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ВЪЗДЕЙСТВИЕ НА КОЕФИЦИЕНТА НА ТРИЕНЕ ВЪРХУ КАЧЕСТВОТО НА ШЕВА НА ОБЛЕКЛА ОТ ДЕНИМ

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Резюме:

Някой денимни облекла се изработват преди апретурата. Поради тази причиниа са изследвани коефициентите на трине на тъкани преди и след апретура със сплитка кепър 3/1.

Очаквано, статичният коефициент на триене е по-висок от коефициенат на триене при плъзгане. Динамичните коефициенти на триене се влияят по-силно от посоката на триене, отколкото статичните. Най-високите коефициенти на триене се измерват по посока на относителното триене основа - нишки на основата. Този факт е резултат от структурните особености на тъканта, а именно от кепровата тъкан, която се характеризира с диагонални ефекти.

Също така няма значителни разлики в коефициентите на триене на трите плата, което е нормално, като се вземат предвид малките разлики в характеристиките на плата.

С увеличаването на налягането, нараствт стойностите на коефициентите на триене, което е резултат от по-голямата реална контактна площ, върху която се получава триенето.

Този факт ясно показва, че чрез увеличаване на налягането на притискащото краче на шевната машина, адхезията между тъканните слоеве по време на шиене може значително да се подобри.

Получени са стойности на коефициенти на триене по-високи от 1. Коефициент на триене 1 означава, че силата на триене е равна на нормалната сила; когато коефициентът на триене е повече от 1, това просто означава, че силата на триене е по-голяма от нормалната сила. За относително меки материали с неравномерни повърхности на триене, като текстил, процесът не може да бъде описан като чисто триене. Поради силите на сцепление и сцепление възниква сцепление, което увеличава силата на триене.

IMPACT OF THE COEFFICIENT OF FRICTION ON THE SEAM QUALITY OF DENIM JEANS

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Abstract:

The so called "blue jeans" were invented in the far 1873 and remain modern nowadays. Their quality is determined by the properties of the fabric and that of the seams. The quality of the seam depends on many factors, one of which is the coefficient of friction between the fabrics that influences the slippage of the layers each to other during the sewing process. The value of the friction coefficient depends on the material used, the linear density and the twist of the warp and weft threads, the weave, the density of the threads, and the finishing treatment. In order to increase the friction forces between the fabric layers, a pressure by means of a presser foot is exerted on them.

The study is carried out for denim fabrics made of 100% cotton in twill weave. The static and dynamic coefficients of friction before and after finishing at different pressure levels are determined.

Key words: Static and dynamic coefficients of friction, Denim fabrics, Finishing, Seam quality

1. Introduction

In the sewing industry, the quality of a product is defined by a set of product properties that satisfy certain consumer needs and/or requirements.

Some authors supplement these approaches with another one: the "21st Century Approach", in which to the professionals, managers and workers, the scientists are added as an important factor in the quality and reliability management system(Tasev, 1996),(Tasev, 2002).

In the context of this study, the authors support the "21st Century Approach" involving as well scientists in the quality management. The main reason for such decision is that research is moving at a fast pace, ahead of business. The complexity of quality management in this process makes the participation of scientists, both in quality management and in technological processing (Andonova, 2004) mandatory.

Many scientific publications have been published indicating the basic functional, constructive, technological, economic, aesthetic, ergonomic, hygienic, social, etc. quality characteristics of the sewing products (Andonova, 2017), (Germanova-Krasteva, D. & Petrov, Ch., 2008). The quality characteristics of the sewing products are formed at the stage of their technological processing.

In this article, we focus on the importance of the coefficient of friction on the qualitative performance of the sewing operations, especially for clothing. The quality of a garment is also judged not only by the sewing materials – fabric, threads, buttons, zippers, adhesive materials, etc., but as well by the quality of the seam – an indicator which is often overlooked.

When joining two pieces of clothing, there should be no mutual displacement, i.e. when making the stitches of the seam, one layer to be stretched and the other one – puckered (Figure 1a) (COATS - Eliminating Seam Puckering). When making a hem, there must be no twist of the hem. Often, when attaching the sleeves to the armholes of the garment, there are displacements, which lead to twisting of the sleeves and discomfort when the clothing is being worn. Such effect could appear when sewing the legs of the jeans (Figure 1b) (Seam Defects | Common Seam Quality Defects in Garments).

Figure 2. Defects caused by mutual displacement of fabric layers

The defects in poor-quality seam can be clearly seen in garments made of plaid or striped fabric, as well as in garments with a print, when the patterns are displaced. These seam defects are often due to the low friction coefficients at rest of the two layers of fabric on each other and their displacement, while the elements of the garment are being sewn together.

2. Experimantal

Denim fabrics made in Strumatex PLC situated in Blagoevgrad (Bulgaria) have been tested. They are produced from 100% cotton yarns in twill 3/1. Tests are made before and after finishing (raw and ready state), because often the finishing treatments, when producing jeans, are made after sewing.

Table 1. Characteristics of the tested cotton fabrics

No	Item	Code	Mass per unit area	Linear density (count) of the yarns		Number of threads in unit length (thread density)	
				warp	weft	warp	weft
			g/m^2	tex	tex	threads/dm	threads/dm
1	Kiparis raw	A11	212	40	50	355	180
2	Kiparis ready	A12	247	40	50	386	178
3	Boro raw	A21	268	36	60	355	200
4	Boro ready	A22	282	36	60	384	200
5	Boby raw	A31	254	36	60	355	182
6	Boby ready	A32	261	36	60	386	176

The experiments were performed using the - meter MXD-02 of Labthink, China (Figure 2).

