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THE EFFECT OF WASHING CYCLES ON THE SEWING PROPERTIES OF SHIRTING COTTON FABRICS

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ABSTRACT

In this study, 100% cotton poplin shirting fabric was procured and the sewing quality in different washing cycles was evaluated. For the seam strength and tensile strength tests, 5, 10 and 15 washing cycles were performed on the samples prepared both in the weft and warp directions, in accordance with the standard, using a laboratory type washing machine. At the same time, the seam efficiency values from the obtained data were calculated using the formula. The results showed that the highest tensile strength and seam strength values in both fabric directions were in the unwashed samples. It was observed that these values tended to decrease with the increase of washing cycles.

INTRODUCTION

Sewing quality is one of the important parameters that directly affect the overall quality of a garment. Washing cycle, which is a natural part of the usage cycle of a textile product, is one of the important parameters that affects the mechanical and performance properties of the fabric. There are many studies in the literature examining the effect of washing cycles on the garment. The effects of different washing types on fabric tensile and seam strength (Zerent et al., 2018), the effect of fabric softener usage on seam quality (Kozeniauskiene et al., 2013), and the effects of washing cycles on the properties of elastane-containing denim fabrics (Çeven et al., 2017) were investigated. Shawky (2022) examined the seam puckering, seam strength and seam elasticity after 10 washing cycles of two different 100% cotton fabrics and revealed that the fabric type and stitch density had a negative effect on the pre- and post-wash seam strength.

METHODS

In the study, 100% cotton poplin fabric, which is frequently preferred in shirting fabrics, was examined. The fabric was procured from the market. The fabric construction was 1/1 plain weave, the mass per unit area was 130 g/m², fabric thickness was 0,21 mm, and the fabric density was 90 threads/cm in weft and 110 threads/cm in warp. For the preparation of sewn samples, a Juki DDL-9000B lockstitch machine, a 90 Nm sewing needle and a polyester corespun sewing thread were used, while other parameters were kept constant.

The washing process was carried out using a James Hill Wascator FOM71MP washing machine with 5, 10 and 15 repetitions of washing. For washing operations were performed according to the "TS EN ISO 6330:2022" standard and the 4N program was preferred, which simulates daily use in this standard. Ten-



sile strength tests were carried out on the Zwick Z010 (Roell) testing equipment in accordance with the “TS EN ISO 13934-1:2013” standard. Seam strength tests were also carried out in this equipment in accordance with the “EN ISO 13935-1:2014” standard both in the weft and warp directions with 5 repetitions. Moreover, for calculating the seam efficiency, equation 1 was used.

$$\text{Seam Efficiency (\%)} = \left(\frac{\text{Seam Strength (N)}}{\text{Tensile Strength (N)}} \right) \times 100 \quad \text{Seam Efficiency (\%)} = \left(\frac{\text{Seam Strength (N)}}{\text{Tensile Strength (N)}} \right) \times 100 \quad (1)$$

RESULTS AND CONCLUSIONS

The results of the seam strength, tensile strength and seam efficiency examined in the study are given in Table 1.

Table 1 Results of seam strength, breaking strength and sewing efficiency

		Test direction	Unwashed	5 repeats	10 repeats	15 repeats
Seam strength (N)	Weft		272.71	260.27	239.1	235.61
	Warp		257.48	249.98	245.23	244.33
Tensile strength (N)	Weft		464.96	460.78	411.53	408.71
	Warp		677.41	671.53	662.06	638.15
Seam efficiency (%)	Weft		59.17	57.2	59.91	58.45
	Warp		38.23	37.25	37.05	38.32

According to the results of the one-way ANOVA test performed to examine the effect of washing repetitions on tensile strength, it was determined that there were statistically significant differences in both weft and warp directions ($F_{\text{weft}} = 8.90 - p_{\text{weft}} = 0.01$, $F_{\text{warp}} = 6.45 - p_{\text{warp}} = 0.02$). It was determined that the unwashed samples had the highest tensile strength in both directions. The tensile strength values tend to decrease with the increase of washing repetitions. When the effects of washing repetitions on the stitch strength were examined, it was determined that repeated washing in both weft and warp directions had an effect according to the results of one-way ANOVA ($F_{\text{weft}} = 17.56 - p_{\text{weft}} = 0.00$ and $F_{\text{warp}} = 12.61 - p_{\text{warp}} = 0.00$). According to the results of the stitch strength in the weft and warp directions, the highest strength was observed in the unwashed samples. With increasing washing repetitions, the dimensional differences in the fabric structure are balanced, and the decrease in seam strength remained stable between 10 and 15 repetitions. When the effect of repeated washing on the sewing efficiency was examined, no statistically significant result was obtained according to the results of the one-way ANOVA test ($F_{\text{weft}} = 0.58 - p_{\text{weft}} = 0.98$ and in the warp direction $F_{\text{warp}} = 0.13 - p_{\text{warp}} = 0.94$). Sewing efficiency is a criterion that changes depending on seam strength and fabric strength, and since the effect of washing is effective on both parameters, it has been determined that the seam efficiency remains stable in multiple washing processes.

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