Topic № 2
TEXTILE TECHNOLOGIES: SPINNING, WEAVING AND KNITTING

ТЕХНИЧЕСКИ УНИВЕРСИТЕТ
СОФИЯ

ТЕХНИЧЕСКИ УНИВЕРСИТЕТ
ТУ ГАБРОВО
ГАБРОВО

ПРОФЕСИОНАЛНА ГИМНАЗИЯ ПО ТЕКСТИЛ И ОБЛЕКЛО
ДОБРИ ЖЕЛЯЗКОВ

QUALITY CONTROL OF SUTURE THREADS

Diana GERMANOVA-KRASTEVA
Technical University, Faculty of Power Engineering and Power Machines, Textile Department,
8, Kl. Ohridski Blvd, Sofia, Bulgaria
e-mail: dianakra@tu-sofia.bg

Introduction

The wound suture is one the first medical application. First references could be found in ancient Egyptian texts 3000 BC. Nowadays there is a huge variety of suture threads. They may be natural - from animal gut (catgut), silk or linen, synthetic or artificial, absorbable or non-absorbable, mono- or multifilament, coated or uncoated, etc. The use and requirements for surgical threads are strictly regulated and clinically controlled. Among the main regulatory documents are: Council Directive 93/42/EEC concerning Medical Devices, the editions of European Pharmacopoeia, BDS EN ISO 13485: 2016 Medical devices - Quality management systems - Requirements for regulatory purposes. They set out the requirements for controlling geometric dimensions (length and diameter), strength and elongation characteristics, sterilization, packaging and labeling.

Experimental part

An analysis of the existing normative documents was made and the requirements for the surgical sutures were systematized. The indicators for quality assessment of the threads are defined and the methods for their determination and control are selected.

An algorithm for incoming, ongoing and final control and for document flow in the production of suture threads has been developed.

Tests on absorbable and non-absorbable threads were performed. They were carried out in the laboratory of "R1 Suture" Ltd. and included the control of the following suture parameters: appearance (pollution, moss, color unevenness, open braided thread, etc.), conformity of the diameter of the thread metric number, tensile strength of a simple knot

The results obtained were compared with the requirements given in European Pharmacopoeia, 7-th Edition, 2011.

Results

The proposed algorithm includes the sequential steps for performing incoming, ongoing and final control, as well as the required actions. It is designed in the form of flowcharts.

The quality control of the selected absorbable and non-absorbable threads was performed according to the developed algorithm.

Discussion

In the production of suture threads, a quality management system and a well-functioning control mechanism at each stage: entrance, production and acceptable control, are required to guarantee their performance.

Conclusion

In view of their purpose, a number of requirements are set to the sutures and only their strict adherence will guarantee the health of the people and their rapid recovery.

Keywords: Medical textiles, surgery, suture threads, quality control

UDC677

STUDY OF THE EFFECT OF FINISHING TREATMENT ON THE COEFFICIENTS OF FRICTION OF FABRICS FROM NATURAL SILK

Diana GERMANOVA-KRASTEVA[1], Rayka CHINGOVA[2], Sasho ALEKSANDROV [2], Umme KAPANYK [2]

[1] Technical University, Faculty of Power Engineering and Power Machines, Textile Department, 8, Kl. Ohridski Blvd, Sofia, Bulgaria

[2] South-West University, Faculty of Engineering, Mechanical Engineering and Technologies, 66, Ivan Mihaylov Str., Blagoevgrad, Bulgaria

e-mail: dianakra@tu-sofia.bg

Introduction

The study of the coefficients of friction of fabrics is related both to technological issues such as ordering of layers of fabrics, cutting and subsequent separation, packaging and storage, as well as to completely consumer requirements such as sliding on the body, drapery, etc. For silk fabrics, which are characterized by a low mass per square area, the issue of layering and separation of multilayered fabrics becomes even more relevant.

Another characteristic that affects the static and dynamic coefficients of friction is the construction and composition of the silk thread. It is composed mainly of two proteins - fibroin (70-80%) and sericin (20-30%). The fibroin filament emitted from the Bombyx mori silk glands is smooth and soft and forms the structural center of the silk. Sericin is a coating with amorphous structure sticking the filaments to each other. It gives rigidity to the raw thread.

