# ANNALS
# OF THE
# UNIVERSITY OF ORADEA

## FASCICLE OF TEXTILES-LEATHERWORK

**VOLUME XI, 2010**

**No. 2**

# ANNALS
# OF THE
# UNIVERSITY OF ORADEA

# FASCICLE OF TEXTILES-LEATHERWORK


**VOLUME XI, 2010**

**No. 2**


**This volume includes papers presented at International Scientific Conference "Innovative solutions for sustainable development of textiles industry", 28-29 May 2010, Oradea, Romania**

**Contact and Editors' Address:**
**Liliana INDRIE,**
**UNIVERSITATEA DIN ORADEA,**
**FACULTATEA DE TEXTILE SI PIELARIE,**
**Str. B.St.Delavrancea nr. 4,**
**Oradea, 410058, Romania,**
**Tel.: 00-40-259-408448**
**E-mail : lindrie@uoradea.ro**

**Published by**
**Editura Universităţii din Oradea**
**Universitatea din Oradea, Str. Universităţii Nr. 1, 410087, Oradea, Bihor, Romania**
**P-ISSN: 1582-5590**
**CD-ROM-ISSN: 2068–1070**

**CNCSIS ACCREDITATION since 2007 "Clasa B"**

## *EDITORS' NOTE*

The Annals of University of Oradea, Fascicle of Textiles-Leatherwork was published for the first time in 2001, with the occasion of the scientific communication session, organized annually at the faculty; afterwards, the technical review publication was periodical.

The first 7 editions of the journal were edited in Romanian language with an abstract in English and the last three editions were edited entirely in English.

The articles quality increases with every issue. Apart from its improved technical contents, a special care is given to its structure. The guidelines for preparing and submitting an article were modified and developed in order to meet high quality standards requirements.

Beginning with 2007, this technical review has CNCSIS accreditation and classification "Clasa B". The format of issue involves a printed book of extended abstracts of papers and CD-ROM containing the integral papers.

Scientific papers are organized in 4 sections:

- TEXTILES PROCESS AND PRODUCTS
- LEATHER PROCESS AND PRODUCTS
- MANAGEMENT AND MARKETING
- QUALITY, ENVIRONMENT AND SAFETY STANDARDS AND TECHNIQUES

The layout, figures, tables or other wording requirements and copyrights are in charge of the authors.

*Please note that the editors take no responsibility of the results, opinions and conclusion expressed in the published papers*.

Board of editors

Oradea, 2010

# S1. TEXTILES PROCESS AND PRODUCTS

## INDEX OF PAPERS AND AUTHORS


| No | Papers title | Authors | Institution | Page |
|---|---|---|---|---|
| **1** | CAD SYSTEMS APPLICATION FOR DESIGNING PATTERN GARMENTS FOR PREGNANT WOMAN | M. Avădanei, E.Pintilie, E.Filipescu | Technical University "Gh. Asachi, Iaşi, ROMANIA | 10 |
| **2** | TEXTILE PATTERN DESIGN | C. Baciu Urzică | University of Oradea, ROMANIA | 15 |
| **3** | STATTEX - THE PROGRAM FOR EXPERIMENTAL DATA PROCESSING IN COTTON SPINNING MILL | I.Barbu, A. Popa | Aurel Vlaicu University, Arad, ROMANIA | 19 |
| **4** | ON THE VARIATION OF THE NUMBER OF NEPS ON TECHNOLOGIC STAGES IN MILLING FACTORIES | D.L. Bordeianu | Technical University "Gh. Asachi", Iasi, Romania | 25 |
| **5** | EVALUATION OF THE DURABILITY OF MICROENCAPSULTED PRODUCTS APLLIED TO FABRICS BY FOAM | L. Capablanca, M. Bonet, P. Monllor, I. Montava | Universidad Politécnica de Valencia, Alcoy (Alicante), SPAIN | 30 |
| **6** | TRADITIONAL MOTIVES' PROCESSING AND APPLICATION POSSIBILITIES IN FASHION DESIGN | M. Carp, S. Mitu | Technical University "Gh. Asachi", Iasi, ROMANIA | 36 |
| **7** | ALGORITHS DESIGN OF THE FILTERING WOVEN FABRICS WITH COMPOUND STRUCTURE | L.Cioară, I.Cioară | Technical University "Gh. Asachi", Iasi, ROMANIA | 42 |
| **8** | INNOVATIVE SOLUTIONS FOR SPORT SOCKS | V. Creţu, L. Macovei, E. Moisescu | Technical University "Gh. Asachi", Iasi, Romania | 48 |
| **9** | GENERALIZED ALGORITHM FOR CUSTOMIZED DESIGN OF THE SKIRT BASIC PATTERN | M. Diaconu, M. Diaconu, C. Niculescu, S. Olaru | SC Diaman Art SRL, Iaşi, România National Institute of Research and Development for Textiles and Leather, Bucharest, Romania | 54 |

## INDEX OF PAPERS AND AUTHORS


| No | Papers title | Authors | Institution | Page |
|---|---|---|---|---|
| **10** | STUDY REGARDING THE INFLUENCE OF RAW MATERIALS ON THE BEHAVIOR OF FABRICS WHICH UNDERGO STRETCH STRESS | M. Dinu, A. Floca, C. Budulan | Lucian Blaga" University , Faculty of Enieneering, Sibiu, România Faculty of Textile - Leather and Industrial Management, Iasi, România | 59 |
| **11** | IMAGE ANALYSIS OF DYED MATERIALS | M.S. Bucur, M. Dochia, M. Szabo, M.Stan | Aurel Vlaicu University, Arad, ROMANIA The Research-Development National Institute for Textile and Leather, Bucharest, ROMANIA | 63 |
| **12** | APPLICATION OF TEXTILE TECHNOLGY FOR THE PREVENTION OF UVR-INDUCED SKIN CANCER | Md. Ershad Khan | Ahsanullah University of Science & Technology, Dhaka. BANGLADESH | 68 |
| **13** | DETERMINING THE TAKE – DOWN TECHNOLOGICAL PARAMETERS | L. Lutic | Technical University "Gheorghe Asachi", Iaşi, ROMANIA | 74 |
| **14** | SMART TEXTILE, REALITY OF OUR DAYS | L. Macovei., V. Cretu, E. Moisescu | Technical University "Gheorghe Asachi", Iaşi, ROMANIA | 80 |
| **15** | NEW DEVELOPMENT IN THE CORE YARNS MANUFACTURE | F. Marsal, D. Palet , M. Riera , A. Serra, L. Indrie, M. Ratiu | Technological Innovation Centre CTF . Technical University of Catalonia, Terrassa, SPAIN Pinter, S.A. Santpedor, SPAIN Faculty of Textiles and Leatherwork. University of Oradea, Oradea, ROMANIA | 86 |
| **16** | THE CORRELATION BETWEEN COMFORT PARAMETERS OF GARMENT STRUCTURE WITH VELOUR FUR (PART I) | C.C.Matenciuc, S. Mitu | Technical University "Gheorghe Asachi", Iaşi, ROMANIA | 91 |
| **17** | THE CORRELATION BETWEEN COMFORT PARAMETERS OF GARMENT STRUCTURE WITH VELOUR FUR (PART II) | C.C.Matenciuc, S. Mitu | Technical University "Gheorghe Asachi", Iaşi, ROMANIA | 99 |

## INDEX OF PAPERS AND AUTHORS


| No | Papers title | Authors | Institution | Page |
|---|---|---|---|---|
| **18** | THE EXTENSION OF CLOTHING PRODUCTS WITH THE USE OF "SMART" MATERIALS | E. Moisescu, V.Creţu, L. Macovei | Technical University "Gheorghe Asachi", Iaşi, ROMANIA | 103 |
| **19** | TESDG3 – PROGRAM FOR CALCULATING FABRIC WEIGHT WITH LONGITUDINAL STRIPES | D. Oana, I. Oana, F. Kenyeres, A. Simon | University of Oradea | 107 |
| **20** | GENERAL ASPECTS BETWEEN PARAMETERS AND TEXTILE MATERIALS DURING ULTRASONIC WELDING | A. Popp | Technical University "Gheorghe Asachi Iaşi, ROMANIA | 112 |
| **21** | METHODS FOR MEASURING GARMENTS COMFORT AND INFLUENCE FACTORS IN TACTILE COMFORT | V. Porav, L. Doble | University of Oradea, ROMANIA | 118 |
| **22** | MEASUREMENT OF TEXTILE FIBERS STRUCTURAL CHANGES DURING TECHNOLOGIC PROCESES | M. Pustianu, M. Fogorasi, A. Bucevschi, A. Popa, E. Airinei | University "Aurel Vlaicu" of Arad, ROMANIA | 123 |
| **23** | ANALYSIS OF SEAM STRENGTH ON DIFFERENT NEEDLE SIZE | Mohammad Rafiqur Rashid[1] Mohammad Faizur Rahman[2] | Dept. of Textile Technology, Ahsanullah University of Science & Technology (AUST), Dhaka, BANGLADESH | 128 |
| **24** | FEMININE UNDERWEAR: SOME HYGIENIC PRINCIPLES | R. Salvado, J. Malheiro | University of Beira Interior, Covilhã, PORTUGAL | 135 |
| **25** | STUDY ON THE EFFECT OF STITCH LENGTH ON BURSTING STRENGTH OF KNIT FABRIC | Sheikh Abdullah Shadid, Mohammad Faizur Rahman | Department of Textile Technology, Ahsanullah University of Science and Technology (AUST), BANGLADESH | 142 |

# S2. LEATHER PROCESS AND PRODUCTS

## INDEX OF PAPERS AND AUTHORS


| No | Papers title | Authors | Institution | Page |
|---|---|---|---|---|
| **26** | CREATING THE 3D IRREGULAR SHAPES OF THE SHOE LAST USING BICUBIC B-SPLINE CURVES | M. Drişcu | "Gh.Asachi" Technical University, Iaşi, ROMANIA | 147 |
| **27** | APPROACHES ON THE CONSTRUCTIVE DEVELOPMENT OF THE ZIPPER HANDBAG | F. Harnagea, M.C. Harnagea, | Gh. Asachi" Technical University Iaşi, ROMANIA | 151 |
| **28** | CHOOSE OPTIMAL VARIANT STRUCTURES THE MATERIALS UPPER OF FOOTWEAR FOR THE PERSON WITH DIABETES | N. Ischimji, S. Mitu, L.Mărcuș | Gh. Asachi" Technical University Iaşi, ROMANIA | 156 |
| **29** | SHOES AESTHETIC DESIGN STAGES | M.Iuhas, F. Kenyeres, G. Bohm | Gh. Asachi" Technical University Iaşi, ROMANIA | 162 |
| **30** | WATERPROOF FOOTWEAR | C. Ionescu Luca, E. Chirilã | Gh. Asachi" Technical University Iaşi, ROMANIA | 166 |
| **31** | ANALYSIS OF ORGANIZATIONAL FORMS OF EXISTING TECHNOLOGICAL FLOWS IN FOOTWEAR/LEATHER ENTERPRISES | M. Malcoci, I. Pascari, R. S. Volocariu, E. Odochiciuc | Tehnical University of Moldova, Chisinau | 172 |
| **32** | RESEARCHES ON THE COMPRESSION BEHAVIOUR OF RIGID LEATHER SUBSTITUTES | C. Secan, F. Harnagea | University of Oradea, ROMANIA “Gh.Asachi” Technical University of Iaşi, ROMANIA | 179 |
| **33** | THE IMPORTANCE OF KNOWLEDGE IN PHISICS IN FOOTWEAR MANUFACTURE | N. Talmazan[1], M. Malcoci[1] | Tehnical University of Moldova, Chisinau | 184 |
| **34** | STRUCTURES AND MANUFACTURING FABRICS OF SEVERAL SAFETY FOOTWEAR DESIGNS | R. Zaharie Butucel , C. Ionescu Luca | Concern “General Contractor” Oradea, ROMANIA Technical University “Gheorghe Asachi” of Iassy, ROMANIA | 186 |

# S3. MANAGEMENT AND MARKETING

## INDEX OF PAPERS AND AUTHORS


| No | Papers title | Authors | Institution | Page |
|---|---|---|---|---|
| **35** | PROMOTING STRATEGIES FOR SHOE FORMS THROUGH INTERNET | N. A. Andreescu, M. O. Iuhas | University of Oradea, Romania | 193 |
| **36** | THE INCREASING PARTICIPATION RATE IN EDUCATION, EMPLOYMENT PREREQUISITE TO ENSURE QUALITY. A QUANTITATIVE STUDY IN THE BIHOR COUNTY, IN THE NATIONAL AND EUROPEAN UNION CONTEXT | F. Chipea | University of Oradea, Romania | 196 |
| **37** | ESTABLISHING EDUCATIONAL PRINCIPLES USED FOR TRAINING ENGINEERS DESIGNERS IN THE FIELD OF CLOTHING INDUSTRY | V. Danila, S. Balan | Technical University of Moldova,, Chişinău, Republic of Moldova | 202 |
| **38** | A MODEL OF MANAGEMENT SYSTEM REGARDING THE COMMERCIAL HUMAN RESOURCES INSIDE THE ROMANIAN TEXTILE COMPANIES | R. P. Lăzărescu | „Gh. Asachi" Technical University of Iasi, ROMANIA | 207 |
| **49** | PROSPECTS OF IMPLEMENTATION OF INTEGRATED MANAGEMENT SYSTEMS IN THE FIELD OF ECONOMIC UNITS TEXTILE GARMENTS FROM R MOLDOVA | V. Scobioală | Technical University of Moldova | 212 |
| **40** | ASPECTS OF THE CLOTHING PRODUCTS CONSUMER'S SATISFACTION | S. Tripa, C. Marc, V. Banciu | University of Oradea, Romania | 216 |

# S4. QUALITY, ENVIRONMENT AND SAFETY STANDARDS AND TECHNIQUES

**INDEX OF PAPERS AND AUTHORS**


| No | Papers title | Authors | Institution | Page |
|---|---|---|---|---|
| **41** | POLYURETHANE-UREEA NANOFIBERS FOR WASTEWATER PURIFICATION | I. Bălău Mîndru, T. Bălău Mindru, V. Tura | Technical University "Gh. Asachi", Jassy, ROUMANIA<br>"Al. I. Cuza"University, Jassy, ROUMANIA | 220 |
| **42** | TOXICOLOGY OF TEXTILE DYES | S. Bota, L.Indrie, M. Rațiu | University of Oradea, ROMANIA | 227 |
| **43** | MONITORING THE PROCESS PARAMETERS USED IN THE PUMPING STATION HYDROPHORE WATER FOR TALL BUILDINGS | C. A. Botiş, M. Şuteu, I.Mihăilă | SC Compania de Apă Oradea S.A,ROMANIA University of Oradea, ROMANIA | 232 |
| **44** | "IN VIVO" CULTURE OF HEMP CULTURE FOR TEXTILE AND PHARMACEUTICAL INDUSTRY | Romocea Julieta - Emilia, Grassi Gianpaolo | Oradea University, Oradea, ROMANIA, Centro di Ricerca per Colture Industriali CRA – CIN, Rovigo, ITALY, | 236 |
| **45** | CONSIDERATIONS REGARDING THE EUROPEAN LEGISLATION IN THE FIELD OF THE SWEEPINGS RESULTED FROM THE TEXTILE INDUSTRY | C. S. Timofte | University of Oradea, Romania | 241 |
| **46** | A MULTI-LEVEL APPROACH TO SITTING TEXTILES WASTE TREATMENT RESOURCES | M. Vidovic, B. Ratkovic | University of Belgrade, Faculty of Transport and Traffic Engineering,Belgrade, SERBIA | 245 |
| **47** | THE CHARACTERIZATION OF STOUT HUMAN BODY | E. Filipescu, E. Filipescu M. Avadanei | Technical University "Gh. Asachi", Jassy, ROUMANIA | 252 |

ANNALS OF THE UNIVERSITY OF ORADEA
FASCICLE OF TEXTILES- LEATHERWORK
Volume I, 2010, No. 2

# CAD SYSTEMS APPLICATION FOR DESIGNING PATTERN GARMENTS FOR PREGNANT WOMAN

**Manuela AVĂDANEI[1], Ecaterina PINTILIE[2], Emilia FILIPESCU[3]**

[1]*Technical University "Gh. Asachi", Faculty of Textile, Leather and Industrial Management, Iaşi ,ROMANIA, e-mail:mavad@tex.tuiasi.ro*
[2]*Technical University "Gh. Asachi", Faculty of Textile, Leather and Industrial Management, Iaşi ,ROMANIA, e-mail:tinap@tex.tuiasi.ro*
[3]*Technical University "Gh. Asachi", Faculty of Textile, Leather and Industrial Management, Iaşi ,ROMANIA, e-mail:emfi@tex.tuiasi.ro*

***Abstract:*** Designing and manufacturing apparel products for mothers should consider body changes during pregnancy period in order to fulfill aesthetic, psychological and functional requirements. For manufacturers is important to find new competitive solutions to produce such garments in a vey short time, at a good price for a very dynamic market. This paper presents some flexible solution to design garments for pregnant woman with specific design modules of CAD systems

***Key words:*** pregnancy, modeling, flexible patterns, CAD system

## 1. INTRODUCTION

During pregnancy, woman body registers important transformations of its outline shape. Over the 40 weeks of pregnancy, the changes are more obvious in the second and third pregnancy semester. The body loses its initial shape and dimensions because of: fetus weight and dimensions, amniotic fluid, uterus fluid retention, fat deposits in tissues, daily activity and psychological conditions.

**Figure** 1.Clothes for pregnant woman

Design process and clothing diversification for a pregnant woman must consider body changes during pregnancy period. Those women want multifunctional products, with flexible fastening systems but at an affordable price.

