

RESEARCH ARTICLE

Study on Eri Union Fabric for Various End-Uses

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Abstract

The Eri union fabrics were constructed to study the properties of fabric. To construct Eri union fabric, the Eri yarn was used as warp with acrylic and viscose rayon yarn as weft. In the study, the fabrics were prepared with three different basic weave (plain, twill and satin weave). Those woven fabrics were tested for physical, mechanical and functional properties and analyzed statistically. Further, data were evaluated to find out the influence of mechanical properties on functional properties. Moreover, based on the weave, fabric texture, handle and the combinations, the diverse products were prepared from the woven fabric and preference was taken from the respondents.

Keywords: Eri union fabric, acrylic, viscose rayon yarn, functional properties, diverse products.

Introduction

In recent years, the fabrics of different blends and union fabrics available in the market for various end uses. The raw material—the yarn of different types are used for producing different varieties of fabrics to meet the fashion. Raw materials used for fabric construction are cotton, silk, wool, jute, synthetic etc. (Azad and Jafrin, 2009). Union fabric is made by using different yarn in warp and weft direction. Union fabric is durable, crease resistant, absorbent, lustrous and resiliency etc. Various kinds of union fabrics can be produced by combination of cotton, rayon, ramie, polyester, acrylic etc. with silk to reduce the cost of the silk fabric as well as the weight of the fabric (Nayak *et al.*, 2009).

Silk is often referred to as 'The Queen of textile'. It is the strongest natural fibre. China is the first country to discover the silk fabric during 2600 BC. For many years, China alone used to produce silk fibre and was producing this fine fabric as the demand developed the secret was stolen out of China and eventually a large silk industry developed in Europe, Spain, Italy, France, India, Syria etc. India is the only country, which produces all the four major types of silk, which are of a great commercial importance. The four major types of silk are viz., Mulberry, Tasar, Muga and Eri. Apart from mulberry silk, the other silk i.e. Muga, Tasar and Eri silk are generally termed as non-mulberry and make one of the finest facts of India's rich culture. Eri silk and other wild silk are gaining popularity in recent days as the fibre contributes to the socio-economic upliftment of the rural population. Ericulture is mainly practiced in North Eastern regions of India. The states of Assam, Nagaland, Meghalaya and Manipur account nearly 98% of Eri or Endi silk produced in the country. It is also cultured in the states of Bihar, Orissa, West Bengal and Andhra Pradesh on a smaller scale (Itagi *et al.*, 2006).

From the literature, it has been found that till now not much work has been done on Eri union fabric in a systematic manner (Desai, 2008). Further, considering the different properties of Eri silk, viscose rayon and acrylic, an attempt is made in the present study to interweave Eri silk with viscose rayon and acrylic and determine its properties so that every consumer can enjoy the unique richness of Eri silk with excellent softness and lustre of viscose rayon and wrinkle resistance with light weight of acrylic (Patali *et al.*, 2001; Arora and Sharma, 2010). The Eri union fabric obtained will offer flexibility in choosing varieties of Eri fabric with cost-effective yet attractive fabric. Therefore, the combination of the viscose and acrylic with Eri silk will reduce the cost of Eri fabric as well as weight to the fabric. The combination will improve the wash and wear, warmth, elasticity and anti-crease properties of the Eri fabric. Moreover, the products diversification of Eri silk has also been taken up by the central silk board of India and industry like Fabric Plus Pvt. Ltd. Hence, the present work has been undertaken to with the following objectives:

1. To construct Eri/viscose rayon and Eri/acrylic union fabric by using different weave.
2. To study the physical properties of woven fabric.
3. To develop value-added diversified products.
4. To take preference of the end products.

Table 1. Physical properties of yarns.

Physical properties	Types of yarn		
	Eri silk	Acrylic	Viscose rayon
Yarn count (Ne)	2/60s	2/40s	2/40s
Average twist (TPI)	11	14	6
Average tenacity (g/den)	2	3	2.5
Elongation (%)	20	31	22

Table 2. Constructional details of Eri/viscose rayon and Eri/acrylic union fabrics.

