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Research Paper

Assessment of lac dyed eri silk and naturally coloured cotton fabrics

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■ **ABSTRACT :** Environmental awareness, hazards of chemical industries, dyes and increased health consciousness of consumers have paved way for environmental friendly inventions that include variety of fibres, dyes and chemicals. Natural colour cotton, organic cotton, natural dyes, enzymatic finishes, are few of them. An effort was made to weave eco-friendly fabrics using a combination of lac dyed Eri silk with naturally brown coloured cotton. Two fabrics *viz.*, lac dyed pure Eri silk fabric (2/80s) and Eri (warp) x Naturally coloured cotton (weft) union fabrics formed the test sample. Results revealed that, pure Eri silk fabric exhibited greater tenacity, elongation percentage, lower drape co-efficient and colour strength compared to union fabric, whereas Eri x NCC union fabric showed higher values of fabric thickness, weft way bending length, weft way crease recovery angle and abrasion resistance, indicate the fabric to be stiffer and coarser. Hand spun, naturally coloured cotton yarn showed unequal distribution of slubs and snarls which gave novelty appearance and textural effect on handloom Khadi fabric. Thus, lac dyed Eri silk x NCC union fabric; a unique eco-friendly fabric was best suitable for designer's made-ups, shirts and dress materials.

■ **KEY WORDS:** Eri silk, Lac dye, Naturally coloured cotton

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Cotton in its pure form and with blends is the principal textile fibre of the universe and is one of the world's most socially vital and economically important agricultural cash crops that has played a very important role in the lives of Indians, and is thus called the 'fabric of India'. In recent years the colour linted cotton has gained popularity wherein the fibre is short, coarse and weak, thus submissive to hand spinning. Of the colour cottons cultivated, brown and green are the most common ones. The recent investigations in brown cottons highlighted various positive features like higher lint yield, acceptable fibre quality, spinnability, colour stability, enhancement of single yarn strength and pigmentation on scouring and mercerization (Gokarneshan, 2003). These inventions further expanded the utility and application of colour linted cotton for bed linen, furnishings and other variegated consumer goods as well as household textiles.

Thus, naturally colour linted cotton forms the basic raw material to the handloom sector because of its fibre length, which is ultimately spun into coarser and uneven yarns. Further, naturally colour linted cotton may be blended with other natural and man-made fibres to overcome the undesirable and to impart desirable properties to produce blended and union fabrics. The utilization of these colour cotton yarns in producing blended and union fabrics are eco-friendly since it avoids artificial dyeing that averts the contamination of environment, pollution and health hazards.

The wooly white Eri silk is often referred to as the Ahimsa silk or the fabric of peace as the process does not involve the killing of the silk worm. Eri silk is a boon for those who practice absolute non-violence and do not use any product obtained by killing any living creature. Hence, Vegans and other monks in India prefer this silk (*http://en.wikipedia.org*).

Lac is the most ancient of animal dyes. Lac is the resinous

protective secretion of the tiny lac insect. The insects secrete a thick resinous fluid which envelopes their bodies and the secretions from individual insects coalesce and form a hard continuous encrustation over the twigs. The hard encrustation is available on the surface of different trees and bushes. The twigs are harvested and the encrustation scraped off, dried and processed to yield shellac or dye. This contains about 0.5 per cent to 1 per cent of dye depending upon the climatic conditions. History of lac goes back to the Vedic period when it was known as 'Laksha'. The term was further used as lake *i.e.*, for the insoluble salt of the dye pigments. Lake is formed by the action of the mordant and the dye.

The term 'Khadi' means cotton khadi, is Indian handspun and hand woven cloth. The raw materials may be cotton, silk or wool, which are spun into threads on a spinning wheel called a Charkha. It is a versatile fabric, cool in the summer and warm in winter. The fabric got its importance from Mahatma Gandhi when he revived the 5000 year old process of hand weaving as part of his movement of freedom fight in 1920s. Khadi over the decades has moved from a freedom fighter's identity fabric to a fashion garment (*http:// www.indiaprofile.com*).

The handspun naturally colour linted cotton yarn with unequal distribution of slubs and snarls in the yarn give a fancy appearance and texture to the ultimate fabric that can go as designer's fabrics. Thus, cotton, Eri silk and lac dye being ancient and eco-friendly, this research was planned to produce union fabrics that are unique, environmental friendly and are designer's fabric.

■ RESEARCH METHODS

Dyeing of Eri silk yarn with lac dye :

Eri silk (2/80s) was dyed with 3 per cent lac dye using 2 per cent formic acid mordant to produce a colour which is nearer to the naturally coloured cotton.

Production of union fabric :

Lac dyed Eri silk as warp was interwoven with Naturally Coloured Cotton (NCC) *i.e.*, Dharwad Desi Coloured Cotton – 1 (DDCC-1) of 2/8s count, to produce union fabric. Totally two fabrics *viz.*, Eri x Eri pure silk fabric and Eri x NCC union fabric were produced on handloom and these fabrics were assessed for their mechanical and functional properties.

Assessment of mechanical and functional properties of these fabrics :

The mechanical properties *viz.*, cloth count, cloth weight, thickness, bending length, crease recovery angle were assessed using pick glass, electronic weighing balance, Ana thick, stiffness tester and crease recovery angle, respectively. The functional properties *viz.*, tensile strength and elongation per cent, Abrasion resistance and drapability were assessed using universal testing machine, martindale abrasion tester and drape meter, respectively.

