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Effect of structural design on the comfort properties of eri union fabrics

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ABSTRACT

For the purpose of the study eri yarn was used as warp and red eri, cotton, polyester, acrylic and rayon yarns were used as weft. Five plain weave eri union fabric samples were woven on the fly shuttle handloom and another five patterned eri union fabric samples were woven on the fly shuttle handloom using jacquard attachment with jacquard accessories. The constructed eri union fabrics were tested with standard test methods for certain comfort properties like moisture absorption, wicking, air permeability and thermal conductivity. Findings revealed that eri union fabrics were highly suitable for garments. Structurally designed eri union fabrics were more suitable for winter wear.

Key Words : Union fabric, Eri, Red eri, Cotton, Polyester, Acrylic, Jacquard, Structurally designed, Patterned

INTRODUCTION

Eri is a silk predominately found in Assam and comes from the silk worm *Samia ricini*. Eri silk is often referred to as Ahimsa silk or the fabric of peace, as the process does not involve the killing of silkworm moths which leave the cocoon as soon as it is ready to be spun.

Eri silk fabrics possess excellent thermal property and are used for making shawls, stoles and jackets mainly for the domestic market. Gogoi and Kalita (2009) opined that eri silk offer tremendous blending possibilities with other fibres like wool, cotton and polyester, and can also be interwoven with manmade fibres such as rayon, acrylic, polyester, etc. to produce union fabrics.

Union fabrics are made by using two different sets of yarns of different fibres for the warp and weft directions so that good qualities are emphasized and poor qualities are minimized, there by resulting in fabric having the properties of both the yarns.

If eri is woven as union fabric with other fibre yarns, we can expect attractive fabrics with improved functional properties. Making the fabrics with a pattern which is structurally designed will further enhance the appearance and aesthetic appeal of the fabrics thus making them suitable for the fashion industry at the national and international level. Keeping this mind a study was under taken with the following objective.

Objective:

To study the effect of structural design on the comfort properties of eri union fabrics.

METHODOLOGY

Selection of yarns:

Yarns collected were-

- For warp, eri silk yarn of 2/140 NM count was selected.
- For weft, five different types of yarns were selected to match with the selected eri warp as mentioned below:
  - Red eri yarn of 2/140 NM count

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Table 1 : Nomenclature of the fabric samples

Sr. No.	Union yarn	Woven fabrics	Nomenclature
1.	Eri x Red Eri	Plain	EEp
2.	Eri x Cotton	Plain	ECp
3.	Eri x Polyester	Plain	EPp
4.	Eri x Acrylic	Plain	EAp
5.	Eri x Rayon	Plain	ERp
6.	Eri x Red Eri	Patterned	EEd
7.	Eri x Cotton	Patterned	ECd
8.	Eri x Polyester	Patterned	EPd
9.	Eri x Acrylic	Patterned	EAd
10.	Eri x Rayon	Patterned	ERd

Table 2 : List of tests conducted

Sr. No.	Comfort properties	Test method	Apparatus used
1.	Absorption (Absorbency)	Drop test, (AATCC/ ASTM test method TS-018, procedure for absorbency) method	-
2.	Wicking	Capillary action method (Booth, 1968)	-
3.	Air permeability	I.S method: 11056	Shirley's Air permeability apparatus
4.	Thermal insulation	Disc method	Lees disc apparatus.

- Cotton yarn of 2/80NM count
- Polyester yarn of 50 Denier
- Rayon yarn of 50 Denier
- Acrylic of 2/36 NM count were selected to match with the selected eri yarn to be used for warp.

Selection of loom:

– Fly shuttle frame loom,
– Jacquard attachment and accessories-
a. Griff, b. Hook, c. Knife, d. Needle, e. Four sided cylinder, f. Needle board, g. Spring box, h. Grate, i. Neck chord, j. Harness, k. Comber board, l. Mail eye, m. Lingoes, n. Perforated cards.

Nomenclature:

Nomenclature of the samples was done according to the yarns (warp and weft) and pattern used for weaving the fabric samples and is shown below in Table 1.

Tests and methods used:

To test the comfort properties of the woven eri union fabrics, following tests were carried out as shown in Table 2.