Union fabric	Weave type	Yarn	Yarn type	Twist direction	Yarn count	Direction
Eri/Eri (EEP)	Plain	Eri	2 ply	S twist	2/60s	Warp
		Eri				Weft
Eri/viscose Rayon (ERP)	Plain	Eri	2 ply	S twist	2/60s	Warp
		Viscose rayon			2/40s	Weft
Eri/acrylic (EAP)	Plain	Eri	2 ply	S twist	2/60s	Warp
		Acrylic			2/40s	Weft
Eri/Eri (EET)	Twill	Eri	2 ply	S twist	2/60s	Warp
		Eri				Weft
Eri /viscose rayon (ERT)	Twill	Eri	2 ply	S twist	2/60s	Warp
		Viscose rayon			2/40s	Weft
Eri /acrylic (EAT)	Twill	Eri	2 ply	S twist	2/60s	Warp
		Acrylic			2/40s	Weft
Eri/Eri (EES)	Satin	Eri	2 ply	S twist	2/60s	Warp
		Eri				Weft
Eri/viscose rayon(ERS)	Satin	Eri	2 ply	S twist	2/60s	Warp
		Viscose rayon			2/40s	Weft
Eri/acrylic (EAS)	Satin	Eri	2 ply	S twist	2/60s	Warp
		Acrylic			2/40s	Weft

Table 3. Instruments used for determining the properties of Eri union fabrics.

Properties	Instrument	Standard methods
Fabric count	Pick glass	BS method 2862:1957
Thickness (mm)	Heal's thickness gauge	BS method 2544:1968
Fabric tensile strength (kgf)	Instron tensile tester	ASTM method 12676-1989
Fabric abrasion	Martindale abrasion tester	IS method 12673-1989
Stiffness	Shirley's stiffness tester	BS method 3356-1961
Crease recovery	Shirley's crease tester	IS method 4681-1986
Drapability	Drape meter	-

Materials and methods

Eri silk yarn: Milled spun Eri silk yarn of 2/60s was collected and a grey viscose rayon and acrylic yarn of 2/40s was collected from Gar-Ali market, Jorhat, Assam, in the form of hanks. The Eri union fabric was woven in Fabric Plus Pvt. Ltd. Guwahati with three basic weave. The physical properties of the yarns are given in Table 1.

Constructional details of Eri union fabrics: Constructional details of Eri silk, viscose rayon and acrylic union fabric are given in Table 2. The union fabric was constructed using basic weave i.e. plain weave, twill weave and satin weave. The warp yarns are Eri silk (2/60s) and the weft yarns are viscose rayon and acrylic (2/40s) of 2 ply respectively.

Physical testing of union fabrics: In the present study, the union fabrics were tested for important mechanical properties viz., yarn count, fabric count, fabric thickness and fabric stiffness and functional properties of fabric tensile strength, fabric crease recovery, fabric abrasion and pilling. The union fabrics were tested for mechanical and functional properties as per the standard methods (Table 3).

Preparation of value added diversified products: Value added diversified products were designed and constructed by following the drafting methods. Moreover, in this study different garments and products were prepared based on fabric structure and yarn combination and subjective evaluation were done on the basis of respondent's opinion.

Results and discussion

Assessment of mechanical properties of union fabrics: It might be inferred that in case of all the weaves the sample Eri/viscose rayon showed maximum numbers of threads in both warp and weft direction (Table 4). Therefore, it may be concluded that the Eri/viscose rayon fabric are finer than the other fabrics and this may be due to different construction process of fabric, yarn content and yarn structure. The thread count in warp direction was almost same due to the fact that similar warp threads were used for weaving of all the samples. In general, it is observed that the Eri/Eri sample of all the three weaves have a higher thickness compared to other fabrics (Table 5). This may be because of spun yarn structure of Eri.

Table 4. Fabric count in three different weaves.

