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Development of Eri union fabrics for diversified products

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Abstract

The union fabrics were made from eri with cotton and eri with polyester. The 2/60s eri silk yarn was used as warp and 2/40s cotton and polyester yarns were used as weft to construct the eri union fabrics using three different weaves namely plain, twill and satin. The prepared eri x cotton and eri x polyester union fabrics and also the pure eri x eri fabrics were tested for different physical properties. Properties of union fabric developed in a traditional handloom using 60s reed count. The quality parameters, viz., fabric tensile strength and elongation, crease recovery, drapability, thickness, abrasion, stiffness of the developed fabric, met essential apparel requirements. A comparative subjective evaluation of the fabric quality, viz., aesthetic appearance, luster, texture, was made with the help of a group of people from different age, educational and occupational background to examine the tactile properties as well as suitability of the fabric for the prepared products, all the respondents felt that eri x cotton twill, eri x polyester twill and eri x polyester satin were good in appearance. Texture and luster were found to be medium to high. About a very few respondents felt that fabrics were crispy.

Keywords: Union fabric, eri, cotton, polyester

Introduction

In recent years, the fabrics of different blends and union fabrics are available in the market for various end uses. The raw material - 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) ^[5]. Union fabric is made by using different yarn in warp and weft direction. Union fabric is durable, crease resistant, absorbent, lustrous and resilient. Various kinds of union fabrics can be produced by combination of silk with cotton, rayon, ramie, polyester, acrylic, etc. to reduce the cost of the silk fabric as well as the weight of the fabric (Nayak *et al.*, 2009) ^[13].

Eri silk ranks next to tassar silk in commercial importance. Eri is a multivoltine silk spun from open-ended cocoons. In the year 2012-2013, the total eri raw silk production in India was 3116 MT and the total useful silk waste available in the country was about 1.8 million kg, of which, one-third was consumed by spun silk waste (ESW) (Dutta *et al.* 2000) ^[12]. Silk waste in rural areas is spoiled, as its use is not known. If all the available silk waste is properly kept and utilized for the spinning of 100% spun yarns or used in making blended yarns with fibers such as polyester, a good amount of foreign exchange can be earned by exporting finished goods instead of exporting silk waste at low prices.

In the reported work, an attempt has been made to develop union fabric besides blending. If eri is woven as a union fabric with other yarns, we can expect an attractive fabric with improved functional properties. 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. The Eri union fabric obtained will offer flexibility in choosing varieties of Eri fabric which would be cost-effective yet attractive. 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 of two different yarns offer most valuable possibilities because the two components are very dissimilar. Union fabrics if woven with eri warp and cotton weft and eri warp and polyester weft will create a variegated effect and the fabrics are expected to open up a new horizon for diversification of products other than

wrappers and scarf. The produced materials would be cheaper and an artisan can expect to gain and learn more for a subsistence living.

Materials and methods

The union fabric used in this experiment was made from Eri with cotton and Eri with polyester. The eri yarn was collected from the Fabric plus, Silk industry Guwahati, Assam, India. The wooly white spun eri silk of 2/60s count was chosen for the study. Cotton and polyester yarns were selected 2/40s count and collected from local market Jorhat, Assam, India.

Fabric preparation

A plain, twill and satin weave fabrics were developed using a traditional handloom of 60s reed count. 2/60s yarn count were used for all the three (3) weaves i.e. plain, twill and satin weave. Eri silk yarn was used as warp in this study and eri, cotton and polyester yarns were used as weft to construct the eri union fabric.

Determination of fabric properties

Structural parameters of the fabric, such as fabric count (IS 1963-1969), thickness (IS-7702-1975), were measured by following standard methods. Cover factor was calculated separately for warp and weft using the expression recommended by Booth (1968) [1]. Bending length was measured by using a stiffness tester (Booth, 1968) [1] following BS 3356-1961. The test samples were tested for crease recovery as directed in the IS 4681:1968 method by using the Shirley's crease tester. Readings for both warp and weft were recorded separately.

The tensile strength and elongation was measured using Instron tensile tester following the ASTM test method: 22561, 1968. Drapability of a fabric with a circular specimen was directed by using a drape meter following the method recommended by Booth (1969). The abrasion resistance of a fabric consists of friction between the cloth and some other material was analyzed using 'Martindale Abrasion Resistance Tester'. The specimens were abraded as directed in IS test method: 12673-1989. Pilling property of a fabrics were rated

by as directed by Booth (1968) [1] ASTM D4970/D4970M box was rotated at 60 revaluation/min for 5 hr.

