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Evaluation of Mechanical Properties of Regenerated Bamboo and Muga silk Blended Fabric for value addition

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Abstract- Blending different types of fibres is a widely practiced means of enhancing the performance and the aesthetic qualities of a fabric. Blended yarns from natural and man-made fibres have the particular advantage of successfully combining the good properties of both fibre components, such as comfort of wear with easy care properties. These advantages also permit an increased variety of products to be made, and yield a stronger marketing advantage. The demands from fabrics have changed with the developments in technology and the rising living standards. In this study the bamboo and silk fibre was blend in carding and drawing stage and yarn were produced in three different ratios 20:80, 50:50 and 80:20.These yarns were further weaved in plain weave and the functional properties of the fabrics produced were evaluated .It was found that the woven blended bamboo muga fabrics can successfully use as apparel as well as value added products.

Keywords: Blending, Carding, Drawing, Drape ability, Wicking.

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1. INTRODUCTION

Fiber blending has been a common practice in the textile industry for a long time, stimulated to a great degree by the availability of an ever increasing number of manmade fibers. Blending different types of fibres is a widely practiced means of enhancing the performance and the aesthetic qualities of a fabric. Blended yarns from natural and man-made fibres have the particular advantage of successfully combining the good properties of both fibre components, such as comfort of wear with easy care properties. These advantages also permit an increased variety of products to be made, and yield a stronger marketing advantage. Bamboo fibre is a regenerated cellulosic fibre produced from bamboo.

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The type of bamboo used for apparel is Moso bamboo *(Phyllostachys pubescents).* Starchy pulp is produced from bamboo stems and leaves through a process of alkaline hydrolysis and multi-phase bleaching. Further chemical processes produce bamboo fibre. Bamboo fibres fabrics are characterized by their good hygroscopicity, excellent permeability, soft feel and easy dyeing. The main difference between the bamboo and silk fibres is that silk is a protein fibre, whereas bamboo is regenerated cellulosic fibre. But in general physical properties of regenerated bamboo fibre is always tends nearer to the properties of silk fibre. Considering the above factors, it was planned to blend silk and bamboo viscose with a goal to produce yarn fine enough with extreme soft feel with good moisture absorbency and which facilitates a brilliant colour and to be woven into fabrics having novel surface characteristics and visual appeal. Hence the present work has been conducted with the objectives Bamboo fibre with silk, and to construct fabric using blended yarn and evaluate their properties to produce value added products.

2. Material and Methods:

Table 1: Details of fibres selected for the study:

English name	Local name	Scientific name	Family
Moso Bamboo	Baah	*Phyllostachys pubscents*	poaceae
Muga silk	Muga	*Anthearea assaminasis*	satturniidae

Bamboo fibre is regenerated cellulosic fibre produced from bamboo. The type of bamboo used for apparels is Moso bamboo (*Phyllostachys pubscents*). Bamboo fibres fabrics are characterized by their good hygroscopicity, excellent permeability, soft feel and easy dyeing. The muga silkworms (*Antheraea assama*) belong to the genus antheraea and produce an unusual golden-yellow silk thread which is very attractive and strong. The special characteristics muga silk is it is durable, it has the highest tensile strength amongst all other natural silk.

As the raw material of bamboo and silk are differ and also the basic fiber properties vary, hence they need to undergo different processes till they are suitable for good blending. The silk is always available in cocoon form. These cocoons contain sericin gum which is to be removed for further smooth processing. So the first process is degumming further followed by other processes. Silk contains 10-15% of sericin which is to be removed either by boiling with soap water or sodium carbonate followed by hydro extraction (removal of excess water). This process reduces the sericin content to 2-3% which is optimum for further opening and carding. This process also opens the cocoon to a fluffy form.In this process parallelization and individualization of the silk fibres is done, which is essential for maintaining quality of the end product. Combing is done to shorts fibres and naps present in the gilled uncombed silk sliver was removed and retains only the long range of fibres that is suitable and compatible to blend it with fine top bamboo fibres. Collected bamboo fibre is also has to undergo opening before getting converted to bamboo top form of required weight suitable to blend it with silk top. After cutting fibres into required length the bamboo fibres were subjected to carding machine to convert the bamboo into sliver form known as carded bamboo top. After these operations the silk slivers and bamboo slivers were blended through the drawing process.In this process thorough blending of both the bamboo and silk fibres were done with 10 canes of sliver. According to the blend ratio of fibres, numbers of canes were used in this operation. The number of slivers for bamboo and silk depends on the ratio required in the blend and weight/meter of individual slivers.

2.1. Yarn Preparation

Yarns of three different blends along with 100% bamboo and muga silk yarn were produced after proper blending. The blend proportion of prepared yarns samples were 20:80, 50:50 and 80:20of bamboo/silk. The yarns produced were then wound to form cones.

