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COMPARATIVE STUDY OF PHYSICAL PROPERTIES OF COTTON, BAMBOO, VISCOSE AND MODAL UNION FABRIC 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 physical properties of fabric in terms of GSM and Thickness 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.GSM and Thickness of modal fabric was found best out of Bamboo, Viscose and Cotton union fabric.

KEYWORDS: *GSM, Thickness, Cotton, Viscose, Bamboo, Modal, Shrinkage.*

INTRODUCTION

GSM and thickness is one of the primary fabric quality parameters. To purchase a fabric or need to get the fabric development done, must mention fabric GSM requirement. The thickness of the fabric depends of the yarn thickness (yarn count), and density of the yarns in the woven fabric. Lighter and thinner fabrics have lower GSM. The openness of the fabric increases with the reduction of its GSM [(1)]. Garments made up of lighter fabrics used in the summer and in winter prefer wearing clothes made of the thicker fabrics for warm in winter. After washing of fabric or garment, fabric GSM increases due to shrinkage of the fabric length and width [(2)]. The lighter your fabric is, the more breathable and summer suited. It is no surprise that fabrics like linen and cotton are very light and wear in summer season but now looking for something to wear all season, that's why this research paper use to study GSM and thickness properties of union fabric Viscose, Bamboo and Modal other then cotton fabric to provide option to consumer of cotton. These substitute fibers are having equivalent or better properties then cotton [(3)].

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 discus 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: 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

Table 4: Physical Properties (GSM and Thickness Values) of Grey and Scoured Fabrics

Fabric Types	GSM		Thickness (mm)	
	Grey	Scoured	Grey	Scoured
Cotton-Modal	151.23	153.50	0.29	0.31
Cotton-Bamboo	152.45	154.16	0.33	0.35
Cotton-Viscose	155.12	156.40	0.36	0.38
Cotton-Cotton	156.61	158.72	0.37	0.51

Physical Properties

GSM

Effect of fiber type on GSM of grey and scoured fabrics

Table 5: GSM of Grey and Scoured Fabrics

Fabric Type	GSM	
	Grey Fabrics	Scoured Fabrics
Cotton-Modal	151.23	153.50
Cotton-Bamboo	152.45	154.16
Cotton-Viscose	155.12	156.40
Cotton-Cotton	156.61	158.72

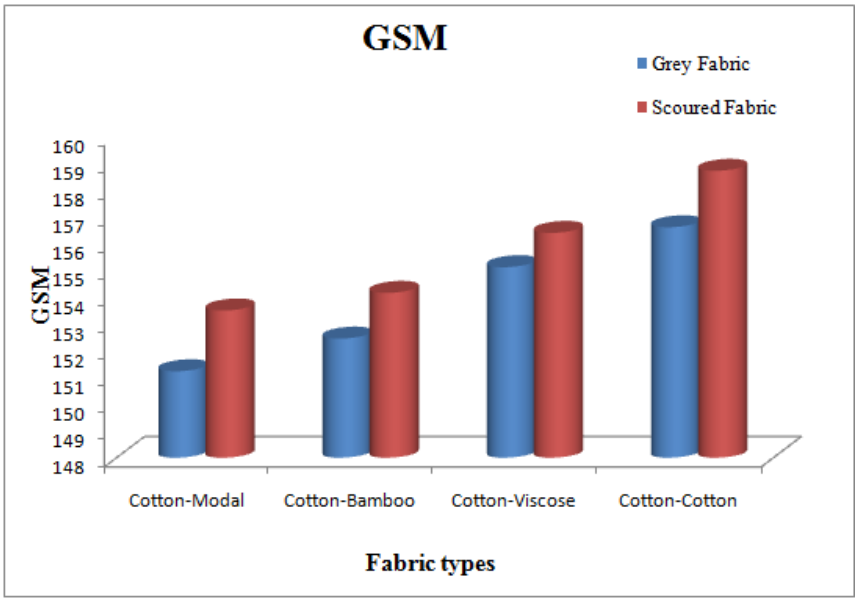

Figure 1: GSM of Grey and Scoured Fabrics.

Table 5 and Fig.1 show the values of GSM of grey and scoured fabrics.Values of GSM in scoured fabrics and grey fabrics were found to be highest due to shrinkage for Cotton-Cotton and lowest for Cotton-Modal fabric, whereas Cotton-Viscose and Cotton-Bamboo show values in between [5, 4]. From the statistical analysis it was observed that there is a significant difference in GSM values of all the experimental fabrics (statistically significant one way ANOVA report can be seen from annexure A.1).