RESULTS AND DISCUSSION

Constructional details of plain and patterned union fabrics are as follows :

Table 3 : Constructional details of eri union fabrics- plain and patterned

Sr. No.	Yarn used/ union	Weave	Warp	Weft	Nomenclature	Yarn type	Reed counts	No. of Cards
1.	Eri x Red Eri	Plain	Eri	Red Eri	EEp	2 ply	72	-
		Patterned			EEd			41
2.	Eri x Cotton	Plain	Eri	Cotton	ECp	2 ply	72	-
		Patterned			ECd			41
3.	Eri x Polyester	Plain	Eri	Polyester	EPp	2 ply	72	-
		Patterned			EPd			41
4.	Eri x Acrylic	Plain	Eri	Acrylic	EAp	2 ply	72	-
		Patterned			EAd			41
5.	Eri x Rayon	Plain	Eri	Rayon	ERp	2 ply	72	-
		Patterned			ERd			41

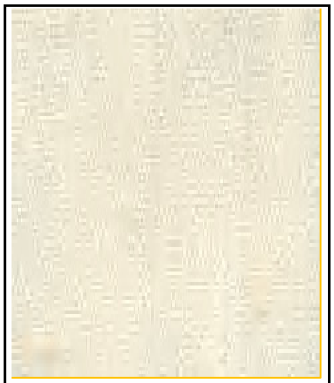

Fig. 1a : Plain eri union fabric Eri x Red eri plain (EEp)

Fig. 1b : Patterned eri union fabric Eri x Red eri Design, (EEd)

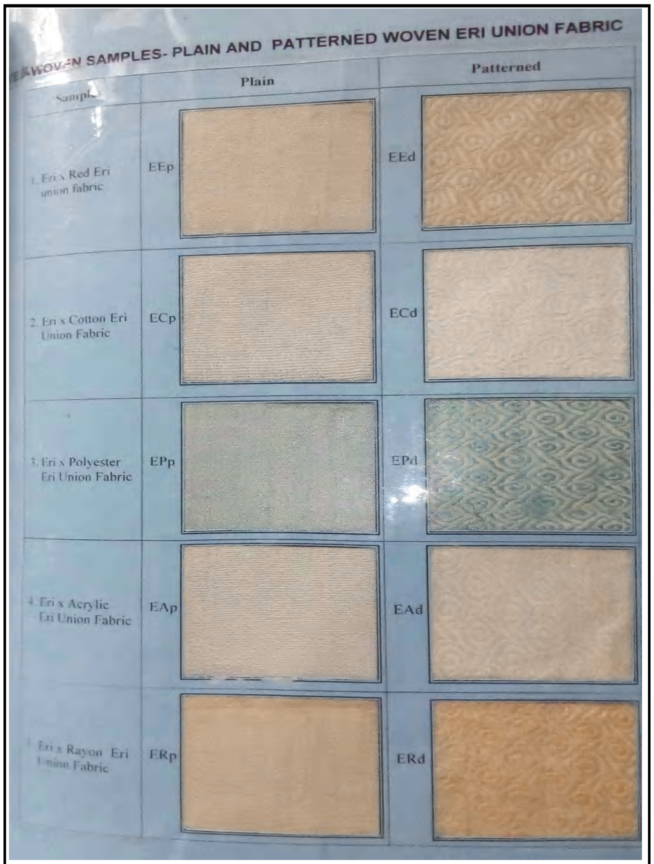

Fig. 1 c: Woven eri union fabric samples -plain and patterned

Comfort properties of Eri union fabrics:

Comfort is a quality parameter that has been found to be very important. Clothing comfort is an extremely complex phenomenon resulting from the interaction of various physical and non physical stimuli.

Fabric comfort is a feeling which may be physical or psychological in nature and its importance will vary according to the end use of the product and personal preference of the consumers. However, certain important factors that will influence physical comfort to a great extent are moisture absorption, wicking, air permeability and thermal conductivity. These properties were assessed using standard methods.

Absorbency (Absorption):

Moisture absorbency of fabric mainly depends on the fabric structure, type of yarn structure and surface tension of fabric (Vatsala, 2002).

Drop test method (AATCC/ASTM Test Method TS-018, procedure for absorbency) was used. Absorbency measures the time it takes a drop of water placed on the fabric surface to be completely absorbed into the fabric.

From Table 4, it is seen that among the plain eri union fabric samples, EEp took maximum absorbency time of 6.45 seconds while the absorption time for the other samples was much lower. On the other hand, in case of patterned eri union fabric samples, EEd took the highest time of 4.20 seconds which was lower than the time taken by its plain counterpart. The other combinations took much less time as seen in the table. This indicates that all the selected combinations of eri union fabrics have good absorbency.