Weave type	Fabrics	Direction	
		Warp	Weft
Plain	EEP	48	31
	EAP	49	39
	EVRP	50	42
Twill	EET	40	60
	EAT	41	68
	EVRT	42	70
Satin	EES	41	75
	EAS	42	78
	EVRS	43	80

Table 5. Fabric thickness in three different weaves.

Weave type	Fabrics	Cloth thickness (mm)
Plain	EEP	0.41
	EAP	0.41
	EVRP	0.35
Twill	EET	0.53
	EAT	0.42
	EVRT	0.40
Satin	EES	0.52
	EAS	0.40
	EVRS	0.38

Table 6. Fabric stiffness in three different weaves.

Weave type	Fabrics	Bending length (cm)	
		Warp	Weft
Plain	EEP	1.44	2.85
	EAP	1.38	2.61
	EVRP	1.30	1.55
Twill	EET	3.13	3.60
	EAT	2.80	2.83
	EVRT	2.70	2.70
Satin	EES	3.20	3.33
	EAS	2.73	2.79
	EVRS	2.60	2.69

Table 7. Fabric stiffness in three different weaves.

Weave type	Fabrics	Recovery (°)	
		Warp way	Weft way
Plain	EEP	97.33	87.00
	EAP	99.67	121.00
	EVRP	98.67	102.50
Twill	EET	106.75	99.75
	EAT	125.00	122.00
	EVRT	112.25	114.75
Satin	EES	89.00	94.25
	EAS	127.25	112.75
	EVRS	110.75	105.25

The union fabric of Eri/acrylic sample registered higher thickness than Eri/viscose rayon in all three weaves which may be due to higher twist per inch present in acrylic yarn compared to viscose rayon filament. Eri/viscose rayon fabric was the lowest thickness found in three woven fabric. It may be because of filamentous nature of viscose rayon yarn. In case of overall comparison, the twill weave fabrics have the highest thickness which may be due to weave structure.

Table 6 indicates the fabric bending length of plain weave, twill weave and satin weave samples. The values of warp way are lower than the weft way in all samples of three weave. The Eri/Eri sample has a greater value than other fabric may be due to its yarn structure, cloth thickness and fabric weight which indicates that the Eri/Eri sample fabric is rougher compared to other fabrics. In all sample, EVRP, EVRT and EVRS showed lowest value may be because of least weight and thickness. The crease recovery of the three weaves had different recovery degree in warp and weft way (Table 7). This difference may be due to the different weave structure used for producing union fabrics. It is interesting to note that there is an increasing crease recovery in all tested samples of Eri/acrylic and has maximum crease recovery which indicates good resistance to crease form and this may be due yarn properties or may be due to operational weave process.

Functional properties of union fabrics: Eri/acrylic sample exhibited highest tensile strength in all the three weaves followed by Eri/viscose rayon and the lowest tensile strength was found in Eri/Eri sample in all weaves (Table 8). This may be due to different weave construction used for fabric production or may be due to yarn combination and coarsens of yarn. Moreover, among three weaves, the twill weave has the highest tensile strength in weft way and this may be due weave construction method. In general, in all the samples, the Eri/acrylic combination had highest number of cycles. It may be due to the tensile strength of the Eri/acrylic yarn combination. Lowest abrasion resistance was found in Eri/Eri samples in all the three weaves (Table 9). Different loss of mass also found in the sample fabric and this may be due to the process of abrasion which revolves in multi-directional causing fibrous substance in the form of dust which raised from the fabric surface and gradually resulted into fuzz, nap and finally the yarn breaks and loss of thickness as well as loss of mass in fabrics. It can be concluded that Eri/Eri samples registered the maximum drape coefficient which depicts that the fabric is stiffer than the Eri/acrylic and Eri/viscose rayon combination (Table 10). This may be due to thread per inch or may be due to the yarn content and cloth weight. The lowest drape coefficient was found in Eri/viscose rayon indicating its flexibility and pliability.

