Farhana et al., J Textile Sci Eng 2015, 5:5
DOI: 10.4172/2165-8064.1000208

Journal of Textile Science & Engineering

Research Article Open Access

Comparison of Seam Strength between Dyed and Un-dyed Gabardine Apparels: A Research on Lapped and Superimposed Seam

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Abstract

Today is the golden age of fashion. Fashion garments and apparel has been used everywhere to cope with the fashion era. These fashion garment and apparels are made of the fabrics of various structures and components through various processes. Among them gabardine is one of the most remarkable type of fabric and apparel dyeing is the latest process used for fashion apparel. We are going to have a look into the seam strength variations between dyed and un-dyed gabardine apparels after conceding the garment dyeing process. It is a comparative research work which will deliver us very effective knowledge about various types of seam, seam strength and seam performance. For comparative study many dummy apparels body have been produced as samples which are dyed in Hams washing and dyeing limited. After that all samples have tested in Thermax woven dyeing laboratory. Since Bangladesh is a very potential fashion market and the fashion garments are being manufactured more and more. Hence the fashion trend is rapidly going to garments dyeing from conventional fabric/yarn dyeing processes. Gradually garments dyeing order are increasing higher to higher.

Keywords: Seam; Seam strength; Gabardine apparel; Dyed apparel; Un-dyed apparel; Apparel dyeing

Introduction

Apparel is one of the fundamental needs of mankind's living. So it's being got more and more priority day by day. This basic apparel has come up to the fashion today with the chronological evolution of fashion. Apparel or garment industry includes a diversity of these fashion products to meet up the demand. Now-a-days the latest technologies are being applied in apparel industries. Today's fashion and apparel market is highly competitive and to sustain in this market, fashion producers mainly rely on the quality issues not on prices merely. And from this aspects raw material properties, sewing performance and seam quality becomes very important.

Fabric and sewing thread is the basic raw material of apparel industry. Characteristics of the raw material influence the seam quality of the garment. The apparel designers are primarily interested in the raw material properties for high seam quality and consumer is mainly interested in appearance, comfort, and wears ability of the garment. Proper selection of raw material not only gives comfort to the wearer but also helps in smooth working of manufacturing process and lead to defect free garment.

A large variety of sewing threads is used in clothing industry. The majority of the sewing threads used by the clothing industry are made from cotton and polyester fiber [1]. Threads made from natural fibers such as linen and silk and certain manmade fibers, for example nylon, acrylic and viscose are also used in clothing industry [2].

Many factors influenced the quality of seams. These factors can be classified into four principal origins: Speed, needle, thread and fabric. It was found that fundamental interactions between these factors still exist [3]. For the purpose of making good seam, great number of techniques has been developed until today but nothing has been as successful as sewing process. Stitch is placing the sewing materials like fabrics with in and out by needle. Different stitches and stitch types are being used for flexible materials like knitted apparels and suits; they are being used f or less flexible knitted products and for sewing relatively inflexible materials like woven fabrics as well. Despite of recent developments on automation of general set up; sewing threads are still irreplaceable material in apparel sector. The mistakes arisen from the sewing threads having been eliminated by new studies which performed by manufacturers. As a result of technological developments: smooth, steady and strong sewing threads provide advantages for all stitch types [4].

Seam

A seam is a method of joining two or more pieces of materials together by a row/series of stitching. The purpose of most of these seams is purely functional and can be called as constructional seams. Straight, neat, smooth, even seams that are not twisted, ropey, or rippled contribute to aesthetics of the garment/apparel.

According to British Standard 3870, there are eight types of seam,

Class 1 (superimposed seam)

Class 2 (lapped seam)

Class 3 (bound seam)

Class 4 (flat seam)

Class 5 (decorative seam)

Class 6 (edge neatening Seam)

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Received May 26, 2015; **Accepted** June 30, 2015; **Published** July 30, 2015

Citation: Farhana K, Syduzzaman M, Yeasmin D (2015) Comparison of Seam Strength between Dyed and Un-dyed Gabardine Apparels: A Research on Lapped and Superimposed Seam. J Textile Sci Eng 5: 208. doi:10.4172/2165-8064.1000208

Class 7

Class 8 [5].

