Design and Development of Silk Floss / Cotton Blends Handloom Fabrics

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Abstract: ***The present study was carried out to add value to silk floss by developing blended union fabrics. Blending of silk floss and cotton was done by simple stack method and yarns were spun on foot operated medleri charkha. The blend proportions are cotton/silk floss 50:50 and 70:30 and 100 per cent of silk floss yarn were produced. Three union fabrics were also made using pure cotton yarn in warp and blended yarns and pure silk floss in weft. Result revealed that, the cotton x silk floss (control sample) union fabric had highest cloth cover and cotton x cotton/silk floss (70/70) blended union fabric has better dimensional stability, highest thickness and cloth weight.***

Keywords: Silk floss, blending, union fabrics, geometrical properties

1. Introduction

The textile industry is not only one of the oldest but also continues to be one of the main stay of the world economy. The evolution of the textile industry has brought about big changes in the function of fabric engineering. Today in the Indian scenario, textile industry contributes up to 9 per cent of its gross domestic production and provides employment to over 35 million people, which accounts to 5 per cent of the country's export earnings (www.thenews.com). Among textiles, sericulture is also a very important agro based industry. It is a labour intensive industry in all its phases- cultivation of silkworm, food plants, silkworm rearing, silk reeling and other post cocoon processes such as twisting of yarn, dyeing, weaving, printing and finishing. It provides employment to approximately 60 lakh persons. There are many advantages in sericulture *viz*., high employment potential, provides vibrancy to village economics, low gestation, high returns, women friendly occupation, eco-friendly activity and so on (www.texmin.nic.in).

Silk is a natural protein fibre, considered as the "Queen" of textiles. India is a second largest silk producing country in the world and has the distinction of producing all the four varieties of silk viz., Eri, Muga, Tasar and Mulberry respectively. Sericulture industry comprises of 4-5 major activities from land to fabric viz., mulberry cultivation, silk worm egg production, silk worm rearing, silk reeling and twisting, weaving, dyeing, printing and finishing. Different types of material wastes are generated during the production of silk goods. Silk floss is one of the by-product obtained during cocoon harvesting. It includes all kinds of raw silk which may be unwindable and hence it is considered as waste. Introducing the technology will facilitate in developing diversified raw material for the handloom sectors. In terms of providing employment to 124 lakhs people, the handloom stand next to agriculture in the unorganized sector (Verma *et al.* 2013). Therefore, the present study was planned to develop value added silk floss/ cotton blended union fabrics for utilizing silk floss and strengthening the income generating capacity of the handloom weavers.

2. Objectives

To develop blended union handloom fabrics and assess the geometrical properties of cotton/silk floss blended union fabrics

3. Materials and Methods

The raw material used in the study included silk floss and cotton. The study was conducted in the Department of Textile and Apparel Designing, College of Rural Home Science, UAS, Dharwad Spinning and weaving was done near by villages Kelageri, Chikkamalligawad of Dharwad district.

Blending and spinning of silk floss/cotton fibres

Silk floss and cotton was blended in ratio of 100:0, 50:50 and 70:30 (Cotton/silk floss) by simple stack method and spun into yarn on foot operated medleri charkha. Using developed blended yarns further produce union fabrics on handloom. Cotton yarn was used as warp and blended yarns used as weft. The details of fabric information are given in Table-1. A total of three fabrics were constructed in that 100:0 blended union fabric was taken as control sample. Further, developed blended yarns were assessed for the geometrical properties viz., cloth count, cloth thickness, dimensional stability and cloth weight.

