



Characterization of Seam Strength and Seam Slippage on Cotton fabric with woven Structures and Finish

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Available online at: www.isca.in

Received 9th August 2012, revised 20th August 2012, accepted 22nd August 2012

Abstract

In the present work, the quality of fabric samples was controlled, now the garment longevity depends on the seam parameters like various factors such as seam strength, seam slippage, seam puckering and yarn severance. In the present work, fabrics of different blend proportions i.e., cotton and was prepared with different woven structures like plain, twill, satin. These fabrics were treated with fabric softener like silicone. After all the above trials the seam strength and seam slippage were studied for both finished and unfinished materials. The seam strength and seam slippage were studied using instron tensile strength tester, the studies were performed at 6.0mm breaking load and it was observed that the breaking load of unfinished samples were depicting higher strength than the finished without seam opening. The fabric samples of plain weave were found to have greater seam performance than the twill and satin. Various other factors influencing the seam strength and seam slippage are also discussed in detail.

Keywords: Seam strength, seam slippage, woven structure, seam performance, silicone finish.

Introduction

The seam performance and quality depend on various factors such as seam strength, seam slippage, seam puckering, seam appearance and yarn severance. Sewing needle penetration forces and fabric deformation during sewing are effective factors for seam performance, too. Appearance and performance of the seam are dependent upon the quality of sewing threads and their dynamic behaviour. One essential requirement of any thread is that it must be compatible with the needle size, various sewing machine settings (sewing speed, thread tension) and the fabric on which it is being sewn. Seam damage can be a serious cost problem, often showing only after the garment has been worn. The most important parameters that have an influence on seam damage tendency are fabric construction, chemical treatments of the fabric, needle thickness and sewing machine settings with sewing thread. Fibre content, yarn construction, tightness and density are important parameters for fabric construction on seam damage. Seam damage caused by the needle penetration through the fabric may affect its seam performance. Needle cutting or yarn severance occurs due to stiffness of the fabric, yarn and its lack of the mobility. Instead of moving and deforming, when the needle penetrates the fabric structure, the yarn is ruptured or burned.

A fabric can be thermally damaged if the needle has a high warming-up value which results in the melting of the material being sewn. Some researchers stated that common apparel products, the seam is an essential part of the garment¹. Seam damage also results due to high friction between the needle and the fabric. The damaged places are generally dense spread. There are especially dense fabrics which are sensitive to sewing damage. During the stitch formation the cloth being stitched

may be damaged in a way which is more mechanical rather than thermal. Generally, in the seam operation, finishing with silicone reduces the friction (mechanical abrasion) between the fabric and the needle. Consequently, the needle penetration force and damage to the fabric is also decreased. The silicone finish reduces the friction between fabric yarns by increasing their mobility. Experience has demonstrated that the strength of many woven fabrics is considerably reduced by the sewing operation. Also, if the seam efficiency ratio falls below 80%, the fabric experiences excessive seam damage by sewing operation. The result of sewing should be a flawless seam, which is only possible when the sewing parameters are coordinated with thread and fabric properties. Hence, in the present study, an attempt has been made to study the sewing performance of the structurally varying cotton and polyester/cotton woven fabric structure with cotton and polyester spun sewing thread respectively. The size of sewing thread is denoted by linear density (tex, cotton count, metric count etc.) or ticket number (equal to three times the metric count of the thread). Tex is the universal system used to represent the sewing thread size^{2,3,4} showed the impact of sewing thread size on seam strength. Higher sewing thread size was subjected to greater friction during sewing, which ultimately reduced its strength. This consequently led to poor seam strength.

A seam is manufactured employing sewing methods, with the idea that the seam should satisfy all the requirements imposed by a number of end-users of apparel products^{5,6}. For any apparel product, it is necessary to clearly understand the seam, as it is the basic element of an article of clothing.

A large number of studies⁷⁻¹³ have determined the seam strength according to ASTM 1683-04 standards, which express the value

of seam strength in terms of maximum force (in Newton (N)) to cause a seam specimen to rupture. This is measured by using the following equation:

$$S_s = K S_b$$

Where: S_s = sewn seam strength (N); K = a constant equal to 1000 for SI units; S_b = observed seam breaking force (N).

In general, the seam quality mainly depends on the strength and the appearance of the seam itself. Seam strength and appearance affects both the functional and aesthetic performance of an apparel product and is important to its scalability and durability. A good quality seam must have flexibility and strength with no seaming defects such as puckering or skipped stitches; and the overall appearance of the seam must meet the design requirements of the apparel products. Besides the consideration of the quality level of the apparel product, judgement of seam quality requires consideration of the purposes of the apparel products as well. For some functional garments such as sportswear, the requirements of seam strength may be higher than the need for seam appearance, while for some apparel products such as nightgowns, the appearance of the seam is of higher importance.