Seam class 1 (superimposed seam): These generally start with two or more pieces of material superimposed over each other and joined near an edge, with one or more rows of stitches. There are various types of seams within this class. A superimposed seam can be sewn with Stitch Types 301 or 401 to create a simple seam. The same seam type can also be sewn with Stitch class 500 (Over edge stitch) or Combination stitches (e.g., Stitch class 516) [6] (Figure 1).

Seam class 2 (lapped seam): In this class of seam, two or more piles of material are lapped (i.e., with edges overlaid, plain or folded) and joined with one or more rows of stitches. One of the most popular of this class is the Lap felled type, involving only one stitching operation – a strong seam with fabric edges commonly used to protect jeans or similar garments from fraying. The superficially similar French seam type involves two stitching operations with an intervening folding operation – a flat, folded seam with only one row of stitching visible on the top surface. This seam class consists of a minimum of two components and can have different varieties consisting of a number of rows of stitching (Figure 2).

Seam strength

The seam strength of a sample refers to the force acting upon a seam, at the time of fabric failure along the line of needle penetration. Seam strength refers to the load required to break 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 unsewn fabric [7,8].

Few factors that determine the strength of a seam include:

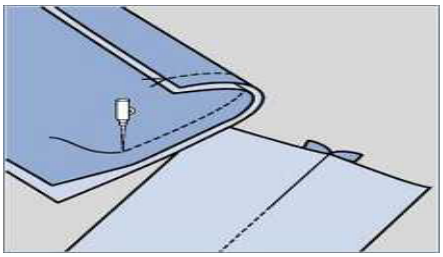

Figure 1: Superimposed seam.

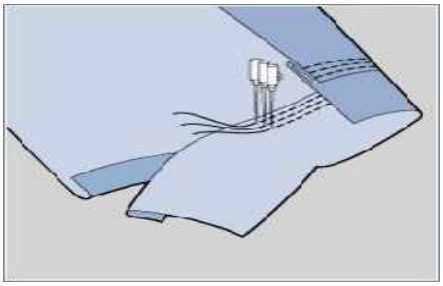

Figure 2: Lapped Seam.

Figure 3: Garment dyed apparels.

Fabric Type, Weight, Strength, Durability.

Thread Fiber Type, Construction, and Size.

Stitch and Seam Construction

Stitches per Inch (A and E).

Gabardine

Gabardine is a tightly woven warp-faced twill weave fabric. Warp-faced fabrics have more warp or lengthwise yarns on the surface of the fabric than filling or crosswise yarns. Twill weave fabrics show a diagonal wale, or raised line, on their surface. The fine wale is closely spaced, slightly raised, distinct, and obvious only on the fabric's face. The wale angle in gabardine is 45 or 63 degrees. Gabardine always has many more warp than filling yarns, often twice as many warp yarns as filling yarns. Fabric weights range from 7 ounces per square yard to 11 ounces per square yard. Fabric density ranges from 76 warp ends per inch (epi) by 48 filling picks per inch (ppi) to 124 epi by 76 ppi. The combination of the weave structure, yarn size, and warp to filling ratio creates the wale angle. A steep (63 degree angle) twill gabardine is often used in men's wear while a regular (45 degree angle) twill gabardine is often used in women's wear. In the most common interlacing patterns the warp crosses two filling yarns before going under one filling (2 x 1) or the warp crosses two fillings before going under two fillings (2 x 2) to create right-hand twills in which the wale line moves from the lower left to the upper right.

Garment/apparel dyeing

Garment Dyeing or piece dyeing means that garments are sewn "raw" and dyed only after sewing. Garment dyeing is increasingly fashionable; many collections are garment dyed especially trousers. The unmistakable look is much appreciated. At the same time Garment Dyeing allows high levels of flexibility regarding colors, logistics, materials management and therefore supply.

Most important fiber for Garment Dyeing still is and will be cotton. But elastic fabrics get more and more important. With regard to the sewing thread, special considerations are necessary to keep the quality of the seam at the usual standard. Sewing threads with good dyeing properties, sufficient strength and optimal sew ability are needed (Figure 3).

