BEHAVIOUR ASSESEMENT OF INTEGRATED KNITTED USED IN UPHOLSTERY ARTICLES, DURING UTILISATION

Ş.l. dr. ing. **Liliana LUTIC**

"Gheorghe Asachi" Technical Universityof Iaşi,
Faculty of Textiles & Leather Engineering and Industrial Management

REZUMAT. Tricoturile sunt utilizate cu succes aproape în toate compartimentele activităţii umane: industrie, agricultură, armată, medicină, sport, timp liber etc. (Agrotech, Buildtech, Clothtech, Hometech, Geotech, Medtech, Protech, Sporttech, Mobiltech, Indutech, Packtech, Oekotech). Acest fapt este posibil datorită diversităţii formelor de prezentare, a masei specifice reduse în comparaţie cu alte materiale textile, a posibilităţilor de dirijare a proprietăţilor. Zilnic, sunt găsite noi aplicaţii, tricoturile înlocuind materialele tradiţionale, costisitoare, sau greu de realizat din punct de vedere tehnic. Evaluarea calităţii tricoturilor are ca punct de plecare stabilirea celor mai importante caracteristici de calitate ale acestora, ca primă etapă pentru o analiză multicriterială, pe care să se poată fundamenta deciziile privind asigurarea unui raport optim între cerinţele beneficiarilor şi calitatea produsului. Pentru tricoturile destinate articolelor de tapiţerie caracteristicile privind durabilitatea şi menţinerea în timp a aspectului pot fi considerate prioritare. Avându-se în vedere faptul că la tapiţarea saltelelor sau a articolelor de mobilier cu structuri tricotate, este absolut necesar să se cunoască aderenţa acestora pe ambele suprafeţe de contact, lucrarea prezintă o metodă de evaluare a rezistenţei la frecare prin alunecare, care pune în evidenţă această caracteristică.

Cuvinte chele: tricot, testare, calitate, durabilitate, aspect, tapiterie.

ABSTRACT. Knitted is successfully used in almost every compartment of human activity: industry, agriculture, military, medicine, sports, leisure activities, etc. (Agrotech, Buildtech, Clothtech, Hometech, Geotech, Medtech, Protech, Sporttech, Mobiltech, Indutech, Packtech, Oekotech). This is possible due to the variety of the presentation forms, their reduced weight in comparison to other fabrics and the possibility of management of their properties. New uses are found daily for knitted that can replace traditional materials, costly ones, or those that are difficult to be made technically. Quality evaluation for knitted fabrics starts with the determination of their most important quality characteristics that serve as a first stage for a multi-criteria analysis for the decisions regarding the optimum ratio between beneficiary requests and product quality. For knitted used in upholstery items, the characteristics that involve durability and maintaining their aspect through time can be important. Taking into consideration that on mattress upholstering or furniture pieces covered by knitted structures it is absolutely necessary that we know the exact adherence of both of the contact surfaces, this paper presents one method of evaluating the friction through sliding resistance that reveals this characteristic.

Keywords: knitted, testing, quality, durability, aspect, upholstery.

1. INTRODUCTION

Technical knitted used for the confection of mattresses (the Hometech branch) have a large variety of products with different structures and primary materialsthat must meet the specific requirements solicited by the beneficiaries [1, 2]:

- constructive requirements: dimensional correspondence, composition, structure, weight;
- aesthetic requirements: the mattresses' appearance, the material that was used for the upholstering, the colour or colour scheme, the sewing, the seams, etc;
- requirements concerning the thermal and psychosensorial comfort, flexibility, extendibility, elasticity;
- requirements about health safety, the content of toxic substances, flammability, the rate of disintegration in the environment;
- availability requirements: durability, the ability to maintain its shape, appearance, colours and size over time;
- requirements concerning the cleaning, mending, refurbishing, decontamination, etc. of the mattress.

These requirements stand at the base of the creation and design processes and they are stated in the documentation of the product.