## 2. CONTENT

In this period, pregnant women prefer to wear trousers with different lengths (long and ¾) with straight or flared silhouette manufactured from knit or fabric. These pants are associated with straight or flared blouses, shirts or sweaters.

Clothes for the 2 and 3 pregnancy quarters are mainly design with support on shoulders to ensure comfort, movement (overall products).

Fastenings systems must be flexible to allow adjustments variations according to the abdomen changes. In these conditions, fastening systems are with buttons or zipper placed on the full product length to facilitate light strip. If the garment is very flared, fastening systems may be partial, with buttons, zipper and staples. If the garments are support on waist ,fastenings systems may have buttons, hooks or elastic adjustable on 3 to 4 cm distance, correlated with the modification ratio (fastening systems are on the left or right side and easy handling).

In nowadays, the rhythm of changes becomes faster and faster and the manufacturers must design flexible clothes for pregnant women in a short time and for good price. This fact is possible if they use specialized module of CAD systems, which allows rapidly changes of the pattern, from usual to special (for pregnant woman).

***Made to Measure Module*** is suitable to design flexible garments patterns for short orders or custom manufacturing system (mass customization). This module from Gemini CAD system allows the use of geometrical method for designing garment patterns. The computer stores each design stage. The design uses basic geometric features, which create new points, correlated with previous one. The points position are established by the designer as fixed or variables quotas. When the model is saved, there are saved all stages, which conduct to the network pattern. After that, is necessary to draw lines or curves anchor to geometrically points.

There are two major benefits arising from this designing method (regarding product grading):

• patterns embedded in geometrical layer are automatically redrawn for each size mentioned in dimensional table;

• the patterns anchored to geometrical layer can be automatically modified for a custom design by introducing client's individual measures in sizing table. The garment model pieces are automatically built after changing dimensional table.

These two major advantages compensate the extra effort and time required to build geometric anchoring layer, because grading operation completely disappears (every time, the computers builds the pattern by "reading" table information). Made to Measure module from Gemini CAD system has following areas:

-*work area* → where is the list of construction stages made with geometric design features;

-*designing area* → contains a table with functions used to build geometric construction and four buttons which allow some changes: add or remove some instructions from the list (you can show or hide some functions);

-*description area* → has description function, empty fields in which you can type or click necessary information (numeric values or formulas). There is an area, which shows the errors.

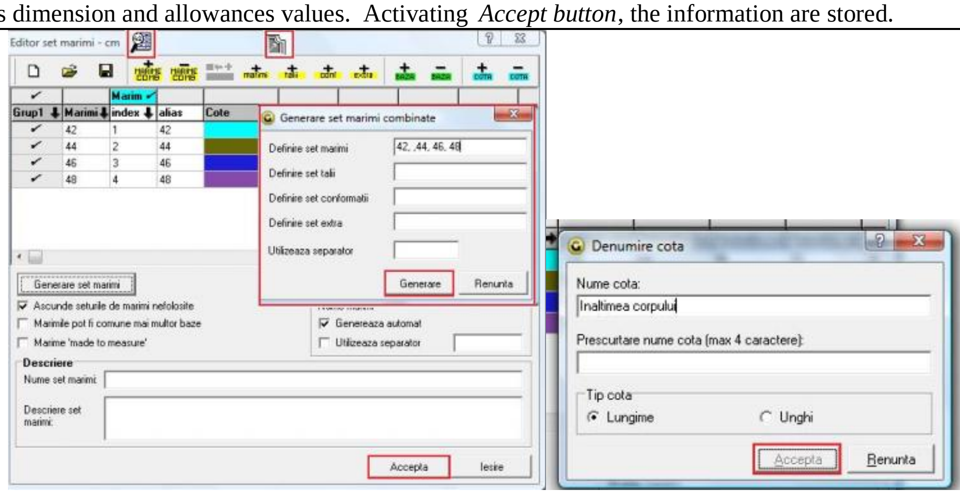
-*a list of shares* → placed in the user input (Edit window);

-*a list design buttons* → buttons for geometric design functions.

Table 2 shows several stages of garment pattern construction stages using Made to Measure module from Gemini CAD System (trousers pattern).

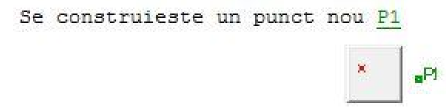
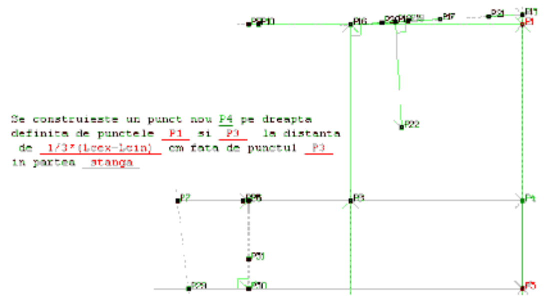
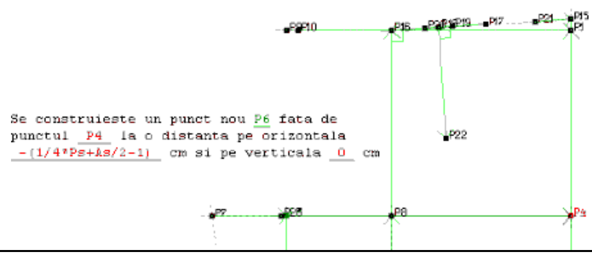
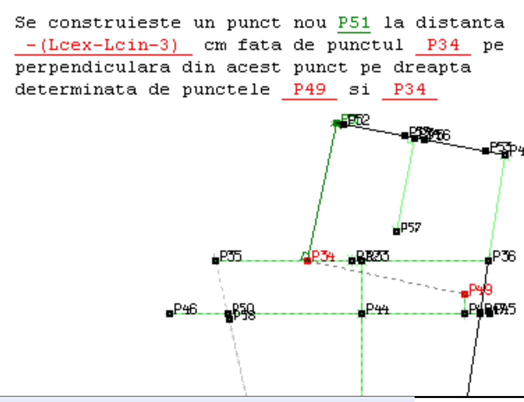
**Table 2**

***Step 1***: Select Grading / Edit set sizes. In this window we type all needed information: sizes, body measurements, garments dimension and allowances values. Activating *Accept button*, the information are stored.




**Figure**

***Step 2***: Activate *Made to Measure* icon. There we type mathematic relations, fixed values for establishing the position of main points in geometric layer.

| | | |
|---|---|---|
| 1. | We put a free point P1 (0, 0) to start the draw; this point is the pattern origin. |   |
| 2. | We place the point P3, (the level of the hip line) related to the P1 point, which using *X, Y function from another point.* *P1 P3*= (Lcex-Lcin)/3 |   |
| 3. | We place point P6 width front on the hip line related to P4, using *X, Y function from another point*. P4P6= (1/4Ps+As/2-1) |   |
| 4. | We fix the position of P51, the highest point of the back pattern, related to P34, using function: *Point on a perpendicularly* P34 P51= (Lcex-Lcin)/3 |   |

In this way, we follow all needed stages to construct the pattern (trousers pattern)

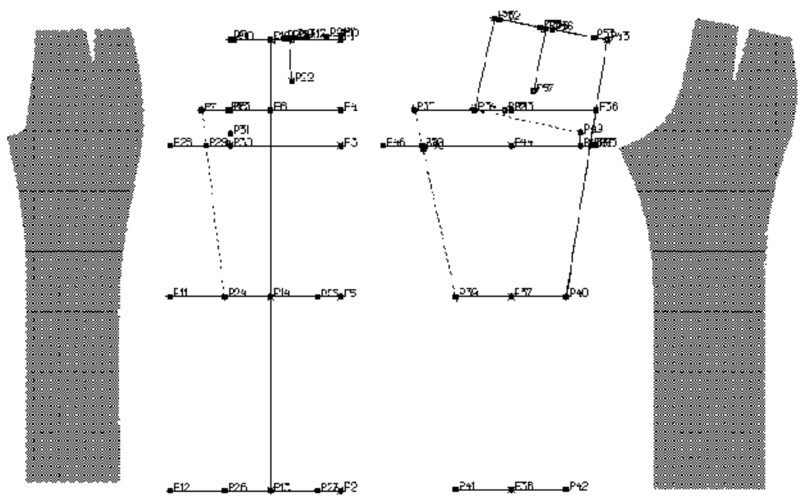


**Figure 2.** Basic patterns of trousers

All designed patterns are anchored to geometric layer. Pattern shape and dimension can be changed either by typing new values in sizing table or by changing dimensioning relations of geometric points. In this way, any base pattern and model pie ces from them is changing according to individual measurement of pregnancy period.

Therefore, garment pieces model result by following methods:

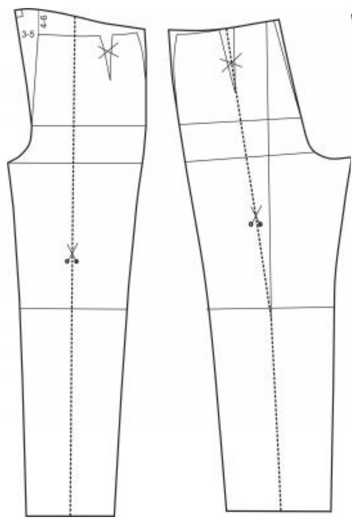
-*method I*: from basic patterns (which are stored in the computer and those pattern were designed for non- pregnant woman) change, according to garments features and body dimensions (from the pregnancy period). The area of the piece increase by introducing folds or pleats in order to ensure comfort and movement parameters.

-*method II*: typing new values for initial data, according to individual measurement of the pregnancy period and/ or changing the structure of mathematic relations (this modification is determined by the body measurements and shape). After that, we modify the patterns according to the model features .

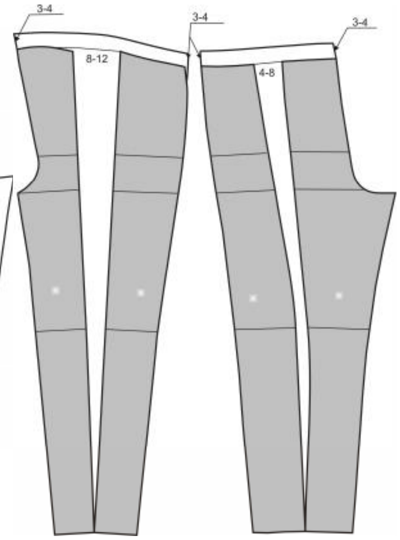
In the paper we show the main steps to obtain the model patterns for trousers for a pregnant woman by applying these two described methods (table1) .The model has a straight silhouette, with elastic on the waistline for flexibility.

**Table 1** Trousers patterns

Trousers model

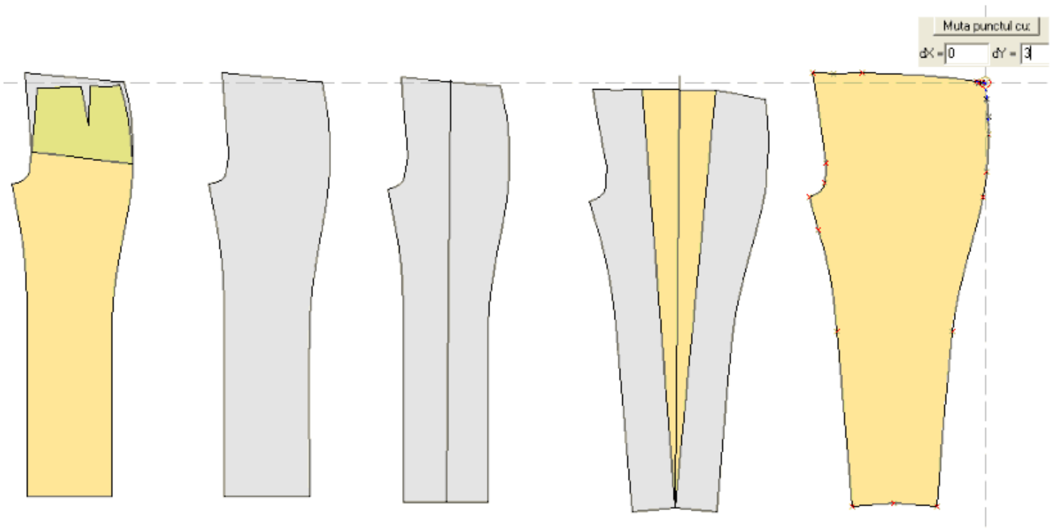



Front and back alteration




Final patterns (front and back)

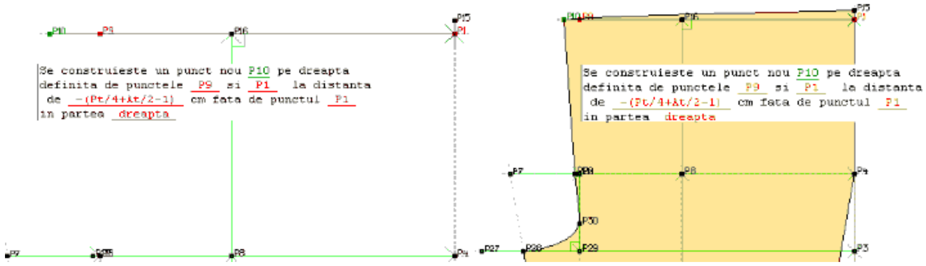
Method I



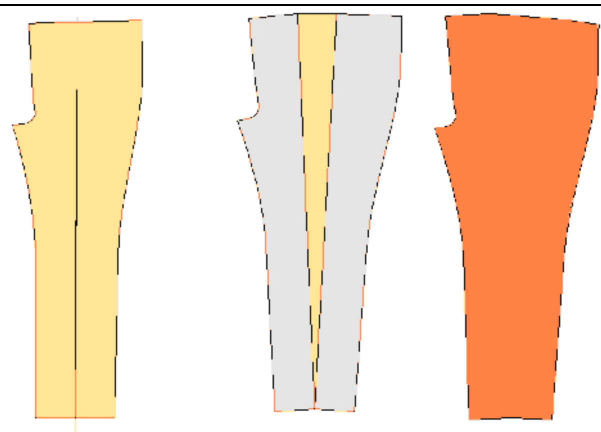

| | | | | |
|---|---|---|---|---|
| Drawing a supplementary piece for changing front pattern (waist length) and balance | First shape of front pattern | Dividing front pattern | Rotate the 2 pieces (3-5°each one, according to the body size from pregnancy stage) | Final stage of he pattern (rising waist line with 3 cm and model that line) |

If the model must be design for the third pregnancy stage is necessary to consider new values for body measurements and different mathematic relation. Those changes are very easy to do if we use Made to Measure Module.
In this case, the waistline from the front pattern rise up, correlated w ith the abdomen modification rhythm or shape (the pattern balance must change according to the shape of abdomen).

Method II




In measurement table, the value for waistline is changed (according to the body size from pregnancy stage). The waistline rises up with 3 or 4 cm for elastic.



| | | |
|---|---|---|
| The front pattern is cut in 2 pieces. | Each piece is rotated with 3-5° for a wider waist length | Final shape of the pattern. |

The modeling method is choosing accordi ng to the garment peculiarities and pregnancy stage. If a company needs to produce garments for the first semester of pregnancy, there will be used usual pattern, modeling according to the garment type and shape. If a company need to produce garments for the second and third period is necessary to design a special pattern, by changing the structure of dimensions used to design the basic network. After that, all the pieces of the model will have a different shape and size (those pieces result from the patter n, which is anchored to geometric layer).

## 3. CONCLUSIONS

CAD systems, through specialized modules allow designing patterns for a wide variety of bodies. This paper presents and exemplifies the main steps to follow for design patterns garments for pregnant woman, using CAD systems (Gemini CAD, Gemini Pattern and Made to Measure). With specific functions is easy to adapt initial design of geometric patterns to the body shape and size. A clothing company that manufactured casual products can diversifies its product structure to do such clothes, without additional efforts of technology and skilled workforce. By this way, that company will innovate and produce new products/models in short series, diversified and/or individualized products (mass customization production system).

## 4. REFERENCES


1. Filipescu, E., Avadanei, M., –*Structura si proiectarea confectiilor textile.Indrumar de laborator*, Editura Performantica, 2007,ISBN 978-973-730-412-4
2. Pintilie, E., Ciubotaru, G., Avădanei, M., *Proiectarea confecţiilor textile asistate de calculator*,Ed. Performantica, Iaşi, 2006, ISBN 973-730-259-1
3. * * * : STAS 6802-91. *Îmbrăcăminte pentru bărbaţi. Dimensiunile corpului* .

- * *: *ISO/TR 10652- Body dimensions*

ANNALS OF THE UNIVERSITY OF ORADEA
FASCICLE OF TEXTILES- LEATHERWORK
Volume I, 2010, No. 2

# TEXTILE PATTERN DESIGN

**BACIU URZICĂ Corina**

*University of Oradea, România,*

*bucorina@yahoo.com*

*Motto:*
*"Ornament is a means by which Beauty or Significance is imparted to Utility." [3] p.154*

***Abstract:*** Decorations on various supports represent a common presence in our world, and evidences for this assertion are provided to us from the most different directions and in the most various way. "Since time immemorial, one of mankind`s characteristics has been a pleasure in beauty and in decorative objects." [6] p.16 Ceramics, glass, architectural motifs, printed or woven textiles are some of the materials which craftsmen or professional artists felt the need to adorn with simple or intricate decorations, depending on the case. If we consider the changes undergone by decorations during time, it is surprising to find out how continuous and unchanged the way of there use is in decorative arts. This demonstrates a deeply understanding of pattern construction. "From all over the world, those styles of decorative design that have withstood the test of time are deserving of further use as inspiration. In fact, the buying public expects to find fresh new interpretations of traditional styles and themes." [9] p. 88
***Key words:*** ornament, pattern, composition, repetiţion, design, unique, series

## 1. INTRODUCTION

Any educational programe on decorative arts (we include here The Decorative Arts Department at the Visual Arts Faculty –Oradea) intends to lay the foundations for the field of textiles designing for woven or printed fabrics and textile products and it aims at forming competences in designing decorative compositions with aesthetic and utilitarian functions for different textile fabrics. Therefore, different methods and techniques are presented by which one can develop decorative motifs on a surface, so they can be suitable for a transposition on a fabric through weaving or printing techniques.