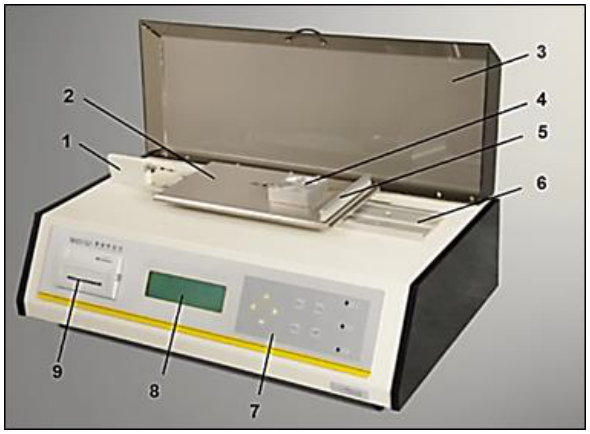

Figure 2. μ-meter MXD-02 of Labthink

Two samples were cut for each test. The first one has dimensions of 80 x 200 mm, and was positioned so that the longer side to be in the direction of the warp threads. It was placed on the movable platform *2* face up and fastened by the spring clamp *5*. The second sample has dimensions of 120 x 120 mm, and was placed on the sliding block *4*. It was cut and positioned so that the friction to be carried out in the following directions: in the direction of the warp yarns (warp direction), of the bias direction (45 degrees) or in the direction of the weft yarns (weft direction).

The sliding block has a mass of 200 g and the sliding speed was 100 mm/min.

Additional weights were placed on the block to determine the effect of the pressure on the friction coefficients. Measurements under pressure of 200 g (no additional weight), 300 g (+100 g) and 400 g (+200 g) were performed.

Five trials were made for each item in each direction and pressure level and the mean values were calculated.

3. Results

The experimental results for the static and dynamic friction coefficients when changing pressure and direction of friction are summarized in Table 2.

Table 2. Static and dynamic coefficients of friction

Item	Pressure	Static coefficient of friction			Dynamic coefficient of friction		
	g	Warp direction	Bias direction	Weft direction	Warp direction	Bias direction	Weft direction
A11	200	0,827	0,819	0,800	0,639	0,540	0,682
	300	0,905	0,933	0,936	0,795	0,722	0,850
	400	1,022	0,983	1,064	0,938	0,890	0,993
A12	200	0,959	0,918	0,787	0,744	0,658	0,641
	300	1,061	1,001	0,912	0,959	0,844	0,787
	400	1,177	1,073	1,101	1,096	1,031	1,000
A21	200	0,875	0,833	0,770	0,700	0,572	0,583
	300	1,033	0,921	0,934	0,861	0,771	0,778
	400	1,135	1,035	1,082	1,029	0,916	0,955
A22	200	0,861	0,938	0,880	0,738	0,661	0,665
	300	0,981	0,972	0,997	0,890	0,849	0,867

4. Discussion

Analyzing the experimental data, it can be seen that the increase in pressure leads to a growth in the values of the friction coefficients, which is result of the bigger contact surface on which the friction occurs.

This fact clearly shows that by increasing the pressure of the presser foot of the sewing machine, the adhesion between the fabric layers during sewing can be significantly improved.

Increasing the pressure twice (from 200 to 400 g), the friction coefficients grow by an average of 42.4%.

The finishing processes have no statistically proven effect on friction coefficients. The changes are within the scattering of the measurements.

Dynamic coefficients of friction are more strongly influenced by the direction of friction than static ones. The highest coefficients of friction are measured in the direction of relative friction warp - warp threads. This fact is a result of the structural features of the fabric, namely of the twill weave, which is characterized by diagonal effects.

There are also no differences in the friction coefficients of the three fabrics, which is normal taken into account the small differences in fabric characteristics.

The results that make an impression, however, are the obtained coefficient values over 1. A lot of specialists share the misconception that friction coefficient is limited between the values 0 and 1. While the values of the friction coefficients usually tend to be between 0 and 1, there are also

friction coefficients which exceed the accepted upper limit. For example, the static friction coefficients for some soft metals such as aluminum, gold, platinum, copper and other exceed 1. This is confirmed by experimental studies indicating values of friction coefficients for some pairs of materials higher than 1 (Leach, 2004), (Hirani, 2016), including for fabrics (Das A., Kothari, V. K. & Vandana, N., 2005), (Sülar, V., Öner, E. & Okur, A., 2013), (Germanova-Krasteva D. & Aleksandrov S., 2013).

A friction coefficient of 1 means that the force of friction is equal to the normal force; when the friction coefficient is more than 1, it just means that the force of friction is greater than the normal force. For relatively soft materials with uneven friction surfaces, such as textiles, the process could not to be described as a pure friction. Due to cohesion and adhesion forces occurs traction which increases the friction force.

5. Conclusion

In order to produce quality sewing products, it is necessary to have a good knowledge of the material characteristics (including friction chararteristics) and to take them into account at every stage of production. The good knowledge of the properties of different fabrics is a prerequisite for high-quality design and comfortable clothing, since the technological features of production processes can lead to structural changes of the original model.

When making a product of fabric with low friction coefficient, models with minimum structural and decorative cuts should be designed, and additional technical devices (Andonova, 2005) that do not allow displacement of the fabric layers should be used. In addition, in the case of low friction coefficients, the number of technological features increases, leading to a narrow specialization of production.

A study on the effect of the finishing treatment, pressure and direction on the static and dynamic friction coefficients for denim fabrics intended for jeances was carried out. It clearly shows that the friction coefficients of the denim fabrics are high (between 0.54 and 1.19), and they are influenced by the pressure and direction of friction. Choosing correctly the influential factors the possibility of slippping and mutual displacement of the materials during sewing could be reduced that is a prerequisite for obtaining qualitative, smooth and uniform seams.

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