A STUDY TO INVESTIGATE THE MOST SUITABLE SEAM-STITCH COMBINATION FOR SIDE SEAM OF SHIRTS IN RELATION TO SEAM STRENGTH AND SEAM DRAPABILITY

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INTRODUCTION

The apparel industry is a fast growing competitive industry. Nowadays many other alternative technologies such as moulding, spot welding, adhesives etc. can be used to construct garments or to join fabric panels. Although, there are new technologies to construct garments or join fabric panels, still the most popular method is the sewing technique. Sewing is assembling the garment pieces together with a thread formed into stitches producing a seam. Seams give a shape to the garment by stitching one or several thickness of materials. Therefore, seams and stitches are important elements of apparel construction (Choudhary & Goel, 2013). Also, it is very important to consider the effect of stitch density on the seam performances of garments (Tarafdar et al., 2007). Due to the poor selection of these construction parameters, many quality related problems can occur during the production as well as during the use of garments (Ali et al., 2016). Physical and performance features of seams directly affect the quality of a garment (Park & Kang, 1999). The selection of the best combination of seam type, stitch type and stitch density for any garment is very important in terms of cost, quality and comfort. The overall performance of seams affects the durability and comfort of the garment (Bhavesh et al, 2018). The selection of a suitable sewing thread is also important for quality seam constructions. As per Anderson, 100% spun Polyester threads are most suitable for the woven fabrics than other threads (Anderson, 2009). When considering the construction of shirts, side seams can be constructed using various seam types such as Superimposed and Lapped seam types , stitch types such as Lock stitches, Chain stitches and Overlock stitches and stitch densities from 12 to 16 stitches per inch (SPI). Those sewing construction parameters should be selected carefully in order to obtain high quality seam constructions. Though research studies have been carried out for seam properties and characteristics by using various materials and parameters, research studies have not been done to determine the suitable seam -stitch combinations for the side seam of shirts. Hence, the main objective of this investigation is to find out the most appropriate seam types, stitch types and stitch densities for side seams of shirts in relation to seam strength and seam drapability, which influence both physical and performance features of seams.

METHODOLOGY

1. A literature survey was done to identify the factors in relation to the research topic to gather information to carry out the project successfully.

2. Appropriate fabric type, sewing thread type along with two (02) ticket numbers, three (03) seam types, four (04) stitch types along with three (03) stitch densities and five (05) suitable seam-stitch combinations were selected for the experiments.

3. The testing standards, machines and equipment for seam strength and seam drapability testing were also selected.

4. A total of 150 samples were prepared as per the testing standards. Out of these 150 samples, 75 samples were prepared for the testing of seam strength. For each seam-stitch combination 15 samples were prepared, 5 samples each for 3 stitch densities. The same

procedure was followed to prepare the other 75 samples for the testing of seam drapability.

5. The samples were tested for seam strength and seam drapability to determine the most appropriate seam-stitch combination for side seam of shirts.

EXPERIMENTAL DESIGN

Part A: Selection of Materials and Construction Parameters

The fabric selected was a commonly used fabric type for shirt construction. Sewing threads and the parameters were selected as per the industrial practices and the findings of the literature review. Due to time limitation, the research study was limited to the material types and construction parameters given in the table 1.

Table 1: Selected materials and construction parameters for the experiments

Selected conditions	For seam strength and seam drapability tests
Fabric	Fibre content: 65% Polyester and 35% Cotton, Fabric structure: Plain weave, Weight: 102 g/m^2, Ends per inch: 117, Picks per inch: 79
Sewing thread	100% Spun Polyester: 75 Ticket Number (Tkt.) for overlock stitches and other bottom stitches, 50 Ticket Number (Tkt.) for other top stitches
Stitch densities	12, 14 & 16 stitches per inch (SPI)
Seam types	Superimposed type a (SSa), Lapped seam type b (LSb) and c (LSc)
Stitch type	Single needle lock stitch (301), Double lock chain stitch (401), Three thread overlock stitch (504) and Five thread overlock stitch (516)
Selected seam-stitch combinations	Specimen set 1: SSa with 504 and 301 Specimen set 2: SSa with 504 and 401 Specimen set 3: SSa with 516 Specimen set 4: LSb with 401 Specimen set 5: LSc with 401 (with twin needle)

Part B: Selection of Standards, Machines and Equipment

The selected testing standards, machines, equipment are given in the table 2.