Methodology

For the purpose of this research, different jobs have been done in different work places. To complete this work, the whole work has been done in three stages in three different laboratories. Firstly, apparel sewing (leg panel) has been done in Apparel Manufacturing Engineering laboratory, Bangladesh University of Textiles, then apparel dyeing has been done in apparel dyeing factory named Hams

Washing and Dyeing Limited, Tejgaon I/A, Dhaka and finally apparel testing that is seam strength test has been done in a Testing Lab of Thermax Woven dyeing Limited, Norsingdi. So this experimental work has been done in three steps as below:

i. Sewing

ii. Dyeing

iii. Testing

Experimental Work

Sewing

Sample selection: Apparel: Trouser/Pant (Leg panel)

Fabric: Twill fabric, 100% cotton

Sewing Thread: Two types; Tex 60, Tex 105; 100% cotton.

Specifications: Fabric (Table 1)

Sewing Thread (Table 2)

Variables for work: Variable parameters (Tables 3 and 4).

Dyeing

Direct dyestuff has been used (Figure 4).

Testing

Garments seam strength testing: Test Method: **ISO 13935-2: 1999**,

Textiles – Seam tensile properties of fabrics and made-up textile articles-Part 2: Determination of maximum force to seam rupture using the grab method.

Results and Discussion

Effect of the types of seam and stitch on seam strength

There is a significant difference of seam strength between un-dyed and dyed samples for both lapped and superimposed seam.

Lapped seam: Table 5 shows the loss of seam strength between un-dyed and dyed samples. In case of gabardine apparels, the loss of seam strength of dyed lapped seam is varying from 5 to above 10 in percent (Table 5) (Figure 5).

By this Figure 5, it has been observed that the samples off odd number beginning from 1 to 23. All samples made by Lapped seam. Each and every sample shows 2 types of numerical values of seam strength measured by seam strength tester in Newton (N) Axis X expresses the sample number and axis Y expresses the seam strength.

Parameters	Gabardine
Material	100% cotton
Fabric Construction	Twill 1/3
Yarn, Warp/cm	52
Yarn, Weft/cm	20
Mass (gm/m^2)	217
Yarn count (warp)	20's
Yarn count (weft)	16's

Table 1: Specification of Gabardine Fabric.

Tex number of sewing thread	Ticket number	Count (Ne) of sewing thread	Length (M)
60	030	30/3	5000
105	018	18/3	5000

Table 2: Specifications of Sewing Thread.

Needle size	16, 18
Seam	Lapped, Superimposed
Stitch	Class 400, class 500

Table 3: Different variables for Work.