In the apparel industry, overall seam quality defined through various functional and aesthetic performances desired for the apparel product during their end use. The functional performance mainly refers to the strength, tenacity, efficiency, elasticity, elongation, flexibility, bending stiffness, abrasion resistance, washing resistance and dry cleaning resistance of the seam under conditions of mechanical stress for a reasonable period of time¹⁴⁻¹⁶.

Basically, seam quality may be examined from two main aspects: functional and aesthetic performance. Most previous studies^{17,18} investigated the functional performance of seam mainly in terms of the seam strength and/or seam efficiency.

The cut and sewn apparel product industry convert a two-dimensional fabric into three-dimensional apparel. Many processes are involved during apparel production, till the stage of finished apparel to be seen in a shop-window, on a tailor's dummy, or on a coat hanger is reached. While there are other methods of shaping fabrics into apparel products, stitch seaming is by far the most common method used worldwide.

Properties like as, strength, tenacity and efficiency is required for determining the serviceability of apparel. Elasticity, elongation, flexibility, and low bending stiffness of seam are needed to easily elongation, flexibility, and low bending stiffness of seam arc needed to easily bend, shift, and fold without damage to the seam or change to the silhouette of the garment. Seam also comes under abrasion with body parts at wear or at the time of washing or dry cleaning. It is expected that seam should have good abrasion and/or washing and/or dry cleaning resistance. There are also certain aesthetic requirements of a seam to the consumers' body sensory mechanism (hand, eye)¹⁹.

Fabric properties which affect the seam quality are discussed by

many previous researchers²⁰⁻²². These properties arc cover factor, weight, thickness, strength, extensibility, bending rigidity, bending hysteresis, shear rigidity and shear hysteresis. In the following sections these fabric properties are discussed in brief. Lubrication finish protects the thread from strength reduction and/or breakage during sewing, which, in turn, produces high seam efficiency and less chance of seam damage^{23,24}.

There are various factors which can affect the seam strength and seam appearance. Many previous studies^{25,26} showed that seam appearance and performance depend on the interrelationship of fabrics, threads, the stitch and seam selection, and sewing conditions, which include the needle size, stitch density, the appropriate operation and maintenance of the sewing machines etc. The combination of materials that are assembled with the sewing thread and sewing conditions vary from individual to individual. Selection of sewing thread and sewing condition for a particular type of material is an integral part of producing a quality seam.

The different parameters of sewing thread such as the thread type, size and finish would have a definite effect on seam strength and appearance^{27,28}. The clothing industry tends to use the polyester spun thread with standard finish for most apparel products unless special requirements are demanded. In the apparel industry, after a particular type of seam and stitch is selected for the construction of an apparel product, the apparel designer and/or manufacturer needs to select the thread size and to determine the seam boldness required for seam construction. Seams with different degrees of boldness serve different purposes as design features. Some types of garments such as the jeans prefer a seam with more prominent design, while other garments such as the dress shirt conventionally prefer the Seams be sewn more inconspicuously. The seam boldness is an important element of determining the seam appearance, and the size of sewing thread becomes the primary factor for the manufacturers to consider for the required seam quality. The sewing conditions such as the thread tensions and pressure of pressure foot should be adjusted based on the thread size and the material to be sewn. However, the stitch density may vary at different seam locations. Stitch density was deemed to be an important attribute in seam quality because it assembles the fabric components together. The change of stitch density exerts a great influence on seam strength and appearance.

There are also numerous studies²⁹ on the seam quality based on the aesthetic performance. However, these studies focus mainly on the seam defects such as the seam puckering, seam damage. Furthermore, few studies had been evaluated the seam quality from both aspects of seam: the functional and the aesthetic³⁰.

However, in these studies, in order to evaluate the seam quality, the authors did not combine the functional and aesthetic performance of the seam. Up to now, very limited work has been done to study the seam quality on functional and aesthetic performance together. This study attempts to analyse the seam quality from the aspects of both functional and aesthetic

performance, and to study the effect of thread size, fabric properties and stitch density on seam quality in various types of fabric materials. The success of this study could help apparel manufacturers to evaluate the seam quality more effectively when a particular sewing thread size and stitch density are applied to a particular type of fabric. In turn, this would facilitate apparel engineers in the production planning and quality control.

For proper appearance, seam should not contain any defects including skipped stitches, unbalanced stitches, looseness, seam grin, distortion or unevenness or puckering, unsteadiness, improper drape-ability, uneven seam density and yarn severance or damage. A defect free seam is required for consumer satisfaction at the point of sale of apparel and helps to increase the scalability.

