2019

ITMC

Conference & Smart Textiles Salon

7th Edition of the International Conference on Intelligent Textiles & Mass Customisation

November 13-15, 2019
Marrakech, Morocco
Palm Plaza Hotel

BOOK OF ABSTRACTS

Partners ITMC

GroupeCTTGroup · Shinshu University · esith Constructeur de compétences · 200 Years Ghent University · ensait

For more information: Phone: +212 5 22 23 41 24, Fax: +212 5 22 23 15 85 , Email: itmc@esith.ac.ma
Website: http://itmc.esith.ac.ma

November 13-15, 2019
Marrakesh, Morocco

7th Edition

of the International Conference

on Intelligent Textiles & Mass Customisation

November 13-15, 2019, Marrakesh, Morocco

Palm Plaza Hotel

Book of Abstracts

Organised by:

ESITH, Morocco (www.esith.ac.ma)

ENSAIT, France (www.ensait.fr)

Ghent University, Belgium (www.ugent.be/ea/testiles/en)

CTT Group, Canada (www.gcttg.com/en)

Shinshu University, Japan (www.shinshu-u.

Conference Chairman:

Mrs. Lieva Van LANGENHOVE, University Ghent, Belgium
M. Jacek MLYNAREK, Groupe CTT, Canada
M. Kanji KAJIWARA, University Shinshu, Japan
M. Vladan KONCAR, ENSAIT, Roubaix, France
M. Mohamed LAHLOU, ESITH, Casablanca, Morocco

International scientific committee Chairman

Prof. Vladan Koncar, ENSAIT, France

International scientific committee

Dominique Adolphe, ENSISA, France
Ilze Baltina, Riga Technical University, Latvia
Mirela Blaga,"Gheorghe Asachi" Technical University of Iasi, Romania
Francois Boussu, ENSAIT, France
Ender Bulgun, Izmir University of Economics, Turkey
Omar Cherkaoui, ESITH, Morocco
Izabela Ciesielska, Ghent University, Belgium
Cédric Cochrane, ENSAIT, France
Mohamed Dalal, ESITH, Morocco
Eric David, ETS, Canada
Wim Deferme, Hasselt University, Belgium
Andrej Demšar, University of Ljubljana, Slovenia
Ariadna Detrell, AEI TÈXTILS, Spain
Patricia Dolez, University of Alberta, Canada
ElSayed Elnashar, Kafrelsheikh University, Egypt
Fernando Batista Nunes Ferreira, University of Minho, Portugal
Said Gmouh, UH2C, Morocco
Ana Marija Grancaric, University of Zagreb, Croatia
Lubos Hes, Technical University of Liberec, Czech Republic
Mustapha Hlyal, ESITH, Morocco
Lena Horne, Université de Manitoba, Canada
Amane Jada, IS2M, France
Charafeddine JAMA, ENSCL, France
Mounir Jaouadi, University of Monastir, Tunisia
Huseyin Kadoglu, Ege University, Turkey
Kanji Kajiwara, Shinshu University, Japan
Fatma Kalaoglu, Istanbul Technical University, Turkey
Ilda Kazani, Polytechnic University of Tirana, Albania

Vladan Koncar, ENSAIT, France
Shohei Koyama, Shinshu University Japan
Senem Kursun Bahadir, Istanbul Technical University, Turkey
Aziz Lallam, ENSISA, France
Jacek Mlynarek, GCTT, Canada
Kolos Molnár, Budapest University of Technology and Economics, Hungary
Slah Msahli, University of Monastir, Tunisia
Munir Ashraf, National Textile University, Pakistan
Vincent Nierstrasz, University of Borås, Sweden
Georgios Priniotakis, Piraeus University of Applied Sciences, Greece
Maja Radetic, University of Belgrade, Serbia
Sigitas Stanys, Kaunas University of Technology, Lithuania
Masayuki Takatera, Shinshu University, Japan
Hussain Tanveer, Virtual University of Pakistan, Pakistan
Xuyuan Tao, ENSAIT, France
Lieva Van Langenhove, Ghent University, Belgium
Savvas G. Vassiliadis, Piraeus University of Applied Sciences, Greece
Olivier Vermeersch, GCTT, Canada

