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Original Research Article

A study on properties of union fabrics developed with sisal fiber for textile application

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ABSTRACT

Present study was done to explore the properties of developed union fabrics *i.e.* sisal-cotton/viscous and sisal-polyester. Ratio for each fabric was taken as 50-50. Sisal remained weft for all the fabrics and other were as warp. Fabrics were developed and analyzed for their physical properties. Sisal-polyester fabric was examined as of maximum strength, abrasion resistance as compared to the other two fabrics and Sisal-cotton/viscous also showed good properties like drapability, crease recovery, bending length. So, it can be used in upholstery material and in some parts of garments using lining.

KEYWORDS

Sisal | cotton | cotton/viscous | polyester | union fabric | fibre properties | textile application

CITATION

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Introduction

Sisal fiber is a natural fiber with the botanical name *Agave sisalana*, is a species of Agave that yields a stiff fibre used in making various products. The first commercial plantings in Brazil were made in the last 1930s and the first sisal fiber exports from there were made in 1948. Today Brazil is the largest world producer of sisal fiber with 1, 30,000 tons/year. Sisal plants consist of a rosette of sword shaped leaves about 1.5 to 2 meters tall. Young leaves may have a few minute teeth along their margins, but loose as they mature. Propagation of sisal is generally by using bulbils produced from buds in the flower stalk or by suckers growing around the base of the plant, which are grown in nursery fields until large enough to be transplanted to their final position. The sisal plant has a 7-10 year life span and typically produces 200-250 commercially usable leaves. Each leaf contains an average of around 1000 fibers. The fibers account for only about 4% of the plant by weight. Sisal is considered a plant of the tropics and subtropics, since production benefits from temperatures above 25°C and sunshine. Fiber is extracted by a process known as decortication, where leaves are crushed and beaten by a rotating wheel set with blunt knives, so that only fibers remain. Traditionally, sisal has been the leading material for agricultural twine because of its strength, durability, ability to stretch, affinity for certain dye stuffs, and resistance to deterioration in salt water. With the increasing demand of eco-friendly fabrics, sisal fibre will serve the purpose. But it is a harsh fibre so its mixing with other fibre is needed so that the resultant fabric has more enhanced properties like comfortability, flexibility, drapability, etc. In order to meet these enhanced properties cotton, cotton/viscous and polyester yarns were taken for mixing purpose. Below some studies are mentioned which resembles like present study: The study "A comparative study on properties of acrylic-cotton blend fabric" undertaken to find out affect of different blend ratio of acrylic cotton properties of fabric. Main purpose of study was to blend both the fibres and produce fabric which will exhibit properties that best of both the fibres. It was concluded that in acrylic/cotton blend fabric to be used for dress material the percentage of acrylic can vary from 60-80%. As such fabrics will give good crease resistance, good wear performance and will be comfortable to wear. Pilling tendency of such fabrics can be controlled by some chemical treatments (Ola, 1999). The study "Extraction and Evaluation of fibres from Agave Sisalana Leaves" was done and it may be concluded that hot water retting is best method for extraction of agave fibre. Its properties are somewhat similar to other cellulosic fibres although it is a coarse fibre but it can be made pliable and spinnable by various finishing treatments which can be used for furnishing and apparel purposes. (Atsula, 2001).

Raw Material Procurement

Sisal fibre, cotton, cotton/viscous and polyester yarns were used in this study. Sisal fibre was procured from Women's Development Organization, Dehradun. Cotton, cotton/viscous and polyester yarns were purchased from Jaipur.

Fabric Production

Weaving of union fabrics was done with plain weave at Weavers' Service Centre, Jaipur on handloom.

Constructional details of union fabrics

S.No	Union Fabric	Code	Direction	Fibre Content	Weave Type	Ratio
01	Sisal × Cotton	F1	Warp	Cotton	Plain Weave	50:50
			Weft	Sisal		
02	Sisal × Cotton/ Viscous	F2	Warp	Cotton/ Viscous	Plain Weave	50:50
			Weft	Sisal		
03	Sisal × Polyester	F3	Warp	Polyester	Plain Weave	50:50
			Weft	Sisal		

Table 1. Constructional details of union fabrics

Tests Evaluation of Developed Fabrics

Preliminary Data

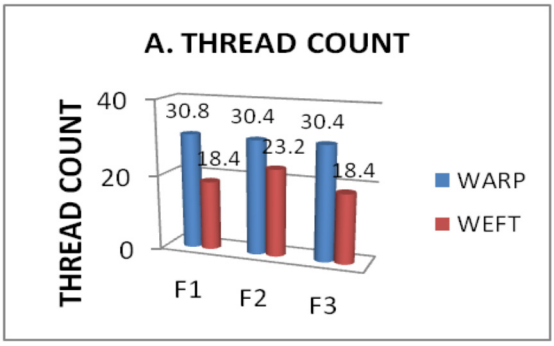

Fig- A. depicting the thread count of the fabrics. Among the three union fabrics F2 was of maximum thread count i.e. 30.4×23.2 (705.28) and F3 was of minimum thread count i.e. 30.4×18.4(559.36).