Apart from all the above aesthetic mentioned requirements, seam should also meet the design requirement of the consumers for apparel. The different degree of boldness of seam can help to fulfill different purposes as design features and affect the appearance of the garment. In the apparel industry, seam boldness is commonly used as a prime dimension for evaluating the design prominence of a seam^{31,32}. Therefore, overall quality of a seam depends on the requirements imposed by the consumers. Good overall seam quality is essential for the longevity of an apparel product, which together with consumer satisfaction during wear and care procedures affect its saleability. The apparel industry uses different dimensions for the evaluation of seam quality on the basis of the requirements of a seam from the consumers' point of views³³. In order to understand various seam performances, knowledge of various factors affecting the seam quality is necessary. Seam quality is governed by a broad spectrum of factors including sewing thread type and size, fabric, sewing machine speed, needle kind and size, stitch type and density and operator skills^{34,35} etc. For better seam quality, it is important to consider the complete harmony of the key fabric properties, sewing thread properties and sewing condition parameters used. The functional and aesthetic performance of the seam line is the result of all these factors. Seam strength refers to the load required to break a seam. This measure the strength and tenacity of a seam. Two pieces of woven fabric are joined by a seam and if tangential force is applied the seam line, rupture ultimately occurs at or near the seam line. Every seam has two components, fabric and sewing thread. Therefore, seam strength must result from the breakage of either fabric or thread or, in more cases, both simultaneously. Research has revealed that the load required to rupture the seam is usually less than that required to break the un-sewn fabric.

The ASTM 1683-04 seam strength standard is worth emphasizing due to its accuracy and ease in processing measurements. Hence, this method is widely used by the apparel industry for the evaluation of seam strength worldwide. Seam slippage is expressed as the transverse ratio of seam strength to fabric strength including the ratio of elongation of fabric to the ratio of elongation at the seam³⁶. Any movements of the warp

and weft yarns away from a seam line under transverse stresses exacerbate the potential slippage. A lot of scholars^{37,38} has suggested measuring seam slippage according to the ASTM 1683-04 standard for evaluation of seam quality. In this standard, the force required for slippage of 0.6mm of seam has been determined. The measurement of seam slippage from the ASTM 1683-04 standard is well established as an international standard and most apparel industries follow this method to evaluate seam slippage.

A few researchers conducted research on the effect of thread finishes on seam quality. They stated that the lubrication finish is used on a sewing thread to assure better seam quality due to its protective nature from needle heat in the course of garment manufacturing.

There are various types of finishes; however, in general the clothing industry tends to use standard lubrication finish for better seam performance in apparel stated that mercerized and glazed cotton thread have higher strength, durability, abrasion resistance than normal soft cotton threads.

Increased strength, durability and abrasion resistance help to get greater seam efficiency, seam strength and seam slippage. Additionally, they mentioned that other finishes like, water resistance, soil resistance, flame resistance is specific to the end use of the apparel and fabric to be sewn.

On the other hand, few researchers³⁹ found that sewing thread size is one of the important factors affecting seam strength. Generally, higher sewing thread size leads to greater seam strength for any apparel. Corroborate the fact that higher sewing thread size has a strong positive impact on seam strength.

Some scholars emphasized that fabric cover factor has considerable effect on seam strength and/or seam efficiency. Their study revealed that fabrics with high cover factor have an increased tendency to break the fabric yarns (warp and/or weft) at the time of sewing⁴⁰. The breakage of yarns in fabric ultimately reduces the seam functional performance such as seam strength and seam efficiency⁴¹.

There are various factors for seam quality: fabric properties, sewing thread and sewing conditions and others (human factors, environmental factors). Fabric is the basic raw material for the apparel products. Generally, all the fabric properties such as. Weight, cover factor, thickness, strength, extensibility, bending rigidity, bending hysteresis, shear rigidity, shear hysteresis and coefficient of friction have considerable effect on seam quality of apparel products. The different parameters of sewing thread are type, ply, finish, twist and size would have a definite effect on the functional and aesthetic performance of the seam. If there is no special requirement, the apparel industry mainly selects the spun-polyester, 3-Ply, normal twist and standard finish sewing thread for all types of sewing fabrics¹⁵. However, the size of the sewing thread is the most crucial for that seam quality as the improper selection of sewing thread size directly affects the seam quality of apparel products. There are also a lot of sewing

conditions such as stitch type, seam type, stitch density, sewing machine speed, needle size, pressure of pressure foot, feed dog. Thread tension and needle plate, which affect the seam quality. Among the above mentioned sewing conditions, stitch density is the only attribute, which can vary at different seam locations and has a direct impact on the quality level of apparel products^{17,39}. Therefore, stitch density deemed to be a most important sewing condition in the course of garment manufacturing. The remaining sewing conditions are adjusted during the course of apparel manufacturing based on the thread size and/or the material to be sewn. So, these are not considered as important factors for seam quality analysis in the present study.

Material and Methods

The detailed experimental procedure involved in carrying out this project work is described below

Procurement of Fabric: The 100% fabrics of different weaves of plain, twill, and satin are procured, the fabric specifications clearly understood from table-1. The grey fabric procured is bleached and dyed. Silicone finish is applied to the conditioned fabrics.