Typically, the weaving is performed with raw fibers, and after weaving the fabric goes through a series of finishing treatments, the main of which is boiling. It eliminates the sericin to a great extent. Therefore, we expect that the changes in the silk threads after treatment will lead to significant changes in the values of the friction coefficients of the ready fabrics.

Experimental part

The study was performed on 4 fabrics of different structure: weaves, densities of the warp and weft threads in fabric and linear densities of the threads.

The following fabric characteristics before and after finishing were measured: mass per square area; densities of the warp threads; densities of the weft threads; static coefficients of friction; dynamic coefficients of friction.

The friction coefficients were measured using the -meter MXD-02 of Labthink, China, according to BDS EN ISO 8295:2006. They are determined at different levels of pressure: 200, 300 and 400 g and in different directions: warp-warp threads and warp-weft threads.

The percentages of change in the studied characteristics were calculated. Results are presented in tabular and graphical form.

Results

The following facts have been established:

- after finishing the fabric shrinks much more in the direction of the warp threads than in the direction of the weft ones;
- although the fabric shrinks, its mass per square area decreases by 14 to 20%;
- the friction coefficients increase linearly according the pressure;
- the static and dynamic coefficients of friction after treatment increase and the change is over 100% for some structures and directions of friction.

Discussion After finishing, especially after boiling, much of the sericin is dropped. The silk filaments contact more tightly and this leads to an increase in the friction and adhesion forces.

Conclusion The static and dynamic coefficients of friction of raw and finished fabrics made from natural silk are determined. The reasons for the increase in the values of the friction coefficients after treatment have been identified and analyzed.

Keywords: Static and dynamic coefficients of friction, fabrics from natural silk, finishing

UDC677

STUDY OF PILLING RESISTANCE OF COMPOUND STRUCTURE LINEN AND FLAX WOVEN FABRICS

Indrė TAUTKUTĖ-STANKUVIENĖ, Eglė KUMPIKAITĖ
Kaunas University of Technology, Faculty of Mechanical Engineering and Design,
Department of Production Engineering, Studentų str. 56, LT-51424 Kaunas, Lithuania
e-mail: indre.tautkute-stankuviene@ktu.edu

Introduction

Linen and hemp has some similarities, because they both are bast cellulosic fibres and some differences in their properties and appearance because of different structure of the fibre [1]. One of the most important end-use properties of woven fabrics is pilling resistance [2]. The authors think that this fabric's property may also differ for linen and hemp woven fabrics. Thus, the aim of the study is to analyse and compare pilling resistance of linen and hemp woven fabrics.

Experimental part

The investigated fabrics were woven from linen 38 tex yarns and hemp 38 tex yarns in warp and weft. They were woven in compound double-layer weave using Itema R500 (Italy) weaving loom in joint-stock company "Klasikinė tekstilė" (Lithuania).

The pilling resistance tests were performed using Martindale Abrasion and Pilling Tester MESDAN-LAB, Code 2561E (SDL ATLAS, England), in accordance with the standard ISO 12947-2.

Results and discussion

The experiment results show that grades of loom state linen and hemp woven fabrics are the same, i.e. 3.5. This result is quite high after 5000 abrasion cycles. However, the pilling results of dyed fabrics are lower, i.e. they seek 2,5 grade for hemp fabric and just 1,5 grade for linen fabric after 2000 abrasion cycles. It can be stated that both results are low, but the results of linen fabric was worse.

Conclusions

The grade of linen fabric is higher than the grade of flax fabric during the pilling tests performed, because the hemp fibre is stronger and longer in comparison to linen fibre. The pilling resistance of the dyed fabrics was lower than this of loom state fabric, because fabrics receive different chemical and mechanical effects during finishing.

Keywords: hemp and linen woven fabrics, pilling resistance, loom state and dyed fabrics, pilling grades.

References

1. Jakub Wiener, Vladimir Kovačič, Petra Dejlova, Differences between Flax and Hemp, AUTEX Research Journal, 2003, Vol. 3, No. 2, pp. 58-63.
2. Li Jun, Feng Jiohao, Zhang Jianchun, Wear Properties of Hemp, Ramie and Linen Fabrics after Liquid Ammonia/Crosslinking Treatment, Fibres & Textiles in Eastern Europe, 2010, Vol. 18, No. 5(82), pp. 81-85.