Sample no. 1 Sewing thread linear density Tex 60 Stitch per Inch: 13-14 Needle size: 16 Lapped seam Stitch class 400	**Sample no. 3** Sewing thread linear density Tex 60 Stitch per Inch: 10-11 Needle size: 16 Lapped seam Stitch class 400
Sample no. 5 Sewing thread linear density Tex 60 Stitch per Inch: 7-8 Needle size: 16 Lapped seam Stitch class 400	**Sample no. 7** Sewing thread linear density Tex 60 Stitch per Inch: 13-14 Needle size: 18 Lapped seam Stitch class 400
Sample no. 9 Sewing thread linear density Tex 60 Stitch per Inch: 10-11 Needle size: 18 Lapped seam Stitch class 400	**Sample no. 11** Sewing thread linear density Tex 60 Stitch per Inch: 7-8 Needle size: 18 Lapped seam Stitch class 400
Sample no. 13 Sewing thread linear density Tex 105 Stitch per Inch: 13-14 Needle size: 16 Lapped seam Stitch class 400	**Sample no. 15** Sewing thread linear density Tex 105 Stitch per Inch: 10-11 Needle size: 16 Lapped seam Stitch class 400
Sample no. 17 Sewing thread linear density Tex 105 Stitch per Inch: 7-8 Needle size: 16 Lapped seam Stitch class 400	**Sample no. 19** Sewing thread linear density Tex 105 Stitch per Inch: 13-14 Needle size: 18 Lapped seam Stitch class 400
Sample no. 21 Sewing thread linear density Tex 105 Stitch per Inch: 10-11 Needle size: 18 Lapped seam Stitch class 400	**Sample no. 23** Sewing thread linear density Tex 105 Stitch per Inch: 7-8 Needle size: 18 Lapped seam Stitch class 400
Sample no. 25 Sewing thread linear density Tex 60 Stitch per Inch 13-14 Needle size: 16 Superimposed seam Stitch class 500	**Sample no. 27** Sewing thread linear density Tex 60 Stitch per Inch: 10-11 Needle size: 16 Superimposed seam Stitch class 500
Sample no. 29 Sewing thread linear density Tex 60 Stitch per Inch: 7-8 Needle size: 16 Superimposed seam Stitch class 500	**Sample no. 31** Sewing thread linear density Tex 60 Stitch per Inch: 13-14 Needle size: 18 Superimposed seam Stitch class 500
Sample no. 33 Sewing thread linear density Tex 60 Stitch per Inch: 10-11 Needle size: 18 Superimposed seam Stitch class 500	**Sample no. 35** Sewing thread linear density Tex 60 Stitch per Inch: 7-8 Needle size: 18 Superimposed seam Stitch class 500
Sample no. 37 Sewing thread linear density Tex 105 Stitch per Inch: 13-14 Needle size: 16 Superimposed seam Stitch class 500	**Sample no. 39** Sewing thread linear density Tex 105 Stitch per Inch: 10-11 Needle size: 16 Superimposed seam Stitch class 500
Sample no. 41 Sewing thread linear density Tex 105 Stitch per Inch: 7-8 Needle size: 16 Superimposed seam Stitch class 500	**Sample no. 43** Sewing thread linear density Tex 105 Stitch per Inch: 13-14 Needle size: 18 Superimposed seam Stitch class 500

Table 4: Numbering of Samples with specific variables.

Figure 4: Process flow chart of Dyeing with Direct Dyestuff.

Sewing thread linear density Tex	Needle size	Sample No.	Lapped seam strength in Newton(N) before dyeing	Lapped seam strength in Newton(N) after dyeing	Lapped seam strength loss in percentage
		1	218.3	201.9	7.5
	16	3	198.5	188.3	5.1
60		5	173.8	161.1	7.3
		7	222.7	201	9.7
	18	9	204.6	185.4	9.3
		11	176.9	158.9	10.1
		13	225.6	207.3	7.8
	16	15	201.5	187.6	6.8
105		17	187	170.3	8.9
		19	224.8	206.8	8
	18	21	205.6	195.3	5
		23	191.1	171.5	10.2

Table 5: Comparison of Lapped Seam Strength between Dyed and Un-dyed Gabardine Samples.

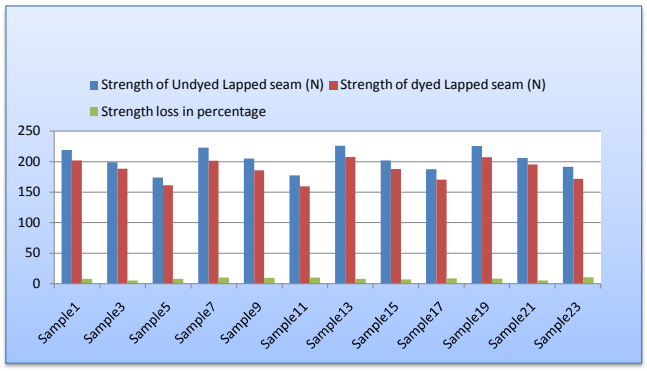

Figure 5: Comparison of Lapped Seam Strength in Newton (N) between un-dyed and dyed samples.

Here the lapped seam strength always less in dyed samples.

As per Figure 5, it is clearly understood that the difference of seam strength or the loss of seam strength between un-dyed and dyed samples.