Pattern design is an important domain in wares production, and we can also include printed and woven textiles for clothing or interior decoration in this category. As for textile fabrics, different categories of patterns will take specific forms determinated by the type of the textile material on which they are applied, the transposition technique (printing or weaving), destination, age, gender and colour tendences determinated by the same factors, but by fashion trends too. While in the clothing industry tendencies change each season, in the field of interior decoration these changes are slower. (once every three or five years)

Unlike the decoration of an unique textile product, in the design of series production the pattern is repetitive. When drafting it, one must take into account clear requirements such as the size of the product, its limitations imposed by the technique of transposition, the limitations of the printing and weaving apparatus, aesthetic, functional and commercial requirements. [5] p.386 The simpliest method of patterning a textile fabric is to change the colour, the spin or the thickness of warp or weft threads in the loom, thereby producing stripes or ribbed effect. [1] p.550

For this purpose both technical and artistic knowledge in the field are important, including here knowledge about the evolution of the artistic styles. Textiles patterns are created in such a way so that they could merge with the natural texture, colour and appearance of the fabric. „The design of a textile fabric should reflect the innate qualities of materials from which they were made." [7] p. 31. They can come in a wide range of forms, from the figurative to the abstract ones, from those with vivid and bold colours to the pale and delicate ones, from those with a clear rigorous drawing to those with painting effects, all being interpreted as evidence of the thoughts and actions of those who have created them. The colours choice depends on the creator's imagination, due to the understanding of the specific needs imposed by the textile design and the material use.

In a work of art the composition is controlled and limited by the edges of the canvas, whereas in the compositions with repetitive ornaments the motifs grow and develop endlessly on all sides. Regarding things in such a manner, it probably seems easier to develop a project in which the forms are displayed freely than to create a composition with decorative ornaments. In fact, both directions imply skill, inspiration, resourcefulness, sense of colour, proportions, and balance. The restrictions required by production and transposition methods may be understood as challenges that stimulate the one who creates, and not as obstacles in the way of creativity. Those who see the projects of repetitive decorative composition too restrictive might not have entirely understood the mechanical repetition on which their structure is based on. We can mention here Andy Warhol [8] who had the inspiration to use the mechanical repetition with mouldings, stamps and other printing techniques for his artistic compositions to create works of art with images resumed through multiplication. The mechanical aspect of images resumption evokes industrial processes by which the represented objects are created, and not only. The resumption of images has, in this case, cultural implications that talk not only about the repetitiveness that marks the modern life, mass production, conformity and also about proliferation through the media of certain images which lead to our desensitisation. Finally, by investigating aspects of modern experience, repetition represents a hint to the mass culture imagery, but at the same time has effect on inherent abstractiveness of things.

Resuming the previous idea, we exemplify a theme for designing ornaments approached during the practical courses of "Design Series", having as an inspirational source the iron elements belonging to Art Nouveau movement which flood the interior and the exterior of many buildings in Oradea, a style that "at the dawn of 20th century created a form of ornamentation which embraced all spheres of art in equal measure." [6] p. 30. The ironwork elements used for banisters, balconies, gates, fences, from tendrils, delicate hooks, diapers, squares created from interwoven grids of wire nets to lines with vibrant or syncopate wavy rhythm, are the elements which lie at the bedrock of the construction of new decorative ornaments which will decorate textile fabrics this time. "The *fin de siecle* marked a design transformation from the desire to hang on to historicist motifs, to the dawn of a new modernity; a realisation that rationalism and efficiency were necessary for the new century." [4] p. 270. Motifs from rough and rigid metal will become through interpretation lithe and sensitive, creating new laced shapes with sinuous, elegant and graceful lines which plait and flow continuously. They can be created using classical techniques (watercolours) or on computer (Photoshop, Corel).

"The development of a motif into decorative ornament calls for the use of all the principles thus far established, plus familiarity with the medium to be used and the inventiveness that comes only with some experience." p.35 [2]. Once each student has established the decorative motif which he intends to use, based on a documentation upon Art Nouveau style, the next step is to establish the rule to repeat it through putting it in relation so that he can obtain the desired composition. There are a few rules that can be applied when developing the motif on a surface, so as to contiue endlessly on all surfaces and we briefly present them:

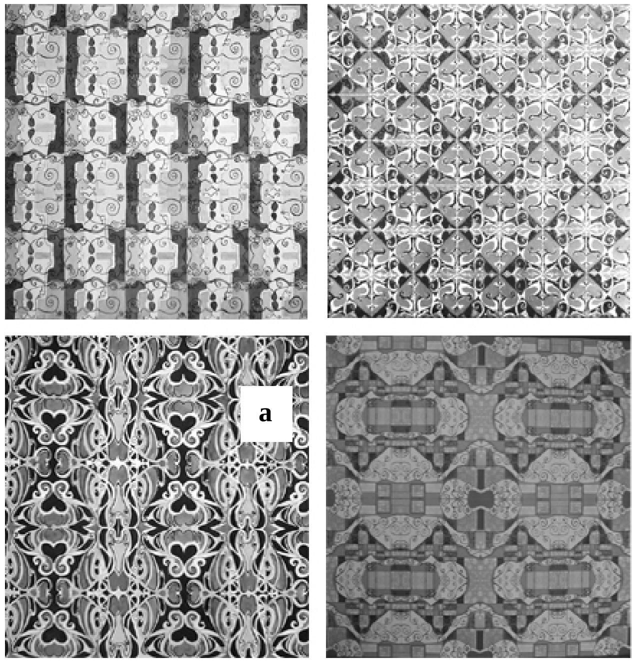
-the side repeat or the repetition created by the succession of one unit or by position or colour alternation of one or two different motifs

-the side repeat using a turnover pattern effect that is identically repeating itself along a symmetry axis

-the side repetition using turnround pattern effect, is a more complex example of turnover repetition when a quarter motif pivots from the center (this repetitive structure is prefered for carpets and scarves due to the nondirectional character)

-the drop repeat by mouving the motifs with 1/2, 1/3, 1/4 to the next one to obtain more complex combinatorial formulae between motifs and to loose the vertical or horizontal alignment (this brick arrangement offers a better blending between motifs)

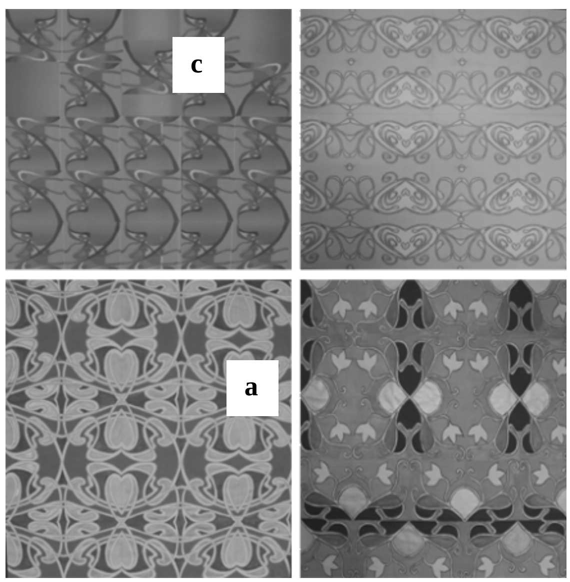
No matter how complicated the ornament is, the compositional structure is built by drawing uniform grids that represent frames which will further include them. The project must contain enough frames as to allow us to understand the rule by which the ornament is repeated. These marks are not part of the model; they are mere means of work that help us to establish the way the ornament is repeated in order to obtain the patterned composition. A special attention must be paid to the forms and their relationship on the limit marks, to create continuity between these, between forms and background, between parts and the whole. This (the ornament) doesn't necessarily have to be incorporated within the limits of the frame, but it may surpass these limits, in which situation the patterns will join more naturally and organically with the adjoining ones.




b

**Figure 1**

**Figure 1a.** Project for a printed fabric used for interior decoration (curtain using 5 colours)
**Figure 1b.** Project for a printed fabric used for cloathing articles using 3 colours
**Figure 1c**. Project for a printed fabric udes for cloathing articles using 5 colours
**Figure 1d.** Project for a woven fabric used for interior decoration (courtain using 5 colours)




d

b

Fig. 2

**Figure 2a.** Project for a printed fabric created on computer, used for interior decoration (curtain using 5 colours)

**Figure 2b.** Project for a printed fabric, created on computer used for interior decoration (curtain using 3 colours)

**Figure 2c.** Project for a printed fabric used for interior decoration (curtain using 5 colours)

**Figure 2d.** Project for a printed fabric used for interior decoration (curtain using 5 colours)

The designs presented in the adjoining images for exemplification are based on the line value which follows the principle of organic growth. c According to the chosen rule, ornaments d receive another rhythmical value. The fluid, moving line is valuated here and there by colour and transparency effects that remind us of the stained-glass of the Art Nouveau. The decorative linear drawing follows either the waved stylistics, typical for this style that explores the vegetal element using dynamic, flexible, full of energy lines or the geometric sobriety where the lines play is controlled by symmetry rules.

The decorative motifs may look like small spots, isolated and scattered , more or less organized or looking like dense block patterns. In the first case the forms (the positive elements) are not connected with one another and appear to float in the negative space represented by the background. In the second case the positive elements are closed to each other and overlapped forming block patterns whereas the negative ground loses its importance. A special situation appears when the shape (the positive space) is identical to the negative space, and thus it creates an ambiguous relation between the two elements, as in the M.C. Escher case. [10]

In pattern designing the size and visual directions created by them are important. For example, the ones that flow lengthwise are suitable for clothing articles and if pattern flows overall one can save fabric when tailoring, the ones on the width are suitable for upholstery. In the same way, the size of the pattern must be in accordance with the fabric destination.

In conclusion, textile patterns are woven, plaited, embroidered or printed drawings that aim at valuating the textile products. They award distinctive qualities to a textile product and carry the mark of that one who created them. Flowers, animals and geometrical forms are common themes for textile patterns. Blurred or vibrant, abstract or figurative, simple or complicated, they can have symbolic values besides aesthetic qualities.

## 2. REFERENCES


1. *Dictinary of Art The*, ISBN 0-19-517068-7, Oxford University Press, 1996 p.550
2. Gage Harry Lawrence, *Applied Design for Printers*, ISO-8859-1, United Typothetae of America Chicago p.35
3. Glazier Richard, , A Manual of Historic Ornament, ISBN 0486421481, Dover Publications, Incorporated, 2002 p.154
4. *International Arts and Crafts*, ISBN 978-84451-262, Flame Tree Publishing, London, 2005 p.240
5. Meyer Franz Sales, *Ornamentica,* Editura Meridiane, Bucureşti, 1998
6. Natasha Kubish, Pia Anna Seger, *Ornaments*, ISBN 978-3-8331-4035-8 Hastings House Publishers, 2007, p.16, 30
7. *Textiles and Interiors*, 1-84013-266-3 Quantum Book, Ltd. London, 1999 p.31
8. *Warhol Andy*, ISBN 978-973-714-231-3, Editura Aquila, Oradea, 2008
9. Waterman Anne, *Surface Pattern Design*, ISBN 0803867794, Hastings House Publishers, 1998 p. *88*
10. www.mcescher.com/Gallery

ANNALS OF THE UNIVERSITY OF ORADEA
FASCICLE OF TEXTILES- LEATHERWORK
Volume I, 2010, No. 2

# STATTEX - THE PROGRAM FOR EXPERIMENTAL DATA PROCESSING IN COTTON SPINNING MILL

**Ionel Barbu, [1], Alexandru Popa [2]**

[1]***Aurel Vlaicu University, Arad, Romania***, *ROMANIA*

Corresponding author: Ionel Barbu, E-mail: ionelbarbu@yahoo.com

***Abstract:*** The quality improvement is essential for every textile enterprise. The optimisation of quality could be possible only by using the best materials. The quality of products for customer reflects the materials used in factory, the cycle of production, the processing of each technolog ical line and also the maintenance of maschines on the entire technological line. If one of these criterions is neglected, the quality expected by the client ( customer ) won't be the optimal one. The **STATTEX** program is very useful for physico-machanical labs for determination of the fibers physical-mechanical characteristics while the reception on new materials is done, for determination of the semi-finished products characteristics and also for processing of the data from analysis report elaborated for each 3000 kg lot of fibers or any time when it's necessary.
***Key words:*** design in textile, cotton spinning, physical-mechanical characteristics, statistics

## 1. INTRODUCTION

The quality improvement is essential for every textile enterprise. The optimisation of quality could be possible only by using the best materials. The quality of products for customer reflects the materials used in factory, the cycle of production, the processing of each technological line and also the maintenance of maschines on the entire technological line. If one of these criterions is neglected, the quality expected by the client ( customer ) won't be the optimal one.

The notion of optimisation is adopted relative because the company will be able to secure better materials, to hire a larger staff, to replace the parts of the machines more often.

Only these measures will improve the quality, but the real rise of costs could catapult the company out from the market.

The lab and the technical service have to be capable of supervising the whole cycle of production in different ways.

The success of improving will be assured only by learning the causes of different imperfections of semi-finished products and goods.

The main objective is the control of the causes and not of the effects. It is also necessary to out run the primar data a little over the genneral informing level.

The statistics methods permit the value of every individual characteristic on each fabrication cycle. When the fabrication cycle is improved the statistic limits are als o more precise .

The **STATTEX** program is very useful for physico-machanical labs for determination of the fibers physical-mechanical characteristics while the reception on new materials is done, for determination of the semi-finished products characteristics and also for processing of the data from analysis report elaborated for each 3000 kg lot of fibers or any time when it's necessary.

The **STATTEX** program solved the following problems:

- Reading of experimental data;
- Arrangements of the pool data;

- Elimination of the aberrant values using the Dixon or Grubbs tests depending on the sample volume and after then their visualization;
- Presents a report for the remaining values;
- Lists this report on printer;
- Calculates the valid values and their classification;
- Testing the concordance between experimental and normal distribution by using the concordance $\chi^2$ or the Kolmogorov-Smirnov tests depending on sample volume;
- Allows the option for listing a report on printer which contains the helping table for the concordance tests;
- Graphic representations:
    - The histogram
    - The polygon of the relative frequencies
    - The polygon of the absolute frequencies
    - The diagram of the cumulate frequencies
- Allows the option to list the graphic representations on the printer
- Calculates the typical poll values (arithmetical average, median line, mood value, amplitude, dispersion, the average square deviation, the coefficient of variation, the absolute average deviation, the coefficient of linear irregularity, the coefficient of asymmetry, the coe fficient of vaulting and the excess);
- Allows the option for listing the VTS report that contains the typical poll values calculated previously for interpreting the results.

The program has 453 kB and it is very complex as it solved even rather difficult pr oblems. It starts from classification of poll values to graphic representations and reports listings that allow the results analyze and decisions concerning the leading of technological processes.

By helping of a few modifications, the program could be use d in other fields of activity where it's necessary the processing of a great number of experimental data (e.g.: in chemistry labs, in research, etc.)

The program is very friendly and it permits its using very easy in Romanian language by every laboratory – assistant.

## 2. LOGIC SCHEME

The logic scheme of the **STTATEX** program is presented in fig.no.1. was realized by using the bibliographic indications [ 6 ]. This is a logic scheme with ramifications considering the fact that both testing and removing the aberrant values by Dixon or Grubbs tests and testing the concordance of experimental repartition with the normal one, by $\chi^2$ or Kolmogorov-Smirnov testes, are done with different algorithms depending on the sample volume.

The meaning of the used notations in representing of this logical scheme is the usual one for applying those tests.