UDC677

BIO-COMPOSITES REINFORCED WITH 3D KNITTED PREFORMS

Saber Ben ABDESSALEM, Samar TURKI
Monastir University, National Engineering School of Monastir, Textile Materials and Process Research Unit, Monastir, Tunisia
e-mail: saber_ba@yahoo.fr

Textile-reinforced composites are widely used in composite applications where a lightweight and rigid structure is an imperative target. As reinforcement materials, spacer fabrics are making a greater interest in composite materials field, in order to replace conventional sandwich panels. Spacer fabrics are three-dimensional structures made of two fabric layers linked vertically with pile yarns or fabric cross-links. They can be seen as a solution to the critical problem of bonding between skins and core in classical sandwich composites. They are obtained by weaving or knitting technologies. At present, studies of such fabrics are mostly based on weaving and warp knitting but not flat knitting. In fact, woven spacer fabrics could not present complex shapes which limited the uses of the 3D composite. Warp-knitted spacer fabrics are connected with pile yarns and not with connecting layers. Thus, 3D composites based on warp-knitted spacer fabrics are expected to be used only for cushioning applications and protection materials. Flat-knitted preforms are promising since they allow a flexible manufacture of complex shapes in a unique process step, a better ratio weight/stiffness, and a good resistance to fatigue and corrosion.

This work deals with the development of 3D flat-knitted composites using cotton yarn and unsaturated polyester resin. According to literature, materials used in the development of flat-knitted spacer fabrics are more concentrated on glass and carbon fiber owing to their high modulus. Thus, we have tried to develop bio-composites by using a natural yarn during the development of the reinforcement material. U and V-shaped spacer fabrics were produced with a Stoll 330 TC flat-knitting machine, in order to assess the impact of fabric cross-link shape on composite mechanical performances.

In this study, three-point bending and flat compression tests were performed by a Lloyd EZ 20 testing machine, on the consolidated composites.

It was found that composite material with U reinforcement has the best compression resistance whereas the best bending properties were obtained with V shaped connection. Consequently, mechanical performances of knitted sandwich structures are greatly affected by the connecting layer's shape. Thus, the selection of the spacer fabric according to its composite envisaged application is of primary importance.

In conclusion, the developed structures present competitive solution for light weight composites such as solar panels and sound absorbers. The use of the cotton yarn as a reinforcement material, in this research, can be seen as a trend to develop bio-composites in order to reduce the environmental impact of man made fibers.

Keywords: Spacer Fabrics, Flat knitting, Cotton preforms, Polyester Matrix, Mechanical properties.

UDC677

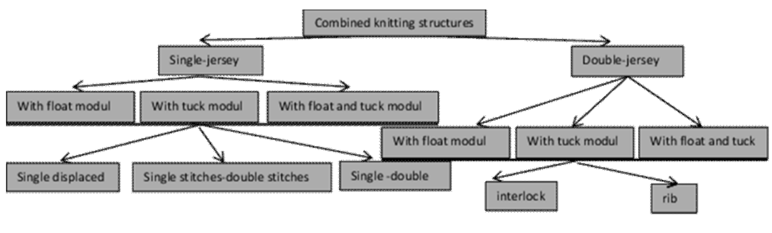
MODERN CLASSIFICATION OF COMBINED KNITTING STRUCTURES

Georgios PRINIOTAKIS
Department of Industrial Design and Production Engineering
University of West Attica, Athens, Greece

Recently, new garments with specific properties have been introduced into the garment industry and the production of new fashionable garments, which add to the versatility of contemporary clothing. Such are the combined knitting structures which, in addition to having the positive properties of knitting, are also of less elasticity and stretchability and have a good shape and stable stitch structure. This allows them to be used where woven fabrics have traditionally been used so far. The combined structures are single-faced (single-jersey) and double-faced (double-jersey) structures consisting of float (miss) and tuck stitches modules [1]. Mainly braided circular machines with a higher gauge (12E-24E) are [2, 3, 4]. The initial application of these structures was in France, where based on interlock or rib knit modules [2] used to stabilize the knits. In this regard, in 1950, the first circular knitting machines with 12 systems were built to allow the mass production of these structures. Spenser D. [2] examines a small part of these structures and their development without special classification. These structures are discussed from Iyer C., Mammel B. and Schach W., [4], how presented many of the combined knitting structures used without particular classification and arrangement. Usually, these structures are small repeats in course (2-6), and when using individually selected needles and differently colored threads, these repetitions can be infinitely large. The repetition in wale is also usually small (2 to 12) and may be unlimited in jacquard unbalanced structures [5].