Subjective evaluation of union fabrics: Majority of respondents stated good appearance for EEP and EES sample. While 2.5% stated poor appearance to EVRP union sample. Among union fabrics, EVRP and EVRS opined high lustre. Cent percent of respondents expressed that EEP, EET and EES was moderately lustred. Majority of respondents opined that sample EAS (82.5%) was soft to touch. Majority of respondents stated that sample EVRS (80%) has the finest texture among all the fabrics and EEP, EET and EES has cent percent medium texture.

Hundred percent respondents opined that all the products were suitable for prepared products excepts tie and baby frock prepared from EET and EAP fabric (Figs. 1a-h, Table 11).

Table 8. Fabric tensile strength in three different weaves.

Weave type	Fabrics	Tensile strength (kgf)	
		Warp way	Weft way
Plain	EEP	47.38	37.01
	EAP	54.99	42.31
	EVRP	52.26	37.10
Twill	EET	43.01	59.03
	EAT	51.47	82.24
	EVRT	45.06	82.34
Satin	EES	41.80	65.33
	EAS	44.80	77.12
	EVRS	44.32	70.82

Table 9. Fabric abrasion resistance in three different weaves.

Weave type	Fabrics	No. of cycles	Loss in mass (%)
Plain	EEP	713	3.37
	EAP	822	5.03
	EVRP	812	3.57
Twill	EET	700	3.04
	EAT	920	4.93
	EVRT	823	4.68
Satin	EES	745	4.28
	EAS	848	5.21
	EVRS	769	3.24

Table 10. Fabric drapability in three different weaves.

Weave type	Fabrics	Drape coefficient (%)
Plain	EEP	53.31
	EAP	47.11
	EVRP	46.30
Twill	EET	51.42
	EAT	49.23
	EVRT	41.23
Satin	EES	47.67
	EAS	45.03
	EVRS	43.09

Table.11. Respondent's opinion on general appearance and suitability of the fabrics.

Types of fabric	Products	Suitability (%)	Appearance (%)		Lustre (%)		Texture (%)		Handle (%)
			Good	Poor	High	Moderate	Fine	Medium	
EEP	Waist coat	100	100	-	-	100	-	100	100
EET	Tie	90	95	-	-	100	-	100	95
EES	Stole	100	100	-	-	100	-	100	100
EAP	Baby frock	87.5	40	-	20	80	50	50	65
EAT	Skirt	100	55	-	32.5	67.5	42.5	57.5	60
EAS	Embroider stole	100	72.5	-	45	55	32.5	67.5	82.5
EVRP	Cushion cover	100	60	2.5	40	60	22.5	77.5	32.5
EVRT	Waist coat	100	60	-	80	20	60	40	67.5
EVRS	Top	100	85	-	82.5	17.5	80	20	72.5

Fig. 1a-h. Diverse products prepared from Eri union fabrics.



Fig. 1a. Skirt made of Eri/acrylic twill weave; 1b-c. Made of Eri/Eri twill weave and satin weave (stole and baby waist coat). 1d. Top made out of Eri/viscose rayon satin weave union fabric. 1e-h. Cushion and embroider stole made of Eri/acrylic satin weave union fabric. 1f. Baby coat made of Eri/viscose rayon plain weave. 1g. Tie made of Eri/viscose rayon twill weave union fabric.

Conclusion

Experimental findings provide information of Eri union fabrics. Eri with acrylic and viscose rayon union fabrics was found to be better quality in respect of mechanical and functional properties than pure Eri/Eri fabric. Further, it also revealed that Eri/acrylic and Eri/viscose rayon was suitable for making different products as rated by the respondents. Thus, the fabric produced from Eri with acrylic and viscose rayon union fabric was unique with good appearance, lustre with low weight. It not only boosts the Ericulturist for good cocoon production but also provide a vast area for product diversification to meet the national as well as international demands. This finding may also be useful to industries like Fabric Plus Pvt. Ltd. and Vanya silk promotion cell of India because these industries also deals with value added products of natural fibre.

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