Table 2: Selected testing standards, machines and equipment

Description	Seam strength test	Seam drapability test
Testing standards	ASTM D1683	ISO 9073-9
Machine and Equipment	Tensile Tester -Tinius Olsen Tester	Drape meter and an electronic balance

Part C: Preparation of the Samples for Testing

All seams in the samples were made in warp direction as the side seams of shirts are also constructed in warp direction. A total of 150 samples were prepared as shown in the table 3.

Table 3: Summary of sample prepared for testing

Test type	Samples for seam -stitch combination	Samples for stitch densities	Total samples
Seam Strength	Five (05) samples each for five (05) seam-stitch combinations	Five (05) samples each for three (03) stitch densities	75
Seam Drapability	Five (05) samples each for five (05) seam-stitch combinations	Five (05) samples each for three (03) stitch densities	75

TESTING OF SAMPLES

Testing the seam strength: The testing was carried as per standard ASTM D1683. Each conditioned fabric sample was clamped to the tensile testing machine and the force was applied until seam failure occurred.

Testing the seam drapability: The testing was carried as per the method B of standard ISO 9073-9. As per the standard, a paper ring was cut and the weight of the paper ring was measured (w_1). Then the fabric sample was placed on the drape meter and allowed to drape into folds around the lower supporting disc. A paper was placed on the top of lid of the drape meter and the draped shadow area of the fabric sample was traced. The marked shadow area was cut and measured (w_2).

DATA COLLECTION AND ANALYSIS

For reference purposes, fabric strength and fabric drapability of five (05) unsewn fabric samples were measured. The average fabric strength value and the fabric drapability of unsewn samples were 469 N and 1.1853 respectively. The individual seam strength and seam drapability values were measured by using the prepared 75 samples for each experiment. These samples were prepared as per the respective standards. By using these values, average values for each specimen set and for each stitch density for both seam strength and seam drapability were determined.

RESULTS AND DISCUSSION

Five (05) specimen sets represent the selected seam-stitch combinations for side seam construction. The figure 1 shows the average values of the seam strength of five (05) specimen sets, which includes three (03) selected stitch densities for the study. It shows that the seam strength has been increased in sets 1 to 4 with the increase of the stitch density. In set 5, with the increase of the stitch density, the seam strength has been reduced. The set 5 shows the highest seam strength, whereas the set 2 shows the lowest seam strength. The highest seam strength was shown by the samples of 12 SPI in the set 5. The lowest seam strength was shown by the samples of 12 SPI in the set 2. The seam strength analysis can be performed to many other different combinations. The discussion of such analysis was hindered by the space limitation.

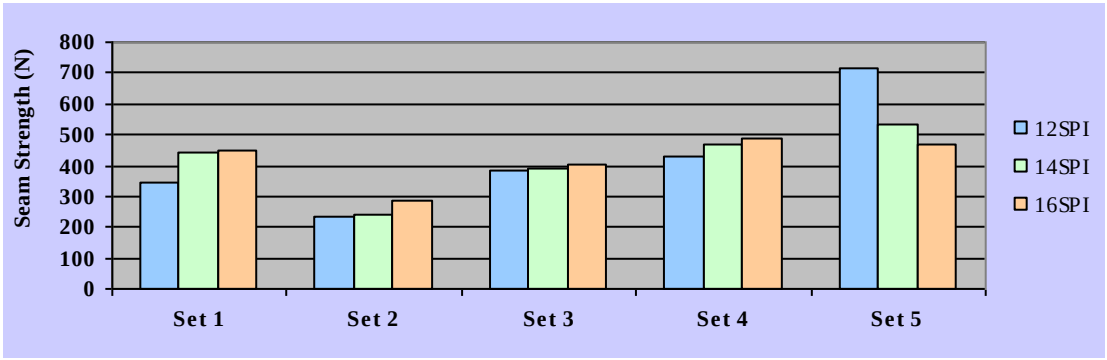

Figure 1: Seam Strength

Figure 2 shows that the seam drapability has been reduced in sets 1 to 5 with the increase of the stitch density. The set 2 shows the highest seam drapability, whereas the set 5 shows the lowest seam drapability. The highest seam drapability was shown by the samples of 12 SPI in the set 2. The lowest seam drapability was shown by the samples of 16 SPI in the set 5. The

seam drapability analysis can be performed to many other different combinations. The discussion of such analysis was hindered by the space limitation.