Static mechanical stress (extensibility/elasticity, tearing resistance and elongation, sliding resistance, piercing resistance, tearing etc), and dynamic mechanical stress (shock resistance), which can be

destructive or not happen frequently during the product's use. The stress can be applied as one cycle (tearing and piercing resistance) or as more cycles (elasticity, fatigue resistance, friction, pilling) [3].

The gauging of the textile materials behaviour during stress is done by using different standard indices representing fabric's quality features, which are standard.

For evaluating the durability of integrated knitted fabrics used for upholstering, in this paper friction through sliding strain was tested, as well as the resistance and capacity of pilling.

2. INTEGRATED KNITTED USED IN UPHOLSTERY ARTICLES

Integrated knitted fabrics are complex multilayer type structures. The fibres used for the fabrics are specifically chosen according to the final use of the fabric. Both faces of the fabric contain fibres with esthetical, comfort, protection and durability features, while the filling fibres serve the purpose of thermal isolation and elastic rebound after compression.

In table 1 we find illustrated and described the integrated knitted variants that are studied in this paper [5, 6, 8].

3. EVALUATION OF QUALITY CHARACTERISTICS THAT REVEAL THE INTEGRATED KNITTED BEHAVIOUR DURING USE

The knitted fabrics presented above can be used as outer layer for producing mattresses covers, furniture and automobiles upholstery and for interior design (covers, coverlets), etc. It is necessary that these knitted have special features:

- easy to model 3D;
- elastic rebound ability after mechanical stress while in use;
- proper adhesion strength to contact surfaces.

In these conditions the evaluation of friction through sliding resistance is most important.

3.1. Determining method for friction through sliding resistance

The Shirley device (presented in figure 1) is used for evaluating the friction through sliding resistance by applying the testing method in conformity with the British standard BS 3424 [3, 10].

Table 1. **Characteristics of the analysed knitted variants**

No.	Knitted variant	Characteristics
1.	V 1 	Structure: double relief rib jacquard Composition/raw material: Front yarns: PES 24/1 Nm Ground yarns: PES 150 den Filling fibres: PA 300 den SEMI-DULL; Rapport: 1/2 Width: 2,30 m Weight: 210 g/m^2
2.	V 2 	Structure: double relief rib jacquard Composition/raw material: Front yarns: PES 100%, Nm 18/1 Ground yarns: PES 150 den Filling fibres: PES 900 den Rapport: 1/4 Width: 2,30 m Weight: 220 g/m^2
3.	V 3 	Structure: double relief rib jacquard Composition/raw material: Front yarns: bamboo viscose, Nm 20/1 Ground yarns: 100 % PES 150 den Filling fibres: PES 1200 den Rapport: 1/4 Width: 2,30 m Weight: 250 g/m^2
4.	V 4 	Structure: double relief rib jacquard Composition/raw material: Front yarns: bamboo viscose, Nm 20/1 Ground yarns: 100 % PES, 150 den Filling fibres: PA 1250 dTex Rapport: 1/2 Width: 2,30 m Weight: 320 g/m^2
5.	V 5 	Structure: irregular jacquard Composition/raw material: Front yarns: 52% PES, 48% viscose, Nm20/1 Ground yarns: PES 150 den Filling fibres: PES 1200 den Rapport: 1/2 Width: 2,72 m Weight: 342 g/m^2
6.	V 6 	Structure: double relief rib jacquard Composition/raw material: Front yarns: 52% PES, 48% viscose, Nm20/1 Ground yarns: PES 150 den Filling fibres: PES 1200 den Rapport: 1/4 Width: 2,46 m Weight: 257 g/m^2

Fig. 1. Shirley device for testing friction through sliding resistance.

For testing, from each type of analysed knitted, six samples will be cut with the dimensions of 50 mm width and 120 mm length. Both the samples as well as the standard material that covers the friction platform will be acclimatized in a standard atmosphere.