Organising Committee

Mrs. Lieva Van LANGENHOVE, University Ghent
M. Vladan KONCAR, ENSAIT
M. Jacek MLYNAREK, Groupe CTT
M. Mohamed LAHLOU, ESITH
M. Abderrahmane FARHATE, ESITH
M. Omar CHERKAOUI, ESITH
M. Mustapha HLYAL, ESITH
Mrs. Touria AIT OZZO, ESITH
Miss. Jihane LAHMAR, ESITH
Miss. Hasna RACHADI, ESITH
Mrs. Kawtar KOUZMI, ESITH
M. Ayoub NADI, ESITH
M. Mehdi EL BOUCHTI

Thermal resistance of double jersey fabric knitted by different yarn raw material

D Kopitar, Z Pavlovic, Z Skenderi and Z Vrljicak

University of Zagreb, Faculty of Textile Technology, Department of textile design and management, Prilaz baruna Filipovica 28a, 10000 Zagreb, Croatia
E-mail: Dragana.kopitar@ttf.hr, zeljka.pavlovic@ttf.hr, zenun.skenderi@ttf.hr, zlatko.vrljicak@ttf.hr

Keywords: One; Two; Three; Four; Five; Six (up to 6 words arranged in alphabetical order)

1. Introduction:

More and more yarns are being made in the world that will replace classic cotton yarns produced by the ring spinning system. For a number of reasons the increasing number of population does not cause a proportional increase in the production of cotton yarns. Therefore, yarns by different raw materials are manufactured that will replace or complement cotton yarns in different areas of application. Investigations on textile properties carried out by physiologists showed that raw material composition does not significantly affect comfort parameters since humans can not feel the difference between different raw material compositions or type of fabric. Contrary to physiologists, researches done by textile experts indicate that there are relevant differences in heat and water vapour resistance of fabrics made by different raw materials. In research where knitted fabrics produced from cotton and angora fibres in different ratios where analyses, it was indicated that 25 % of angora fibre caused significant difference in relative water vapour permeability values. In another research, untreated fabric made of spun polyester yarn has higher water vapour resistance than the one made of cotton, where after fabric treatment, the decrease in water vapour resistance for polyester fabric is significant, but it is not for cotton fabric. Recent research showed that different types of fibres and yarns are being used to improve the heat and moisture management, therefore comfort of the fabric wearable next to the skin [6]. In most of the studies of thermo-physiological properties man-made fibres are compared to natural fibres, fabrics made by different yarn structure or different fabric parameters where researchers did not manage to produce yarns or fabrics that was identical, differing only in one single factor. The present research aim is to analyse knitted fabric parameters and influence on thermal resistance of double jersey knitted fabrics. The fabrics were made on the same knitting machine with same production parameters by yarn finesses of 20 tex. Yarns were produced in one factory differing only in raw material, namely cotton, Viscose®, Tencel®, Modal® and polyester.

2. Material and Methods

A circular double bed knitting machine gauge of E17 was used for knitting the fabrics. It is used to knit plain or plated double knit jersey fabrics, and due to its construction, it is recommended to knit single cotton yarns from 12 to 36 tex or ply yarns from 10 tex x2 to 17 tex x2. This type of machine has 8 knitting systems so it was necessary to prepare 8 individual yarn spools for each yarn group (cotton, Viscose®, Tencel®, Modal® and polyester). The tensile force of the yarn fed to the knitting system was regulated with Coni positive feeders. Twenty meters of each sample were knit. The fabric take-down was performed by two pairs of rollers located 70 cm away from the knitting zone. The fabric was not wound onto a fabric roll but it was plaited down on the tray below the take down rollers. The research work was carried out on five double jersey knitted fabrics, knitted from cotton, Viscose®, Tencel®, Modal® and polyester ring spun yarns finesses of 20 tex. Basic structure parameters such as horizontal and vertical fabric density, fabric thickness and mass per unit area are tested. Based on the fabric thickness and mass per unit area, porosity and fabric thickness cover factor were calculated.

Thermal resistance of the knitted fabric were determinate by measuring thermal resistance under steady-state conditions using the Sweating Guarded Hot Plate according to standard ISO 11092:2014. The Sweating Guarded Hot Plate simulates the heat and moisture transfer from the body surface through textile fabric to the environment under specified environmental conditions. Standard environment for testing thermal resistance is air temperature of 20 ± 0.1 °C and relative humidity of 65 ± 3%. The thermal resistance of knitted fabric gives quantitative evaluation of fabric as thermal barrier to the wearer.