Fabric wicking:

Wicking is an important phenomenon that contributes to thermal comfort properties of fabric. The absorption of metabolic sweat and its dispersion across the fabric surface is determined by fabric wicking rate. Miller and Tyomkin (1984) pointed out that spontaneous uptake of liquid in a fabric has always been called wicking that also stated that when a porous material such as fabric is placed in contact with a liquid, spontaneous uptake of liquid may occur.

From Fig. 2, it is revealed that the wicking height of plain eri union fabrics was found to be highest in sample EAp, 4.2 cm in warp and 3.8 cm in weft direction. The lowest was found in sample ECp, 2.9 cm in warp direction and 3.0 cm in weft direction. It is seen that wickability was more in warp direction as compared to the weft direction in all combinations of plain eri union fabrics. On the other hand, for patterned woven fabric sample- highest wicking height was found sample EEd, 4.8 cm in warp and 4.6 cm in weft direction and lowest was seen in

Table 4 : Drop Absorbency of eri union fabrics – plain and patterned

Sr. No.	Plain		Patterned	
	Sample	Water Absorbency (Time in seconds)	Sample	Water Absorbency (Time in seconds)
1.	EEp	6.45	EEd	4.20
2.	ECp	2.50	ECd	2.10
3.	EPp	1.33	EPd	1.40
4.	EAp	1.13	EAd	1.37
5.	ERp	1.14	ERd	1.45
	S.Ed	0.534	S.Ed	0.362
	CD	1.106	CD	0.891
	CV(%)	1.137	CV (%)	2.012

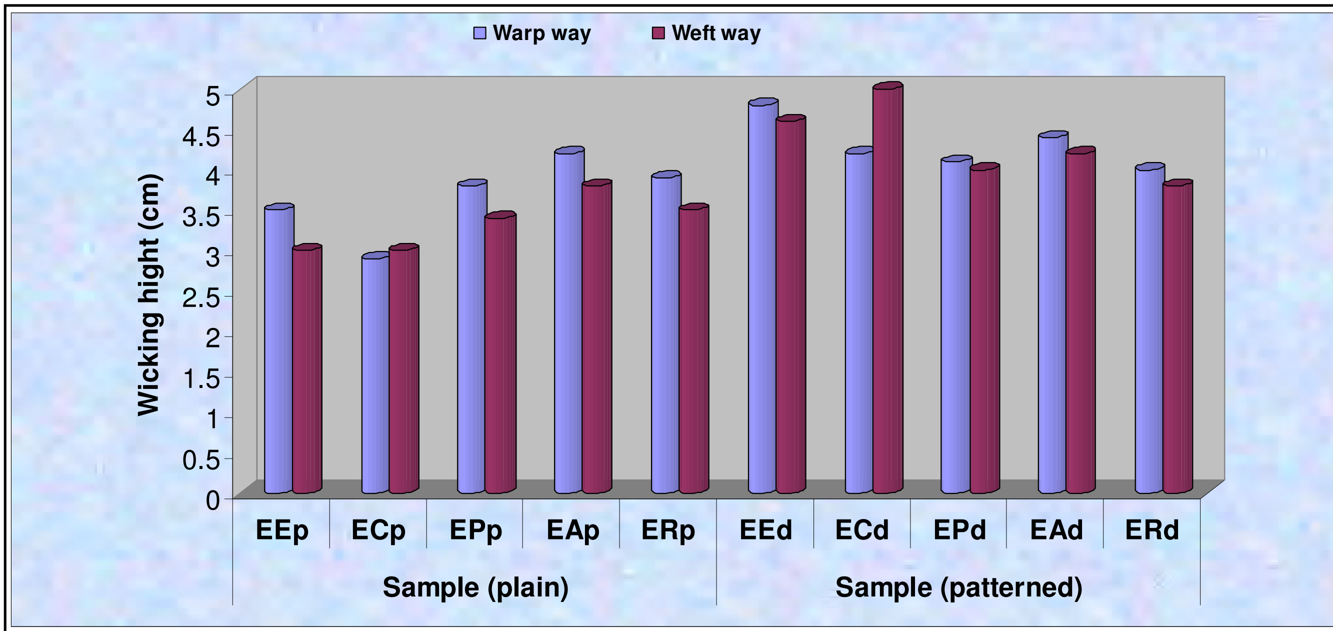

Fig. 2 : Wicking height of eri union fabric- plain and patterned fabrics (cm)

sample ERd, 4.0 cm in warp direction and 3.8 cm in weft direction.

Wicking height was more in the patterned eri union fabric samples, may be due to compact fabric structure, longer floats and fewer intersections compared to plain eri union fabric samples.