While functioning, the incline of the friction platform takes place on a constant rhythm of 15^0/minute, the measuring precision being 0,5 degrees.

Friction through sliding resistance is determined by measuring the incline angle (α [°]) of the friction platform, recorded when on its surface the "testing slide" moves, with the knitted sample attached. This way the adherence of the knitted to the contact surface is established.

The friction index (μ), specific for each type of knitted is determined with the following formula (1):

$$\mu = tg\alpha \quad (1)$$

Taking into consideration that on mattress upholstering or on furniture pieces with knitted structures, their adherence to both contact surfaces must be known, the measurements of friction indexes (μ) was done on the front side, as well as the back side of the analysed knitted.

3.2. Experimental determinations in order to establish the knitted adherence

In this paper, from the six variants of integrated knitted structures analysed, samples were taken with standard dimensions, cut on the direction of the stitch well, on both contact surfaces.

Medium values of the friction platform incline angle (α [°]), as well as those of the friction index μ, for the analysed knitted, are presented in table 2.

The comparative analysis of the six variants of knitted regarding the determined friction index is suggestively represented in figures 2, 3, 4, 5 and 6.

Table 2. **Medium values of the friction platform incline angle and of the friction index for the knitted variants analysed**

Knitted variant	Front side				Back side			
	Stitch well direction		Stitch row direction		Stitch well direction		Stitch row direction	
	α [°]	μ	α [°]	μ	α [°]	μ	α [°]	μ
V 1	38,5	0,79	40,0	0,85	32,0	0,62	37,5	0,77
V 2	40,0	0,84	40,5	0,86	29,0	0,56	34,5	0,69
V 3	32,5	0,64	35,5	0,71	30,0	0,58	40,0	0,85
V 4	34,5	0,69	38,0	0,78	31,0	0,60	38,0	0,78
V 5	39,0	0,81	39,5	0,82	31,5	0,61	39,0	0,81
V 6	39,0	0,81	40,0	0,84	30,0	0,58	38,5	0,80

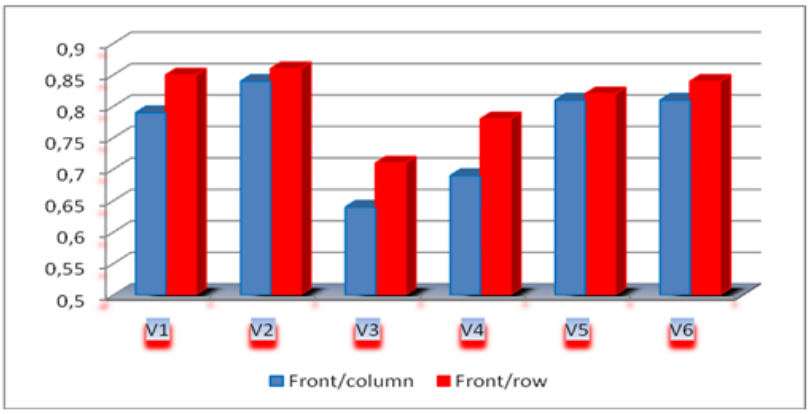


Fig. 2. Friction index variation on the front side of the knitted.