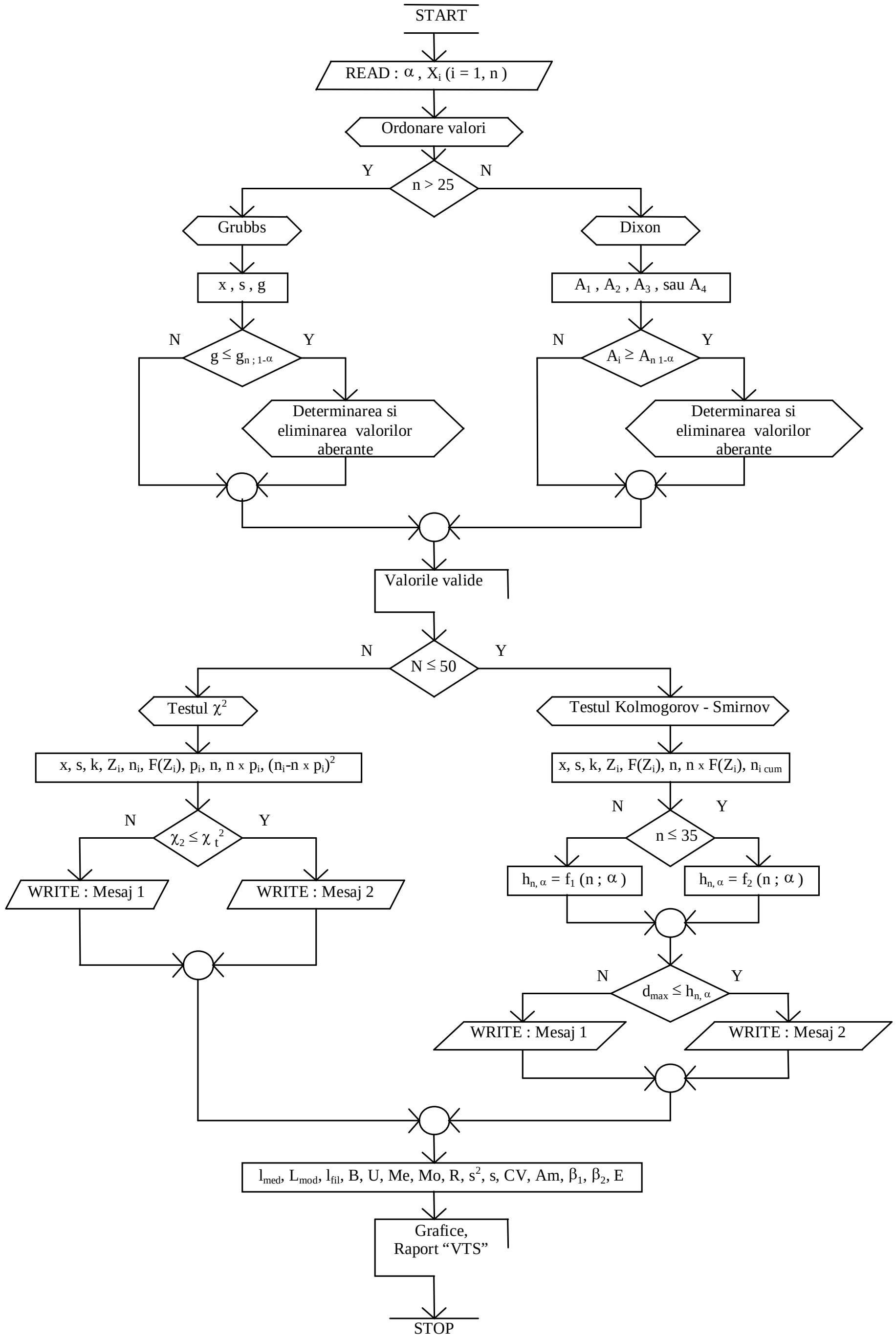



**Figure 1.** The logic scheme of the **STTATEX** program

## 3. THE USING BOOK

After the action with the mouse the little appears on the "OK" mini **-** window:

"Culegere date experimentale

Eliminare valori aberante

Se aplica testele Dixon sau Grubbs"

"Collection of experimental data

Removing aberrant values

Applying Dixon or Grubbs Tests"

It is going with the rolling up by "**y**" and then "↵". It is introduced the statistics assurance from the taster 90%, 95% or 99% depending on the number of experimental values " **N**".

The table “Collection of experimental data” appears and there are introduced “Indicator” the order number of experimental data and “Value” – the value of these ones. The movements are realized using **←,↑,→,↓** and finally it is used **F4**.

The message “Are you confirming? “(**Y/N**) appears when it’s necessary to check the introduced data and if wrong values are introduced “**N**” and then “↵”must be pressed and after that the wrong values are corrected by the arrows and **BACKSPACE**. If the dates are correct, “**Y**” and then ↵ must be pressed. In this moment the calculation of the “A” or “g” statistics starts for the testing of the aberrant values, function of the sample volume using the Dixon and Grubbs tests.

After this a table with all the introduced values appears on the screen and the aberrant ones are marked with “*****”. The visualization of the entire table is made with the ↑ and ↓ arrow, or if there are more values the ***Page up*** and ***Page down*** keys are used.

After visualization the **F4** key is pressed and the process for the elimination of the aberrant dates begins and the *“Expunere rezultate test”(“Exposure of the test results”)* table is presented. This table includes only the valid experimental dates.

When **F4** is pressed the following menu appears:

“Afisare” *(“Display”)*

*“Continuare” (“Continue”)*

If *“Afisare”(“Display”)* is selected and then ↵ is pressed a report with all the valid values will be displayed on the screen and the return to the anterior menu is realized by pressing ***“Ctrl+Pause”***. When *“Continuare” (“Continue”)* is selected, the following menu appears:

“Listare” *(“Print”)*

*“Revenire” (“Return”)*

If *“Listare” (“Print”)* is selected the report containing the valid dates is printed and if *“Revenire” (“Return”)* is selected the program keeps running.

After this, a window that presents the result of the valid values count and the type of the concordance test that is being applied. To continue, one must press “**Y**” and then ↵.

Pressing F1 chooses the meaning level, and a table shows up. From this table, the meaning level is chosen using ↑ and ↓ arrows and pressing ***F2*** will cause the program to run again. Pressing ***F4*** will cause the presentation of a part of the necessary calculations for the concordance test between the current and the normal repartition. Function of the values of the *“dmax”* and “$\chi^2$”statistics and function of the result of the comparison between them and the values in the table one of the following messages will be displayed:

"Această repartiţie urmăreşte o repartiţie normală"

(“This repartition follows a normal repartition”)

or:

"Această repartiţie nu urmăreşte o repartiţie normală”

(“This repartition doesn’t follows a normal repartition”)

For the program to go on a key must be pressed and after doing so the possibility to display or to print a report that includes the helpful tables for the necessary calculations of the $\chi^2$ or Kolmogorov – Smirnov tests, exists.

When *“Revenire” (“Return”)* is selected the graphics defilation begins: the absolute frequencies polygon, the relative frequencies polygon, the histogram and the cumulative frequency curve, and the pass from one graphic to another is made by pressing ↵.

After this *“L”* is pressed to process the dates about the fibers length (considering that a series of specific parameters appear, parameters like the spinner length, the modal length etc.) or any other key and ↵ to analyze the results about the analyzed parameters.

The calculation of the typical poll values and their representation *“in clar” (“clearly”)* on the screen and after pressing a key there exists the possibility to display a report on the screen with all the typical poll values or to print this report. *“Ctrl+Pause”* and the selection *“Continuare” (“Continue”)* followed by *“Listare” (“Print”)* makes the pass from display to print.

When *“Revenire” (“Return”)* and then any key is pressed the return to the initial menu *"Proiectarea tehnologică asistată de calculator" (“Computer assisted technologic projection”)* is realized.

### 4. UTILIZATION EXAMPLE

When the torsion of a yarn Tt =16 tex for warp has been verified, 60 determinations were made and the following values were obtained:

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 880 | 930 | 920 | 910 | 952 | 894 | 928 | 940 | 910 | 960 |
| 920 | 820 | 972 | 970 | 900 | 910 | 920 | 894 | 840 | 952 |
| 952 | 864 | 928 | 920 | 920 | 840 | 900 | 900 | 950 | 930 |
| 910 | 838 | 930 | 910 | 924 | 940 | 970 | 920 | 928 | 924 |
| 920 | 864 | 894 | 960 | 972 | 920 | 924 | 880 | 890 | 890 |
| 924 | 900 | 928 | 880 | 980 | 950 | 910 | 860 | 924 | 860 |

After counting the experimental dates, the following message will be displayed on the screen:

***" Se aplică testul Grubbs "***

*("The Grubbs test is applied")*

By applying the Grubbs test the value 820 comes out as aberrant, this value is eliminated and a report containing only the valid values can be printed.

After the number of valid values is determined, the following message is displayed:

*" Se aplică testul $\chi^2$ "*

*("The $\chi^2$ test is applied")*

By applying the $\chi^2$ test the value of the calculated statistics, $\chi^2$ =5.18, is compared with the one in the table $\chi^2$ = 10.6 and after that the following message is displayed on the screen:

***" Repartiţia curentă urmăreşte o repartiţie normală "***

*("The current repartition follows a normal repartition")*

The graphic processes of the valid experimental dates (the absolute frequencies polygon, the relative frequencies polygon, the histogram and cumulative frequencies polygon) are presented after that.

All the typical poll values are calculated in the end and the report containing these values can be printed:

***Typical poll values***

| | |
|---|---|
| *The base* | *59,3 %* |
| *The minimum poll value* | *838 tors/m* |
| *The maximum poll value* | *980 tors/m* |
| *The arithmetic average* | *915,7 tors/m* |
| *The poll median line* | *920 tors/m* |
| *The poll module* | *928,4 tors/m* |
| *The poll amplitude* | *142 tors/m* |
| *Dispersion* | *$1142,7(tors/m)^2$* |
| *The average square poll deviation* | *33,8 tors/m* |
| *The coefficient of variation* | *3,69 %* |
| *The absolute average deviation* | *25,96 tors/m* |
| *The coefficient of linear irregularity* | *2,95 %* |
| *The coefficient of asymmetry* | *2,45* |
| *The coefficient of vaulting* | *2,77* |
| *Excess* | *-0,23* |

## 5. REFERENCES

1. Rusanovschi, V., Copilu. V. (1978). *The cotton spinning mills projection*. The Technical Print House, Bucharest.
2. Barbu, I., Bucevschi, A., Marincas, A., Cristea, M. (1997). *Cotton spinning mills*."Aurel Vlaicu" Univ. Print House, Arad, 1997
3. *** - "Paradox" - Borland International Inc. SUA -1993;
4. Rau, P. (1995). *Paradox (3.5, 4.0, 4.5 versions) users guide*. SAH-PRESS Print House, Bucharest.
5. Ciocoiu, M., Barbu, I., Onită, A. (1998). *Computer Assisted Technologic Projection In Cotton Spinning Mills-2nd volume*, Aurel Vlaicu Univ. Printing House, Arad.
6. Cristea,V. (1997). *Programming techniques*- Teora Printing House, Bucharest, 1997.

ANNALS OF THE UNIVERSITY OF ORADEA
FASCICLE OF TEXTILES- LEATHERWORK
Volume I, 2010, No. 2

# ON THE VARIATION OF THE NUMBER OF NEPS ON TECHNOLOGIC STAGES IN MILLING FACTORIES

**Demetra Lăcrămioara Bordeianu**

*Technical University "Gh. Asachi", Iasi, Romania*

Demetra Lăcrămioara Bordeianu, E-mail address: dlb@tex.tuiasi.ro

***Abstract:*** This research studies three different mixtures of cotton type fib ers in order to follow the variation of the number of neps and impurities of the semi-finished on a technological production, and we can conclude as in the processes where the fibers are beaten the number of neps is rising.
***Key words:*** cotton, neps, impurities, spectrograms, thinning, thickenings

## 1. INTRODUCTION

The stability of the plant fibers in semi-finished products and in finished products is one of the most important requirement which influences the unfolding in good terms of the mechanical processing phases and also the usage duration, comf ort and looks of the clothings products. This feature is primarily determined by the characteristics and properties of the individual fib ers from the structure of the used fibers.

A particular case of the stability of fibers in plant structures is the pill ing effect, a phenomenon found in all types of plant fibers. Pilling has been the object of many scientific research and studies, some of them on the dimensions of fibers, on the shape of the transversal section, on the frequency and form of the waves, etc. A new factor who brought its contribution to pilling is the flatlessness of the visco-elastic motion of the fibers in plant structures.

The appearance of neps during the processing of the fib ers creates difficulties in the process of fiber manufacturing and negatively influences the quality of the finite product.
The neps are fiber agglomerations, visible to the eye, with a low mass (0,01...0,1mg), and can contain in their interior small residues of leaves, in this case, neps are much heavier (0,1...0,3m g).

Little is known about the mechanism of the creation of neps, research show that they start evolving from the cotton plant and their number increases under the strike of the processing machines. A better understanding of this process could help control and reduce this neps creation process.

## 2. EXPERIENCED VARIANTS

In order to follow the variation of the number of neps on technologic p hases, 3 different combinations were taken into study. They are marked $R_1$ $R_5$ şi $R_2$ from which the same fineness of thread (Nm 50/1) has been obtained, eliminating in this way a fluctuating parameter. The used combinations were :

($R_1$) 33% combed cotton + 67% Pes
($R_5$) 50% carded cotton + 50% Pes
($R_2$) 50% Pes + 50% Cello

The characteristics of the component fibers from the used combinations are centralized in tables 1, 2 and 3.

**Table 1**

*($R_1$)     33% cotton + 67% Pes*

*Raw material*

| Raw material's name | Participation rates (%) | Fineness | | Pressley Resistance x 1000 lb/inch$^2$ | Fiber's Length (mm) | Number of neps /10g | Number of impurities/10g |
|---|---|---|---|---|---|---|---|
| | | Nm | Micronaire | | | | |
| FixedGhiza 70 | 40,33 | 7352 | 4,06 | 112,139 | 36,8 | 696 (0,23%) | 746 (3,24%) |
| Piral Ghiza 70 | 33,66% | 6818 | 4,34 | 113,335 | 37 | | |
| Arona Ghiza 75 | 26% | 6410 | 4,76 | 123,600 | 33 | | |
| Pes | 67% | 6818 | den 1,55 | $(g\ f)_5$ | 38 | 216 | 368 |

**Table 2**

*($R_5$)     50%* carded cotton *+ 50% Pes*

*Raw material*

| Raw material's name | Mixing Participation percentage | Fineness | | Pressley Resistance x 1000 lb/tol$^2$ | Fiber's Length (mm) | Number of neps /10g | Number of impurities /10g |
|---|---|---|---|---|---|---|---|
| | | Nm | Micronnaire | | | | |
| Russian cotton type I | 25% | 6357 | 4,50 | 90,697 | 28,5 | 573 (0,441%) | 1050 (2,08%) |
| Russian cotton type II | 12,5% | 5434 | 3,92 | 88,304 | 27,5 | | |
| Sudanese cotton | 25% | 6250 | 3,26 | 90,735 | 27,0 | | |
| Turkish cotton extra | 6,25% | 5556 | 4,36 | 86,031 | 27,0 | | |
| USA cotton | 12,5% | 5172 | 4,28 | 84,436 | 26,8 | | |
| Turkish cotton | 18,75% | 6250 | 4,14 | 98,620 | 28,5 | | |
| Pes Cotton type | 50% | 6000 | 5 | 5 | 37,58 | 216 | 368 |

**Table 3**

*($R_2$)     50% Pes + 50% Cello*

*Raw material*

| Raw material's name | Mixing Participation percentage | Fiber's Length (mm) | Fineness (den) | Tenacity (cN/tex) | Neps /10g | Flaws/100g |
|---|---|---|---|---|---|---|
| Pes | 50% | 37,25 | 1,50 | 5,9 | 216 | 368 |
| English Cello | 25% | 37,28 | 1,52 | 1,7 | 320 | 14 |
| Belgian Cello | 15% | 37,28 | 1,52 | 2,6 | 320 | 14 |
| Romanian Cello | 10% | 37,28 | 1,52 | 1,5 | 320 | 14 |

## 3.RESULTS AND INTERPRETATIONS

For the combinations studied the main characteristics of the fibers have been determined, also the content of impurities and neps (according to the existing STAS – the quality requirements) for each technologic phase and the results are centralized in tables 4, 5 and 6.

**Table 4**

*R1 Semi-finished*

| Name of equipment | Fiber's Length (mm) | Micronaire Fineness | Pressley Resistance x1000 lb/inch$^2$ | Neps /10g | Impurities/10g |
|---|---|---|---|---|---|
| Axial-Flow cleaner | 37 | 4,05 | 120,795 | 1620 | 1792 |
| Level cleaner | 36,5 | 4,08 | 113,076 | 1548 | 1424 |
| Machine suitable to beat cotton | 36 | 3,88 | 120,128 | 2448 | 1372 |
| Carding | 34 | 4,10 | 116,668 | 1260 | 714 |

| Name of equipment | Fiber's Length (mm) | Micronaire Fineness | Pressley Resistance x1000 lb/inch$^2$ | Neps /10g | Impurities/10g |
|---|---|---|---|---|---|
| Flails | 29 | 4,12 | 116,772 | 4580 | 21560 |
| Blending machines | 35,4 | 4,08 | 117,426 | 1035 | 583 |
| Combing machines | 35,2 | 4,12 | 116,668 | 936 | 71 |
| Combing | 29,5 | 3,74 | 107,130 | 11353 | 1136 |
| Lamination machine II | 34 | 4,20 | 116,425 | 729 | 60 |
| Waste machines | 34 | 4,20 | 116,668 | 715 | 56 |

**Table 5**

*R5 Semi-finished*

| Name of equipment | Fiber's Length (mm) | Micronaire fineness | Pressley Resistance x1000 lb/ţol$^2$ | Neps /10g | Impurities /10g |
|---|---|---|---|---|---|
| Level cleaner | 27,5 | 4,25 | 89,176 | 1460 | 1968 |
| Horizontal Double Breaker Picker | 27,1 | 4,25 | 90,120 | 1414 | 1328 |
| Simple Breaker Picker (fine) | 27,6 | 4,18 | 90,196 | 2162 | 1072 |
| Machine suitable to beat cotton | 27,6 | 3,92 | 88,198 | 3862 | 1080 |
| Carding | 27,8 | 4,12 | 92,278 | 3040 | 884 |
| Flails/ carding | 24,8 | 4,74 | 81,608 | 6780 | 33580 |
| Lamination machine II | 27,7 | 4,25 | 89,276 | 1780 | 604 |
| Waste machines | 27,7 | 4,18 | 89,276 | 1880 | 577 |

**Table 6**

*R2 Semi-finished*

| Name of equipment | Neps /10g | Flaws/100g |
|---|---|---|
| Multi-mix | 513 | 69 |
| Machine suitable to beat cotton | 752 | 56 |
| Carding | 285 | 51 |
| Lamination machine II | 256 | 68 |
| Waste machines | 236 | |

The impurities and neps content has been determined through the manual method. The variation of the number of impurities and neps on technological phases is graphically present ed in Figure 1.

For the machines that are part of the beating process the variation of the number of neps and impurities was closely followed after each point of beating. The results obtained are graphically described in Figure 2.

