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Evaluation of mechanical properties of ERI and ERI union fabrics

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Abstract
A study was performed on the study on the physical properties of Eri union fabrics. Here, the Eri yarns of 2/60s was used as warp and cotton and polyester yarns of 2/40s used as weft to construct the Eri union fabrics using three different weaves namely plain, twill and satin. From the experimental results, it was seen that the strength of the Eri × Polyester plain, twill and satin weaves were better than the pure Eri × Eri fabrics of all the weaves. Although the other properties were also improved when compared with pure Eri × Eri fabrics.

Keywords: Union fabric, eri, cotton, polyester

1. Introduction
Eri silk which is known as poor man's silk is gaining popularity in the recent years. Considering its eco- friendly attributes, it is considered as "Textiles of next millennium". Indeed, eri silk has been known to the world and perhaps, much more to the people of the North-eastern region of India than others for many centuries. Many communities in Assam, especially the Bodos consider eri silk a part of their age-old culture and civilization. For years, eri silk has remained a locally available substitute for wool in North-East India for making winter clothing (Oommen, 2003).

Eri silk possess excellent thermal properties and offers tremendous blending possibilities with other natural silks, wool, cotton, jute and synthetic fibres. Blends of eri with bast fibres and polyester and also union fabrics with polyester and cotton open a new horizon for diversification of products other than wrappers and scarfs. The produced materials would be cheaper and an artisan can expect to gain and learn more for a subsistence living (Somashekar, 2003).

Besides blending, if eri is woven as a union fabric with other yarns, we can expect an attractive fabric with improved functional properties. A union fabric is a textile fabric, which is woven from different yarns in warp and weft. In this type of fabrics the properties of two different yarns are combined together to get a new fabric having the properties of both the yarns. Union fabric enables the weavers to combine two different sets of yarns so that good qualities are emphasized and poor qualities are minimized, thereby having the fabrics with better functional properties. Union fabrics are manufactured with high quality raw materials and skilled professional to enhance the quality of the products.

Materials and Methods
The union fabric used in this experiment is made from Eri with cotton and Eri with polyester. Eri silk yarn was used as warp and cotton and polyester yarns were used as weft to construct the eri union fabrics using three different weaves namely plain, twill and satin. The Eri yarn was of 2/60s count and cotton and polyester yarns were of 2/40s count. Fabrics of pure Eri x Eri in plain, twill and satin weave were also constructed for comparison. The important mechanical properties like fabric count, fabric weight, fabric thickness, fabric stiffness, crease recovery etc. of the plain, twill and satin weave fabrics were tested. The union fabrics were tested for mechanical properties as per the standard methods (Table 1).

Table 1. Instruments used for determining the properties of Eri union fabrics.

Properties	Instrument	Standard methods
Fabric count (Numerical expression)	Pick glass	BS method 2862:1957
Fabric weight (g/sq.mt)	Electronic weighing balance	-
Fabric thickness (mm)	Heal's thickness gauge	BS method 2544:1968
Fabric stiffness (cm)	Shirley's stiffness tester	BS method 3356-1961
Crease recovery(degree)	Shirley's crease tester	IS method 4681-1986

Table 2: Constructional details of Eri union fabrics: Constructional details of Eri union fabrics are given in

Fabrics	Weave types	Direction	Yarn	Yarn type	Yarn count	Reed count
Eri/Eri (EEP)	Plain	Warp	Eri	2 ply	2/60s	60s
		Weft	Eri	2ply	2/60s	
Eri/Cotton (ECP)	Plain	Warp	Eri	2ply	2/60s	60s
		Weft	Cotton	2ply	2/40s	
Eri/Polyester(EPP)	Plain	Warp	Eri	2 ply	2/60s	60s
		Weft	Polyester	2 ply	2/40s	
Eri/Eri (EET)	Twill	Warp	Eri	2/ply	2/60s	60s
		Weft	Eri	2/ply	2/60s	
Eri/Cotton (ECT)	Twill	Warp	Eri	2/ply	2/60s	60s
		Weft	Cotton	2/ply	2/40s	
Eri/Polyester (EPT)	Twill	Warp	Eri	2/ply	2/60s	60s
		Weft	Polyester	2/ply	2/40s	
Eri/Eri (EES)	Satin	Warp	Eri	2/ply	2/60s	60s
		Weft	Eri	2/ply	2/60s	
Eri/Cotton (ECS)	Satin	Warp	Eri	2/ply	2/60s	60s
		Weft	Cotton	2/ply	2/40s	
Eri/Polyester (EPS)	Satin	Warp	Eri	2/ply	2/60s	60s
		Weft	Polyester	2/ply	2/40s	

Findings and discussion

Mechanical properties of union fabrics

Fabric count (Numerical expression)

Table 3 shows the fabric count of pure Eri x Eri and its union fabrics of plain, twill and satin weaves respectively. It was revealed from the table that warp count of all the samples of pure Eri x Eri and union fabrics of Eri x Cotton and Eri x Polyester plain, and satin weaves did not vary much though variation was seen in case of twill weave fabrics. This may be because Eri yarn of same yarn count was used in the warp direction of all the samples. However, it was highest (50) for Eri x polyester plain and lowest for Eri x Eri twill (40).

