest value of bending length in warp and weft way while Cotton-Cotton fabric shows highest value of bending length in warp and weft way and the other two fabrics i.e. Cotton-Bamboo and Cotton-Viscose exhibits in between values of bending length in warp and weft way.The fiber resilience value affects the bending length; less the fiber resilience less the bending length. Modal fiber has lowest fiber resilience value as compared to other three fibers i.e. Cotton, Bamboo and Viscose that is why Cotton-Modal fabric shows lowest bending length [2, 3, 4].By using the one way ANOVA method on sigma plot software it was proved that the difference observed in the scoured fabrics is statistically significant (ANOVA report can be seen from annexure A.1)

Crease Recovery

Effect of fiber type on Crease Recovery of grey and scoured fabrics

Table 5 Crease Recovery of grey and scoured fabrics

Fabric types	***Crease recovery (degree)***			
	Grey		**Scoured**	
	Warp	**Weft**	**Warp**	**Weft**
Cotton-Modal	123.20	120.40	129	133
Cotton-Bamboo	118.50	116.10	121	125.50
Cotton-Viscose	98.50	100.15	103.20	104.50
Cotton-Cotton	94.00	95	96	100

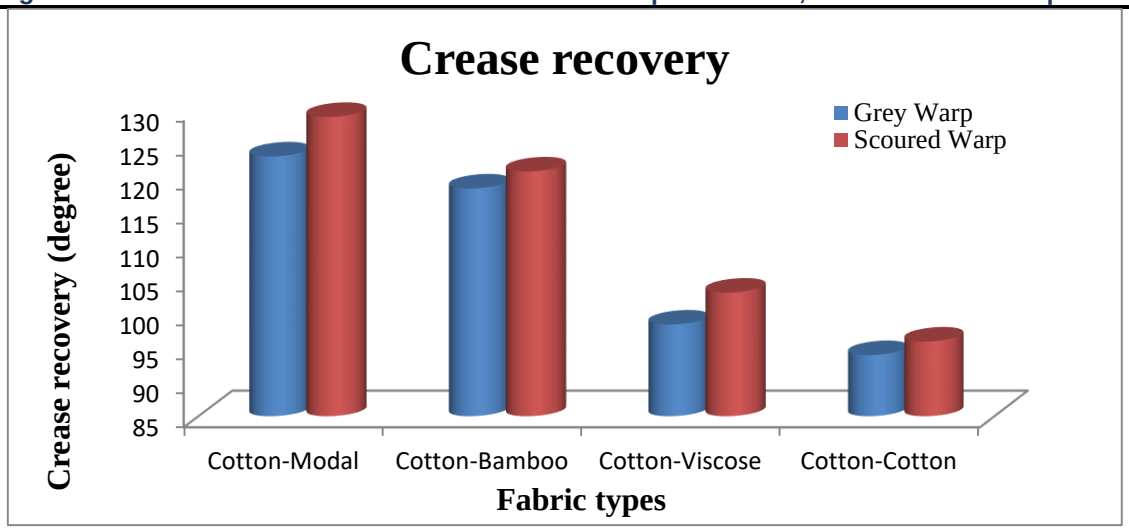

Fig.3 Crease Recovery (Warp way) of grey and scoured fabrics

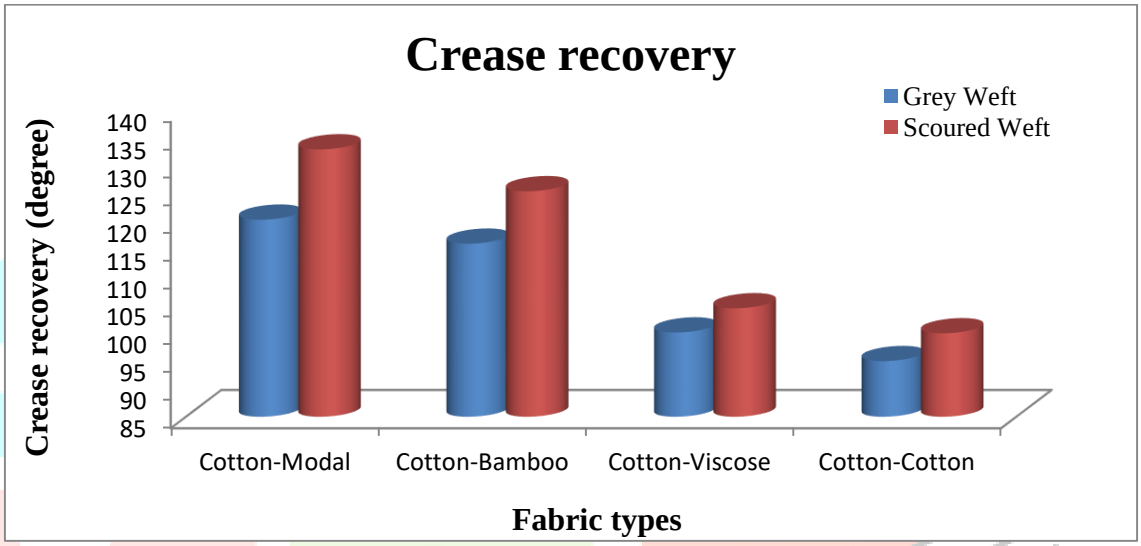

Fig.4 Crease Recovery (Weft way) of grey and scoured fabrics

From Table 5 and Fig. 3, 4 it can be observed that Cotton-Modal fabric exhibits the highest value in warp and weft way while Cotton-Cotton fabric shows lowest value of crease recovery in warp and weft way and the other two fabrics i.e. Cotton-Bamboo and Cotton-Viscose exhibit medium value of crease recovery in warp and weft way. The fiber resiliency value of fiber helps the fabric to recover from its stress and strain. More is the fiber resilient more will be the crease recovery or vice versa. As modal fiber is having highest resiliency property out of four fibers hence, Cotton-Modal fabric shows highest crease recovery value [5, 7]. By using one way ANOVA it was proved that the difference in thecrease recovery values of scoured fabrics isstatistically significant (statistically significant one way ANOVA report can be seen from annexure A.2).

Conclusion

Bending length, crease recovery values of Cotton-Modal fabric found to be lowest whereas Cotton-Cotton fabric shows highest values of bending length and crease recovery. Cotton-Bamboo and Cotton-Viscose fabrics are showing medium values of bending length and crease recovery respectively.

Further studies can be made in the following areas

- Different weave combinations can be taken for optimizing the fiber and fabric properties.
- Varying linear density can be utilized to see the effectiveness of yarn count on handle properties.