The discovery of the length was based on the cumulative diagrams of the fiber's length, diagrams obtained through the sorting-out method on the machine with a field of combs.

As for the number of thinness, thickenings and neps the quality level of the yarn produced and its adjustment towards the world-wide level was established. (table 7).

**Table 7**

The quality adjustment of the fibers to the global level

| Mix | Flaws | Fiber quantity | World-wide level | Quality |
|---|---|---|---|---|
| R5 | S=85 | 1000 m | 90% | Weak |
| | Î=1059 | | 95% | Weak |
| | Neps=829 | | 90% | Weak |
| R1 | S=0 | 1000 m | 25% | Very good |
| | Î=29 | | 10% | Very good |
| | Neps=32 | | 10% | Very good |
| R2 | S=20 | 1000 m | 50% | good |
| | Î=164 | | 50% | good |
| | Neps=72 | | 25% | Very good |

The usage of the Uster Regularimeter allows the tracking of the evolution of the transversal section of fibers and semi- finished and also the graphic recording of this value. The analysis of the transversal section evolution diagram gives us a serie s of directions for the size and type of product's levelness.

Besides the finding of the Uster irregularity, of the number of thinness, thickenings and neps, through the analysis of the spectrograms, obtained at the speed of 25 m/min, some technological causes have been identified, which have produced recurrent flaws in the fib er, this coming from ring spinning machines.

In Figure 3 there are examples of spectrograms obtained for the combination of pol yester with cello fiber, R2 recipe.

## 4. CONCLUSIONS

From the view point of the variation of the number of neps and impurities of the semi -finished on a technological production, from the research and the analysis of the results and comparing the 3 used blends the following conclusions can be drawn :

- in the processes where the fib ers are beaten the number of neps is rising (chart 1)

- in the following technological phases : car ding, lamination, mixing, the number of neps is decreasing, accentuated by the combing machine (for the mix 67% Pes + 33% combed cotton)

the best behavior, from the viewpoint of the number of neps and impurities, has the mix 50% Pes+50% Cello, so, the chem ical fibers, where there are the lower values, followed by R1 (67% Pes+33% combed cotton) and R5 (50% Pes+50% carded cotton) (chart 2).

- regarding the irregularity of the fib ers, expressed by the Uster machine, under the configuration of the number of thinning, thickenings and neps, the fiber form recipe R1, followed by the R2 fiber and R3 fiber have the best behavior.

After the study of the fiber's rare flaws content, the obtained values compared with the digital norms Uster Classimat lead us to the con clusion that the fibers are under the global medium level of 50%.

As for the milling, the chemical fib er (R2 50% Pes + 50% Cello) has a better behavior on a technological process, but subsequent studies are required for the mechanical finishing and for the finite products (fabrics, clothing products etc).

Taking into consideration the bad influence that neps have on the usage of raw materials (because eliminating them good fib ers end up as residue) and the difficulty of their elimination (thanks to their small size), it is recommended to avoid as much as possible the usage of the machines that beat the material by holding it (their number increases) and to pay a special attention in cho osing the adjustments on the carding and the combing machine, these havin g a higher capacity of reducing the number of neps.

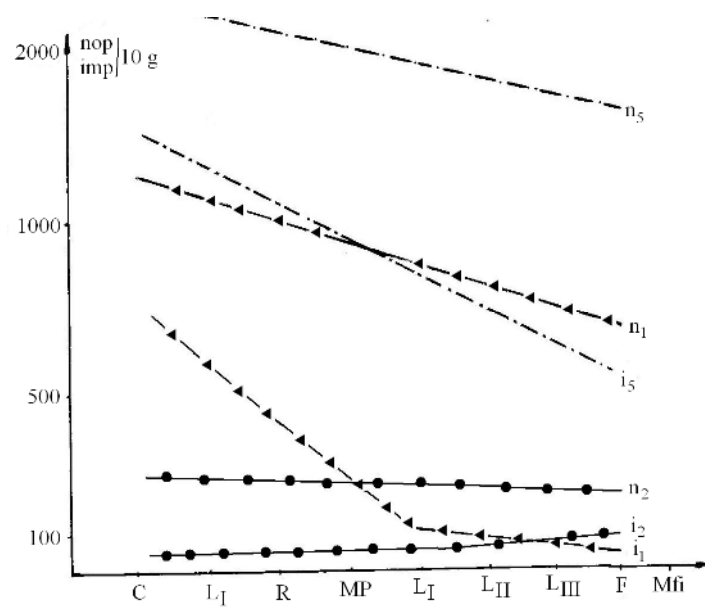



**Figure 1**: The variation of the number of neps and impurities in technological phases

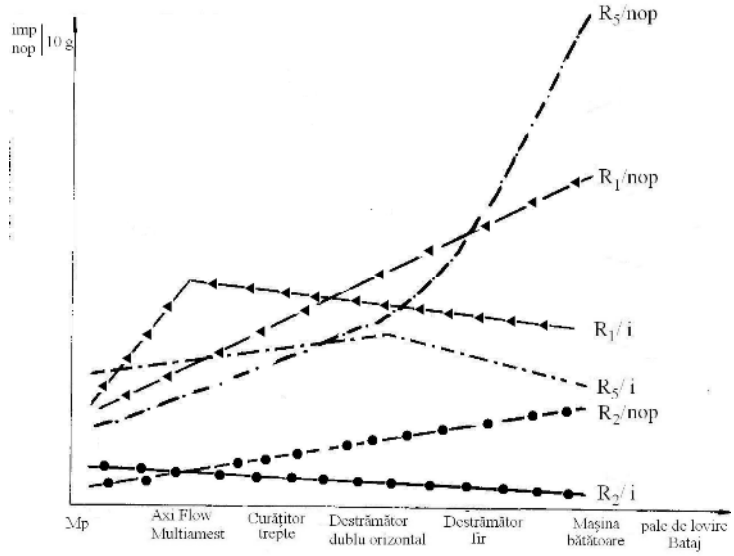



**Figure 2**: The variation of the number of neps and impurities in the beating process

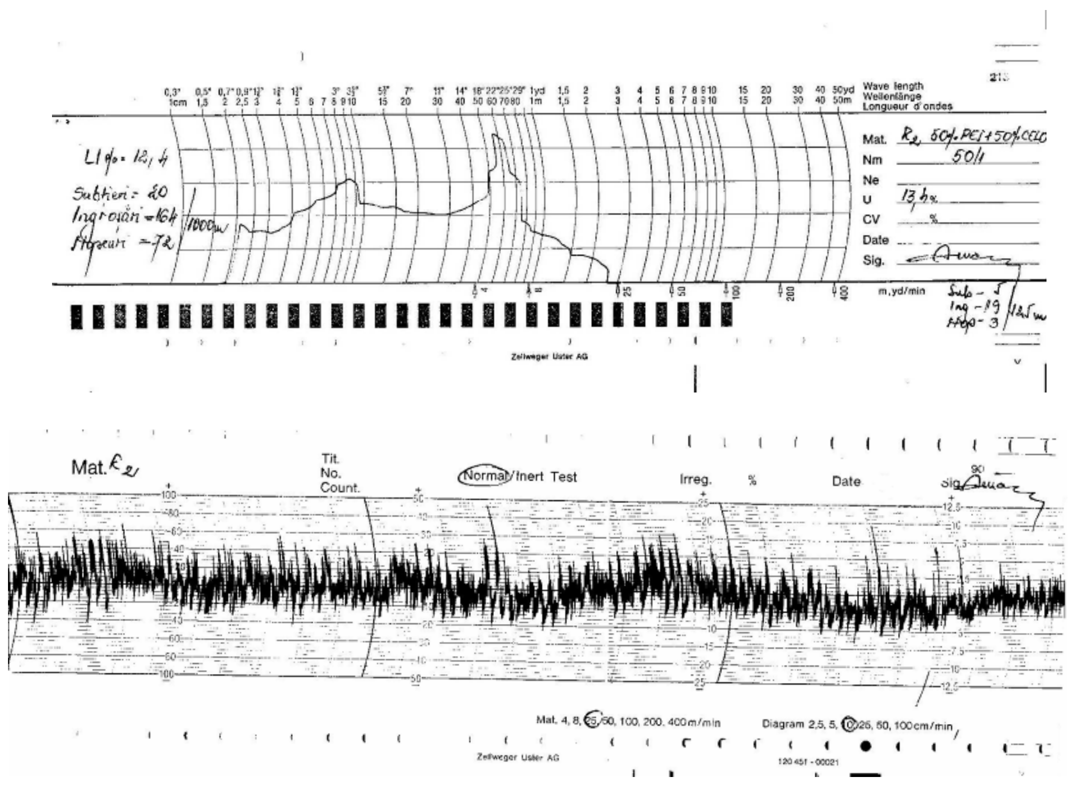



**Figure 3**: Spectrograms for the R2 mixture (50%pes + 50%cello)

## 5. REFERENCES


1. Bordeianu, D. L. – Fibre trextile, Ed. Universităţii Oradea, 2005
2. Vlad, I. – Fibre textile, Ed. Didactică şi pedagogică Bucureşti, 1964
3. Copilu, V., Vlăduţ, N., Florescu, N., - Filatura de bumbac, Ed. Tehnică Bucureşti, 1976
4. Asandei, N., Grigoriu, A., - Chimia şi structura fibrelor, Ed. Academiei RSR, Bucureşti, 1983
5. Ionescu-Muscel, I., - Fibre textile la sfârşit de mileniu, Ed. Tehnică, Bucureşti, 1990

ANNALS OF THE UNIVERSITY OF ORADEA
FASCICLE OF TEXTILES- LEATHERWORK
Volume I, 2010, No. 2

# EVALUATION OF THE DURABILITY OF MICROENCAPSULTED PRODUCTS APLLIED TO FABRICS BY FOAM

**L. Capablanca, M. Bonet, P. Monllor, I. Montava**

*Universidad Politécnica de Valencia, Alcoy (Alicante), SPAIN*

Corresponding author: M. Bonet, maboar@txp.upv.es

***Abstract:*** This work is focused on studying microcapsules useful life on cotton fabrics applied by foam. The behavior of microencapsulated product has been analyzed on three cotton fabrics.
Cotton fabrics have undergone several washing cycles in order to determinate the effectiveness of the application procedure. Two experimental techniques, scanning electron microscopy (SEM) and counter apparatus have been used in order to determinate the effectiveness of the application procedure.
We conclude that the application procedure is an important factor to consider in the microcapsules application on fabrics. Process conditions and substantial quantities of products are also parameters to consider in order to ensuring the stability and durability of microencap sulated.
***Key words*:** fragrances microcapsules, foam, fabrics, washing, size distributions

## 1. INTRODUCTION

Microencapsulation technology has been improved in recent years and there are a wide range of applications in food, cosmetics and other industria l sectors. The number of commercial applications of microencapsulation in the textile industry continues growing today.

The encapsulation in the textile industry is used to protect fragrances or other active agents from oxidation caused by heat, light, hum idity, and exposure to other substances over their lifetime. It has been also used to prevent the evaporation of volatile compounds and to control the rate of release. [1]

Fragrance encapsulation is one of the applications of this technology in the textile sector. Microencapsulation technology allows us an opportunity that can favour its durability on fabrics [2]. In the past, adding the aromatic matter in traditional dyeing, finishing or printing processes could make a fabric with a fragrant finish. Howev er, the durability of the fragrance was poor, especially once the fabric had been washed. [3]

The microcapsules can be applied by impregnation, bath exhaustion, foam, spraying and coating. Previous works [4] have compared different application methods, imp regnation versus bath exhaustion. Padding was the procedure that obtained the best results when compared with bath exhaustion [4].

The aim of this work is to study another application method of microcapsules, *foam*. The durability of citric aroma present in microcapsules deposited on three cotton fabrics when fabrics are washed allow us to determinate the method effectiveness.
Scanning electron microscopy (SEM) was used in order to study microcapsules presence on fabrics. Multisizer counter allowed us to counting the number of particles and their size contained in water from washing cycles.

## 2. EXPERIMENTAL

### 2.1 Materials

Denim fabrics used were 100% cotton. Fabric characterization was carried out applying standard UNE EN 12127 to evaluate mass per un it area. Characterization results are show in Table 1.

**Table 1:** Fabrics characterization

| Sample | Structure | Weight ($g/m^2$) | Warp (yarn/cm) | Weft (yarn/cm) |
|---|---|---|---|---|
| Fabric 1 | Twill | 320 | 30 | 18 |
| Fabric 2 | Twill | 370 | 30 | 18 |
| Fabric 3 | Twill | 380 | 30 | 18 |

### 2.2 Microcapsule application on fabric

Commercial microcapsules were applied to the surface of the fabrics by foam in an industrial process. A polyurethane resin was used as a binder. Bath treatment was composed of 300 g of resin, 50g of microcapsules commercial product and the rest up to 1000g, foam products, thickening agent, stabilizer and water.

Pick-up (bath absorption) obtained was about 12%.

Samples were thermally fixed.

### 2.3 Washing process

Washing process was carried out in a Heraus Linitest applying standard ISO Standard 105 C10. When a cycle was finished samples were dried on a horizontal surface and the wastewater s form washing cycles were collected in order to analyze them. All samples were examined by SEM after 1, 5, 15 and 20 cycles.

### 2.4 Instrumental techniques

For fabric surface observation a scanning electron microscopy Phenom microscope (FEI Company) was used. Each sample was fixed on a standard sample holder and sputter ed with gold and palladium.

he particle size distribution and the quantity of microca psules contained in wastewater form washing were measured by BECKMAN COULTER® (Multisizer Z1, Coulter electronics). Three replicates were performed for each bath from washing cycles in order to reduce error and an average result was used.

## 3. RESULTS AND DISCUSSION

### 3.1 Application procedure

Figure 1 shows the SEM micrographs of the three cotton fabrics with microcapsules applied by foam. It was not possible quantify microcapsules presence using this technique. SEM only allowed us to observe the fabrics surface, detecting the microcapsules presence, location and condition.

When figure 1 is analysed, it can be observed a great quantity of empty microcapsules deposited on fabrics. There is a significant difference when compared with other applications met hods, such as impregnation and bath exhaustion [4]. Application procedure can affect the microcapsule stability.

esin presence can be observed in SEM micrographs. If the encapsulated fragrance is applicated only onto a substrate and dried, the microcapsul es could be lost during a hot, wet, frictional washing because there is no affinity between the microcapsules and the fabric. The resin enable to fix the microcapsules to the fabric.

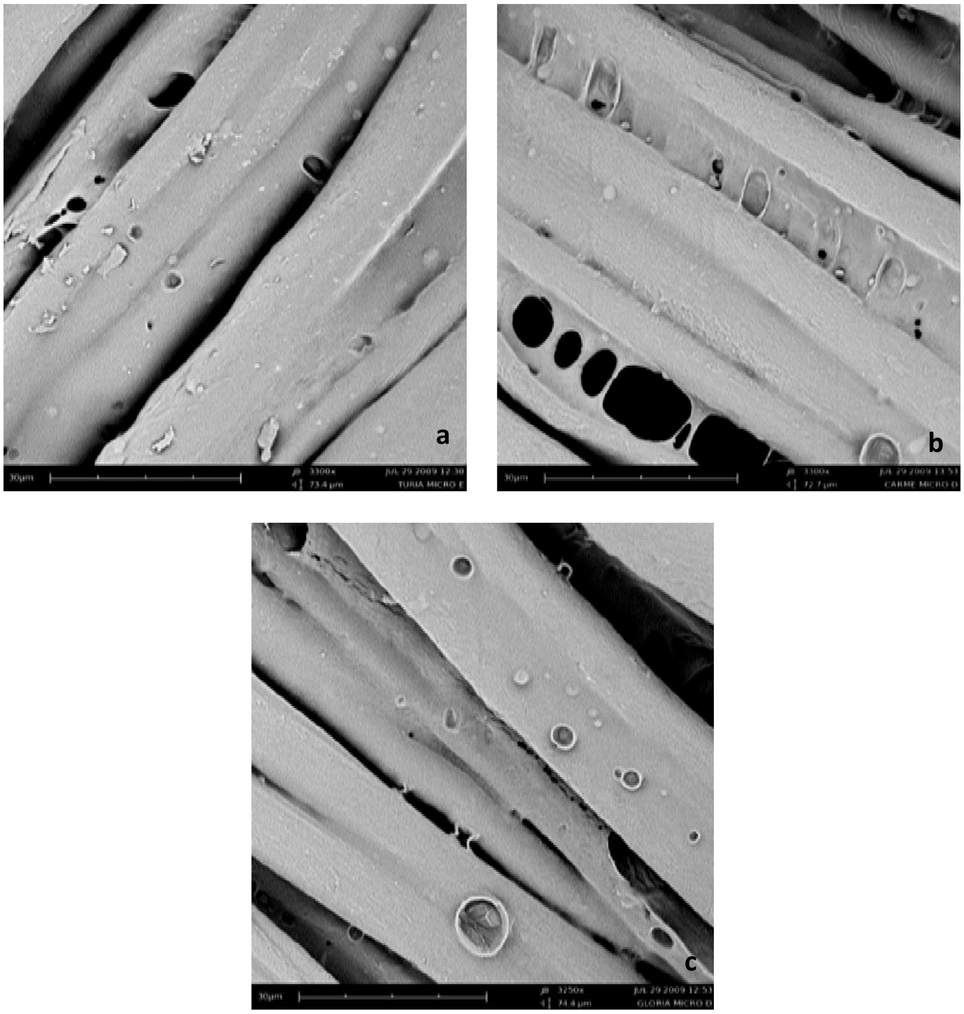



**Figure 1:** SEM micrographs of cotton fabrics with microcapsules
(a) Fabric 1. (b) Fabric 2. (c) Fabric 3

It was observed differences between the microcapsules size on fabrics. Larger microcapsules were empty while smaller microcapsules were full.

