



# **Impact of Fabric Sew Ability Properties on Seam Performance: A Review**

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## **Abstract**

The sewing ability of the fabric is the prime characteristic of fabric, which allows a fabric to be sewn at the maximum extent of high-speed industrial sewing machine and will not cause any mechanical deterioration of the fabric. This vital property must be checked before the fabric is going to be seamed because it provides the required quality and performance of an apparel. Which also reduces many major or minor defects of the end product or garment by improving seam appearance and performance. Various factors can affect fabric sewability and different assessments can be done to check the sewability performance of the fabric. A comprehensive literature survey has been done in this regard and discussed in the article.

**Keywords:** Sew ability, Apparel, Fabrics, Seam.

## **1. Introduction**

Apparel industries typically manufacture 3D products from 2D fabrics and the garment manufacturing process has some basic steps that have been completed to make a finished product. However, sewing (seam, stitch) is the commonest method of converting fabrics to garments, is used around the world [1-2]. The type of seams and stitches directly affects the comfort, quality, and fit of a garment. The outlook and performance of the seam depend on types of stitch and seam, the density of stitch, settings of the sewing machine, and thread quality. The suitability of the clothing depends on the strength of the seam, its tenacity, and efficiency. On the other hand, the performance of seams of any garment dependent upon mechanical properties and \ Structure of the fabric, durability, longevity, reliability, extensibility, appearance, and the effectiveness of seam. [3]

The quality of the garment also depends on fabric sewability. Sewing ability is normally

defined as the ability and facility of being able to effectively sew fabric components without damaging the fabric and providing the end-use with a desired given quality and performance. [4,5]. The production of the garment from high-quality fabrics not only provides comfort to the wearer but also contributes to the smooth running of the production process and results in near-perfect garments [6]. Furthermore, the sewing performance of clothing also depends on the cover factor of the fabric, the weight of the fabric, the heaviness, tensile strength, shrinkage percentage of the fabric, elasticity, bending stiffness, flexural rigidity, and shear stiffness. [7]

Besides these, the grade and performance of sewn items depend on so many factors. These are the strength of seam, seam slippage, seam puckering, outlook, and thread breaks. The combination of all these factors contributes to the sewing ability of the fabric,

which is thought to be one of the most important facets of apparel science [5].

In this review article factors that can affect fabric sewability performance, as well as seam appearance and performance are discussed along with the assessment method of fabric sewing ability by reviewing a comprehensive literature survey on this field.

## 2. Discussion

### 2.1. Factors that affect fabric sewability

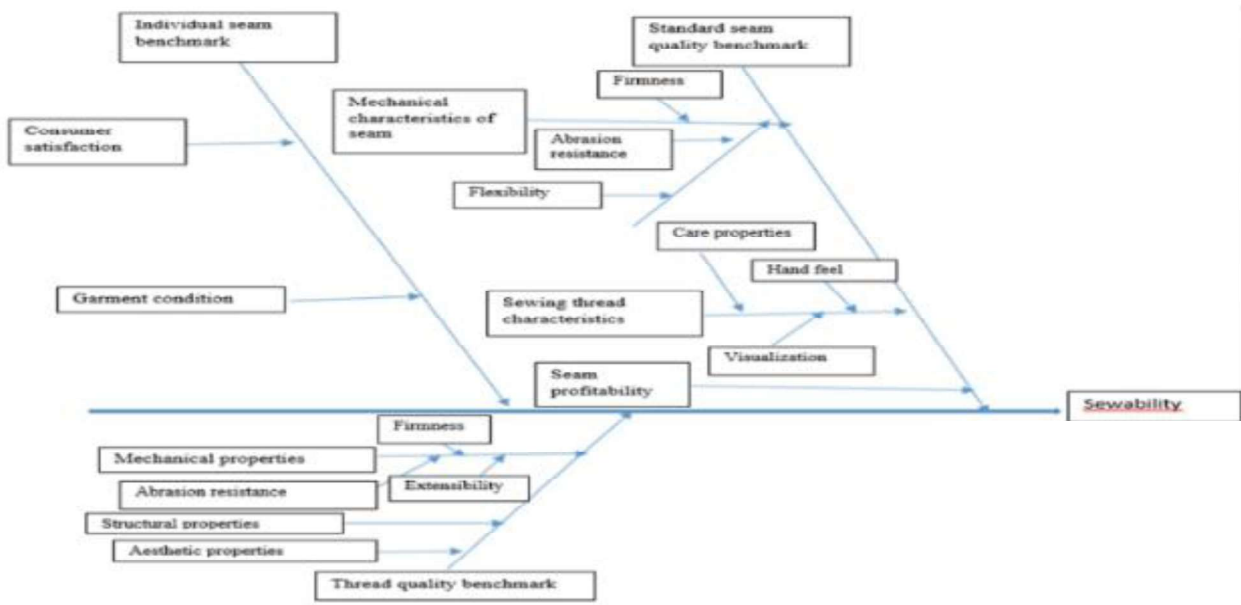
#### 2.1.1. Sewing thread quality

The sewing thread plays a vital role in the success of the sewing operation; an incorrect thread can affect the quality of the garment and the sewing machine [8]. Sewability depends upon the quality of sewing thread. Which is also related to the seam quality. RODICA HARPA, 2011 created a cause-effect diagram (fig 1) that shows the mechanical characteristics as the quality standard of the sewing thread and the standard of the seam quality, among many important characteristics that can ensure sufficient sewing ability. [9]

efficiency decreases as the thread density increases. Lighter weight denim fabric should be sewn with fine polyester thread or cotton sewing thread of courser count. Coarser denim should be sewn with either coarser core-spun sewing thread or coarser 100% polyester sewing thread for achieving adequate seam efficiency. 100% Cotton thread is not preferable for heavy denim fabric [5].

