SENSORY COMFORT EVALUATION OF WOOL FABRICS BY OBJECTIVE ASSESSMENT OF SURFACE MECHANICAL PROPERTIES

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ABSTRACT

The sensorial comfort is one of the most important aspects of clothing, mainly for next-to-skin garments such as trousers for summer. The perceived comfort of wearers of these garments depends to a great extent on the tactile properties of the fabrics. One of the most important surface characteristics of fabrics is the friction coefficient. Two laboratory equipments were developed to evaluate this parameter, the KES-FB4 module of Kawabata system and the FRICTORQ. In this research are compared the results of the fabric objective measurements of the surface roughness and friction measured using the KES-FB4 (surface tester) and the friction coefficient measured by FRICTORQ equipment, in light-weight wool fabrics.

Key Words: sensorial comfort, textile hand, surface friction

1. INTRODUCTION

Several marketing studies point out that modern consumers consider the tactile sensory evaluation one of the most important attributes in their purchase of textiles. Sensorial or tactile comfort, many times just simply identified by "hand", is essentially a result of how much stress is generated in the fabric and how it is distributed over the skin and therefore has a strong relationship with both the mechanical and surface properties of the fabric.

Therefore, one of the most important characteristics of fabrics for clothing is the coefficient of friction [2], although the friction coefficient is not an inherent characteristic of a material or surface, but results from the contact between two surfaces [3].

Recently, a new laboratory instrument (FRICTORQ) was proposed by the authors for the assessment of this property. Several studies were performed in order to find a relationship between friction coefficient (μ), as measured by FRICTORQ, and fabric friction properties measured by other instruments and other surface evaluations based on subjective assessments [3-6]. A comparative study with another widely respected instrument, the KES-FB4 module, is the main purpose of this research.

2. MATERIALS AND METHODS

The materials in study are composed by light-weight wool fabrics for men summer suits made of high quality fine wool materials commercially available, including Italian "cool wool" coded A1, A2 and A3 (Table 1). The fabrics were design in order to vary the tie factor (from 1 the most tied material, to 0.624 the more loosed material). Those were finished in yarn top dyeing (TD) and the final dry finishing was the same for all fabrics (Shearing, Continuous Decatizing, Kier Decatizing and Steaming). All samples were prepared and tested under a conditioned atmosphere.

Table 1. Materials characterisation

Fabrics Samples Code	Yarn Count (Nm)	Weave	Tie Factor	Thickness (mm) [0.5 gf/cm^2]
A1	2/80	Plain	1,000	0.394
A2	2/80	(2/1) Twill	0.667	0.471
A3	2/80	(3/1) Twill	0.624	0.563
B1	2/64	Plain	1,000	0.429
B2	2/64	(2/1) Twill	0.667	0.506
B3	2/64	(3/1) Twill	0.624	0.604
C1	2/52	Plain	1,000	0.552
C2	2/52	(2/1) Twill	0.667	0.612
C3	2/52	(3/1) Twill	0.624	0.744

To measure the fabrics friction coefficient FRICTORQ laboratory instrument and the KES-FB4 friction module (Table 2) were used and the results compared.

Table 2. Main characteristics of used instruments

	Parameters	Contact Area	Contact Condition	Specimens
FRICTORQ	μ	8 mm x 8 mm	3,5 kPa	Circular Ø113 mm
KES-FB4	MIU MMD	5 mm x 5 mm 5 mm x 5 mm	50 g_f	Square 250 x 250 mm
	SMD	0.5 mm diameter x 5 mm length	10 g_f	
	T	2 cm^2	0.5 g_f/cm^2	

3. RESULTS AND DISCUSSION

For each material 15 samples were tested. In the measurements with KES-FB4 each specimen was tested in both warp and weft directions. The results presented are the average values in both directions.

Figure 1 (a, b) presents the results of friction coefficient average and standard deviations for both instruments. The results confirm that the values of the friction coefficient (μ) measured by FRICTORQ are smaller than measured by KES-FB4 (MIU).

FRICTORQ friction coefficient is inversely proportional to the tie factor, where the plain fabrics with the tie factor 1 (A1; B1; C1) present the lower values, following the (2/1) twill with the tie factor 0.667 (A2; B2; C2), and finally the (3/1) twill with the tie factor 0.624 (A3; B3; C3). The values achieved by KES-FB4 show a disperse behaviour.

FRICTORQ standard deviations (sd µ) between specimens are smaller than for KES-FB4 (sd MIU) (Fig. 3b). This leads to the conclusion that FRICTORQ instrument is more accurate than KES-FB4.