The controlled and blended fabrics were weaved in hand fly shuttle loom. From the different blended yarn, fabrics were constructed using plain weave. Blended yarns of different ratios were used for making fabrics in both warp and weft. The nomenclature of the fabric sample was done according to the blend proportions.

2.2. Nomenclature of the sample

BP = Bamboo (control) plain weave
MUP = Muga (control) plain weave
BMUP 20:80 = Bamboo x Muga silk (20:80 ratio)
BMUP 50:50 = Bamboo x Muga silk (50:50 ratio)

BMUP 80:20 = Bamboo x Muga silk (80:20 ratio)

3. RESULT AND DISCUSSION

3.1. Evaluation of fabrics geometrical properties

Table.2: Count and cover factor of blended fabrics (Numerical)

Test Fabric	Fabric Count		Cover factor		Cloth cover
	Warp way	weft way	Warp way	Weft way	
BP	66	54	8.42	7.22	13.63
MUP	66	58	9.31	7.47	15.02
BMUP 20:80	64	54	8.26	7.72	14.98
BMUP 50:50	60	56	7.75	7.49	13.15
BMUP 80:20	64	56	8.26	7.43	13.39

Fabric count in woven textile material is the number of warp yarns (ends) and weft yarns (picks) per inch of a fabric. Data of the table 2.revealed that the all the samples of plain weave controlled and blended fabric have different numbers of fabric count. In warp way, both controlled sample BP and MUP shows highest counts (66) and lowest were in sample BMUP 50:50 (60). These differences may be due to the beating process involved in weaving. In case of weft, maximum number of threads (60) was observed in sample MUP (58) and minimum in BMUP 20:80 (54). Due to the weaving process there may be differences in the fabric count of the test samples. In fabric, cover is considered as fraction of the total area covered by the component yarns. Cloth cover of the fabrics determines the appearance, handle, feel, permeability, and transparency, limits of pick insertion and texture of fabric. It was revealed from the table 2, in case of the cloth cover of all the test fabrics, sample MUP shows highest cloth cover value (15.02) followed by BMUP 20:80 (14.98) and the least value was found in BMUP 50:50 (13.15).The maximum cover factor observed in muga plain and muga bamboo blended fabrics may be due to its highest count.

Table 3. Fabrics weight (g/sq.mt), Thickness (mm) and Crease Recovery (degree) of the test fabrics.

Test Fabric	Total Weight (g/sq.mt)	Thickness (mm)	Crease Recovery (degree)	
			Warp way	weft way
BP	125.56	0.30	108	106.50
MUP	137.41	0.25	98.65	105.00
BMUP 20:80	150.90	0.32	99.50	106.50
BMUP 50:50	149.10	0.35	102.25	112.50
BMUP 80:20	132.24	0.30	105	109.50
CD	**0.845**	**0.014**	**0.406**	**1.157**
CV%	**0.316**	**3.293**	**0.235**	**0.629**

Blended sample BMUP 20:80(150.90 g/sqmt) shows maximum fabric weight and minimum value was found in test fabric bamboo control (125.56 g/sq.mt). It was observed that the muga fabrics with both control and blended shows maximum value in fabric weight and this may be due to the muga silk possessed more slubs and snars might have contribute some weight with yarn structure .Properties like drapability, abrasion resistance of fabric depends on cloth thickness (Booth, 1968). The data depicted in the table 3, showed that the highest thickness was found in the sample BMUP 20:80 (0.32mm) followed by BMUP 50:50 (0.35mm) and lowest was observed in MUP controlled sample and BMP 20:80 were at par (0.25mm) The table revealed that there is more or less difference was found between controlled and blended woven samples.The difference in fabric thickness may be due to the beating process in weaving as well as the amount of twist and the blend proportion of the yarn.Crease recovery is a fabric property which indicates the ability of fabric to go back to its original position after creasing. The crease recovery angles of all the fabrics were depicted in the table. It was seen that in the warp way sample BP showed maximum crease recovery of (108) degree and the lowest crease recovery was shown by control sample MUP (98.65) degree. Crease recovery may be attributed to stiffness and thickness of the woven fabric. Similarly, in the weft way direction, the highest crease recovery of 112.50 degree was depicted by sample BMUP 50:50 and the lowest was observed in MUP (105 degree). It was observed in the table that the crease recovery angle increases with the increase in the bamboo fibre content.