### 3.2 Washing effect

Figure 2 shows SEM micrographs of cotton fabrics after 20 washing cycles. It can be observed that only few small sized microcapsules remain on fabrics after the application of 20 washing cycles. Fabrics lose microcapsules when they are washed.

Excess resin can be observed in SEM micrographs. The microcapsules are broken and empty. Some unbroken microcapsules with small sizes remain on fabric because they are enveloped by the excess resin.

Some odour intensity remained after 20 washing cycles, which means that not all microcapsules have released from fabrics. When cotton fabrics are rubbed the citric aroma is transferred to the fabrics and it can be appreciated.

Larger microcapsules are washed out of the fabrics more quickly (in the first few washing cycles) than the smaller microcapsules which remain on fabrics for more washing cycles.

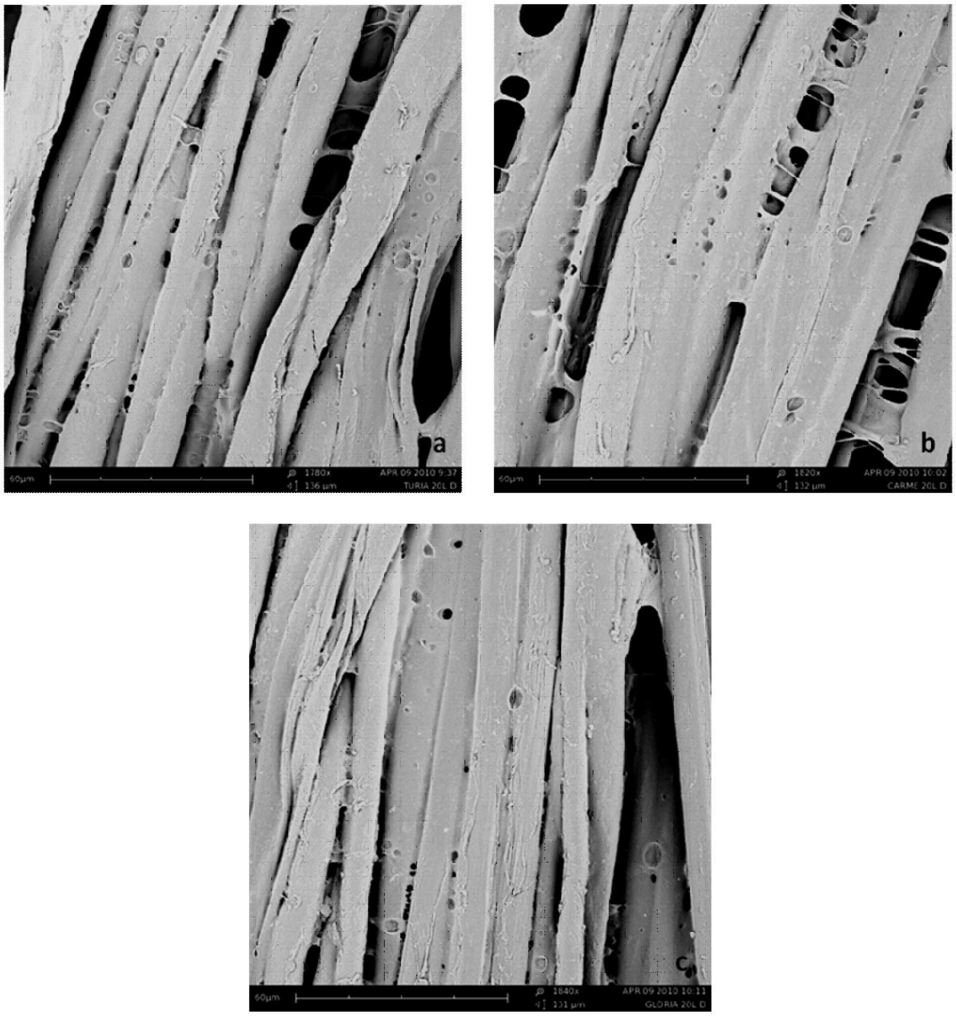



**Figure 2:** SEM micrographs of cotton fabrics after 20 cycles of Standard ISO 105 C10
(a) Fabric 1. (b) Fabric 2. (c) Fabric 3

The quantity and the size of microcapsules contained in the wastewaters from washing cycles were measured. In order to determinate the quantity of microcapsules that were left fabrics, we estimated the quantity of microcapsules containing the commercial product used in the initial bath treatment. Application process was carried out by an industrial process and we only knew the products concentration in the bath.

In order to estimate microcapsules number, we took into account the number of microcapsules in 1L of liquor padding with a concentration of 60g/L of microcapsules. Thus, because this is a concentration widely studied by us and we know the average volume. If we prepare a bath with 50 g of microcapsules in a litre, we determinate there must be about 1.658.722.222 microcapsules in 1000 L. As we knew the pick-up, and the weight of three fabrics we could calculate the quantity of microcapsules on fabrics surface. [5]. Table 2 shows the results.

**Table 2:** Microcapsules on fabrics surface

| Sample | MICS distribution (number ($10^3$)/$m^2$) |
|---|---|
| Fabric 1 | 63.694.933 |
| Fabric 2 | 73.647.267 |
| Fabric 3 | 75.637.733 |

When we analyze wastewater from washing cycles, we should be able to calculate the quantity of microcapsules that remain in the bath by particle measurement, so we can calculated how many microcapsules are washed out of the fabric and the process involved.

The wastewater analysed also allows us to determinate the size of microcapsules. The particles size contained in wastewater from washing cycles ranges from 1,14 and 3µm.

Table 3 shows the number of microcapsules contained in one millilitre of ba th for each washing cycle.

**Table 3:** Microcapsules released from the fabric surface after washing cycles

| Washing cycles | Fabric 1 Particles number ($10^3$) /mL | Fabric 2 Particles number ($10^3$) /mL | Fabric 3 Particles number ($10^3$) /mL |
|---|---|---|---|
| 1 | 17.204 | 7.011 | 30.413 |
| 2 | 4.726 | 3.437 | 1.814 |
| 3 | 3.028 | 3.431 | 2.623 |
| 4 | 2.152 | 1.491 | 3.078 |
| 5 | 2.313 | 3.627 | 2.592 |
| 6 | 3.517 | 2.089 | 1.749 |
| 7 | 2.642 | 2.514 | 2.713 |
| 8 | 2.559 | 3.735 | 3.778 |
| 9 | 1.812 | 2.094 | 2.053 |
| 10 | 1.062 | 1.664 | 1.300 |
| 11 | 2.033 | 1.170 | 1.728 |
| 12 | 1.675 | 1.348 | 902 |
| 13 | 1.014 | 2.748 | 1.593 |
| 14 | 1.580 | 2.429 | 2.875 |
| 15 | 1.339 | 1.199 | 1.404 |
| 16 | 2.052 | 1.067 | 1.070 |
| 17 | 1.753 | 1.341 | 2.671 |
| 18 | 1.382 | 1.838 | 2.938 |
| 19 | 1.949 | 1.227 | 2.308 |
| 20 | 1.238 | 2.097 | 1.955 |
| TOTAL | **57.029** | **47.556** | **71.556** |

It can be appreciated that the number of microcapsules that goes out of the fabric is higher in the first washing cycle, which behaviour is observed in each studied sample. After the first few washing cycles, the quantity of microcapsules leaving fabrics is not so high and moreover it tends to be more or less constant.

Previous works [6] demonstrated that the fabric weight had an important influence in the number of microcapsules deposited on the fabrics. SEM micrographs do not allow us to determinate the influence of fabric weight. The wastewater analysed from washing cycles, en ables to determinate that the number of microcapsules that goes out of the fabric 3 is higher than fabric 1 and 2. Of course, fabric 3 has the highest number of microcapsules on the surface (Table 2). The fabric 1 has less weight than fabric 2 and the numb er of microcapsules that goes out of the fabric 1 is higher than fabric 2. We can conclude that in fabric 2 the microcapsules are more retained by resin and the fabric structure and then not so easily go out.

## 4. CONCLUSIONS

Application procedure is an important factor to consider in the microcapsules application on fabrics. Process conditions and substantial quantities of products are also parameters to consider in order to ensuring the stability and durability of microencapsulated. For example, excess resin can affect the release of microcapsule active material.

Fabrics lose microcapsules when are washed. Scanning electron microscopy is an instrumental technique that allows us to know the presence, location, and sates of microcapsules that remain on fabrics after washing cycles. Particle size analyzer allows us to quantify the quantity of microcapsules and their size contained in the wastewater from washing cycles.

In microencapsulated commercial products there is dispersion in the particle size. Lar ger microcapsules are washed out of the fabric in the first few washing cycles and released the active material before the smaller microcapsules. In the first wash cycles a large quantity of microcapsules leave the fabric, but after eight washing cycles it can be considered more or less constant until 20 washing cycles.

After 20 washing cycles we can confirm some odour intensity remained on fabrics. This means that there are small microcapsules partially filled on the fabric, the active material is still o n the fabric and we can be appreciated the odour.

In the application of microcapsules by foam, fabric weight influence s in the number of microcapsules deposited on fabrics.

### 5. AKNOWLEDGEMENTS

The authors want to thank the Spanish Ministry of Science and Innovation for the financial supported to the project ref. HAT 2009-14210-C02-01. We are also grateful to the Spanish Ministry of Education to award a FPU fellowship to Lucia Capablanca.

### 6. REFERENCES

1. Rodrigues, S.N., Fernades, I., Martins, I.M., Gomes, P.B., Mata, V.G., Barreiro, M.F., Rodrigues, A.E. (2008). Microencapsulation of limonene for textile application. *Industrial and Engineering Chemistry Research*, Vol. 47, No. 12, (2008), pp 4142-4147, ISSN 08885885

2. Rodrigues, S.N., Martins, I.M., Fernades, I.P., Gomes, P.B., Mata, V.G., Barreiro, M.F., Rodrigues, A.E. (2009). Scentfashion®: Microencapsulated perfumes for textile application. *Chemical Engineering Journal*, Vol. 149 (1-3) (2009), pp 463-472, ISSN 1385-8947

3. L, S., Lewis, J.E., Stewart, N.M., Qian, L., Boyter H., (2008). Effect of finishing methods on washing durability on microencapsulated aroma finishing. *Journal of Textile Institute*, Vol. 99, No.2, (2008), pp 177-183, ISSN 00405000

4. Monllor, P., Bonet, M.A., Cases F. (2007). Characterization of the behavior of flavour microcapsules in cotton fabrics. *European Polymer Journal*, Vol. 43 (2007), pp 2481-2490, ISSN 00143057

5. Monllor, P., Capablanca L., Gisbert, J., Díaz P., Bonet, M.A. (2009). Improvement of Microcapsule adhesion to fabrics, *Textile Research Journal,* Vol. 80 (7), pp 631-635
DOI: 10.1177/0040517509346444

6. Capablanca L., Bonet M.A., Monllor P., Díaz P. Influencia del peso del tejido en la adhesión y permanencia de microcápsulas sobre tejidos de algodón, *Proceedings of 35 Simposium de la AEQCT*, Barcelona (Spain), Marzo (2009).

ANNALS OF THE UNIVERSITY OF ORADEA
FASCICLE OF TEXTILES- LEATHERWORK
Volume I, 2010, No. 2

# TRADITIONAL MOTIVES' PROCESSING AND APPLICATION POSSIBILITIES IN FASHION DESIGN

**Carp Mihaela, Stan Mitu**

*Faculty of Textile and Leather Industrial Management "Gh.Asachi" Iasi*

*e-mail:* mcarp@tex.tuiasi.com

**Abstract:** The project presents solutions for the application of Romanian traditional motives in nowadays fashion design, the technical characteristics of their creation, the color palette and the decoration manner.
Since the Romanian embroidery points represent the main source of inspiration, the present tendencies dictate a new approach in women's fashion. In this direction, an attempt was made to improve personal ideas for textile surfaces creation through different combinations of materials and colors. Between traditional a modern, research in the textile field materialized into numerous textile creations whom realization involved the experimentation of classic and modern Romanian folklore clothing confection techniques enrolling them in the present day fashion collections. This collection did not confine just on the creation of a silhouette or a sketch. In the same time, these have been correlated with a main, palpable model which could be industrially produced. Furthermore, the fashion trend that dictates the shape of details also represents an important factor that has to be taken into account on the choice of fashion product's aesthetic shape and the implications of traditional art elements. These aspects, although they have a subjective character and are not necessarily the highlight of textile confection industry technologies, are playing an important role as for the aesthetic and visual comfort of the newly created designs obviously connected to the optical comfort.
**Keywords**: creation//handmade embroidery, Romanian traditional embroidery, fashion design, mechanical embroidery

## 1. GENERAL ASPECTS

Associating the evolution of traditional art and the historical stages of civilization, the following aspects take shape:
- countless archeological discoveries have been made in our country, dating from the Neolithic ages, which comprise geometrical marks employed in the Romanian folk ornamentals.
- the first geometrical signs subsequently cropped have been pointed out in Cuina Turcului village, on the Danube riverbank, near Portile de Fier. The diggings there revealed that the prehistoric man was using the same messages as the ones discovered in Mezin, Ukraine - the sign of the V letter.
- these were combined in a specific way, like the rhombuses carved into horse bones; as decoration, in the center of the rhombus were handmade hatches such ass the ones in the 1,2,3,4 and 5 diagrams.

**Figure 1:** The rhombus and the V signs carved into a horse bone discovered at Cuina Turcului, on the Danube riverbank, dated 11.000 B.C
( source: Vartic, A. *"A geometrical history of Homo Sapiens"* )

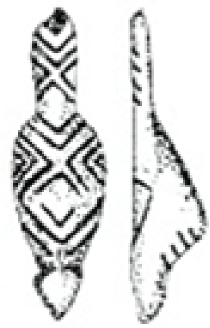


**Figure 2:** Carved in mammoth bone statuette, discovered in Mezin, Ukraine, dated 18.000 B.C.
( source: Vartic, A. *"A geometrical history of Homo Sapiens"* )

Before they were used as decorations, the geometrical signs were the main method of knowledge broadcast. The emergence of the rhombus in the Neolithic alphabet was possible as the fusion of four types of V (appears in the signs of the Superior Paleolithic man).

The rhombus also is an angle-based geometric shape and is represented in the third diagram, by mixing the angles.

An interesting approach on the rhombus is the one in the Neolithic alphabet that suddenly appears in the Paleolithic one too. In this case, the rhombus is a geometrical entity and it is used in a more complex model like in the third diagram. These have been important sources for the ornaments composition that can be found in the traditional and technical creation of the textile art and design.

The spiral, also known as the whirl or the storm, was considered to be the energy, the water flow that balances and borders the logical structures, the frost inducing the blissful mood. This also expresses a cosmic equilibrium that, in fact, has captured the astrologers' attention and it has developed aspects in this field too. Diagram number four is representative and it represents a Romanian astrological cymbal that may be a inspirational source for both the textile art and design as well as for pottery and other specific processing.

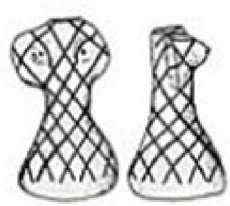


**Figure 3**: Rhombus networks discovered in the Lepenski land, Yugoslavia, on the Danube riverbank.
( source: Vartic, A. *"A geometrical history of Homo Sapiens"* )

**Figure 4**: "Philosophical" cymbal, Draguseni - Romania, Cucuteni culture, dated 4200 B.C., spiral decoration.
( source: Vartic, A. *"A geometrical history of Homo Sapiens"* )

The fifth diagram representation tells its own story, from which the present creators and designers may assume important elements regarding the zigzag and its widening in different ornamental genres. These are present in the traditional art as well as in the fashion specific technical creation. The element alternation from this representation consists of a combination between geometrical elements that may be placed in diverse fashion areas and textile surfaces.

**Figure 5**: Zigzag and winding lines on a pot
dated 4500 B.C., discovered on the Danube riverbank, Romania
( source: Vartic, A. *"A geometrical history of Homo Sapiens"* )

## 2. EVOLUTION AND APPLICATIONS

The ethnological significances of the main signs found in both the Romanian traditional sewing points and pottery history are illustrated even on the dowry chests, where they are carved mainly from the traditional symbols and motives kept alive: the cross, zigzag, rhombus etc.

The folk art sewing points such as the cross, zigzag, rosette, tree of life, image of man, birds are the most applied ones in the Romanian folk traditions. These are well based throughout generations.

The rope is a spiral too that denotes the aspiration for heights, the cross shaped knots have ancient magical significance metamorphosed at some point in time as the symbol of the sun and assumed by the Christian religion at a later time.

The rosette is a solar symbol, a light and warmth spring that life itself depends on.

The tree of life is the ornamental motive of the wooden doors that signify immortal life and endless fertility.

The serpent fills an important part between zoomorphic ornamental motives. It has its origins in the early house serpent, the protector of farms.

These aspects are associated with the subsequent evolutions, when evolved traditional arts applications emerge from different regions and that, without any doubt, have some common elements such as sewing points and their development in embroidery, geometrical and floral motives (depicted in diagram no. six - a & b).

These examples have been the keystone for some personal creations (seventh diagram - a & b), which can be found in sketches serving as important inspirational sources for fashion designers. The eighth, ninth and tenth diagrams are decisive in this matter.