On the other hand, the weft count of all the samples varied. The weft count of Eri x Polyester plain weave union fabric showed highest count (51) compared to pure Eri x Eri and Eri x Cotton plain weave union fabrics. This may be due to the smoothness and yarn count of the polyester yarn. Among all the weaves, the highest weft count (96) was found in Eri x Polyester satin and lowest (39) in pure Eri x Eri plain weave fabrics. This may be because of compactness of weave and the yarn count.

Table 3: Fabric count of three different weaves

Weave type	Fabrics	Direction	
		Warp	Weft
Plain	EEP	48	39
	ECP	49	50
	EPP	50	51
Twill	EET	40	60
	ECT	46	76
	EPT	44	89
Satin	EES	41	75
	ECS	43	78
	EPS	44	96

Table 4: Fabric weight and thickness of three different weaves

Weave type	Fabrics	Total weight (g/sq.mt)	Fabric thickness(mm)
Plain	EEP	148.75	0.41
	ECP	145.56	0.52
	EPP	139.49	0.45
Twill	EET	201.32	0.53
	ECT	191.75	0.45
	EPT	186.25	0.34
Satin	EES	195.18	0.52
	ECS	182.54	0.47
	EPS	170.00	0.38

The fabric weight per square meter of all test fabrics were presented in the Table 4. It was observed from the table that the fabric weight of pure Eri x Eri twill weave was highest (201.32 g/sq.mt) compared to other weaves of pure Eri x Eri, may be due to types of weave employed and the type of yarn. On the other hand among the union fabrics Eri x Cotton twill weave showed highest weight (191.75gm/sq.m) and Eri x Polyester plain weave had the lowest (139.49g/sq.m).It may be because of Eri being spun yarn was characterized by short filaments which are joined end to end, thus giving uneven distribution of slubs throughout the yarn length with 2 ply yarn structure and cotton is also a staple fiber with coarser yarn structure and less yarn count.

Fabric thickness (mm)

Table 4.also reflects about the thickness of the constructed fabrics. It was observed from the table that fabric thickness of Eri x Cotton plain weave fabric was found highest (0.52mm) compared to Eri x Polyester (0.45mm) and pure Eri x Eri (0.41 mm) plain weave fabrics. On the other hand, pure Eri x Eri twill weave fabric and pure Eri x Eri satin weave fabrics showed highest thickness of 0.53 mm and 0.52 mm respectively compared to other union fabric of

twill and satin weave. This may be it attributed to coarser yarn count and irregular yarn surface of the said fabrics. Least thickness of 0.34 was found in Eri x Polyester twill weave fabric.

Fabric stiffness (cm)

The stiffness of union fabrics and pure Eri x Eri fabrics were examined and presented in the Table 5.The result illustrated that among all the test samples highest bending path was shown by Eri x Cotton satin fabric in both warp (3.20 cm) and weft (3.28 cm) direction, which may be due to yarn type, compactness of weave, greater cloth weight and thickness. On the other hand, least bending length was exhibited by Eri x Polyester plain weave union fabric in both warp (1.70cm) and weft (1.55 cm) direction, may be due to least weight of polyester yarn.

Table 5. Fabric stiffness and crease recovery of three different weaves

Weave type	Fabrics	Bending length (cm)		Crease recovery (Degree)	
		Warp	Weft	Warp	Weft
Plain	EEP	2.38	2.60	82.25	87.00
	ECP	2.63	2.85	93.25	102.50
	EPP	1.70	1.55	94.25	121.00
Twill	EET	3.13	3.20	106.00	99.75
	ECT	2.73	3.13	112.25	114.75
	EPT	2.70	2.80	126.75	122.00
Satin	EES	2.70	2.78	89.75	94.25
	ECS	3.20	3.28	110.75	123.25
	EPS	2.60	2.78	127.75	125.25

Crease recovery angle (degree) of fabric

The crease recovery angle of all the fabrics were also depicted in Table 5. It was seen that in the warp direction Eri x Polyester satin weave showed maximum crease recovery of 127.5 degrees followed by Eri x Polyester twill weave with 126.75 degress. This may be attributed to the high resiliency of polyester fiber and the type of weave. The lowest crease recovery of 82.25 degrees was shown by pure Eri x Eri plain weave fabric. Similarly, in the weft direction, the highest crease recovery of 125 degree was depicted by Eri x Cotton satin (123.25 degree) and Eri x Polyester twill (122 degree) and the lowest of (87.00 degree) was shown by pure Eri x Eri plain weave fabric.

Conclusion

From this study, it is observed that in Eri×Cotton and Eri×Polyester union fabrics the properties like fabric weight, fabric thickness, fabric stiffness, etc. are decreased with increasing crease recovery. Hence it is concluded that Eri× Cotton and Eri×Polyester union fabrics are more crease resistant, durable, lighter in weight and have increased drapability. Besides this, fabrics have unique appearance, and provide extra lustre. Eri union fabrics are best suited for making diversified products such as dress, waist coat, tie, cushion cover stole, etc. and also best suited for making baby blankets and jackets for winter seasons. Therefore, development of union fabrics will create a variety in fabric types and cater to the present fashion world.

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