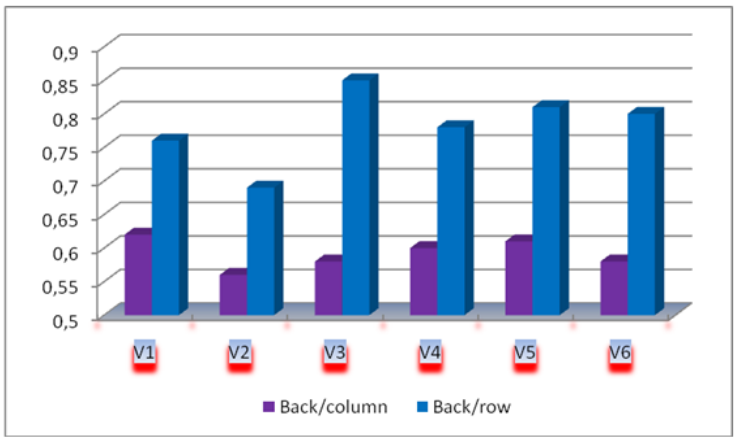
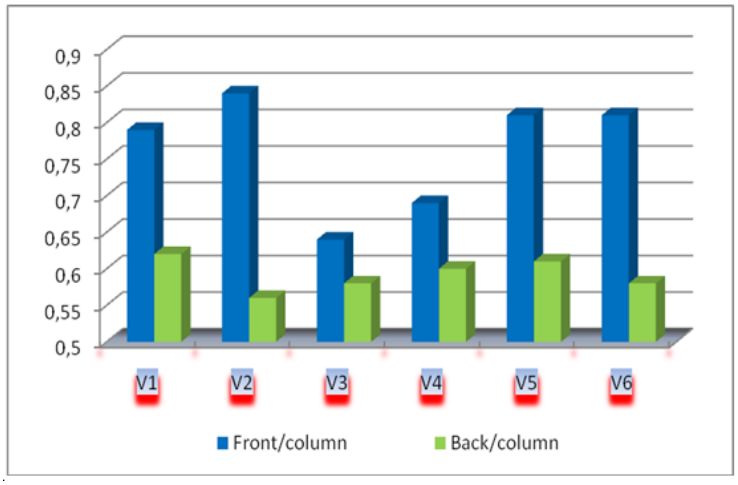


Fig. 3. Friction index variation on the back side of the knitted.

Fig. 4. Friction index variation, on both sides of the knitted, determined on stitch well direction.



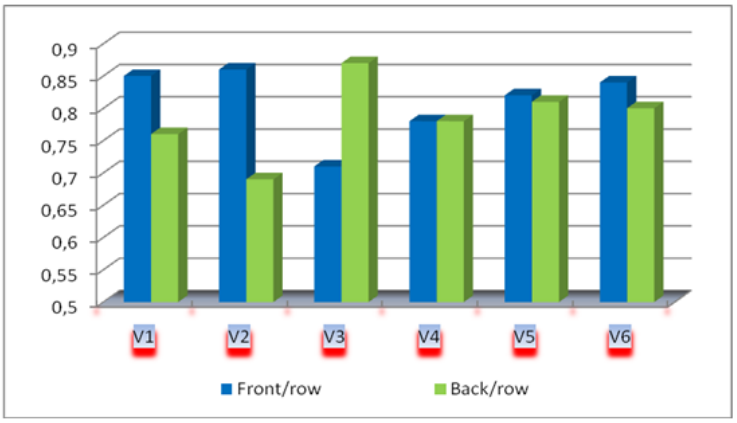
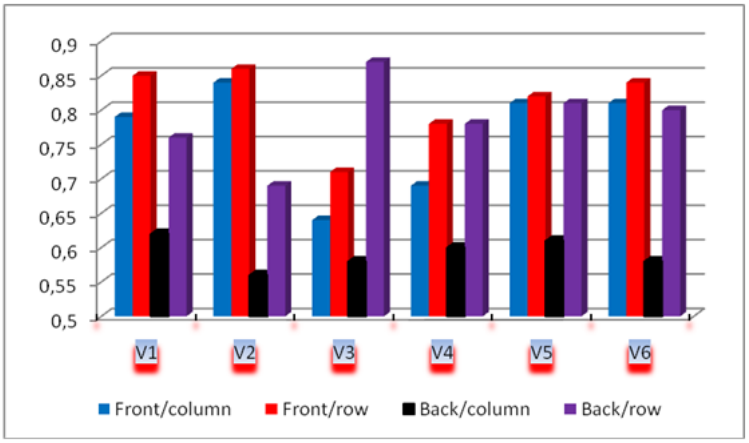


Fig. 5. Friction index variation, on both sides of the knitted, determined on stitch row direction.