The main purpose of this study is to create a complete classification of known combined knitting structures and a complete modern classification. This will help knitwear designers learn about these types of structures and use them in their collections. The diagram gives a complete classification of the combined knitting structures according to the modules used to obtain them. Usually, using a float (miss) stitches modules module, the knitting gains a certain degree of stability by reducing its elasticity. This reduction is directly proportional to the number of float modules in one repeat of the knitting, i.e. $\varepsilon = f(n)$, where "ε" is the stretchability in percentages and "n" is the number of float modules in one repeat. The tuck stitches modules gives a greater volume of knitting and in combination with float and less stretch. Combining the float and the tuck stitches modules in different variants results in combined knits of different construction and properties that could be planned in advance [6, 7].

Key words:combined, knitting, structures, stitch, float, tuck



References:

1. Хараламбус, А., Нов подход при изучаване на структурата на напречно-плетени плетива, Текстил и облекло,бр. 5, 2016.

2. Spenser D., Knitting Technology, third edition, Cambridge England, 2001.

3. Хараламбус, А., Бабините плетки в съвремието, Издателство "Нова звезда" София, 2016, стр. 193, ISBN: 978-619-188-077-5.

4. Iyer C., Mammel B. and Schach W., "Circular Knitting", Meisenbach Bamberg, 1995. Elsevier Science Ltd. Great Britain, 1995.

5. Хараламбус, А., Неуравновесени жакардови ластични плетки, "Текстил и Облекло" 5/1999.

6. Оферман, П., Х., Тауш-Мартон, Основи на плетачната технология, С. Техника, 1983.

7. *Красий,Г., В. Керсек, В. Гамрецкая, Р. Сахарная, Справочник по плетачество, Техника, София,1980.*

UDC677

FROM THE WASTE TO THE YARN

A. LALLAM and L. Ben HASSINE
Laboratoire de Physique et Mécanique Textile, 11 rue Alfred Werner, 68093 Mulhouse, France.
e-mail: a.lallam@uha.fr, lina.ben-hassine@uha.fr

Abstract Since the 1950s, plastics have continued to extend in all human activity fields, whether civil or military ranging from domestic uses to aeronautical applications through the electronics and medical sectors. The development of high performance plastic materials in strategic areas is growing permanently but strongly dependent on fossil resources.

The increased development of these materials is based mainly on the exploitation of natural resources of fossil origin poses two major problems; one is the rapid depletion of raw materials and the other lies in the management of waste generated by the end of life of these same materials.

In order to reduce the impact of these two important factors, several solutions can be contemplated:
• reduce the consumption of fossil material and thus reduce waste to the source;
• provide post-consumer material recycling operations;
• find bio-sourced materials for replacing fossil materials.

In this work, we have chosen to treat the recycling of plastic waste in order to reduce oil consumption and at the same time reduce the level of CO2 generated by the incineration of post-consumer waste. In this study two Poly (Ethylene Terephthalate) (PET) polymers obtained from mineral water bottle and a virgin PET polymer were characterized by viscosimetry, differential scanning calorimetry (DSC) and rheology. Virgin PET showed better rheological and viscosimetric properties compared to recycled PET polymers.

In order to improve properties when reprocessed at high temperatures, recycled polymers were blended with the virgin one. Rheological and thermal properties of extruded recycled/virgin (PETV/R) blends showed a good rheological and thermal compatibility and stability compared to extruded pure recycled polymers. Melt spun yarns obtained from recycled/virgin blends were investigated by static and dynamic mechanical analysis and gave interesting mechanical properties