4. Research findings and discussion

4.1 Cloth Count

The cloth count in woven textile is the number of ends and picks per inch unit length as counted, while the fabric is under zero tension and free from folds and wrinkles. From Table-2 it is observed that, among all the fabrics, the cotton x silk floss (control) union fabric showed higher cloth density (44 x19) followed by cotton x cotton/silk floss (50/50) blended union fabric (44 x 16) and cotton x cotton/silk floss (70/30) blended union fabric (44 x 11). However, there is no variation found in warp density of all the samples. Further, the statistical results showed that the cloth count of developed fabrics was significant at 5 per cent level in warp and weft density. Warp count was significantly greater in number compared to weft count because warp being finer could be aligned more compactly than coarse filling yarn. Higher number of warp count attributed to many important properties *viz.*, strength, drapability, serviceability and cloth balance. The cotton x silk floss union fabric showed highest cloth count may be because of compactness of weave and the yarn count. Warp count of all samples did not show variation because of constant warp yarn count for all the yarn samples. On the other hand, the weft count of all the samples varied. This may due to the unevenness of the handspun yarn and the presence of slubs, snarls, thick and thin places.

Among all the three fabric samples, control sample *i.e.,* cotton x silk floss was compactly woven than cotton x cotton/silk floss (50/50) and cotton x cotton/silk floss (70/30) because of the finer cotton in warp direction and silk floss yarn in weft direction respectively.

4.2 Cover factor

Cloth cover of the fabric depends on cover factor of warp as well as weft which in turn is reliable on factors like yarn count, twist per inch, threads per inch etc. Table-2 depicts the warp way cover factor of all the fabric samples almost all fabric sample retained more or less same *viz.,* 15.33, 15.22, 15.43. On other hand weft way cover factor showed a difference among the fabric samples, where cotton x silk floss (control) union fabric exhibited greatest weft way cover factor of 6.42 followed by cotton x cotton/silk floss (50/50) and cotton x cotton/silk floss (70/30) 5.55 and 3.79 respectively.

The simple one-way ANOVA existing in table indicated that, there was no significant difference in weft way cover factor of all the fabric samples. There was a significant difference in warp way at 5 per cent level of significance.

Warp and weft way cloth count was increased with the increase in the cloth cover and these two factors are directly proportionate to each other. Warp way cover factor was observed more or less same because of constant warp yarn count (20s). There was a variation in weft way cover factor among all the samples. Maximum weft way cover factor was observed in control sample because of lower yarn count than the blended yarns and greater number of neps and coarse count of the yarn in Praveen and Vatsala (1992) reported similar findings.

4.3 Cloth Weight

Cloth weight is articulated either as grams per square meter or as grams per linear meter. Factors *viz.*, fibre, type of yarn, yarn count, fabric count, type of weave, method of construction, type of finish applied etc. add a greater point in important the weight of the fabric.

Table-3 depicts the cloth weight and percentage of warp and weft contributing to distinctive sets of fabric. Cotton x cotton/silk floss (70/30) blended union fabric exhibited highest cloth weight of 296.8 g. consequently cotton x cotton/silk floss (50/50) blended union fabric (266.96 g) and control fabric (242.32 g).

Further it is observed that percentage of warp of cotton x silk floss union fabric higher than blended union fabric and weft percentage of higher in case of cotton x cotton/silk floss (70/30) blended union fabric as compared to cotton x cotton/silk floss (50/50) blended union fabric and cotton x silk floss (control) union fabric.

Cotton x cotton/silk floss (70/30) blended union fabric was heavier than other two fabrics *i.e.,* cotton x silk floss union fabric and cotton x cotton/silk floss (50/50) blended union fabric. This may be due to fibre type *i.e.,* the fabric sample had highest cotton fibre in blend ratio and silk floss is more bulky and coarser fibre and density of cotton was much higher (1.52 g/cm^3) reported in Gohl and Vilensky, 2005. The type of fibre, yarn count, weave type, cloth count factors influenced the mass per unit area. Least mass per unit area was observed in control fabric *i.e.,* cotton x silk floss may be due to absence of blend ratio in weft direction and density of the silk was less (1.34 g/cm^3) reported in Gohl and Vilensky, 2005. Changes in weight may be due to variation in blend composition, yarn count, fabric thickness and fabric density. Besides this fabric density, twist of individual yarn and thickness significantly influences the weight of the fabric similar trend was observed in Kariyappa *et al.* 2007.