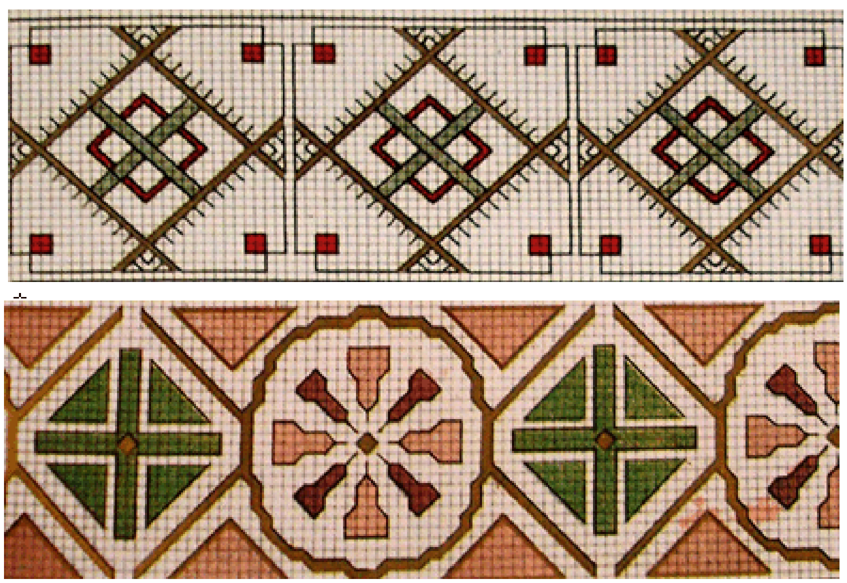


**Figure 6**.a, b: Geometrical and floral motives inspired by Romanian traditional embroidery

a.

b.

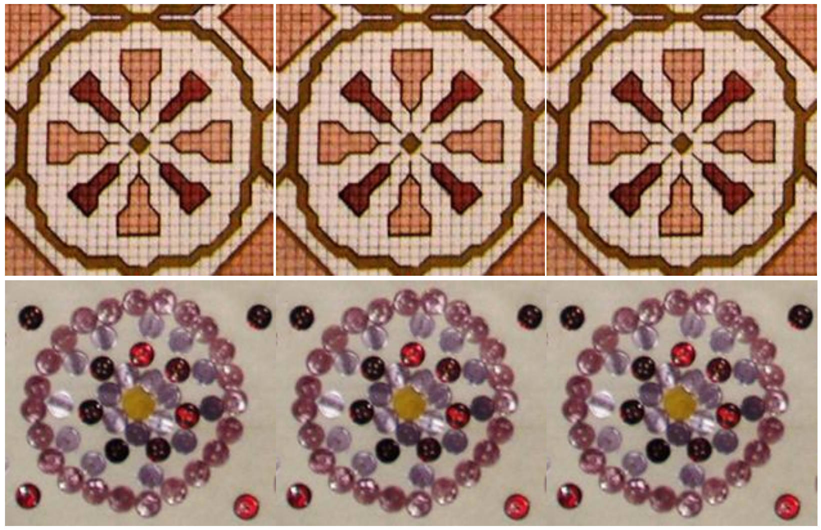


**Figure 7**.a: Diversification proposals; b. Adaptation of stylized motive and processing on textile material

**Figure 8.** a: Women costume from Banat Plains consisted of embroidered blouse and linen with geometrical and floral peasant skirt made of wool and colored silk

**Figure no. 8**. b: Fashion proposal inspired by the Banat Plains' women costume and composed of two pieces: classic skirt and sleeveless blouse embroidered in the shoulder and a pplied pockets' area decorated with geometrical motives as well

**Figure 9**. a: Women costume from Banat Plains with embroidered blouse and linen laps, with colored silk and wool peasant skirt ornamented with floral motives

**Figure 9**. b: Fashion proposal inspired by Banat Plains' women costume, represents a sarafan-dress with floral embroideries on the shoulder straps and front applied pocket

The harnessed ornaments from the fashion proposals are taken over from old pieces of Banat folk costumes found also on home-use items or church ornaments.

The Romanian traditional embroidery art has a vast usage, always being an important inspirational source that has to be put to good use and appreciated for it represents our identity and existence over time, the Romanian culture and traditions.

The research represents just an example because for every geographical region there are important sources with adequate applications, folk costume pieces etc.

Even the mechanical made ornaments represent the result of these inspirations, meaning that some elements included in the automated mechanisms' ensemble are built upon folk creations.

**Figure 10**. a, b: Costume from Banat, with velvet peasant skirt, the embroidered blouse and linen laps, sewed with geometrical motives and net lace next to the fashion proposal representing the benchmark from the waist area with inspired motives from the costume.

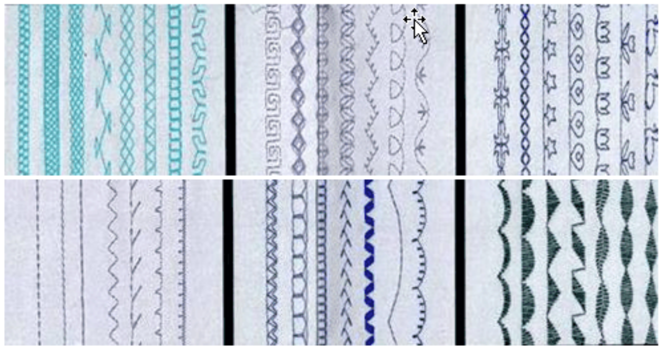


**Figure 11:** Mechanical made sewing

In the present stage, taking into account the performances of c lothes industry equipments, the traditional art creations and the designers' imagination, they can be transposed in the fashion industry because there is a multitude of options, as it results from the eleventh diagram as well, which represents variants of zigzag sewing obtained by high performance equipments and found in the fashion proposals too.

## 3. CONCLUSIONS

Therefore, the following thoughts may take shape:

**-** the traditional art represents an inexhaustible inspirational source helpful for those who pr ocess textile surfaces, leather, fashion products or accessories;

**-** in this direction, the project highlights a brief history that surely can be studied thoroughly and be a real helping hand for those interested in this field;

**-** the matter has an interdisciplinary character, if the idea of a continuous collaboration between historians and folk artists (pottery, knitting, interior fabrics, traditional costumes, wood carving) would be strengthened;

**-** these examples represent only some elements that can be ext ended and be the foundation of those who are stepping into this field;

**-** the objective of this collection was the introduction of an added value to the small and big series products' originality, the proposals lay emphasis on the approach of the most origi nal solutions for the ennoblement of textile materials and products with the aid of embroideries that can be made in any clothes workshop;

**-** the project is based on a fashion documentary synthesis, reflected in the personal creations which highlight means of women clothing ennoblement and have traditional art elements as their inspirational sources.

## 4. REFERENCES


1. Achitei, Ghe. (1979).*The art of the future,* Meridiane Publishing House, Bucharest.
2. Cacoveanu, M. (1992). *Traditional weaving structures from Transylvania and the analysis of capitalization possibilities in the industrial production* , Teza de doctorat.
3. Curteza, A. (2003). *Fashion design. Fundamental concepts*, Performantica Publishing House, Iasi.
4. Curteza, A. (1998). *Design,* Ancarom Publishing House.
5. Dunare, N. (1981). *Apuseni Mountains' folk art*, Meridiane Publishing House, Bucharest.
6. Dunare, N. (1979). *Contemporaneoustraditional ornamentals,* Meridiane Publishing House, Bucharest.
7. Hasegan, M. (2005). *Brief history of tapestry. Aesthetical connotations of contemporaneous textiles,* Artes Publishing House.
8. Mitu, S., Mitu, M. (2005). *Textile confection technology fundamentals*, Performantica Publishing House, Iasi, 2005, vol.1 si II
9. Verghy Miller, M.(2000). *Old Romanian decorative motives",* Vestala Publishing House, Bucharest, 2007

[10]. Vartic, A. *"A geometrical history of Homo Sapiens"*, Dava International Publishing House, Chişinău,

**ANNALS OF THE UNIVERSITY OF ORADEA**
**FASCICLE OF TEXTILES- LEATHERWORK**
**Volume I, 2010, No. 2**

# ALGORITHS DESIGN OF THE FILTERING WOVEN FABRICS WITH COMPOUND STRUCTURE

**L.Cioară[1], I.Cioară[1]**
¶
[1] *Technical University Gheorghe Asachi, Iassy, Roumania,*

Corresponding author: Cioară Lucica, lcioara@tex.tuiasi .ro

***Abstract:*** For filtration by compound woven fabrics porosity is considered a priority functionality parameter. Usually, woven fabrics with compound structures, are accomplished as double structures or double-weft weaves. Double-weft weaves allow the modification of the structural parameters of woven fabrics, by creating the possibility of increasing the weft thread density and the filling/compactness degree, reducing the porosity and, implicitly, air permeability. As a result of this, the filtering fineness is accordi ngly modified. There were elaborated three designing algorithms specific to the double weft woven fabrics, which can be used either for the designing of certain new structures, or for the redesigning or checking of certain existing structures. The calculation programme elaborated on the basis of the three algorithms allows the rapid , simulation of the variants and the selection of the optimum variant for a given situation.
***Key words:*** *filtration, woven fabric, compound structure, algorithm design, simulation structure, porosity*

## 1. INTRODUCTION

Filtration by compound woven fabrics is effected after the principles of depth filtration. For these filtering media, porosity is considered a priority functionality parameter and that is why in the designing calculations the free volume from the filtering medium which the filtrate can pass through, is estimated. Filtering woven fabrics with compound structures are usually accomplished as double structures or double-weft weaves (1,2,3,4). Double-weft weaves allow the modification of the structural parameters of woven fabrics, by creating the possibility of increasing the weft thread density and the filling/compactness degree, reducing the porosity and, implicitly, air permeability. As a result of this, the filtering fineness is accordingly modified. As the compound woven fabrics are bulk structures, in layers, their characterization will be made by a structure indicator that takes into account the woven fabric volume.

## 2. FUNCTIONAL DESIGNING ALGORITMHS

K, compactness degree is a global structure indicator, which lays at the basis of the filtering wovenfabric designing, with a view to obtaining the adequate functionality characteristics (5,6,7,8). The compactness degree indicates the extent in which this capacity of woven fabric yarn filling is used, under the conditions of a given architecture of this. The emptiness degree from the woven fabric represents its porosity degree. According to Darcy’s law, the porosity degree is a factor that determines the speed of the fluid flowing by porous media. K value = 100 indicates the maximum utilization of the woven fabric yarn filling capacity. K value < 100 shows that among the constitutive woven fabric yarns there are empty spaces by which the filtering fluid flows. In con clusion, the determination of the compactness degree of a woven fabric allows then the estimation of its porosity. The functional designing methods of the woven filtering media from this paper are elaborated for filtering woven fabrics with double weft wea ves (figure 1). In this case, the compactness degrees of the warp threads $K_u$, weft threads $K_{b1}$, $K_{b2}$ and the double warp woven fabric $K_t$ are calculated as per the following formulae (4):

$$K_u = \frac{P_u}{P_{u\,max}} \cdot 100(\%) \quad \textbf{(1)}$$

$$K_{b1} = \frac{P_{b1}}{P_{b1max}} \cdot 100(\%) \quad \textbf{(2)}$$

$$K_{b2} = \frac{P_{b2}}{P_{b2max}} \cdot 100(\%) \quad \textbf{(3)}$$

$$K_t = \frac{K_u + K_{b1} + K_{b2}}{3} (\%) \quad \textbf{(4)}$$

In which: $P_u$, $P_{b1}$, $P_{b2}$ represent the real density of the yarns from the considered system, expressed in yarns/cm; Pmax – the maximum possible density of the yarns from the considered syst em, expressed in yarns/cm.

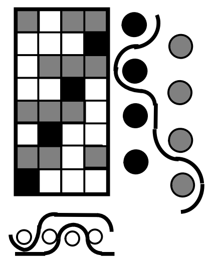


**Figure 1:** Double-weft weave

The porosity $P_z$ of the woven fabric is calculated as per the following formula:

$$P_z = 100 - K_t \quad (\%) \quad \textbf{(5)}$$

For the double weft reversible woven fabric, $K_u$ compactness degree for the double we ft woven fabrics is calculated as per:

$$K_u = \frac{P_u \cdot \left\{ d_u \cdot R_u + \left[ \left( d_u + d_b \right) \cdot \cos\beta - d_u \right] \cdot 2 \cdot t_b \right\}}{R_u} \cdot 100\ (\%) \quad \textbf{(6)}$$

And the $K_{b1}$ şi $K_{b2}$ compactness degrees are calculated as per:

$$K_{b1} = K_{b2} = \frac{P_b \cdot \left\{ R_b \cdot d_b + \left[ \left( d_u + d_b \right) \cos\alpha - d_b \right] \cdot t_u \right\}}{R_b} \cdot 100\ (\%) \quad \textbf{(7)}$$

In which: $d_u$, $d_b$ represent the diameters of the warp and weft threads; $R_u$, $R_b$ – the ratio of the warp and weft weave; $t_u$, $t_b$ – the number of yarn passage from one side to the other of the woven fabric in a weave repeat; cos α, cos β, the yarn crimp angles in the woven fabric.

The calculation relationships for the yarn crimp angles [2] depending on the m degree of the density unbalance are the following:

$$\cos\alpha = f(m) = \sqrt{1 - \frac{1}{(m+1)^2}} \quad \textbf{(8)}$$

$$\cos\beta = f(m) = \sqrt{1 - \frac{m^2}{(m+1)^2}} \quad \textbf{(9)}$$

On the basis of the relationships presented, there were elaborated three designing algorithms for the double weft woven fabrics. Each algorithm has recommendations for an optimum utilization either for the designing, for the redesigning or for the checking. According to the three algorithms from tables 1, the calculation relationships for the designed fabric parameters are presented, by the explaining of the reasoning for their determination.

**Table 1:** The calculation relationships for designed parameters

| **Algorithm I**<br>**Double weft woven fabric which is partially compactness unbalanced on yarn systems** | **Algorithm II**<br>**Double weft woven fabric, which is compactness balanced on yarn systems** | **Algorithm III**<br>**Double weft woven fabric, which is compactness balanced on yarn systems** |
|---|---|---|
| 1. Input data<br>Yarn density<br>$P_u$, $P_b$ [yarns/10cm]; $P_{b1}=P_{b2}$<br>Yarn dismeter $d_u$,$d_b$[mm] | 1.Input data<br>Yarn diameter du,db[mm]; Woven fabric porosity Pz | 1.Input data<br>Yarn density<br>Pu,Pb[yarns/10cm];<br>Woven fabric porosity Pz |
| 2. Unbalance factor of the densities<br>$m = \frac{2 \cdot P_u}{P_b}$ | 2. Woven fabric compactness<br>Kt = f (Pz); Kt = 100 - Pz | 2. Woven fabric compactness<br>Kt = f (Pz ); Kt = 100 - Pz |
| 3.Yarn crimping angle<br>$\cos\alpha = f(m); \cos\beta = f(m)$ | 3. Compactness degree of the yarn systems<br>$K_u = K_{b1} = K_{b2} = K_t$ | 3. Compactness degree of the yarn systems<br>$K_u = K_{b1} = K_{b2} = K_t$ |
| 4. Weave repet $R_u$ , $R_b$<br>identical weaves on the layer are adopted | 4. Unbalance factor the densities<br>2Pu/Pb = m; adopted | 4. Unbalance degree of densities<br>2Pu/Pb = m |
| 5. Number of passages in a weave repeat $t_u$ , $t_b$ | 5. Yarn crimping angle<br>$\cos\alpha = f(m); \cos\beta = f(m)$ | 5. Yarn crimping angle<br>$\cos\alpha = f(m); \cos\beta = f(m)$ |
| 6. Warp compactness degree<br>$K = f(P, d, R, t, \cos)$ | 6. Weave repeat Ru, Rb; identical weaves on the layer are adopted | 6. Weave repeat Ru, Rb; identical weaves on the layer are adopted |
| 7. Weft compactness degree<br>$K = f(P, m, R, t, \cos)$ | 7. Number of passages in a weave repeat: tu, tb; determined on the weave | 7. Number of passages in a weave repeat: tu, tb; it is determined on the weave |
| 8. Weave compactness degree<br>$K_t = \frac{K_u + K_{b1} + K_{b2}}{3}$ | 8. Warpyarns density<br>$P = (K, R, t, d, \cos)$ | 9. Warp yarn diameter<br>$d = f(K, R, P, t, \cos)$ |
| 9. Woven fabric porosity P=f($k_t$)<br>$P_z = 100 - K_t$ | 9. Weft yarn density<br>$P = (K, R, t, d, \cos)$ | 9. Weft yarn diameter<br>$d = f(K, R, P, t, \cos)$ |
| 10. Max. pore area<br>$A_p = f(P, d)$ | 10. Max. pore area<br>$A_p = f(P, d)$ | 10. Max. pore area<br>Ap = f (P, d) |
| 11. Yarn fineness $T_{tex} = \frac{d^2}{A^2}$ | | |
| 12.Woven fabric mass $M = \frac{P_u \cdot T_{texu}}{10} \cdot \frac{100}{100 - a_u} + \frac{P_b \cdot T_{texb}}{10} \cdot \frac{100}{100 - a_b}$ ; $a_u$ , $a_b$ : 1%-15% | | |

**2.1.Algorithm I. The designing of the double weft filters, which are partially compactness unbalanced on yarn systems, depending on the yarn system density and yarn diameter**

This programme stage means the knowing of the basic structural characteristics of the woven fabric: yarn fineness and density. The programme can be used for the identifying of the specific characteristics of filters: the maximum pore opening and porosity. There can be app reciated if the filter is adequate to the characteristics of the filtering process in which it will be used. Also, depending on the conclusions found after the checking, the **redesigning** of the woven fabric can be accomplished, so that it shall correspond to the utilization requirements.