Table-1
Specification of Cotton Fabric

Weave	Warp Count	Weft Count	EPI	PPI	GSM
Plain	30	48	90	54	42.96
Twill	20	20	65	65	67.16
Satin	40	30	100	84	54.57

Bleaching Methodology: The bleaching bath is set to the required conditions according to the recipe given. The temperature is raised to 55°C. The fabric is immersed and worked for 2 minutes. Then the temperature of the bath is raised to 90°C and the material is worked for remaining time. The material from the bath is rinsed in hot water followed by cold water and dried.

Dyeing Methodology: The dye solution is prepared and the dye bath is set to 40°C. The fabric is then immersed in water for 10 min. Common salt is added and worked for 20 minutes. The dissolved alkali solution is added to the bath. The temperature is raised to 80°C in 20 minutes and continued for 30-60 minutes. Dyed fabric was washed with warm water at about 60°C. The fabric was then washed with 1-2 gpl of soap and then dried.

Finishing Methodology: The bath is set to the required conditions according to the recipe given. The pH is brought to

the required level by adding 50% concentrated acetic acid. The fabric is immersed in the solution and worked for one hour at room temperature. The fabric is padded, dried and cured.

Measurement of Fabric Tensile Characteristics: The samples were tested on an Instron for tensile characteristics, like seam strength, seam slippage. The fabric samples were tested at 500 mm gauge length at a constant speed of 5000mm/min and Pretension of 0.50cN/tex on Instron 7000 tensile tester. For each sample, required tests were conducted and the average values of breaking force, breaking time, tenacity, breaking elongation, breaking work are computed.

Results and Discussion

The characteristics of fabrics measured are analyzed and discussed.

From the table 2 - 4 observed that the finished fabric depicts a higher value in fabric breakdown, seam slippage. It is attributed that the finish which we applied over the fabric is influencing the fabric surface characteristics since it has a considerable level of influence on the fabric breakage and the seam slippage. When the fabric tested for seam strength the unfinished fabric represents higher strength than the finished fabric. Whenever the cotton fibre is treated with alkalis' and special finishes it loses its strength basically at that point of focus the cotton fabric which is unfinished has greater strength than the finished fabric. And also it is observed from the figure 1 the load required to open the seam is higher when compared to the finished fabric. The figure 2-4 depicts the effect of fabric breakage and seam slippage when finished. The fabric characteristics of these are based upon linear law of function. Where as the seam strength of the fabric characteristics has the influence of exponential law of function in both warp and weft way.

Table-2
Cotton-Plain Fabric - Breakdown

S. No	Breaking Load (Kgf)			
	Warp		Weft	
	With Finish	Without Finish	With Finish	Without Finish
1	11.2	9.9	20.3	19.5
2	11.2	10.9	19.9	19
3	11.4	10.1	19.5	19.6
Mean	11.2	10.3	19.9	19.4

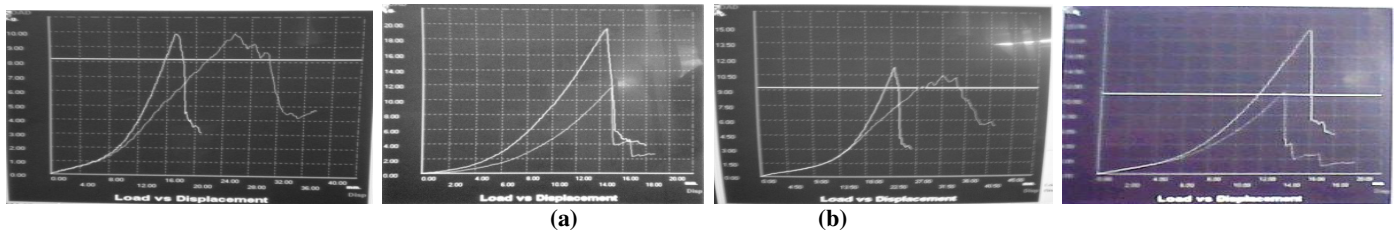


Figure-1 (a-b)
 Load-displacement curve for cotton-plain finished and unfinished fabric at warp and weft direction

Table-3
Cotton-Plain Fabric - Seam Slippage (6.0mm seam opening)

S.No	Breaking Load at 6.0mm opening (Kgf)				Seam opening (mm)			
	Warp		Weft		Warp		Weft	
	With Finish	Without Finish	With Finish	Without Finish	With Finish	Without Finish	With Finish	Without Finish
1	9.2	8.1	19.9 (SONO)	19.3 (SONO)	6	6	1.3	3.7
2	8.5	8.2	20 (SONO)	19.4 (SONO)	6	6	3.2	2.6
3	8.6	8.2	19.8 (SONO)	19.5 (SONO)	6	6	1.9	5.4
Mean	8.8	8.2	19.9 (SONO)	19.4 (SONO)	6	6	2.1	3.9