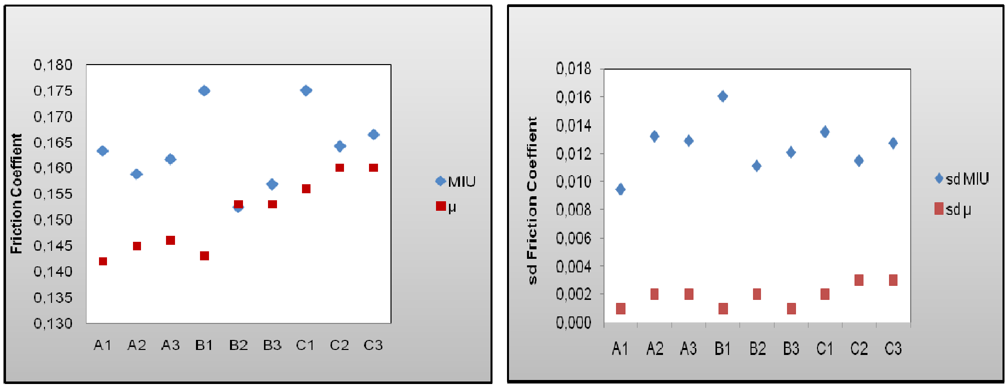

Figure 1. (a) Friction coefficient average (b) Friction coefficient standard deviation

Figure 2 shows that the values obtained by FRICTORQ increase with the yarn count for each fabric weave; yarn count COD A present the lower values, followed by COD B, and then by COD C. In this figure it can also be seen that the friction coefficient average values from FRICTORQ increase with thickness (measure at 0.5 g_f/cm^2). The friction coefficient average values from the KES do not show a statistical tendency with the thickness.

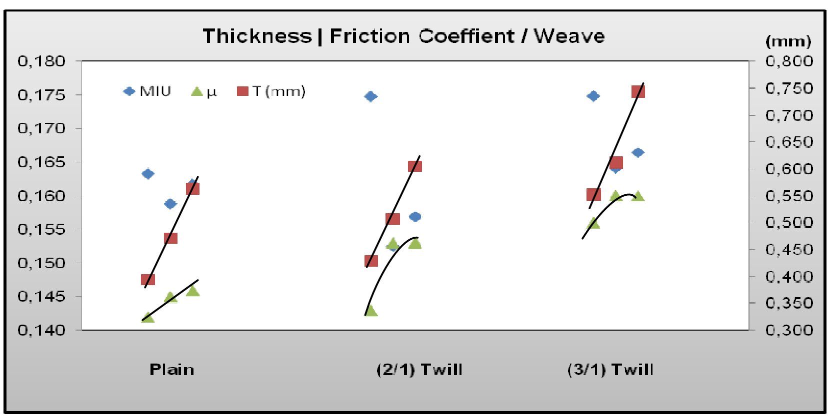

Figure 2. Thickness and Friction Coefficient as function of Weave

Figure 3 shows a polynomial correlation between thickness and friction coefficient from FRICTORQ. The correlation coefficient is valid for a 0,05 significant level. It was not found any relationship between Friction Coefficient parameter from FRICTORQ and Mean Deviation of MIU (MMD) or the Geometrical Roughness (SMD) parameters from KES system.

5. CONCLUSIONS

This research compares the surface property to define the sensorial comfort so called "hand" of wool light fabrics. Results show that Italian "cool wool" fabrics, being the finest in each weave structure are also those with lower friction coefficient measured by FRICTORQ.

To conclude on the relationship between softness/smoothness parameters of this materials with FRICTORQ results, a subjective assessment made with textile experts is being carried out which is not yet completed by the close of this paper.

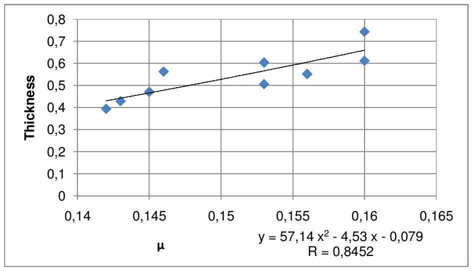

Figure 3. Thickness as function of Friction Coefficient

This work contributes to a better understanding of the surface properties of wool fabrics by increasing the number of assessment tools. If one could confirm this statistical correlation between Friction Coefficient (measured by FRICTORQ) and Thickness for wool materials, by increasing the quantity of testing with different structures, it could therefore contribute to an improvement in the quality control of materials, particularly in the sensorial comfort field.

5. REFERENCES

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