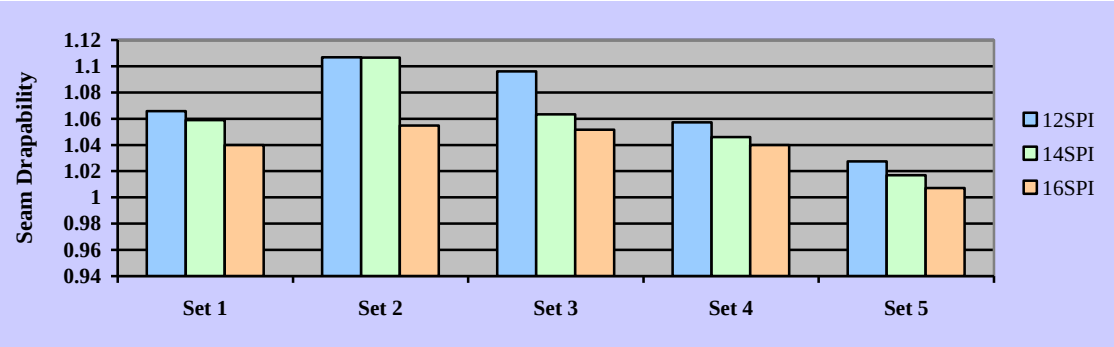

Figure 2: Seam drapability

CONCLUSION

This study was carried out to determine the most appropriate seam-stitch combination for side seams of shirts in relation to seam strength and seam drapability. As a result of this investigation, it was clearly found that the seam strength and seam drapability depend on the selected seam-stitch combinations and stitch densities. It was also found that the fabric strength of unsewn samples was higher except in all the samples in set 5 and 16SPI sample in set 4. In the case of seam drapability, it was found that fabric drapability of the unsewn samples was higher than the samples in all 5 sets. That means the introduction of seams reduce the drapability. The highest seam strength was shown by the samples of set 5, which is the seam -stitch combination with LSc and 401 (with twin needle). The lowest seam strength was shown by the samples of set 2, which is the seam -stitch combination with SSa and 504 with 401. In case of seam drapability, the highest seam drapability was shown by the samples of set 2, which is the seam -stitch combination with SSa and 504 with 401. The lowest seam drapability was shown by the samples of set 5, which is the seam-stitch combination with LSc and 401 (with twin needle). Similarly a large number of relationships can be developed from this study. These findings will be very useful for fashion designers to select appropriate seam-stitch combinations and stitch densities for new designs. Further studies should be carried out to improve the findings of this study with increased number of material types, stitch densities, thread types etc.

REFERENCES

Ali, N., Rehan, A.M., Ahmed, Z., Memon, H., & Hussain, A. (2016) Effect of different types of seam, stitch class and stitch density on seam performance. *Journal of Applied and Emerging Sciences, 5, 32-43.*

Anderson, K. (2009). Selecting the Correct Sewing Thread. Retrieved from https://www.techexchange.com/

Bhavesh, R., Madhuri, K., Sujit, G., Sudhir, M., & Raichurkar, P. (2018). Effect of sewing parameters on sea strength and seam efficiency. *Trends Textiles English Fashion Technology*.

Choudhary, A.K., & Goel, A. (2013). Effect of some fabric and sewing conditions on apparel seam characteristics. Journal of Textiles Volume. Retrieved from http://dx.doi.org/10.1155/2013/157034/

Park,C.K., & Kang, T.J. (1999). Objective Evaluation of seam puckering using artificial

intelligence: Part I: Geometric Modeling of Seam Pucker.

Tarafdar, N., Kannakar, R., & Mondol, M. (2007). The effect of stitch density on seam performance of garments stitched from plain and twill fabrics. *Man-made Textiles in India, 50, 298-302.*