4.4 Dimensional stability

Table 4 reveals the dimensional stability of the blended union fabrics. Highest shrinkage percentage was observed in warp way cotton x cotton/silk floss (70/30) blended union fabric (4.78 %) followed by cotton x silk floss (control) union fabric (4.22 %) and cotton x cotton/silk floss (50/50) blended union fabric (3.42 %). Weft way shrinkage was seen high in cotton x cotton/silk floss (70/30) blended union fabric (5.94 %) subsequently cotton x cotton/silk floss (50/50) blended union fabric (4.9 %) and cotton x silk floss (control) union fabric (4.62 %). Statistical data revealed that there is significant difference at 5 per cent level between all the samples.

Maximum shrinkage was observed in cotton x cotton/silk floss (70/30) blended union fabric because of higher proportion of the cotton fibre. Cotton fibre is very absorbent, owing to the countless polar –OH groups in its polymer attract by water molecules, which are also polar (Gohl and Vilensky, 2005). Thirugnasambantham and Sethilkumar, 2010- reported similar reason that fabric absorb water easily and may be due to control of inter yarn movement within fabric because of fibre hairiness and bulkiness. Less shrinkage was occurred in control sample *i.e.*, cotton x silk floss due to absence of cotton fibre in the weft yarn and silk has a very crystalline polymer system, it is less absorbent than cotton (Gohl and Vilensky, 2005). Shrinkage may be due to straining of fibres during spinning process and the same way warp and weft yarns get strained during the process of weaving. However, same result observed in Kariyappa *et al.* 2014 this strain gets relaxed during washing resulting in shrinkage.

4.5 Cloth Thickness

Table 5 indicates the cloth thickness of the developed blended union fabric. It is always implicit that the thicker the fabric longer the life. It is inferred that the cloth thickness of cotton x cotton/silk floss (70/30) blended union fabric was conspicuously higher (2.19 mm) as compared to other sets of the fabric samples namely, cotton x cotton/silk floss (50/50) blended union fabric (1.87 mm) and cotton x silk floss (control) union fabric exhibited least thickness values (1.34 mm). One way ANOVA depicted a significant difference at 5 per cent level among all the blended union fabrics

Maximum thickness was found in cotton x cotton/silk floss (70/30) blended union fabric may be due to the presence of slubs, snarls of the yarn. Lower yarn twist and greater cloth weight was found in case of cotton x cotton/silk floss (70/30) blended union fabric. This may be because of coarser the yarn and higher hairiness and bulginess, this is inline with findings Thirugnasambantham and Sethilkumar, 2010. Least thickness was observed in control sample *i.e.*, cotton x silk floss because of less twist per inch and least yarn count.

5. Conclusion

The aim of the work was to study the geometrical properties of the blended union fabrics. cotton x silk floss union fabric has higher cloth count and cover factor. Cotton x cotton/silk flos (70/30) blended union fabric has good dimensional stability, higher cloth thickness and cloth weight. these properties make this blended union fabric an good choice as furnishing materials.

References

[1] Gohl, E. P. G. and Vilensky, L. D., 2005, *Textile Science*. CBS publishers& distributors Pvt, New Delhi, India, pp. 42-46.

[2] Kariyappa, Mahadevaiah, B.M., Roy, S., Ramaswamy, G. N., Anantha Krishnan, T. and Srinath, K., 2007, Studies on influence of eri/wool fibre blending on abrasion resistance of eri/ wool blended fabric. *Man-Made Tex. India,* 50(10): 370-374.

[3] Kariyappa, Y. C., Radhalakshmi, K. P., Shivakumar and Bindroo, B. B., 2014, Studies on shrinkage properties of eri silk/wool blended spun yarn and fabrics. *Indian J. Seric.*, 53(1): 68-72.

[4] Kulloli, S. D. and Naik, S. D., 2014, Performance properties of naturally colored cotton and filature silk union fabrics. *Int. J. Recent Scientific Res.*, 5(7): 1330-1333.

[5] Praveena, M. and Vatsala, R., 1992, A study on blending of mulberry silk waste. *Indian Tex. J.*, 103(1): 92-94.

[6] Thirugnanasambantham, A. and Sethilkumar, M., 2010, Properties of silk/modal blended knitted fabrics. *Indian Tex. J.*, 120(4): 22-26.