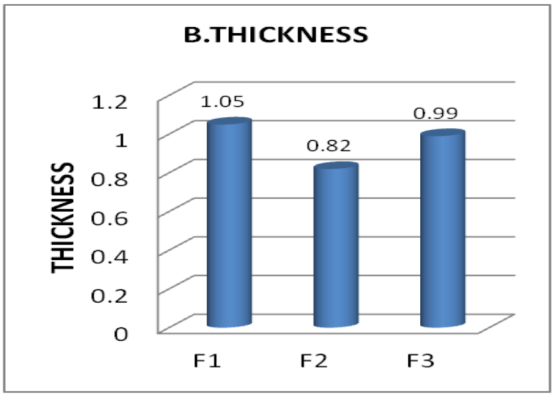

Fig- B. revealing the thickness of the fabrics. It was minimum for F2 *i.e.* 0.82 mm and maximum for F1 *i.e.* 1.05 mm.

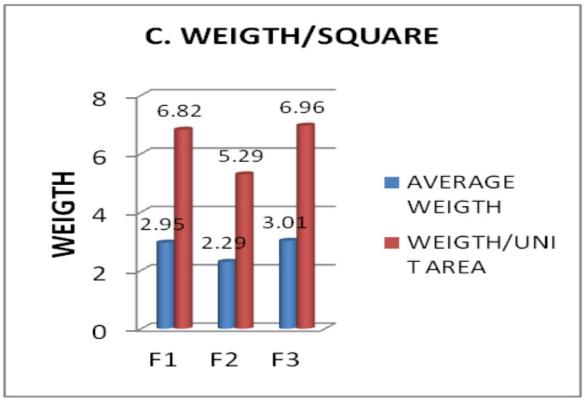

Fig- C. depicting the average weight and weight/unit area of the fabrics. F2 was noted with the minimum value and it was maximum for F3.

Physical Properties

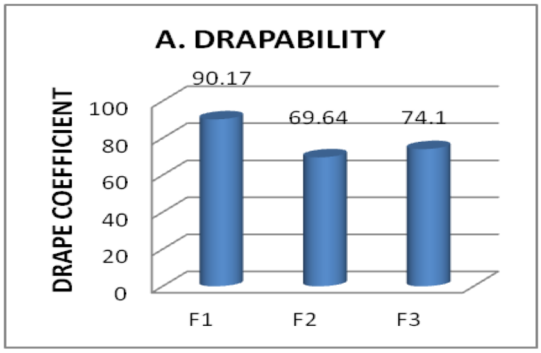

Fig- A. showing the drapability of the fabrics. Drape coefficient was calculated minimum in F2 whereas it was maximum in F1.

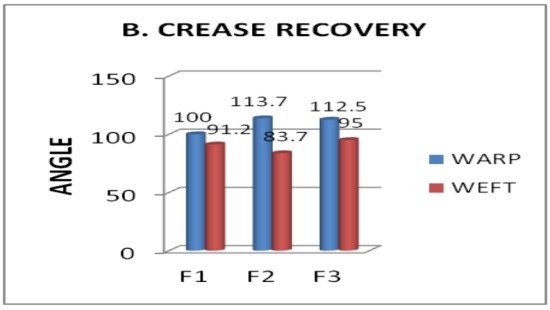

Fig- B. displaying crease recovery for the fabrics. It was observed that F2 had maximum crease recovery in warp direction whereas in weft direction it was F3 which had maximum crease recovery.

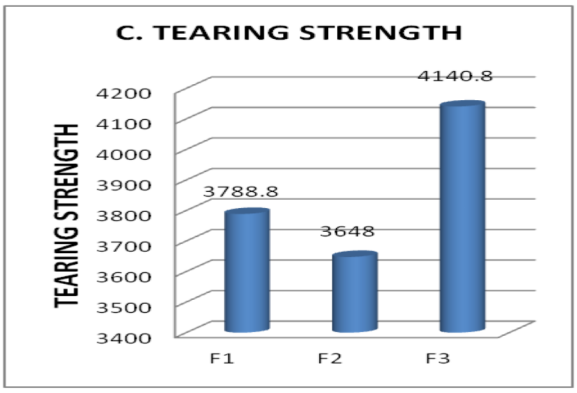

Fig- C. revealing the tearing strength of the fabrics. It was generalised with the test that F3 had the maximum tearing strength as compared to F1 and F2.

