



*Research Article*

# Development of Denim Products in Seamless Form

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## Abstract

It is aimed to develop innovative techniques as an alternative to sewing in denim fabrics, to design seamless garments by applying these techniques and to adapt them to mass production. Seamless products, finishing costs applied to sewing threads and elimination of seam deformations (lycra slips, punctures, warp cuts, etc.); It offers many advantages both at the production stage and for the end users, such as labor costs, the number of machines in the production scheme, energy costs, reduction of yarn and fabric stocks. In addition, by using this method, features such as increasing the aesthetic value, comfort and body movement freedom of the clothes, and adding softness to the clothes can be provided. Within the scope of this study, recipes were prepared with different adhesives and chemicals and seamless denim products were developed by using hot press, ironing, teflon press, ultrasonic sewing and hot air bonding techniques. Strength values at seam points were compared with conventional seam strengths. In addition, bending stiffness, staining and thermal resistance tests were applied. The bonding recipe and process that offers the highest seam strength and heat resistance performance and does not stain was obtained. Denim products produced in accordance with the obtained recipe and recommended process are in daily use and maintenance conditions (1 cycle: 5 days of wearing in a week, 1 time washing using commercial detergent and fabric softener and laying dry) It has been tried on 25 users for 6 months (26 cycles) and it has been seen that there is no performance loss compared to the unused denim product.



**Keywords:** Seamless denim, ultrasonic sewing, hot air bonding, hot press bonding

## 1. Introduction

Clothing has been one of the basic needs of individuals to be protected from the cold, to cover and to be decorated since the earliest times of history. The first examples of the use of garments without seams started with the use of the skin and fur of animals as a garment to cover the whole body in hunter-gatherer societies. Mankind, who obtained the skins of smaller animals over time, resorted to sewing with animal intestines to bring them together and give a form of clothing (Held, 1999).

The sewing that creates clothes is a process known before the invention of writing. According to the remains of Egyptian civilization, it has been determined that people could weave fabrics before sewing, but because they did not know the sewing process, they tied them together and turned them into clothes. In other research, it has been seen that the primitive tribes, who did not invent weaving yet, combined animal hides with sewing (Esen, 2016, s.1).

Provided comprehensive reviews of techniques, which include knitting, weaving, braiding, basketry, crochet, and moulding, which have the potential to develop seamless fashion products (Ng, 1999)

Various reports reflecting consumers' preferences for purchasing apparel products suggest that comfort is one of the most important attributes for consumers, especially when purchasing garments next to the skin or in hot climates (Layton,2001).

The basic pattern preparation in the denim collection stage, which will be created seamlessly, is different from the preparation of a pattern obtained with conventional sewing. In this study, it is aimed to develop innovative techniques as an alternative to seamless form sewing, to design seamless denim garments by applying these techniques and to adapt them to mass production. The most basic output of the study is to reveal the product without the need for sewing; product will be obtained with less yarn, labor and machine usage.

## 2. Materials and Methods



Within the scope of this study, various recipes were prepared using different adhesives and chemicals. Adhesive recipe and process for seamless denim products were developed by using hot press, ironing, Teflon press and hot air bonding techniques.

The most preferred fabric mixture in the denim sector was used in the studies and the content details are shown in Table 1. All of the chemicals used are compatible with the product and do not harm the durability of the product. Seamless denim product trial results were checked with visual and physical tests.

Table 1: Trial Data

Variables	Levels
Fabric composition	96% cotton - 3% polyester - 1% elastane
Chemical	A, B

### 3. Results

Trial studies were carried out with the different adhesives and chemicals supplied; The values with the best results are shared in Table 2 in comparison with the stitched products. The thickness, air permeability, water vapor permeability, capillary wetting, drying speed, strength and seam opening values of the products were tested (Table 2).

Table 2: Physical Test Results of Raw Stitched and Seamless Denim Products

	Thickness (mm)	Air Permeability (mm/s)	water vapor perm.(g/m <sup>2</sup> /day)	Capillary Wetting (mm/s)				Drying speed (g/m <sup>2</sup> /h)	Fabric Breaking Strength (N)		Fabric Tear Strength (N)		Seam Opening (mm)	
				Vertical		Horizontal (mm <sup>2</sup> /s)	Warp		Weft	Warp	Weft			
				Warp	Weft									
				Short	Long	Short	Long							
<b>Stitched Denim Product</b>	2,45	156,13	942,29	0,06	0,03	0,02	0,01	3,14	65,15	1750	486	Torn in the weft direction	28,8	4



<b>Seamless Denim Product</b>	1,18	82,49	867,99	0,22	0,05	0,17	0,05	9,82	64,52	1580	437	Torn in the weft direction	25,3	didn't open

When the test results in Table 2 are evaluated; It has been observed that the seam thickness can be reduced by half with the application of the seamless method. It was found that the seamless denim product reduces the air permeability by half compared to the stitched product, but does not have a negative effect on the water vapor permeability; It was observed that while it increased the capillary wetting approximately three times in the horizontal, it did not cause a change in the drying rate. After the application, there was no negative effect on the strength of the products, and it was determined that the seam opening strength of the seamless product was better than the stitched product.

It is predicted that the physical performances of the products proposed within the scope of the study are at a level that will meet the expectations from this product range and can be used in mass production. A bonding recipe and process that offers high seam strength and heat resistance performance and does not stain was obtained. Denim products produced in accordance with the recipe obtained and the recommended process have been tried on 25 users for 6 months (26 cycles) in daily use and maintenance conditions (1 cycle: 5 days of wearing, 1 time of washing using commercial detergent and fabric softener and drying by laying). It has been observed that there is no performance loss compared to the denim product. The thickness, air permeability, water vapor permeability, capillary wetting, drying speed, strength and seam opening test results for the seamless denim product and the washed denim product are given in Table 3.

Table 3: Physical Test Results of Raw and Washed Seamless Denim Products

	Thickness (mm)	Air Permeability (mm/s)	water vapor perm. (g/m <sup>2</sup> /day)	Capillary Wetting (mm/s)		Drying speed (g/m <sup>2</sup> /h)	Fabric Breaking Strength (N)		Fabric Tear Strength (N)		Seam Opening (mm)
				Vertical	Horizontal (mm <sup>2</sup> /s)		W	W	W	W	



				Short	Long	Short	Long							
<b>Raw Seamless Denim Product</b>	1,18	82,49	867,99	0,22	0,05	0,17	0,05	9,82	64,52	1580	437	-	25,3	didn't open
<b>Washed Seamless Denim Product</b>	1,49	67,69	964,55	0,33	0,07	0,2	0,06	8,84	84,95	1350	426	44,2	22,5	didn't open

Some thickening and a decrease in air permeability were observed after washing; this is to be expected due to fabric shrinkage during the washing process. No change was observed in the strength values, and it was observed that the seam opening values remained constant. An example of a seamless denim product is given in Figure 1.



*Figure 1: Seamless Denim Product*

#### **4. Conclusion**

The production of a seamless garment made of denim fabric is a time-consuming and skilled process. Various researches can be done to develop methods to shorten this period. In the denim sector, which is open to innovation, different experimental techniques can be applied on the products. By changing parameters such as temperature, time, pressure, frequency, samples will be prepared and tested using different machines, adhesives and chemicals.

#### **5. Acknowledge**

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