Subjective evaluation of union fabrics

For visual assessment of union fabrics and also the prepared products, a panel of 40 respondents of different age, education and occupational groups. Some important tactile properties, such as general appearance, texture, luster, handle and suitability of a fabric for making diversified products were assessed by the respondents with the help of a questionnaire.

Results and discussion

Mechanical properties of eri and union fabrics

The mechanical properties of pure eri and union fabrics were evaluated and presented in Table 1. Fabric count in woven textile material is the number of warp yarn (ends) and weft yarns (picks) per inch of a fabric. Determination of count was done with the help of a pick glass as directed by Booth (1969). It is revealed from the table that the slight variation was seen in the weft direction of fabric count sample. This may be due to the cotton and polyester yarn of 2/40s count was used as weft for all sets of weaves, or may be because of yarn type and compactness of weave. The cover factor results shows that the warp cover factor of all the test samples of three different weaves were slightly higher side, may be due to the coarser yarn count of eri and also the 2 ply yarn structure which was used as warp for all the sets of fabrics. Thickness (mm) is the distance between the upper and lower surface of the material measured under a specific pressure using "Shirley's thickness" tester as directed by Booth (1969). The eri x polyester satin weave union fabric was found to be thinner followed by eri x polyester twill union fabric. A marginal difference in the fabric stiffness was observed in both the warp and weft direction of eri x polyester satin weave union fabric, compared with other pure eri fabric may be due to the due to yarn type, compactness of weave, lowest thickness. The crease recovery of eri x polyester satin weave fabric resulted in better recovery followed by eri x polyester twill weave fabric, than the pure eri x eri fabrics. This may be attributed to the high resiliency of polyester fiber and the type of weave.

Table 1: Mechanical properties of fabrics

Weave type	Fabrics	Fabric count (thread/inch)		cover factor (Ne)		Fabric thickness (mm)	Fabric stiffness (cm)		Crease recovery (degree)	
		Warp	Weft	Warp	Weft		Warp	Weft	Warp	Weft
Plain	ECP	45	46	10.79	9.48	0.52	3.28	2.60	82.25	87.00
	ECP	44	45	9.44	7.87	0.41	2.63	2.85	93.25	102.50
	EPP	47	51	8.92	6.54	0.45	2.70	2.80	94.25	121.00
Twill	EET	42	44	11.26	10.54	0.53	3.20	3.20	106.00	99.75
	ECT	46	52	11.7	9.26	0.45	2.73	3.13	112.25	114.75
	EPT	44	57	11.3	9.12	0.38	2.60	2.78	126.75	122.00
	EES	46	45	10.58	9.86	0.52	3.13	2.78	89.75	94.25
Satin	ECS	43	52	10.34	9.19	0.47	2.70	2.38	110.75	123.25
	EPS	44	58	10.18	9.3	0.34	1.70	1.55	127.75	125.25

Functional properties of Eri and union fabrics

Table 2. Shows that the tensile strength of eri x polyester union fabrics resulted in better tensile strength in both warp and weft direction of all three weaves. The tensile strength in the weft direction was much more than in the warp direction this may be attributed to the polyester yarn which is stronger compared to eri and cotton yarns. A marginal increase was observed in the elongation (%) of warp direction of all the weaves compared with weft. This might be due to eri silk yarn which is used in warp direction of all the weaves, or may be

due to the inherent higher elongation properties of eri silk yarn as described by Hazarika et al.2017. The abrasion resistance of eri union fabrics were exhibited better resistance to abrasion than in pure eri fabric. It may be because of polyester yarn which was finer in structure and have less thickness, resulting into better abrasion resistance.

Drape is the ability of a fabric to hang in a graceful fold. Fabric drape is the extent to which a fabric will deform when it is allowed to hang under its own weight (Shinkle 1940) [11]. Drapability of a fabric is a combined effect of several factors

such as shear rigidity, weight, thickness and some other parameters. The eri union fabrics show a balanced drapability than the pure eri fabrics may be due to stiffness of eri yarn. Since drape coefficient of eri union fabrics of all the three weaves was higher than pure eri fabrics of three respective

weaves, this union fabrics can be effectively used for various garment styles with graceful folds. The pilling ratings of all union fabrics of three weaves shows better ratings than the pure eri fabric.