Experiment with "Elmendorf" Tearing Tester

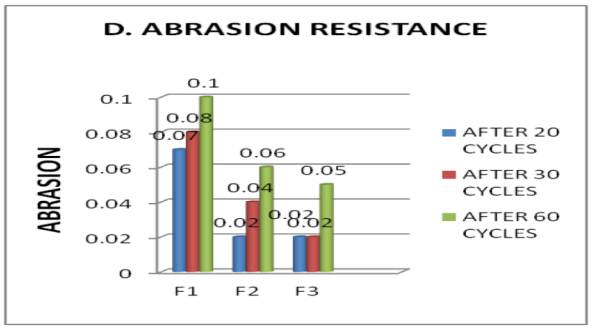

Fig-D. showing abrasion resistance of the fabrics. It was observed that F3 had maximum strength to withstand against abrasion or rubbing. Whereas F1 had maximum abrasion.

Experiment with EC-11Eureka Cloth Abrasion Tester

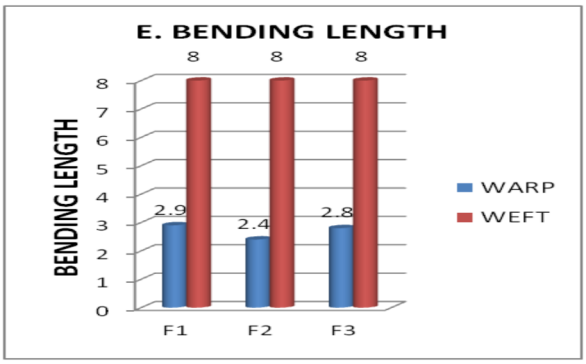

Fig- E. depicting bending length for the fabrics which evaluates the stiffness of the fabric as bending length is directly proportional to stiffness. It was seen that F2 had minimum stiffness in warp direction whereas it was similar in weft direction for all the three fabrics.

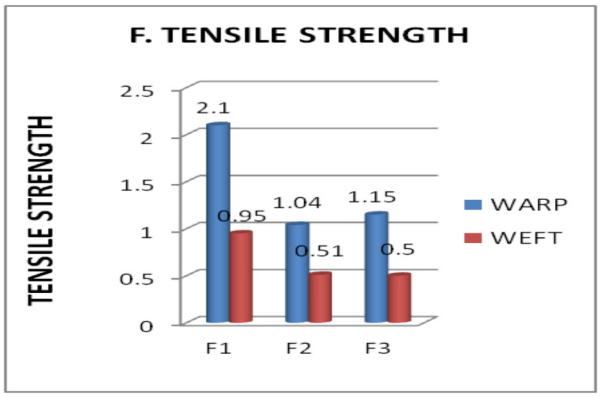

Fig- F. displaying the tensile strength of the fabrics. F1 had maximum load/elongation values than F2 and F3 in both warp and weft direction. So it can be concluded that F1 had more tensile strength than F2 and F3.

Experiment with Tensile Strength Tester

Conclusion

By evaluating all the aspects of the study it can be concluded that F3 had shown good results in tearing strength and abrasion resistance. On the other hand Sisal-cotton/viscous also showed good properties like drapability, crease recovery, bending length. But as Sisal is a harsh fibre so it cannot be used in full garment. To overcome this, lining can be used with it in some parts of the garment. So it can be generalised that these union fabrics can be used in upholsteries, curtains, room dividers, table runner, wall hanging, folders, bags, etc.

This study would impart market value to sisal fibre by introducing them for fabric production for home furnishings, upholstery and make value added products, which would enhance the profitability of sisal farming.

To provide livelihood to the poor through generation of employment in the fibre industry and also in the rural areas in terms of production. Being completely biodegradable and naturally occurring, sisal fibre products are expected to be in great demand in the international markets as they pose no toxic effects to man and environment. Similar studies which will justify the present study work are:

1. The study work "Studying suitability of banana fibre-cotton and banana fibre-wool union fabrics for apparel use" was conducted to answer the future crisis of natural fibre and to exploit properties of both banana and khadi. It was found that although both fabrics sampler had good appearance and luster, they were rough and hard. So it was concluded that they can be used in some parts of garments using linging and for upholstery materials (Agrawal, 2007).
2. The study was "A study on properties of cotton/acrylic union fabric for apparel use" undertaken with the following objectives. The main purpose of the study was to blend the both fibres and producer fabric which will exhibit properties that represent the best of both the fibres. So it was concluded that the fabrics made up of 50:50 ratio acrylic and cotton, can be use for apparel use. Especially in winter season because in this we use acrylic yarn which provides the warmth in this season (Kaushik, 2010).
3. The present work was "A study of physical properties of jute/viscose and polyester and cotton union fabric for apparel use" undertaken with the following objectives. Main purpose of the study was to blend the both fibres and produce fabrics which will exhibit properties that represent the best of both the fibres. It was found jute/viscose and polyester union fabric in the ratio of 30:70 has shown good properties than other 50:50 and 70:30 ratio union fabrics. It was observed that although fabric had good appearance, they were rough and hard. So, it was concluded that the fabric can be use for apparel making. (Bhardwaj, 2008).

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