Keywords: recycling, PET recycling, bottles recycling

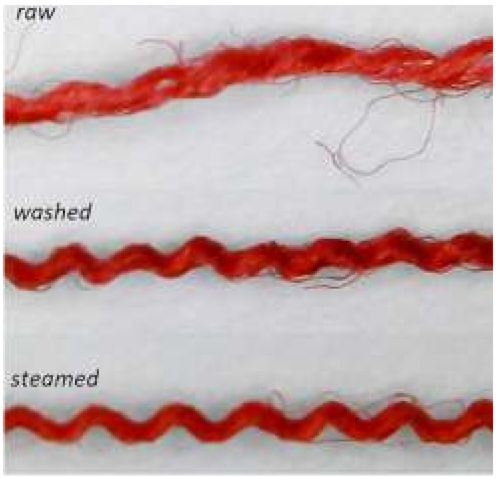
References:
1- A. Elamri, K. Zdiri, O. Harzallah, A. Lallam, "Progress in Polyethylene Terephthalate Recycling" Polyethylene Terephthalate: Uses, Properties and Degradation, Nova Publishers, ISBN: 978-1-53611-991-6, 155-186, 2017.
2- A. Elamri, K. Abid, O. Harzallah, A. Lallam, "Characterization of Recycled/ Virgin PET Polymers and their Composites", American Journal of Nano Research and Applications, Special Issue: Nanocomposites Coating and Manufacturing, 3(4-1), 11-16, 2015.
3- Bachir Itim and Mathew Philip "Effect of Multiple Extrusions and Influence of PP Contamination on the Thermal Characteristics of Bottle Grade Recycled PET; Polymer Degradation and Stability; Volume 117, July 2015, Pages 84-89.

UDC677

VARIATION OF THE WOVEN THREADS DEFORMATION DURING MOISTURE-HEAT TREATMENT OF THE WORSTED FABRICS

Georgi GEORGIEV[1], Plamen LITOV[2] and Ivelin RAHNEV[2]
[1]College of Sliven at TU – Sofia, Bourgasko chaussee 59, 8800 Sliven, Bulgaria
[2]E. Miroglio EAD, Industrial district, 8800 Sliven, Bulgaria
e-mail: IRahnev@emiroglio.com

The presented study focuses on the changes in the structure of the worsted fabrics in their enrichment under the conventional finishing technologies. The main structural changes of the worsted fabrics occur during the removal of the tissue from the loom and then the laundry and thermal fixation of the fabric. These core operations by moisture - heat treatment reveal the main deformations of the warp and weft threads. The following finishing operations focus on removing the internal stresses in the fibres and the linkages between the weaving threads. They do not affect so much on the transverse dimensions and the surface mass of the fabric. The purpose of these operations is to balance the construction and flatten the surface of the woven fabric. Finishing technological operations affect the fabrics in two directions: structural and superficial. In the examined worsted fabric for outerwear and after passing all finishing operations, set by technology, it became clear that after removing the woven fabric from the loom its width begins to fall (from 195 cm raw width) and this sharp decline continues after the first finishing operations of washing and drying by thermal fixing. At the first intermediate quality control, the width of the fabric is already 160 cm and this width is maintained in the next three operations and after softening by thermal fixing the width of the fabric again begins to fall by 2-3 cm per operation until it reaches its final width of 151 cm at the final quality control. With the surface mass, things stand right back from raw it is 167 g/m2 to the first intermediate control, when it is already 190 g/m2, the surface mass increases here as well, and in width it retains its values in the next few operations. Until the fabric undergoes softening with thermal fixing, the surface mass begins to grow again, and after the final operation, it is 206.6 g/m2. In threads densities things are different, the weft density from raw to quality control state changes slightly, and the warp density from raw to final quality control state is steadily increasing, at the beginning it is 249.1 dm-1 and at the final quality control, it is 321.7 dm-1. This is due to the shrinkage of the fabric and its change in width after each moisture-thermal operation. The change in the weft and warp threads can be seen in the pictures taken. In the raw state, the fibres are under stress, and the destroyed warp and weft threads have wavily deformations with different frequencies and amplitudes. After washing and thermal fixing, the basic dimensions of the amplitudes and the wavelength (reciprocal frequency) of the wavy deformed threads are achieved, after their incorporation into the fabric structure. After this process, all subsequent moisture-heat treatments influence the removal of internal stresses and the smoothing of the parameters of the wavy deformations. In the final look, the main and weft threads have a uniform shape and the fabric has a smooth and uniform smooth surface.



Keywords: worsted fabrics, finishing, textile structural changes

Neznakomova Margarita, Tekstilno materialoznanie, ISBN 978-954-438-863-8, TUS, Sofia, 2010
Damyanov G., D. Germanova-Krasteva. Textile Processes: Quality Control and Design of Experiments, Momentum Press, N. Y., 2012, ISBN-13: 978-1-60650-387-4.

UDC677

ФНТС
1885

ЮГОЗАПАДЕН УНИВЕРСИТЕТ
"НЕОФИТ РИЛСКИ"

ТЕХНИЧЕСКИ УНИВЕРСИТЕТ
СОФИЯ

EM
by EDOARDO MIROGLIO