Air permeability:

Air permeability is the capacity of air to flow through the fabric (Tortora and Collier, 1997), which is an important fabric property related to thermal comfort. It is one of the comfort measures that greatly affect the wearer. A fabric that is permeable to air is likely to have relatively high moisture vapour transmission. A highly permeable fabric is likely to transmit inner body heat and moisture toward the outside, increasing the comfort level of the wearer specially in summer.

Air permeability of a fabric is the volume of air measured in cubic centimeters passed per second through 1 cm^2 of the fabric at a pressure of 1 cm of water. The test samples were tested as directed in I.S. method: 11056 by using the Shirley's Air permeability apparatus.

Test results, as depicted in Fig. 3, show that among the plain samples, EAp showed better air permeability value (104.17) followed by ECp (95.00), EEp (83.89), ERp (80.56) and the lowest air permeability was observed in case of EPp (67.78). On the other hand, for patterned fabrics, air permeability of sample EPd was highest (56.67) and of EAd was lowest (25.77). Air permeability was more in case of plain eri union fabrics of all

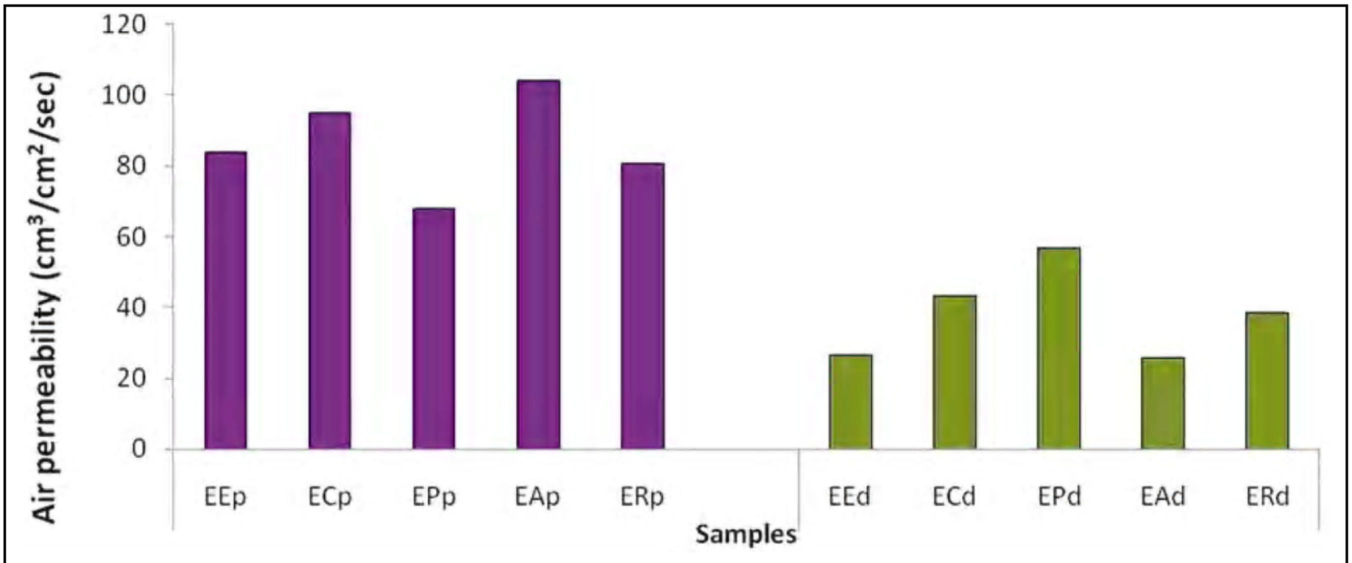

Fig. 3 : Air permeability of eri union fabric – plain and patterned fabrics

combinations as compared to the patterned eri union fabrics of the same combinations. Air permeability was highest in case of EAp, may be due to the crimp in the acrylic fibres. Compactness of fabric structure could be the reason for low air permeability in case of patterned fabrics.

Thermal conductivity:

Thermal conductivity is defined as the quantity of heat transmitted through a unit thickness of materials in a direction as a result of temperature difference under steady state boundary condition (Owate *et al.,* 2007).

The thermal conductivity of a fabric is determined by the rate of transmission of heat through fabric. It is reciprocal of thermal insulation or thermal resistance. Thermal insulation value determines the warmth of that fabric when it is worn by the wearer. It is measured by its thermal resistance, which is the reciprocal of thermal conductivity. A digital instrument was used for measuring thermal insulation value of the fabrics by disc method using Lee's disc apparatus .