- Varieties of union fabrics can be developed by using different blend % of Modal, Bamboo and Viscose in warp and weft directions.

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Annexure A.1

One way anova test results of Bending Length

One Way Analysis of Variance
Data source: Data 1 in finished 2

Normality Test (Shapiro-Wilk) Failed (P < 0.050)

Equal Variance Test: Passed (P = 0.940)

Group Name	N	Missing	Mean	StdDev	SEM
C-M bending	10	0	1.290	0.0149	0.00471
C-C bending	10	0	2.180	0.0149	0.00471
C-B bending	10	0	1.390	0.0149	0.00471
C-V bending	10	0	1.592	0.0181	0.00573

Source of Variation	DF	SS	MS	F	P
Bending Length					
Between Groups	3	11.735	3.912	15716.290	<0.001
Residual	36	0.00896	0.000249		
Total	39	11.744			

The differences in the mean values among the treatment groups are greater than would be expected by chance; there is a statistically significant difference (P = <0.001).

Power of performed test with alpha = 0.050: 1.000

All Pairwise Multiple Comparison Procedures (Holm-Sidak method):
Overall significance level = 0.05

Comparisons for factor:

Comparison	Diff of Means	t	P	P<0.050
C-C bending vs. C-M bending	1.510	214.022	<0.001	Yes
C-V bending vs. C-M bending	0.922	130.681	<0.001	Yes
C-C bending vs. C-B bending	0.840	119.059	<0.001	Yes
C-B bending vs. C-M bending	0.670	94.964	<0.001	Yes
C-C bending vs. C-V bending	0.588	83.341	<0.001	Yes
C-V bending vs. C-B bending	0.252	35.718	<0.001	Yes

Annexure A.2

One way anova test results of Crease Recovery

One Way Analysis of Variance
Data source: Data 1 in finished 2

Normality Test (Shapiro-Wilk) Failed (P < 0.050)

Equal Variance Test: Failed (P < 0.050)

Group Name	N	Missing	Mean	StdDev	SEM
C-M crease	10	0	131.000	1.491	0.471
C-B crease	10	0	123.250	1.493	0.472
C-V crease	10	0	103.160	1.528	0.483
C-C crease	10	0	98.020	1.491	0.472

Source of Variation	DF	SS	MS	F	P
Between Groups	3	7575.355	2525.118	1120.836	<0.001
Residual	36	81.104	2.253		
Total	39	7656.459			

The differences in the mean values among the treatment groups are greater than would be expected by chance; there is a statistically significant difference (P = <0.001).

Power of performed test with alpha = 0.050: 1.000

All Pairwise Multiple Comparison Procedures (Holm-Sidak method):
Overall significance level = 0.05

Comparisons for factor:

Comparison	Diff of Means	t	P	P<0.050
C-M crease vs. C-C crease	33.980	50.622	<0.001	Yes
C-M crease vs. C-V crease	27.840	41.475	<0.001	Yes
C-B crease vs. C-C crease	25.020	37.274	<0.001	Yes
C-B crease vs. C-V crease	18.880	28.127	<0.001	Yes
C-M crease vs. C-B crease	8.960	13.348	<0.001	Yes
C-V crease vs. C-C crease	6.140	9.147	<0.001	Yes