[7] Verma, N., Grewal, N. and Kaur, I. J., 2013, Value addition of mulberry silk waste/ wool blends to develop handloom fabrics. *Asian J. Home Sci.*, 8(1): 14-19.

[8] www.texmin.nic.in

[9] www.thenews.com

Table 1: Constructional details of cotton x cotton/silk floss blended union fabrics

Sl. No.	Blended union fabrics	Direction	Fibre content	Yarn type	Twist direction	Yarn count	Threads per inch	Cover factor	Cloth cover	Weave type
1	Sample 1	Warp	Cotton	2 ply yarn	S	2/20s	44	15.33	18.23	Plain
		Weft	100 % silk floss	Single	Z	5.56 Ne	19	6.42		
2	Sample 2	Warp	Cotton	2 ply yarn	S	2/20s	44	15.22	16.95	Plain
		Weft	Cotton/Silk floss 70/30)	Single	Z	8.12 Ne	11	3.79		
3	Sample 3	Warp	Cotton	2 ply yarn	S	2/20s	44	15.43	17.92	Plain
		Weft	Cotton/Silk Floss (50/50)	Single	Z	8.45 Ne	16	5.55		

Table 2: Cloth count of cotton x cotton/silk floss blended union fabrics

Fabric samples	Cloth count (Ne)		Cover factor (Ne)		Cloth cover
	Warp	Weft	Warp	Weft	
Cotton x Silk floss (Control)	44*	19*	15.33*	6.42*	18.23
Cotton x Cotton/Silk floss (50/50)	44*	16*	15.43*	5.55 *	17.92
Cotton x Cotton/Silk floss (70/30)	44*	11*	15.22*	3.79*	16.95

* = Significant at 5 % level

ANOVA:

Fabric samples	Cloth count (Ne)		Cover factor (Ne)	
	Warp	Weft	Warp	Weft
S.Em ±	3.38	4.00	1.18	1.38
CD 5 %	0.31	0.36	0.10	0.12
CV %	2.43	8.31	2.43	8.31

S.Em (±) = Standard error mean
CD = Critical difference
CV % = Co-efficient of variance

Table 3: Cloth weight of cotton x cotton/silk floss blended union fabrics

Fabric samples	Total weight (g/sq.mt.)	Warp way (%)	Weft way (%)
Cotton x Silk floss (Control)	242.32*	50.21	49.78
Cotton x Cotton/Silk floss (50/50)	266.96*	49.47	50.52
Cotton x Cotton/Silk floss (70/30)	296.80*	45.20	54.79

*= Significant at 5 % level

ANOVA:

Fabric samples	Total weight (g/sq.mt.)
S.Em ±	57.28
CD 5 %	5.58
CV %	6.74

S.Em (±) = Standard error mean
CD = Critical difference
CV % = Co-efficient of variance

Table 4: Dimensional stability of cotton x cotton/silk floss blended union fabrics

Fabric samples	Dimensional stability (%)	
	Warp way (%)	Weft way (%)
Cotton x Silk floss (Control)	4.22*	4.62*
Cotton x Cotton/Silk floss (50/50)	3.42*	4.90*
Cotton x Cotton/Silk floss (70/30)	4.78*	5.94*

*= Significant at 5 % level

ANOVA:

Fabric samples	Warp way (%)	Weft way (%)
S.Em ±	3.79	2.75
CD 5 %	0.36	0.26
CV %	28.95	16.91

S.Em (±) = Standard error mean
CD = Critical difference
CV % = Co-efficient of variance

Table 5: Cloth thickness of cotton x cotton/silk floss blended union fabrics

Fabric samples	Cloth thickness (mm)
Cotton x Silk floss (Control)	1.34*
Cotton x Cotton/Silk floss (50/50)	1.87*
Cotton x Cotton/Silk floss (70/30)	2.19*

*= Significant at 5 % level

ANOVA:

Fabric samples	Cloth thickness (mm)
S.Em ±	0.28
CD 5 %	0.03
CV %	4.91

S.Em (±) = Standard error mean
CD = Critical difference
CV % = Co-efficient of variance