

Evaluation of Sewing Performance of Leather, Denim and PVC Coated Fabric Based on Seam Puckering, Seam Strength and Seam Efficiency

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ABSTRACT

Sewing performance is an important factor in determining quality, security, appearance & durability of a garment. It is related with seam strength, tensile strength of leather or fabric, seam slippage, seam efficiency, stitch density, seam puckering, elongation & elasticity etc. In this work, three types of materials such as leather, denim and PVC coated fabric were selected to construct stitch and turn seams and then their seam strength, seam puckering and seam efficiency were determined following ASTM D 1683 methodology to judge the sewing performance of the three (leather, denim, PVC coated fabric) materials. Here, cutting point needle LR90, three stitches per cm and thread 60/3 were strictly maintained in all seam constructions. The objective of this study is to show comparison of sewing performance among leather, denim and PVC coated fabrics. The seam efficiency for leather, denim and PVC coated fabric were observed as 93.34%, 78.08% and 33.79% respectively. The thickness strain which indicates seam puckering value for leather was 2.22, the seam puckering indicated satisfactory value for leather. Hence, these data indicate the leather has the best sewing performance among the three. Again, breaking load of leather is higher than denim & PVC coated fabrics. So, it is clearly evaluated that leather has the supreme sewing performance which make its first selectivity to use as garments material.

Keywords: Leather, denim, PVC coated fabric, seam efficiency, thickness strain

1. Introduction

Seam refers to the successful joining of two materials by the application of adhesive, stitching, reinforcement tape or any other joining materials. Different types of seam constructions are used in making a garment. Some portion of the garment faces strong forces. That portion of the garment should have sufficient strength to withstand and avoid seam failure.

Seam failure is nothing but the failure of sewing thread or fabric breakage, leaving the seam intact. Strength of thread, stitches/inch, thread tension, type of seam, and seam efficiency of the material affect the strength of a seam or stitch. The material which possesses higher seam efficiency will impart stronger seam than the material with lower seam efficiency.

It is well defined that seam strength increases with the application of stronger sewing thread. Seam strength also increases with the increment of the number stitch/inch up to a certain limit and after that it falls down gradually. Seam and stitching elasticity largely dependent on the elasticity of thread and stitch type. Stitching elasticity should be a little bit higher than that of the material that are used in seam because it helps the material to hold the share forces that is experienced at the end use of the apparel. The elasticity of a seam or stitching depended on the stitch types and thread elasticity [1]. In general, the seam quality mainly interrelated with the strength & appearance of a seam itself. Seam strength, appearance and their durability are

the main criteria for determining the functional and aesthetic performance of any apparel. Generally, seam of best quality possesses moderate flexibility and strength having no defects of the seam such as skipped stitch or puckered seam [2]. As the sewing performance test of different types of materials is a main issue to manufacture quality products, we have found out the best stitch type along with best seam construction for the most stretching zone by evaluating the sewing performance of Leather, Denim & PVC Coated Fabrics. It has also been determined the optimum seam strength of stitch type e.g. lock (301) by using different types of material & a clear guideline has been provided for the selection of seam type for different stretching zone and these guideline act as a standard for the apparel manufacturer. In this paper, three types of material are taken and seam is prepared with those materials by maintaining same stitch/cm, thread, needle and same machine. Therefore, a standard seam is produced for each case and standard test method is followed strictly.

The objective of this paper is to show a comparison of sewing performance among leather, denim and PVC coated fabric and from this comparison, a clear decision can be taken about which material is suitable for making particular garments for particular use. Overall, a standard is shown for the apparel manufacturer.

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2. Materials and method

2.1 Materials

Leather, denim, PVC coated fabric, thread, needle were collected from market for this study. The specifications of the materials are shown in table 1.

Table 1 Material specification

	Material	Color	Thickness mm	Texture	Tanning	Yarn count		Number
						Warp	weft	
1	leather	Black	1.2	Soft & smooth	Chrome	-	-	-
2	Denim	Light blue	1.0	Soft & rough	-	19	27	-
3	PVC coated fabric	Deep blue	0.54	Hard & smooth	-	-	-	-
4	Thread	white	-	Soft & smooth	-	-	-	60/3
5	Needle LR 90	-	-	-	-	-	-	14

2.2 Methodology

The methodology ASTM D 1683 has been followed to determine tensile load. Triplet test was done for each sample. The applied load on the test specimen was perpendicular to the direction of seam line.

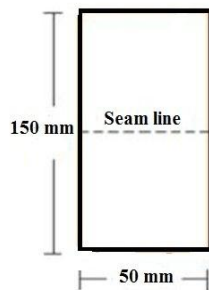


Fig1. Specimen dimension

Jaw speed was 50 mm/min and it was gradually increased up to the breaking point of the specimen.