#### 2.1.2. Dyes selection

The Selection of dyes is important because it also affects seam performance as well as sewing ability. Nurunnabi et al, 2017 [10] compare the endurance of seam before and after dyeing with four alternative dyes (direct, reactive, vat dyes & pigment colors) applied on 100% cotton woven plain structure fabric and later on sewn by white-colored polyester core spun sewing thread (40/2 Tex). After that Vigorous testing procedures were followed according to the ASTM method; D1683-04 and D5034,



**Figure 1.** The cause-effect diagram displaying different sew ability factors [9]

For lightweight denim fabrics, the sewing efficiency increases as the thread linear density decreases; for heavy denim fabric, the sewing

Found that breaking load of undyed garment panels showed higher strength than dyed garments without opening of the seam.



That means dyestuffs can also influence seam performance.

### **2.1.3. Fabric structure/ fabric selection**

Fabric sewability also varies with fabric structure and treatment. F. Fathy Saied et al, 2011 investigates the effect of fabrication and treatment on the sewing ability. A total of twelve samples of 100% cotton/blend fabric (75% cotton 25% polyester) were used, with two different fabric structures (plain and twill). Successive chemical treatment and dyeing were done later. Sewing ability based on NPF (Needle Penetration Force) measured to assess the sewability performance. NPF reduced for twill weave than plain might be due to dense structure. [11]

In the process of sewing woven fabrics, good sewing means that the warp and weft yarns are separated by the needles that go through the fabric without damaging it. When the density of the warp and weft is high, the yarn will be broken or separated by the needle due to the pressure of the adjacent yarns. [12]

For producing high-quality denim garments it is essential to know the relationship between the different weight denim fabric sewability and seam quality, which is similarly important for process manufacturing. The more you increased seam puckering the less sewability for denim you found. However, there is a positive correlation between the sewing ability of denim and sewing efficiency. [13]

Deniz Mutlu Ala et al, 2019 published an experimental study on the sewability (based on NPF) of a  $1 \times 1$  knitted rib fabric, which is a combination of separated yarn ends and variations of stitch densities. After the bleaching and relaxation process sewability is examined based on NPF. Observed that higher the needle gauge, higher the NPF in wale and course directions. Fabrics which are knitted with the parallel gauges and individual ends of yarns, NPF of fabric increases with stitch

densities of fabric. By improving the combination number of individual yarn ends without altering the course density, fabrics also displayed higher NPF. [14]

### **2.1.4. Interlining & linings**

Interlining plays an important role to construct the shape in detail areas, such as the front part of the coat or the blazer, collar, cuffs, lapels, and pocket flaps. In addition, they can stabilize and reinforce areas that are subject to additional stress due to use, such as necklines, linings, patch pockets, waistbands, buttonholes, and plackets. Interlinings can also affect the sewability of properties of fabrics. Esra Zeynep YILDIZ et al, 2010 Published a research paper where 3 woven fabrics are fused with 4 woven interlinings of the same constructions but different weights are fused together and examined their sewability properties with L&M sewability tester in terms of NPF (needle penetration force) and the result found that the perforation force of the sewing needle increases proportionally with the sample weight and thickness. Higher NPF indicates the fabric has higher resistance and vice versa. Due to the higher resistance, the fabric will be defacement during the sewing process. Therefore, it can be said that the weight and thickness of the fabric have a serious influence on NPF. [15]

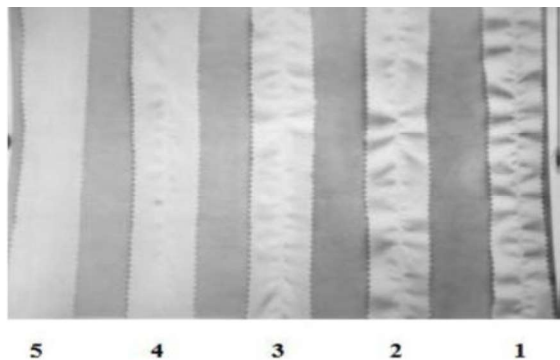
Lining provides comfort to the wearer and preserves the shapes of a garment, and gives the garment a clean look. So, it's also necessary to measure the sewability of lining fabrics. Oktay PAMUK et al, 2011 observes 6 different types of lining fabric and it has been found that the count and density of yarns have a straight effect on the sewing ability properties of the liner fabrics. It has also been noticed that the perforation force of the sewing needle into the lining fabric is affected by the density and yarn count of the fabric in both directions. In addition, statistical research shows that there is a high correlation between

stitch density and fabric weight, and the NPF of the fabric. [16].