Table-4
Cotton-Plain Fabric - Seam Strength

S.No	Seam Strength (Kgf)			
	Warp		Weft	
	With Finish	Without Finish	With Finish	Without Finish
1	10.4 (FTS)	9.9 (FTS)	10.6 (STB)	11.6 (STB)
2	8.8 (FTS)	9.2 (FTS)	10.2 (STB)	12.2 (STB)
3	9.0 (FTS)	9.8 (FTS)	11.1 (STB)	11.3 (STB)
Mean	9.4 (FTS)	9.6 (FTS)	10.6 (STB)	11.7 (STB)

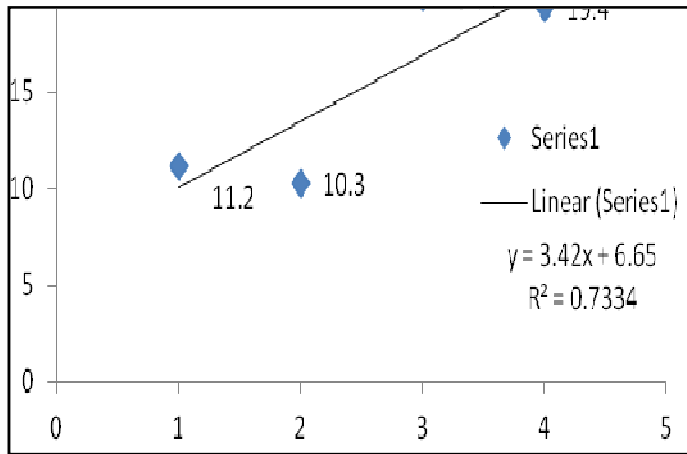


Figure-2
Breaking Load of Cotton Plain Fabric

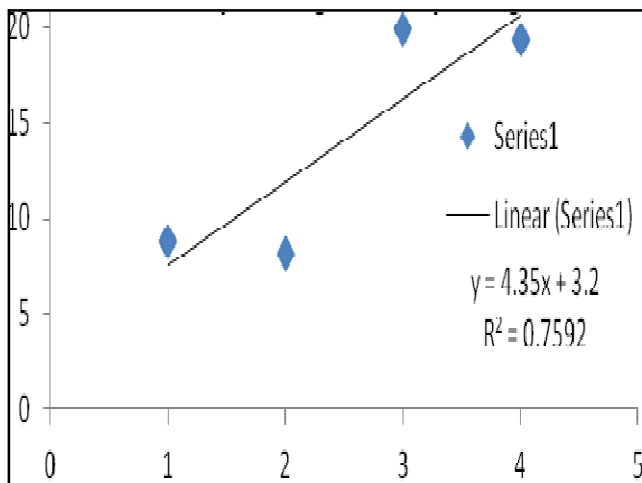


Figure-3
Seam Slippage of Cotton Plain Fabric

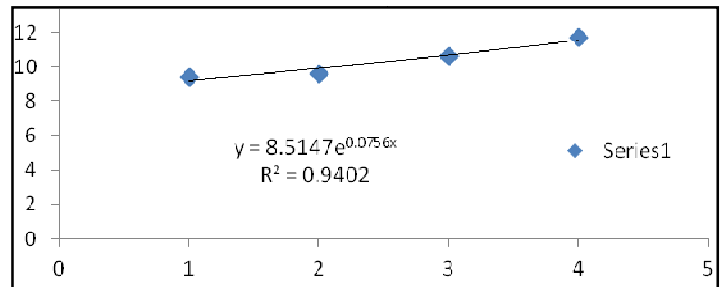


Figure-4
Seam Strength of Cotton Plain Fabric

From the table 5-7 it is observed that there is a greater influence on the fabric characteristics both in warp and weft way direction of the fabrics. The influence of finish is having a polynomial function law over the fabric characteristics. The seam strength of the fabric shows lower value because the no of binding points in twill weave is less when compared with plain weave. The structure of the fabric is having a greater influence along with the finish which we applied over the fabric. That's why the unfinished cotton twill fabric is showing greater seam strength than the finished sample. It is very clearly understood from the figure 5-8. The seam slippage is not at all observed in the load vs. displacement curve. From the above figures 9-13 and from the tables 8-10. It is observed that all the finished fabrics have higher breaking load compared to the unfinished fabrics. This is due to the contribution of floating effect in the satin fabrics. i.e. satin has lesser binding points. Moreover, sewing thread which is selected to sew the fabric is cotton which has a certain level of influence on the fabric seam performance characteristics. The figure - 10-13 represents the scatter plot of the seam strength and seam slippage of the fabrics, in which the breaking load of the fabric, seam slippage and seam strength has lesser effect when finished. Hence the influence of the finish on the fabric follows a polynomial law of function showing very lesser coefficient of determination.