Thickness

Effect of fiber type on Thickness of grey and scoured fabrics

Table 6: Thickness of Grey and Scoured Fabrics

Fabric Types	Thickness(mm)	
	Grey Fabrics	Scoured Fabrics
Cotton-Modal	0.29	0.31
Cotton-Bamboo	0.33	0.35
Cotton-Viscose	0.36	0.38
Cotton-Cotton	0.37	0.51

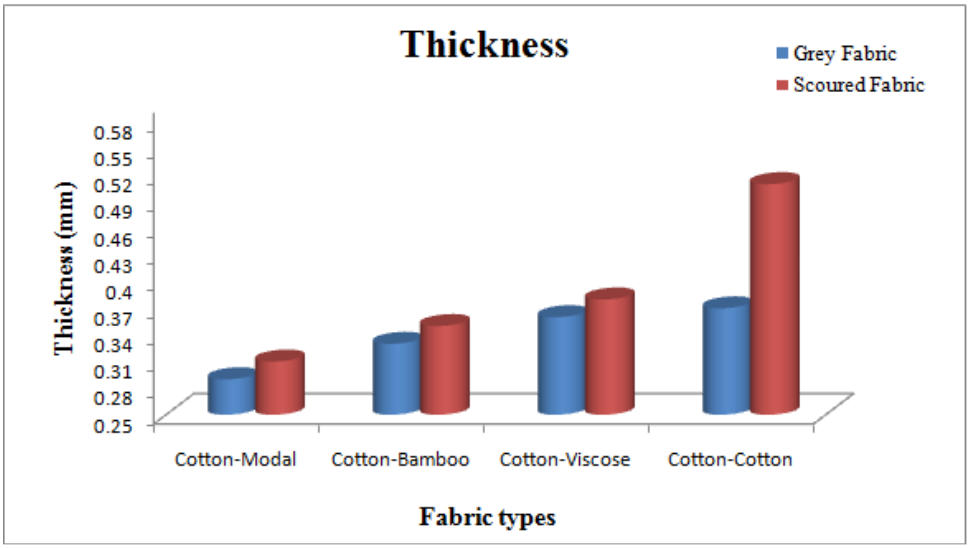

Figure 2: Thickness of Grey and Scoured Fabrics.

As can be seen from Table 6 and Fig. 2, there is a slight change in thickness of grey and scoured fabric due to shrinkage. Thickness values of scoured fabrics and grey fabrics were observed to be maximum for Cotton-Cotton fabric and minimum for Cotton-Modal fabric, whereas Cotton-Viscose and Cotton-Bamboo show the intermediate values of thickness [3, 6]. With the help of statistical analysis using sigma plot software it is found that the difference in the mean values of thickness is statistically significant (ANOVA report can be seen from annexure A.2).

CONCLUSIONS

Fabric thickness, GSM and fabric porosity are found to be lowest for Cotton-Modal fabric followed by Cotton-Bamboo and Cotton-Viscose whereas Cotton fabric shows maximum value of all the above properties.

Further Studies can be Made in the Following Areas

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

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ANNEXURE A.1

One way Anova test results of GSM

One Way Analysis of Variance

Data source: Data 1 in Notebook2

Normality Test (Shapiro-Wilk) Passed (P = 0.736)

Equal Variance Test: Passed (P = 0.935)

Group Name	N	Missing	Mean	StdDev	SEM
C-M gsm	10	0	153.500	2.083	0.659
C-C gsm10	0		158.720	1.819	0.575
C-B gsm10	0		154.160	1.786	0.565
C-V gsm	10	0	156.400	2.254	0.713

Source of Variation	DF	SS	MS	F	P
Between Groups	3	168.219	56.073	14.090	<0.001
Residual	36	143.268	3.980		
Total	39	311.487			

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 gsm vs. C-M gsm	5.220	5.851	<0.001	Yes
C-C gsm vs. C-B gsm	4.560	5.111	<0.001	Yes
C-V gsm vs. C-M gsm	2.900	3.251	0.010	Yes
C-C gsm vs. C-V gsm	2.320	2.600	0.040	Yes
C-V gsm vs. C-B gsm	2.240	2.511	0.033	Yes
C-B gsm vs. C-M gsm	0.660	0.740	0.464	Yes

ANNEXURE A.2

One way Anova test results of Thickness

One Way Analysis of Variance

Data source: Data 1 in Notebook2

Normality Test (Shapiro-Wilk) Passed (P = 0.098)

Equal Variance Test: Passed (P = 0.831)

Group Name	N	Missing	Mean	StdDev	SEM
C-M thickness	10	0	31.000	0.816	0.258
C-C thickness	10	0	51.500	1.179	0.373
C-B thickness	10	0	35.900	0.738	0.233
C-V thickness	10	0	38.000	1.075	0.340

Source of Variation	DF	SS	MS	F	P
Between Groups	3	2300.600	766.867	816.781	<0.001
Residual	36	33.800	0.939		
Total	39	2334.400			

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 thicknes vs. C-M thicknes		20.500	47.308	<0.001	Yes
C-C thicknes vs. C-B thicknes		15.600	36.000	<0.001	Yes
C-C thicknes vs. C-V thicknes		13.100	30.231	<0.001	Yes
C-V thicknes vs. C-M thicknes		7.400	17.077	<0.001	Yes
C-B thicknes vs. C-M thicknes		4.900	11.308	<0.001	Yes
C-V thicknes vs. C-B thicknes		2.500	5.769	<0.001	Yes