Fig. 4 revealed the thermal insulation value among

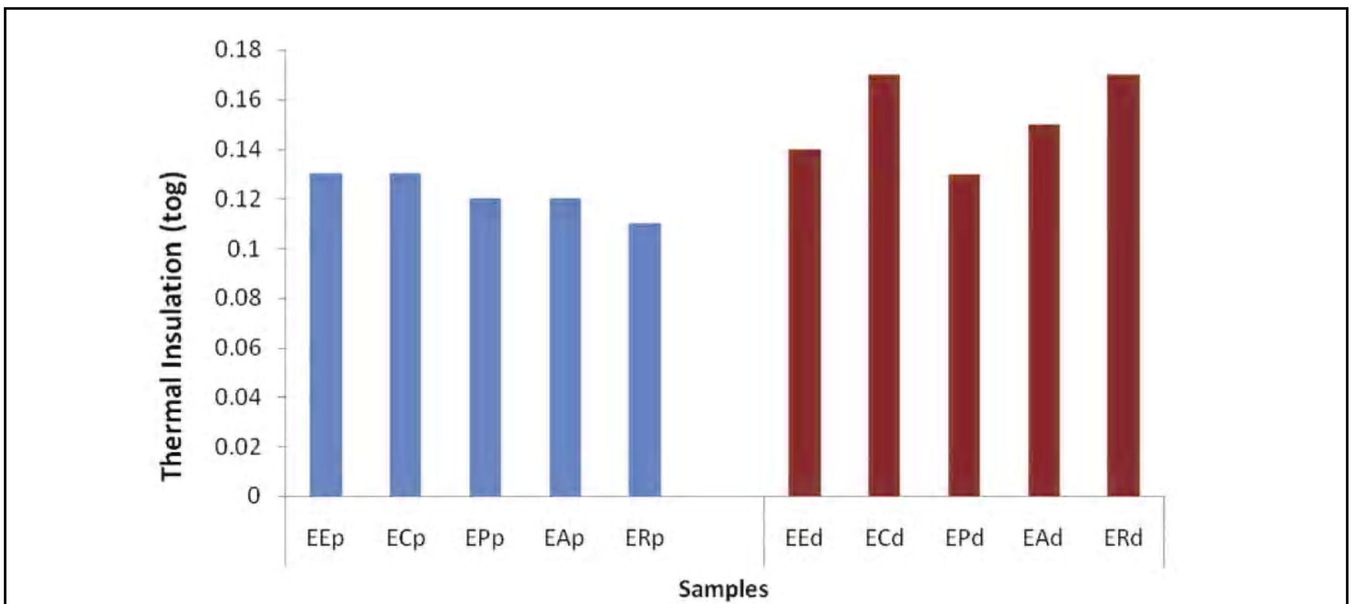

Fig. 4 : Thermal insulation- plain and patterned eri union fabric

plain and patterned eri union fabrics. Among the plain eri union samples, highest thermal insulation was found in EEp (0.13 tog) and ECp (0.13 tog) followed by EPp (0.12 tog) and EAp (0.12 tog) and lowest in ERp (0.11 tog). On the other hand, thermal insulation of patterned eri union fabric samples showed some variation. Highest thermal insulation value was exhibited by sample ECd (0.17 Tog), and ERd (0.17 Tog), followed by sample EAd (0.15 Tog), EEd (0.14 Tog) and EPd (0.13 Tog). The patterned eri union samples of all combinations had higher thermal insulation compared to plain eri union fabrics of the same combination.

Conclusion:

– All the selected combinations of eri union fabrics had good absorbency.

– Wicking height was more in the patterned eri union fabric samples, may be due to compact fabric structure, longer floats and fewer intersections compared to plain eri union fabric samples.

– Air permeability was high in case of plain weave samples of all combinations compared to their patterned counterparts. Compactness of fabric structure in case of patterned fabrics could be the reason for their low air permeability.

– Patterned eri union samples of all combinations had higher thermal insulation compared to plain eri union fabrics of the same combination making them more suitable for winter wear.

– Considering the comfort properties, all selected combinations of eri union fabrics would be suitable for apparel.

– Eri union fabrics offer immense opportunities and have wider scope for promising business avenues in the competitive fashion world for sericulturists, self-help groups, textile designers, handloom weavers and fashion designers.

Structurally designed eri union fabrics could boost the national and international market to fulfill the fashion demand and boost the economy of the state and the country.

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