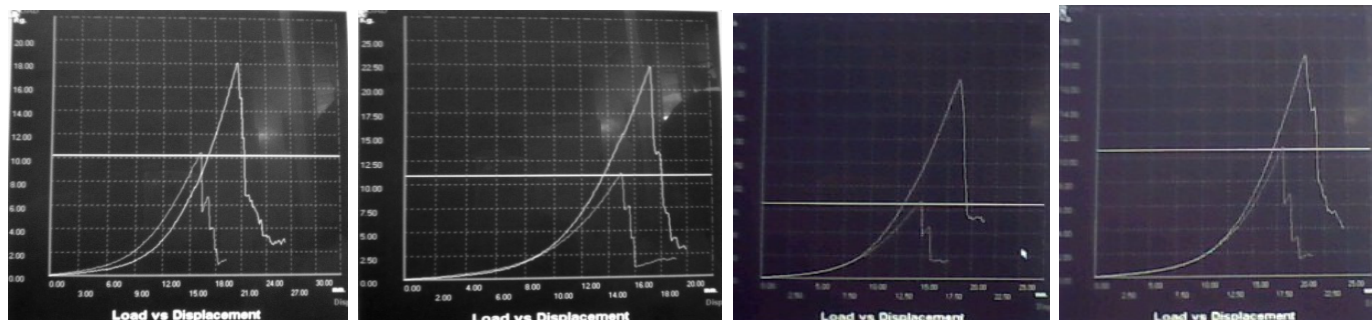


Figure-5
Load-displacement curve for cotton-twill Finished and unfinished fabric at warp and weft direction

Table-5
Cotton-Twill Fabric - Breakdown

S.No	Breaking Load (Kgf)			
	Warp		Weft	
	With Finish	Without Finish	With Finish	Without Finish
1	21.2	18.1	22.8	23.0
2	21.1	19.3	20.8	20.3
3	19.1	20.5	18.5	22.4
Mean	20.5	19.3	20.7	21.9

Table-6
Cotton-Twill Fabric Seam Slippage (6.0mm seam opening)

S.No	Breaking Load at 6.0mm opening (Kgf)				Seam opening (mm)			
	Warp		Weft		Warp		Weft	
	With Finish	Without Finish	With Finish	Without Finish	With Finish	Without Finish	With Finish	Without Finish
1	>20 (SONO)	19.3 (SONO)	>20 (SONO)	>20 (SONO)	1.4	1.1	1.2	0.9
2	>20 (SONO)	19.3 (SONO)	>20 (SONO)	>20 (SONO)	1.7	1.7	1.7	0.9
3	>20 (SONO)	19.2 (SONO)	>20 (SONO)	>20 (SONO)	2.4	0.6	-	1.4
Mean	>20 (SONO)	19.3 (SONO)	>20 (SONO)	>20 (SONO)	1.8	1.1	0.9	1.6

Table-7
Cotton-Twill Fabric Seam Strength

S.No	Seam Strength (Kgf)			
	Warp		Weft	
	With Finish	Without Finish	With Finish	Without Finish
1	8.4 (STB)	10.4 (STB)	9.7 (STB)	9.5 (STB)
2	10.0 (STB)	12.1 (STB)	8.6 (STB)	10.0 (STB)
3	7.6 (STB)	9.8 (STB)	10.9 (STB)	11.1 (STB)
Mean	8.7 (STB)	10.8 (STB)	9.7 (STB)	10.2 (STB)

Table-8
Cotton-Satin Fabric Breakdowns

S.No	Breaking Load (Kgf)			
	Warp		Weft	
	With Finish	Without Finish	With Finish	Without Finish
1	16.8	18.0	12.1	15.1
2	17.1	24.1	14.8	16.0
3	17.7	20.5	14.5	13.4
Mean	17.2	20.8	13.8	14.8

Table-9
Cotton-Satin Fabrics Seam Slippage (6.0mm seam opening)

S.No	Breaking Load at 6.0mm opening (Kgf)				Seam opening (mm)			
	Warp		Weft		Warp		Weft	
	With Finish	Without Finish	With Finish	Without Finish	With Finish	Without Finish	With Finish	Without Finish
1	17.2 (SONO)	>20 (SONO)	13.8 (SONO)	14.8 (SONO)	1.4	1.2	1.3	1.6
2	17.4 (SONO)	>20 (SONO)	13.7 (SONO)	14.7 (SONO)	1.7	1.1	2.9	-
3	17.2 (SONO)	>20 (SONO)	13.7 (SONO)	14.8 (SONO)	3.9	1.4	1.3	1.6
Mean	17.2 (SONO)	>20 (SONO)	13.8 (SONO)	14.8 (SONO)	2.3	1.2	1.8	1.1

Table-10
Cotton-Satin Fabric Seam Strength

S.No	Seam Strength (Kgf)			
	Warp		Weft	
	With Finish	Without Finish	With Finish	Without Finish
1	11.6 (STB)	11.0 (STB)	9.9 (STB)	10.6 (STB)
2	12.0 (STB)	8.6 (STB)	9.4 (STB)	8.8 (STB)
3	13.2 (STB)	8.9 (STB)	7.9 (STB)	11.8 (STB)
Mean	12.3 (STB)	9.5 (STB)	9.19 (STB)	10.4 (STB)