### 2.1.5. Softener finishes

Damage to the seam during the sewing process is one of the most troublesome problems in the garment industry. For knit fabric, this problem is serious because they are easily damaged during sewing, wearing washing [17].

This is due to the fabric's resistance to needle strikes during sewing. This resistance arrives from the spaces (between the fibers or threads) in the fabric. The softener/finishing treatment straightly affects these gaps, thus affecting the sewing ability and the sewing conditions of the fabric. Alime Asli İlleez et al, 2015 conducted a research on the influence of parameters like fabric structure, types of softener, and chemical concentration on the sewing ability and seam aggregation of knitted cotton garments. 5 different softeners of 2 variable concentrations are applied to the pretreated 100% cotton single jersey, fleece, and interlock fabric. Results found softener treatment improves fabric sewability properties by concurring lower NPF force. Also significantly improves seam puckering (fig-2) [18].



**Figure 2.** The photographic comparison of single needle stitched seams [18].

## 2.2. Sew ability Tester

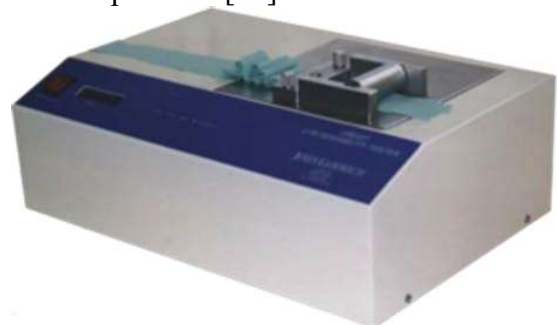
There are two Sewability tester manufacturers worldwide. They are L&M Sewability tester (UK) and Daiei Kagaku Seiki

(Japan) [19]. Among them L&M sewing ability tester is popularly employed which is discussed below.

The L&M Sewing ability Tester has been developed to provide a standard repeatable test for sewability. That means a test that will give information to the dressmaker on whether the fabric provided can be sewn without any difficulty. Information provided by the machine is not affected by changes in sewing conditions or operator skills.

This machine is very helpful for fabric suppliers to ensure that the fabric finish meets the standards. It is also useful for garment manufacturers to ensure that the fabric has satisfactory sewing performance. [20]

It allows continuous measurement of fabric penetration force with a selected needle on a small-scale fabric sample at a rate of 100 penetrations per min. [21]



**Figure 3.** L&M sewing ability tester (the image collected from,

<https://www.crossco.com/products/tft/fabric-garment-testing/lm-sewability-tester/>)

The ease with which the sewing needle penetrates the fabric depends on the friction characteristics of the fabric. In fabrics with low friction characteristics, the fibers and yarns of the fabric can be easily moved to allow the needles to pass through, so the penetration force is low and no damage occurs. In fabrics with high friction characteristics, the fabric components are not easy to move, so the needle piercing force is high. This value may exceed the breaking strength of the thread, so damage may occur or the high friction





encountered by the needle will generate heat, causing the fabric to melt during high-speed sewing. [21]

This device measures the force through the needle into the fabric. The strip of fabric passes the area where the sewing needle penetrates. The fabric samples are 30-40mm in width and at least 100 perforations should be made. Therefore, the extent of the sample is approximately 350mm. [12]

The minimal value (threshold) of the perforation force is set based on the mass/unit area of the fabric. Depending on the fabric type, how many times this value is exceeded is also recorded. The sewability of the fabric correlates to the number of stitches that exceed the formerly specified threshold, relative to the total number of points and declared as a percentage. The sewing operation becomes more difficult as the sewing parameter increases. [15]

When the value is 0% then the sewability of the particular fabric is excellent if the value is 0-10%, the sewability of fabric is granted good, if the value is in between 10-20% is considered to be quite good although no major difficulty arises in the sewing process but if the figure rises to 20% or above then it will be more difficult to sew the fabric even in some cases will be impossible to sew the fabric. [22]

### **3. Recommendations**

Sewability properties of the fabric are a major and vital property for any fabric (knit/woven) so, more research can be carried out keeping variables of different properties of fabrics, yarns, sewing thread, sewing needles, sewing techniques, use of elastane, and so on.

More study should be done on improving the sewability property of fabrics by applying any chemical finishes i.e. doing pretreatment on gray fabric or applying softeners or other chemicals. Here cost analysis should also take into consideration.

### **4. Conclusion**

The performance and quality of sewn garments depend on many factors, such as the strength of seam, seam slippage, wrinkles, appearance, and thread decay [5]. Again all these factors together determine the fabric sewability. So, undoubtedly it can be said that seam appearance as well as seam performance, and Fabric sewability properties, are correlated. To get a better quality end product all the factors which affect fabric sewability and seam performance should be well synchronized. And there is no possible solution except research in this regard. From that point of view, this review article is written. A comprehensive literature study has been done upon writing on this topic. I believe this will help young researchers to create interest and investigate more about this prime fabric property.

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