3.2. Functional Properties of woven Fabric

Figure 1. Tensile strength(kg f) and elongation (%) of blended fabrics

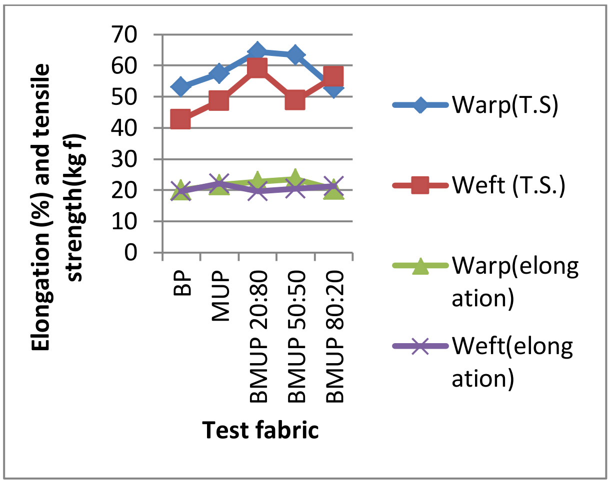

Figure 1, illustrated that among the test samples highest tensile strength (64.36 kg f) was shown by BMUP 20:80 in warp direction, and the least was exhibited by

BP (53.12kg f). While in weft direction, sample BMUP 20:80 has a maximum strength (59.03 kg f) and lowest tensile strength was found in BP (42.65kg f).The highest tensile strength was found in the bamboo muga blended samples, which may be due to the highest strength of the muga silk fibres. The results showed that tensile strength and %elongation of woven fabrics using the blended yarn were increased with an increase in silk content. This is an advantage of silk in the aspect of rendering the strength to the blended yarns and fabrics. The increase in bamboo content decreases the strength of the blended fabrics may be due to the less tensile strength of the bamboo fibre. The tensile strength of the fabrics depends on the fibre type and arrangement, as well as the fabric structures. It was observed that the elongation of all the samples in warp way have more or less difference with each other.

Table 4: Drape coefficient (%), Wickability (cm) and Absorbency (%) of blended fabric

Fabrics	Drape co-efficient %	Wicking height(cm)		Absorption (%)
		Warp way(cm)	Weft way(cm)	
BP	46.10	6.04	6.80	55.52
MUP	51.25	3.20	3.85	41.10
BMUP 20:80	47.22	3.66	3.96	52.51
BMUP 50:50	44.75	3.85	4.02	54.23
BMUP 80:20	42.80	4.22	4.99	57.24

Drape is the ability of fabric to hang in graceful fold. Drape is a manner in which a fabric falls when hang on a form. Fabric drape is the extent to which a fabric will deform, when it is allowed to hang under its own weight. It is largely affected by the yarn twist. The drape coefficient expresses the drapability of the fabric, and the higher the value of drape coefficient, the poorer its drapability. Table 4, depicts that the highest drape coefficient (51.25%) was found in controlled fabric sample MUP plain weave and least drape coefficient was found in fabric sample BMUP 80:20 (42.80). soft fabric drapes closer to the body forming ripples whereas stiff fabric drapes away from the body. Since the bamboo fibre has good absorbency properties, so it may increase the wicking height of the tested samples. On the other hand MUP showed a decreasing trend of wicking height in both the warp and weft direction, which may be due to higher percentage of sericin present in the fibre as well as inner molecular structure of the muga fibre. Result show that the wickability increases with increasing in bamboo fibre content in the fabrics as the bamboo fibre have got very good wickability. The wickability is more in warp direction as compared to the weft direction.This may be due to the fact that the transfer of water is easier in warp direction than weft direction.

The higher wicking heights indicated high absorbency which was due to purity of fibre. The increase in wicking heights of the fibre demonstrated the sufficient removal of gums and other intercellular substances for cellulose mass. Absorbency of fabric mainly depends on the fabric structure, type of yarn structure, and surface tension of water. Here the bamboo muga 80:20 blended test fabrics attained the highest absorbency (57.24%) while muga control sample recorded lowest absorption of water (41.10%). It may be due to the amount of gum present in muga fibre. But in case of other blended samples absorbency increases with the increase in bamboo content.

After evaluation of functional properties and based on fabric texture some of the products were prepared. Value added diversified products were designed and constructed by following the drafting methods. Different products like gents kurta, neckties, jacket etc. were made from the blended fabrics.

PRODUCTS MADE FROM BLENDED FABRICS:

(Nehru Jacket)

(Kurta and Mafflar)

(NECK TIE)

4. CONCLUSION

From the study it may be conclude that bamboo and muga silk blended fabrics have good potential for exports owing to their economics, aesthetic appeal and improved functional properties. Quality characteristics of fabrics produced from blending of bamboo and muga fabrics indicate that these fabrics can be utilised for the manufacture of dress materials and different value added product with distinct characteristics. There is also a vast scope of diversification into the manufacture of home textiles like interior fabrics and furnishings.

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