3. Results and discussion

The results of the knitted fabric parameters, i.e. mass per unit area, knitted fabric thickness, horizontal and vertical knitted fabric density, calculated knitted fabric porosity and thickness cover factor. All tested yarns were ring spun yarns with nominal yarn count of 20 tex from 1.3 dtex fibres with a length of 38 mm. Ring-spun yarns were produced using the carding manufacturing process, comprising fibre preparation phases, spinning preparation, winding and cleaning. A Zinser 351 ring spinning machine connected to an Autoconer X5 winding machine was used for the ring spinning process. The knitted fabrics were made on one machine and under the same conditions, i.e. without machine operation control. A change in all parameters of knitted fabric structure was reflected through fabric mass per unit area, which ranged from 142 g m^{-2} (knitted fabric made of polyester ring spun yarn) to 165 g m^{-2} (knitted fabric made of Viscose® ring spun yarn). The minimum and maximum knitted fabric mass per unit area difference is up to 16 %.

Comparing the knitting fabric thickness, influence of raw material is noticeable. The range of thickness is from 0.58 mm up to 0.64 mm, where knitted fabric made by cotton yarn has higher thickness for 10.3 % related to the fabric made by Modal® yarn. Results have shown the difference up to 14.5 % in knitted fabric cover factor, which ranged from 0.233 g m^{-3} for fabric made from polyester yarn to 0.267 g m^{-3} for fabric made by Modal® yarn. Due to the difference in fibre density and knitted fabrics mass per unit area, range of knitted fabric porosity is from 82.26 % (for the Viscose® knitted fabric) to 83.93 % (for knitted fabric made by Tencel® yarn) which is a difference of only 2 %. Different mass per unit area and thickness of knitted fabrics made by different raw material influenced on the knitted fabric horizontal and vertical density.

The thermal resistance of the knitted fabrics is in the range of 0.019 m^2 °C W^{-1} to 0.030 m^2 °C W^{-1}. The smallest thermal resistance value has the polyester knitted fabric, while the largest thermal resistance value has the cotton knitted fabric. Thermal resistance of cotton fabric is higher for 36.7 % related to polyester knitted fabric. Considering that thermal resistance describes resistance of human body heat passage through knitted fabric to the environment, it can be concluded that cotton knitted fabric will provide better thermal barrier then polyester fabric. Thermal resistance difference of Viscose® (13.6 %), Tencel® (17.4 %) and Modal® knitted fabric (17.4 %) related to polyester is smaller than cotton to polyester thermal resistance difference. Comparing thermal resistance of the knitted fabrics and their basic parameters, it is visible that polyester fabric has the lowest mass per unit area and thickness cover factor which gives heat to easier pass through fabric, i.e. gives the smallest resistance heat to pass. Considering basic knitted fabric parameters, highest mass per unit area doesn't provide the greatest thickness, i.e. greatest thickness factor. It can be concluded that beside basic knitted fabric parameters, different yarn raw material influence on thermal resistance.

4. Conclusion

Based on conducted research it can be concluded that knitting with same yarn finesses and machine production parameters but different yarn raw materials do not provide knitted fabrics with the same constructional characteristic. Knitting with different raw materials namely, cotton, Viscose®, Tencel®, Modal® and polyester, gives mass per unit area in range of 142 g m^{-2} (knitted fabric made of polyester ring spun yarn) to 165 g m^{-2} (knitted fabric made of Viscose® ring spun yarn) which is difference up to 16 %. Beside mass per unit area, influence of raw material on knitted fabric is noticeable through thickness (from 0.58 mm for knitted fabric made by Modal® yarns up to 0.64 mm made by cotton yarns), cover factor (from 0.233 g m^{-3} for fabric made by polyester yarn up to 0.267 g m^{-3} for fabrics made by Modal® yarn). The lowest thermal resistance has the polyester, while the largest has the cotton knitted fabric. Thermal resistance of cotton fabric is higher for 36.7 % related to polyester knitted fabric. Knitting with same yarn finesses and knitting machine production parameters but different yarn raw materials will give knitted fabrics with different basic constructional parameters which will influence on thermal resistance.

Acknowledgment: This work has been supported by the Croatian Science Foundation under the project (IP-2016-06-5278).