A rectangular test specimen was (150 x 50) mm dimension was prepared for each test which is shown in fig.1, and each sample was clamped in between the jaws. Therefore, in each time load at rupture, percentage of elongation was noted. Seam strength, % of elongation, seam efficiency, thickness strain were also determined in accordance with the following equations- (1), (2) and (3).

$$S_E = \frac{S_T}{M_T} \times 100 \quad (1)$$

$$T_s = \frac{t_s - 2t_L}{2t_L} \times 100 \quad (2)$$

$$E_s = \frac{E_L}{O_L} \times 100 \quad (3)$$

Where, S_E , S_T , M_T , T_s , t_s , t_L , E_s , E_L and O_L indicate seam efficiency, seam tensile strength, material tensile strength, thickness strain (seam puckering), seam thickness, material thickness, seam elongation, extended length and original length respectively.

3. Results and discussion

The seam efficiency (%), thickness strain (seam puckering) (%), seam strength (N/mm), percentage of elongation, breaking load (N) of the stitch and turn constructed leather seam are shown in Table 2 and 3. In fig. 2 & 3, seam efficiency (%), seam puckering (%), strength (N/mm²), Load (N), elongation (%) are represented respectively. In fig. 2 it is shown that leather has the highest seam efficiency 98.34% and lowest seam puckering 2.12%, these value indicate high sewing performance of leather. PVC coated fabric has the seam efficiency 98.34% but poor seam puckering. Denim has the seam efficiency 78.08% and medium seam puckering.

Leather has the highest load (94.7 N) and seam strength (2.37 N/mm) which are shown in fig.3, on the other hand denim and PVC coated fabric have load 85.6 N, 37.7 N and seam strength 2.21 and 1.71 respectively.

Higher value of seam efficiency and lower value of seam puckering indicate worth sewing performance. So, it is obvious that leather has the best sewing performance among leather, denim and fabric.

Table 2 Seam analysis using stitch type 301

Category	Types of materials					
	Leather		Denim		PVC coated fabric	
	Load (N)	Elongation (%)	Load (N)	Elongation (%)	Load (N)	Elongation (%)
Mean	94.7	19.3	85.6	21	37.7	14.7
SD	2.83	2.08	2.47	1.73	2.83	1.15
CV%	2.98	10.8	2.88	8.2	7.5	7.8

Table 3 Sewing performance for stitch type 301

Materials		Sew-ability parameters					
		Seam efficiency (%)		Seam strength (N/mm ²)		Seam puckering (%)	
		Mean	SD	Mean	SD	Mean	SD
1	Leather	98.34	1.92	2.37	0.83	2.12	0.2
2	Denim	78.08	2.37	2.21	0.47	2.55	0.2
3	PVC coated fabric	98.34	2.65	1.71	0.43	15.4	0.4

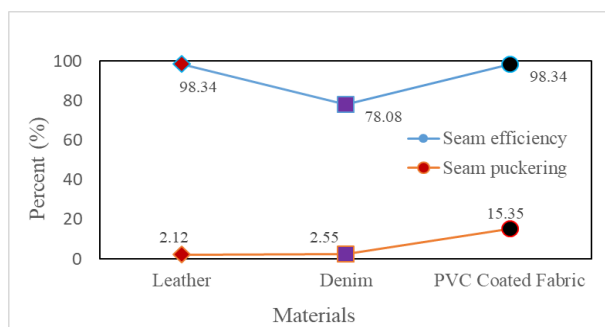


Fig. 2 Percentage of Seam efficiency and seam puckering

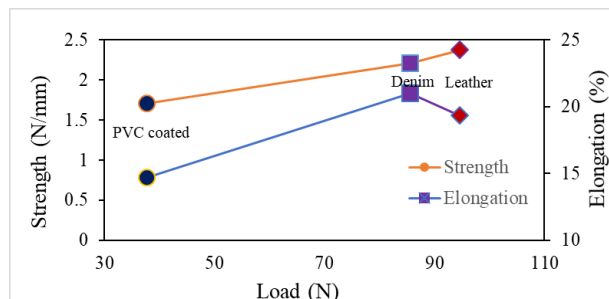


Fig 3. Strength, load and elongation profile of different seams

Leather has the lowest seam puckering (2.12%) among the three, this indicates leather has less tendency of skip stitch and seam slippage, these properties ultimately indicates that leather has superior sewing performance.

4. Conclusion

From this study, it is clear that leather has the best sewing performance among leather, denim and PVC coated fabric based on 301 type of stitch. Leather has showed the highest seam efficiency and lowest seam puckering than other two materials and therefore, this stand for the superiority of leather regarding sewing performance. As sewing performance is an important issue in making garments, this study will definitely guide the apparel manufacturer.

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