Fig. 6. Friction index variation, on both contact surfaces, determined on well direction and stitch row respectively.



4. RESULTS INTERPRETATION AND CONCLUSIONS

The comparative analysis of the testing results and graphics presented in the above figures allowed the following conclusions to be drawn:

● The destination of the analysed knitted (upholstery articles) demands high adherence of these fabrics to both contact surfaces: one with the user (front side) and the interior surface of the product to be upholstered (back side of the knitted).

● The value of friction index on the two sides of the fabric is determined on one hand by their structure and on the other hand by the fibrous composition of the yarns used.

● **By analysing the front side of the knitted** the following aspects were revealed:

- from the integrated knitted types analysed, the most advantageous are variants V2, V1, V6 and V5, on which the friction indexes have the highest values on both the stitch row and well directions;
- this fact is explained by the relief pattern drawing of these knitted structures, and by the yarn count used on the front side of the fabric (thicker yarns);
- on stitch row direction, the friction index values are higher than those determined on the stitch well direction;
- regarding the raw material used, the highest value of the friction index was recorded on variants with the front side made with PES yarns, and the lowest value on variants with the front side made out of mixed bamboo and viscose yarns;
- the fibrous composition of variants V5 and V6 (PES yarns mixed with viscose) has a significant impact on the friction index, raising it in comparison with variants V3, V4 on which the fibrous composition (bamboo/viscose) has lowered the index.

● By analysing the back side of the knitted the following aspects were revealed:

- in this case also, the friction index values on the direction of the stitch row are higher than those determined on the stitch well direction;
- the friction index value on the back side of the knitted is influenced by the degree of irregularity of the surface. In this respect the highest values were recorded on variants V3, V5, V6 and the lowest on variant V2 (with filling yarns of higher count).

● Considering the analysis, the knitted variant with the best quality is variant V2, with the highest adherence.

REFERENCES

[1] Lutic, L.: *Knitted structures used in Mattress manufacturing.*46th International Congress IFKT, ISSN 2285-5378, Romania.

[2] Lutic, L., Moisescu, E.: *Assessing the quality of integrated Knitted fabric used for upholstery.*InternationalSymposium in Knitting and Apparel ISKA,Romania,2013.

[3] Moisescu E., Lutic L., *Metrologie textilă, Tricotaje – Confecţii.* Ed. Performantica, ISBN 978-973-730-525-1, Iaşi, 2008.

[4] Saville, B. P.: *Physical testing of textiles.* Woodhead Publishing Limited, Cambridge, England.

[5] http://www.online-home.ro

[6] http://www.desleeclama.com

[7] http://www.ikea.com/ro/catalog/categories/departments/bedroom

[8] http://www.deslee-interior.com/functions/content

[9] http://www.dormeo.ro

[10] ***, BS 3424/1968 – Shirley Fabric Friction Tester M 264.

Despre autor

Şef lucr. dr. ing. **Liliana LUTIC**
Universitatea Tehnică „Gh. Asachi”, Iaşi

Absolventă a Institutului Politehnic din Iaşi, Facultatea de Tehnologia şi Chimia Textilelor, promoţia 1984; doctor inginer din anul 2005. În prezent, şef lucrări la Facultatea de Textile Pielărie şi Management Industrial. Domenii de competenţă: Tehnologii de tricotare pe maşini circulare / rectilinii de tricotat; Studiul parametrilor tehnologici ai operaţiei de tricotare; Analiza şi controlul calităţii tricoturilor realizate pe maşini circulare / rectilinii de tricotat; Corelarea parametrilor tehnologici în vederea asigurării calităţii proceselor şi produselor; Metrologie Textilă (Testarea caracteristicilor de calitate ale tricoturilor cu aparate de măsură şi control).