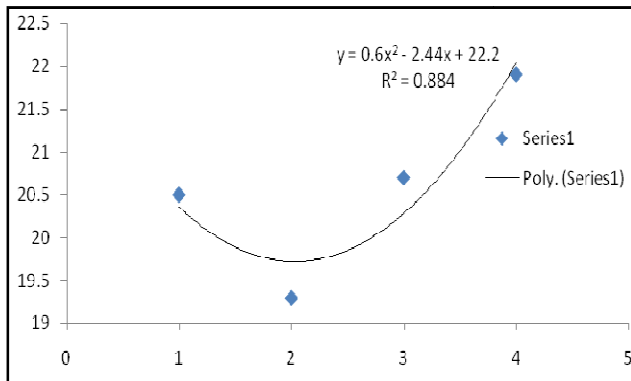


Figure-6
Breaking Load of Cotton Twill Fabric

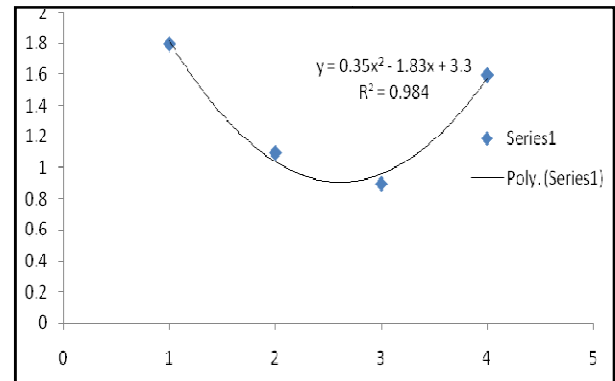


Figure-7
Seam Slippage of Cotton Twill Fabric

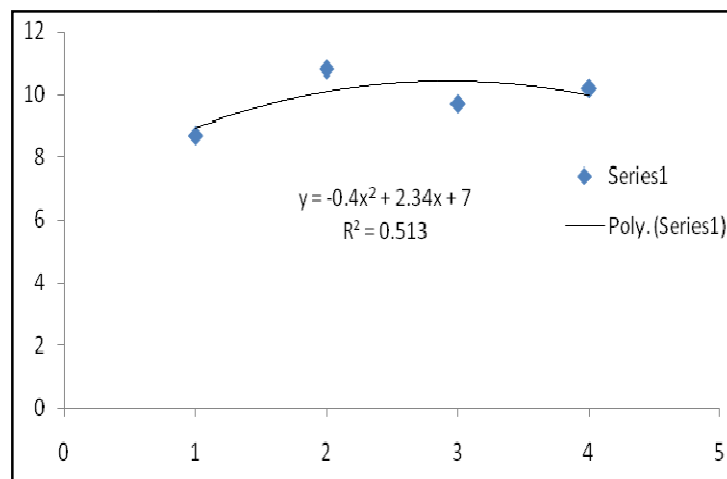


Figure-8
Seam Strength of Cotton Twill Fabric

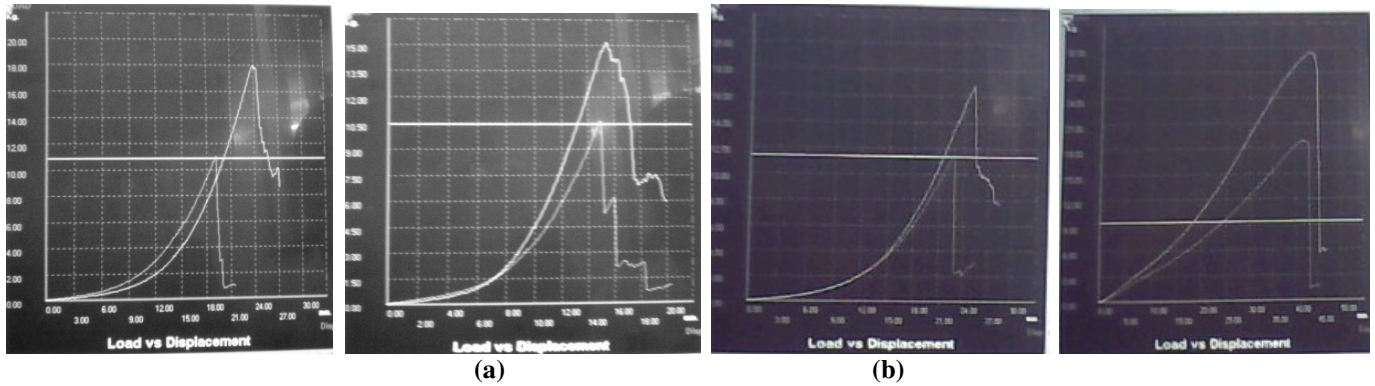


Figure-9 (a-b)