Superimposed seam: Table 6 shows the loss of superimposed seam strength between un-dyed and dyed samples. In case of gabardine

Sewing thread Linear Density Tex	Needle size	Sample No.	Superimposed seam strength in Newton(N) before dyeing	Superimposed seam strength in Newton(N) after dyeing	Strength loss in percentage
		25	212.3	189.5	10.8
	16	27	196.7	176.2	10.4
60		29	172.8	153.2	11.3
		31	216.9	188.9	12.9
	18	33	195.4	171.5	12.2
		35	171.9	151.4	11.9
		37	222.6	193.5	13
	16	39	200.2	179.8	10.1
105		41	176.9	151.8	14.1
		43	224.5	200.9	10.5
	18	45	197.3	179.3	9.1
		47	169.3	152.8	9.7

Table 6: Comparison of Superimposed Seam Strength between Un-dyed and Dyed Gabardine Samples.

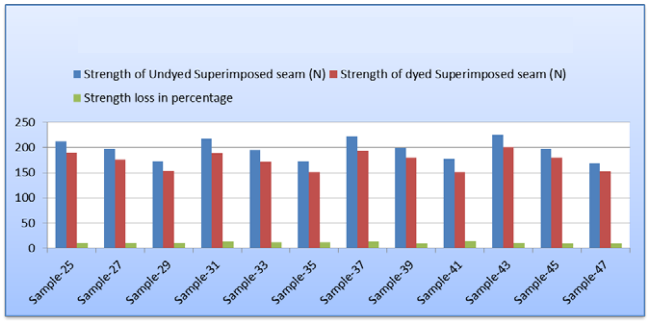

Figure 6: Comparison of Superimposed Seam Strength in Newton (N) between un-dyed and dyed Samples.

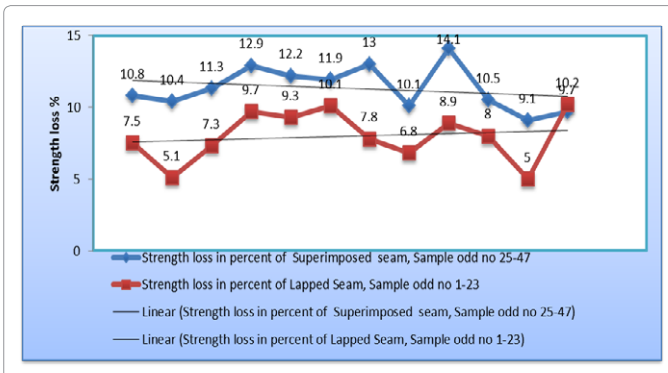

Figure 7: Comparison of Seam strength loss in percent between Lapped and Superimposed Seam.

apparels, the loss of superimposed seam strength is varying from above 9 to 13 percent shown in Table 6. The loss of seam Strength of superimposed seam is higher than lapped seam (Table 6) (Figure 6).

By this bar diagram (Figure 6), the samples of odd number are beginning from 25 to 47. All samples made by superimposed seam. Every sample shows 2 types of numerical values of seam strength measured by seam strength tester in Newton (N). Axis X represents the sample number and axis Y expresses the seam strength. Here it has been found that the superimposed seam strength always less in dyed samples.

As per Figure 6, it has been clearly observed that the difference of seam strength or the loss of seam strength between un-dyed and dyed samples.

By comparing 2 tables (Tables 5 and 6), the loss of seam strength is not equal between lapped seam and superimposed seam. The loss of seam strength of superimposed seam is always higher than the lapped seam which can be representing by line diagram in Figure 7. Both of lapped and superimposed seam shows the fluctuated trend of loss of seam strength after apparel dyeing. Lapped seam shows downward fluctuated trend whereas superimposed seam shows upward increasing trend (Figure 7).

Conclusion

At the end of this research work, we can conclude that, seam strength of dyed apparels is less than that of un-dyed apparels. It is because of undergoing various stages in dyeing process. Different factors of sewing influence the seam strength on dyed apparels individually. The performance of apparels mainly depends on seam and stitch as well as different sewing factors. Here we also found that loss of seam strength for lapped seam is less than that of superimposed seam. So the fashion apparels in which lapped seam is mainly used, are more durable. To cope with the modern fashion era, we have to go through the fashion garments/apparels. And we also need to concentrate on the processes involved in making this fashion garments.

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