Assessment of colour strength :

The colour strength values were also assessed using spectrophotometer.

■ RESEARCH FINDINGS AND DISCUSSION

It is seen from Table 1 that, Eri x Eri pure silk fabric possessed higher values of cloth count (warp-47 and weft-42), weft way bending length (1.18 cm), warp way (100.5) and weft way (106.5) crease recovery angle than Eri x NCC union fabric. The higher values of cloth weight (197.6 g/m^2), thickness (0.62 mm), warp way bending length (1.11 cm) and lower values of cloth count (warp- 44 and weft -40), weft way bending length (0.97 cm), warp way (94.75) and weft way (79.75) crease recovery angle of Eri x NCC union fabric revealed that the fabric to be thick and stiff than pure Eri silk fabric may be because of weft NCC yarn which is coarse and posses slubs and snarls. However, non-significant difference was obtained

Table 1: Mechanical properties of the designed eco-friendly fabrics

Sr. No.	Fabrics	Cloth count (NE)		Cloth weight (g/m^2)	Thickness (mm)	Bending length (cm)		Crease recovery (angle)	
		Warp	Weft			Warp	Weft	Warp	Weft
1.	Eri x Eri pure silk fabric	47	42	155.20	0.52	1.02	1.18	100.50	106.5
2.	Eri x NCC union fabric	44	40	197.60	0.62	1.11	0.97	94.75	79.75
	CD	1.15	NS	0.01	0.01	NS	0.15	NS	3.53
	CV (%)	1.72	4.05	1.27	1.13	4.79	3.12	3.66	1.68

Table 2 : Tensile strength (kgf) and elongation (%) of the designed eco-friendly fabrics

Sr. No.	Fabrics	Tensile strength		Elongation (%)	
		Warp	Weft	Warp	Weft
1.	Eri x Eri pure silk fabric	52.92	46.90	28.04	26.06
2.	Eri x NCC union fabric	51.78	41.14	27.48	9.99
	CD	NS	NS	1.91	0.74
	CV (%)	4.82	7.84	6.04	1.53

Table 3 : Cloth abrasion resistance (cycles) and drapability (%) of designed eco-friendly fabrics

Sr. No.	Fabrics	Abrasion resistance (No. of cycles)	Drapability	
			No. of nodes	Drape co-efficient
1.	Eri x Eri pure silk fabric	428	6	64.59
2.	Eri x NCC union fabric	490	6	79.72

Table 4: Colour strength (k/s) values of the designed eco-friendly fabrics

Sr. No.	Sample	K/S	ΔE	L*	a*	b*
1.	Eri x Eri pure silk fabric	7.201	--	35.16	18.99	-1.90
2.	Eri x NCC union fabric	2.920	19.08	46.65	12.21	11.74

ΔE : Colour difference = $\Delta a^2+\Delta l^2+\Delta b^2$ L : Lightness or darkness a : Redness/greenness b :Yellowness/ blueness

in weft way cloth count, warp way bending length and crease recovery angle among both the fabrics. Thus, cloth count and crease recovery angle of Eri x Eri silk fabric increased while cloth weight and thickness decreased (Rungsima Chollakup *et al.*, 2008).

The warp way (52.92 kgf) and weft way (46.90 kgf) tensile strength of Eri x Eri pure silk fabric was higher than the Eri x NCC fabric. However, the difference in the strength was non-significant (Table 2). Thus, there was not much variation in the tensile strength obtained by replacing Eri by NCC yarns in weft way.

The elongation (%) of the Eri x Eri silk fabric was higher tham the warp way (28.04%) and weft way (26.06%) than Eri x NCC fabric. However, in the weft way, elongation percentage of Eri x NCC fabric was much lower because of NCC yarns, usually less than silk yarns.

It was observed from Table 3 that, Eri x NCC fabric needs more number of cycles (490 cycles) to get abraded than Eri x Eri fabric (428 cycles) revealing that Eri x NCC union fabric can withstand more abrasion than Eri x Eri silk fabric.

The drape co-efficient (%) of Eri x CC fabrics (79.72) was more than Eri x Eri silk fabric (64.59) with equal number of nodes. This showed that, Eri x NCC union fabric was more stiff and thick than Eri x Eri silk fabric which was observed from Table 1.

It was found from Table 4 that, the colour strength value was more in Eri x Eri silk fabric (7.20) since it was lac dyed than Eri x NCC fabric. However, the colour difference value was found to be ΔE = 19.08. As per the L A B values, the colour of the pure Eri silk fabric was lighter, towards red and blue colour. While Eri x NCC was lighter in shade of red and yellow colour. Similar work related to the present topic was also done by Agarwal (1997); Gulrajani *et al.* (1993); Paul *et al.* (1996); Sudhakar and Ninge Gowda (2005) and Singh (2000).

Conclusion :

It if found from the findings that, the eco-friendly union fabric showed similar fabric properties of pure Eri silk fabric, and as cotton was used in weft it was more comfortable. Thus, it can be suggested that instead of producing pure silk fabric, NCC cotton can be used as weft to produce environmental friendly and comfortable union fabric, suitable for all seasons and occasions and can go as a environmental friendly designer's wear (Fig. 1) with less cost.

Fig. 1 : Lac dyed Eri X NCC eco-friendly union fabric

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