Table 2: Functional properties of fabrics

Weave type	Fabrics	Fabric Tensile strength (kg)		Fabric elongation (%)		Abrasion resistance		Drape coefficient (%)	Pilling (rating)
		Warp	Weft	Warp	Weft	No. of cycles	Loss of mass (%)		
Plain	EEP	41.01	42.31	20.01	19.13	700	4.91	43.92	3(hairy& severe pilling)
	ECP	42.57	41.60	25.09	21.44	715	3.57	46.30	2(hairy)
	EPP	49.10	65.19	28.67	26.09	920	3.37	58.04	1(hairy &slight pilling)
Twill	EET	42.85	55.22	19.72	16.82	825	4.21	44.70	3(hairy& severe pilling)
	ECT	42.36	77.12	18.85	13.18	710	4.68	57.04	2(hairy)
	EPT	52.26	59.03	21.57	18.11	942	3.04	58.29	1(hairy &slight pilling)
Satin	EES	44.32	65.33	18.95	17.21	745	3.89	41.62	3(hairy& severe pilling)
	ECS	41.80	34.22	26.62	16.75	730	5.16	45.07	2(hairy)
	EPS	44.80	70.82	26.95	18.31	827	3.24	47.67	1(hairy &slight pilling)

Subjective evaluation of eri union fabric

In general, the respondents opined that the union fabrics of cotton & polyester combinations were having a better aesthetic appearance than the other fabrics of three different weaves. It may be attributed to the cotton & polyester yarn or different weave type. All the respondents felt that eri with

cotton and eri with polyester was good in appearance in respect of pure eri fabrics of all three weaves. It was revealed from the table 3 that the tactile properties of all union fabrics were improved, it may be cause of two different yarns are combine together by having the qualities of both the yarn. This is apparent in Figure 1.

Table 3: Respondents opinion on the visual appearance of fabrics (%)

Parameter	Grade	EEP	ECP	EET	ECT	EPT	EES	ECS	EPS
General appearance	Good	87.5	90	92.5	100	100	95	95	100
	Fair	12.5	10	7.5	0	0	5	5	0
	Poor	0	0	0	0	0	0	0	0
Texture	Fine	0	0	0	7.5	0	0	12.5	0
	Medium	100	100	100	92.5	100	100	87.5	100
	Rough	0	0	0	0	0	0	0	0
Luster	High	0	0	0	50	100	0	50	100
	Moderate	100	100	100	50	0	100	50	0
	Low	0	0	0	0	0	0	0	0
Handle (feel)	Soft	92.5	92.5	95	100	100	97.5	95	100
	Crispiness	7.5	7.5	5	0	0	2.5	5	0
	Stiffness	0	0	0	0	0	0	0	0

The respondent opinion on suitable end uses of developed fabric is shown in Table 4. As per respondents' feedback, the developed fabric may be used for some selective products,

Waist coat, Tie, jackets, stole and some other furnishing items.

Table 4: Respondent's opinion on aesthetic and handle properties of prepared products (%)

Fabric	Suitability %		
	Products	Yes	No
EEP	Waist coat	100	0
EET	Tie	95	5
EES	Stole	100	0
ECP	Cushion cover	100	0
ECT	Top	97.5	2.5
ECS	Jacket	95.0	5
EPP	Cushion cover	100	0



Fig 1: Diversified products of Eri and its union fabrics

Conclusion

Union fabric is a textile fabric which is used to weave in two different yarns in warp and weft. The main motive of this study was to combine two different yarns with eri so as emphasized good qualities and minimized poor qualities of a fabrics. The qualities of a fabric for making diversified products were analyzed. The fabrics were made on a conventional handloom and the suitability of a fabric for making different products was assessed by respondents from different age, educational, and occupational groups. From the investigation, it was observed that eri x cotton and eri x polyester union fabrics had better functional properties with increasing tensile strength, abrasion resistance and drapability of fabric keeping at par eri x eri fabrics. Hence it is concluded that after making eri x cotton and eri x polyester union fabric, the fabric become more strength, durable, lighter in weight and have increased drapability. Besides this, fabrics have

unique appearance, and provide extra luster. 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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