Load-displacement curve for cotton-satin unfinished and Finished Fabric at warp and weft direction

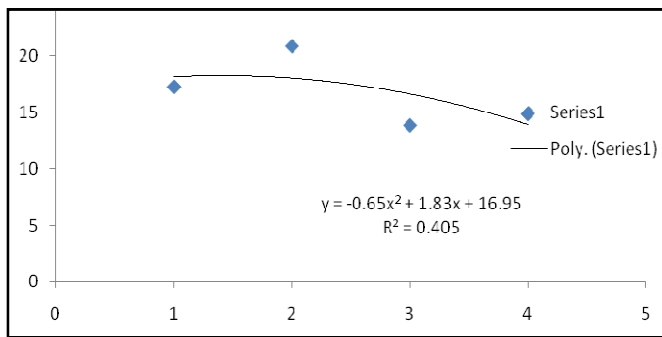


Figure-10
 Breaking Load of Cotton Satin Fabric

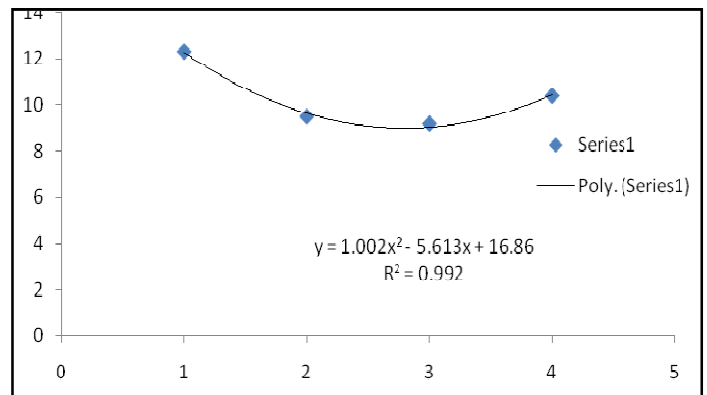


Figure-13
 Seam Strength of Cotton Satin Fabric

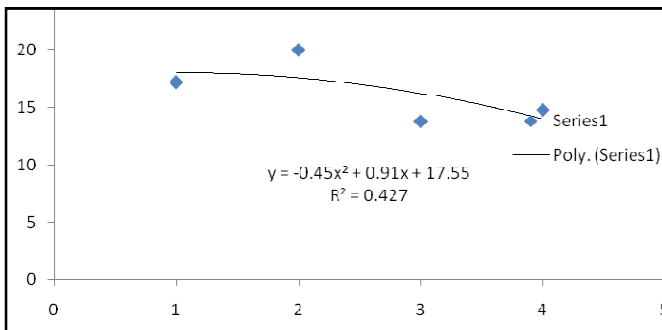


Figure-11
 Seam Slippage of Cotton Satin Fabric

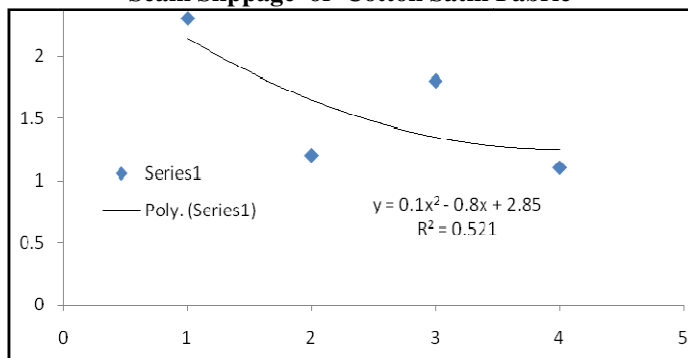


Figure-12
 Seam Opening of Cotton Satin Fabric

Conclusion

From the study it is clear that the resistance to breakage at the application of load is more for polyester/cotton blend than the cotton fabric. While taking a detailed look at the comparison of breaking load required for the finished and unfinished fabric, it is clear that the application of finish has some distinct effects. The fabric construction (EPI, PPI, count, weave type) proves to be playing a major role in the performance of the seam. The cover factor increases with the increase in EPI and PPI, thus resulting in greater fabric strength, the greater is the resistance to fabric and seam breakage. The present study gives a clear understanding about the variation in the requirement of load for various types of weave structures, say plain, twill and satin. From the study it is concluded that the plain fabric has a higher seam performance than the other weave types. Some of the other parameters which were found to influence the seam performance is sewing thread type and the fibre content in the sewing thread. Some of the test results explained that there were no seam opening observed at 6.0mm (seam slippage) in the comparative graph. Instead, the fabric tears at the seam or in most of the cases the sewing threads were broken due to the application of load. To maintain good seam and garment quality, seam performance is the essential parameter that should be taken into account.

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