**2.2.Algorithm II. The designing of the double weft filters which are compactness balanced on yarn systems, depending on the yarn diameter and porosity**

This programme stage is for the **designing** of the unbalanced woven fabric, because as a calculation function a characteristic specific to filters can be imposed, that is its porosity. From the designing calculations there result the yarn density and the maximum pore opening. It can be also used for the **redesigning,** depending on the requirements, because the yarn fineness is a characteristic that does not determine directly the filtration fineness and the process efficiency. There can be **checked** if in the fineness and diameter of the yarns from the woven fabric, the dimension of pores is the necessary one.

**2.3.Algorithm III. The designing of the double weft filters, which are compactness balanced on yarn systems, depending on the yarn system density and porosity**

There is a programme section in which only the **designing** will be carried out, depending on the process characteristics. By the pore dimension, it means that the filtrate composition is known, the filter being a calibrated restriction which restrains the particles with a certain dimension. Porosity is a characteristic which determines the efficiency of the filtering process and influence s the fluid flow speed.

## 3.THE PROGRAMME OF DESIGNING THE FILTERING WOVEN FABRICS WITH COMPOUND STRUCTURE

The presented designing algorithms laid at the basis of makin g up a functional designing programme of the filtering woven fabrics, which are accomplished as compound structures with two wefts and a warp. For each algorithm a program stage was elaborated.

The input data are different from an algorithm to another and are noted in the men u bar. The adopting of certain parameters such as: weave repeat on yarn systems, number of yarnpassages from one side to the other of the woven fabric in a repeat, the A constant for the calculation of yarn fineness and yarn shrinking in the woven fabric i s done by the specialists with experience in this domain.

The programme version presented in the screen of figure 2 is used for the designing of the double weft woven fabrics, which are partially density unbalanced on the yarn systems, but also for the redesigning or checking of the functionality parameters of an existing filter.

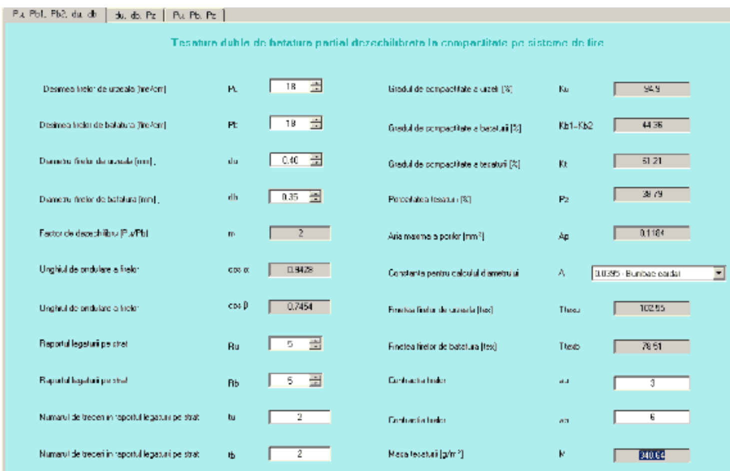



**Figure 2:** The screen of designed programme

The technical characteristics of the designed woven fabrics can be saved and filed in unique files, so that subsequently these could be interpreted and comparatively analyzed. In tables 2, are presented the technical characteristics of the three versions of woven fabrics made of yarns having the same fineness and raw material.

For all the programme versions, the woven fabric mass is calculated as a basic structural parameter. By this parameter, and the association with the yarn fineness and structure, the physical - mechanical characteristics of the woven fabric can be evaluated, such as break resistance, tear resistance, burst resistance or elongations, properties by which the product durability is assessed. If the woven fabric corresponds from the structural point of view with the filtering process, but it is too light for the flow rate, there will be chosen other filter version.

**Table 2:** The technical characteristics of the woven fabrics

| Parameter | UM | Woven fabric Filtru_c1 | Woven fabric II Filtru_c2 | Woven fabric II Filtru_c3 |
|---|---|---|---|---|
| Warp yarn density | yarns/cm | 18 | 18 | 18 |
| Weft yarnn density | yarns/cm | 18 | 22 | 28 |
| Warp yarn diameter | mm | 0,4 | 0,4 | 0,4 |
| Weft yarn diameter | mm | 0,35 | 0,35 | 0,35 |
| Weave compactness degree | % | 62,26 | 73,56 | 85 |
| Woven fabric porosity | % | 34 | 26,44 | 15 |
| Max. pore area | $mm^2$ | 0,118 | 0,086 | 0,057 |
| Woven fabric mass | $g/m^2$ | 332 | 368 | 416 |

Simulation of the fabric filters designed is in figure 3. The simulation is realized with Arahweave software.

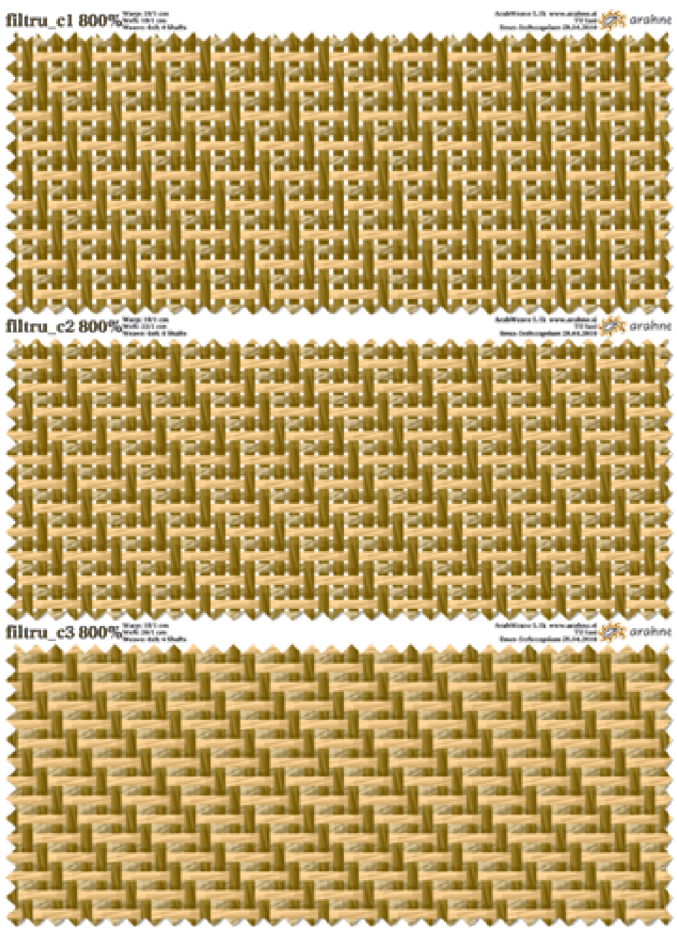



**Figure 3:** Simulation of the fabric filters designed

**4. CONCLUSIONS**

1. Functional designing of the woven filtering media with compound structure impose the taking into consideration of their structural characteristics

2. There were elaborated three designing algorithms specific to the double weft woven fabrics, which can be used either for the designing of certain new structures, or for the redesigning or checking of certain existing structures

3. The calculation programme elaborated on the basis of the three algorithms allows the rapid simulation of the variants and the selection of the optimum variant for a given situation.

## 5. REFERENCES


1.Cioară, L., Cioară, I.& Marchiş, O.(1991).The influence of certain technologic parameters on the capacity of filtering the woven textile planes, *Industria Uşoară*, No.4, pg.239-241, ISSN 1222-5347

2**.** L. Cioară, L. (2002).*Woven fabric structure*, Performantica Publishing House, ISBN 973-8075-16-15, Iassy

3.Cioară, I.& Cioară, L.(2009).Criteria for estimating the functionality of the filtering media obtained by weaving, *Industria Textilă*, No. 1, pg. 21-25, ISSN 1222-5347

4. Elnashar, E.,A.(2005). Volume porosity and permeability in duble –layer woven fabrics, AUTEX Research Journal, No.4, http://www.autexrj.org , Accessed: 10/12/2009

5. Marchiş, A.,Macovei, A. & Mureşan, T. & Ionescu, St.(1964). *Woven fabric structure and designing*,Tehnical Publishing House , Bucharest

6.Marchiş, O., Cioară, L. & Cioară, I..(1991).Considerations on certain factors that influence the porosity of filtering planes, *Industria Uşoară*, No.4, pg.237-238, ISSN 1222-5347

7. Martinova, A.H., Cernikina, L.(1976).*Structure laboratory and woven fabric designing,* Light Industry Publishing House, Moscow

8. Medar, S., Ionescu, F. (1986). *Filters for hydraulic and pneumatic drives*, Technical Publishing House, Bucharest

ANNALS OF THE UNIVERSITY OF ORADEA
FASCICLE OF TEXTILES- LEATHERWORK
Volume I, 2010, No. 2

# INNOVATIVE SOLUTIONS FOR SPORT SOCKS

V. Creţu[1], L. Macovei[1], E. Moisescu[1]

[1] *Technical University "Gh. Asachi", Iaşi, ROMANIA*

Corresponding author: Viorica Creţu, vcretu@tex.tuiasi.ro

***Abstract:*** Any common sock must ensure specific properties for such a garment. In the field of sport socks, these properties must be ensure at a higher level, other new particular requirements being imposed by the destination for a specific sport, some performance sports socks requiring different properties in different zones of the sock. The paper presents some innovative technique and technical solutions to produce: ski socks with no "ride-down" effect, by a split-heel construction, abrasion resistant reinforced sport socks, by using a composite reinforced yarn, terry athletic socks, with terry loops in strategic portions of the foot of the sock, and double layer football socks, containing a double layer structure that can be placed in different variants, on the sock.
***Key words:*** sport sock, ride-down, terry, abrasion resistant, double layer.

## 1. INTRODUCTION

Increasing popularity of active and super-active sports, as football, skiing, tennis, rugby, hokey, imposed for the sport socks new requirements concerning the comfort, the wearability and the resistance to greater stresses and strains they are exposed compared to ordinary dress socks, and even to ensure specific protection functions.

To satisfy one or more of these requirements it were developed technique and technical specific solutions, the paper including:
- the produce of ski socks with no "ride-down" effect;
- the produce of abrasion resistant reinforced sport socks;
- the produce of terry athletic socks;
- the produce of double layer football socks.

## 2. TECHNIC AND TECHNICAL INNOVATIVE SOLUTIONS FOR SPORT SOCKS

### 2.1. Ski socks with no "ride-down" effect

Everybody knows the annoyance and discomfort of socks riding down the ankles and bunching in the shoes. If under normal circumstances, this may be a minor irritant, in athletic applications, especially in skiing, the "ride-down" denies the sock its cushioning effect, which may interfere with the enjoyment or even safety of the sport.

The "ride-down" phenomenon is due to the opposing horizontal and vertical forces generated by the foot and leg portions of the sock, which create a maximum stress on the sock material running through the apex of the heel. The horizontal stretch of the foot causes the sock to be pulled down into the wearer's boot, and the sock becomes uncomfortable and does not adequately cushion the leg.

To stabilize the sock and to avoid his ride-down through the apex of the heel, between the two parts of the heel, one vertical and one horizontal, is knitted a stabilizing area A (Fig. 1), resulting a split-heel construction [2].

This area is a band, extended from the top of the instep around the apex of the heel portion, including an elastic yarn, either knit in plated relationship, as shown in Figure 2.a or laid into the body yarn structure, as shown in Figure 2.b.

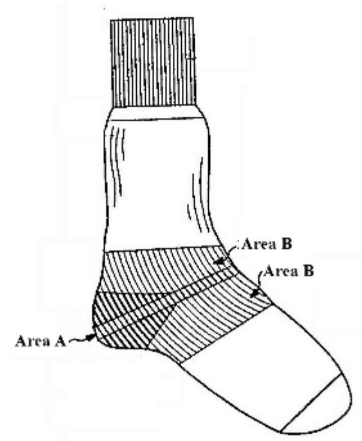



**Figure 1:** Stabilizing area A in a split-heel construction

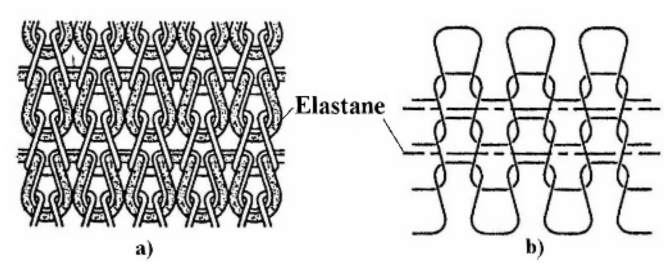



**Figure 2:** Evolution of the elastic yarn in the stabilizing area A
a) knit in plated relationship
b) laid into the body yarn structure

Compared to knitting a conventional sock, where the machine is fitted with short “s” and long “i” butt needles, to knit a sock with a split-heel construction requires the machine to be fitted with three types of needles, short “s”, medium “i1” and long “i” butt needles, placed as shown in Figure 3 [1], the knitting method including the following steps:

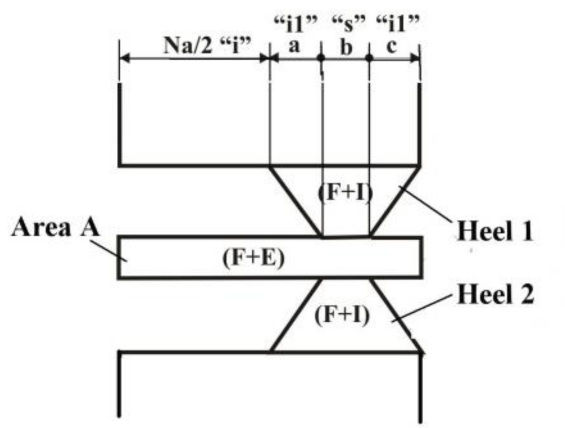



**Figure 3:** Placement of butt needles to knit the split-heel construction

- the knitting of the first part of the heel (1):
  - the long butt needles (Na/2 “i”) are lifted out of the track, and the medium butt needles (2 x Na/6 “i1”) and the short butt needles (Na/6 “s”), left in the track;
  - the machine is made to reciprocate and on every revolution one medium butt needle is lifted out of the track;
  - are used a base yarn (F) and a reinforce yarn (I), in a plated relationship;
- the knitting of stabilizing band area A:
  - the machine is put out of reciprocating mode;
  - all the long and medium butt needles are lowered back into the track;
  - are used a base yarn (F) and an elastic reinforce yarn (E) spandex or similar, in a plated relationship;
- the knitting of the second part of the heel (2):
  - all the long and medium butt needles are lifted out of the track;
  - the machine returns to reciprocation and once every revolution, one medium butt needle is dropping back into the track, so as to progressively widen the fabric. This is continued till the second portion of the heel is symmetrical with the first one;

- at the end of the heel, the machine in put out of its reciprocating and all the needles lowered back into the track. Knitting then resumes on all needles for plain fabric construction.

The band A cuts the sock into two independently operating section s, and acts as a stabilizer between opposing horizontal and vertical forces, which normally act on the heel portion to cause the ride-down. When the sock is used for skiing, the stabilizing band prevents it from pulling itself down and sliding into the wearer/s ski boots.

To reduce more the “ride-down” effect, in areas B (Fig.1) it can be used, in a plated relationship, a base yarn and an elastic yarn.

**2.2. Abrasion resistant reinforced sport socks**

Certain types of garments and their parts are particularly susceptible to the effects of abrasion, resulting in excessive wear and in the end of their useful life, among them being included the socks. Sock are subject to the greatest wear in the toe and heel regions, resulting in developing holes.

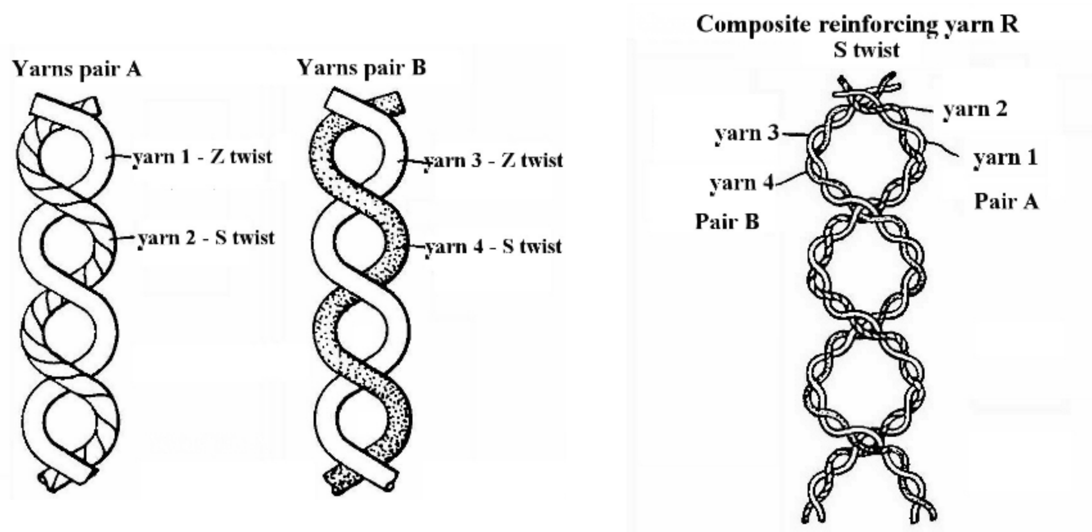
In case of sport socks, where the effects of abrasion are more intense, the increasing of the durability of socks with reinforcing yarns have not been entirely satisfactory since the sock yarn would wear away and leave those yarns intact, creating a bare area, which rend ered the sock unserviceable.

A solution for a good abrasion resistance is plating a special composite reinforcing yarn (R) on the sock body yarn (F) [3].

To produce the composite reinforcing yarn R, it starts from two pairs of yarns, A and B (Fig.4.a):

- pair A - is produced by twisting a textured yarn 1, of a Z twist, together with a textured yarn 2, of a S twist, yielding an S/Z plied yarn;
- pair B - is produced similarly ( yarn 3 ≡ yarn 1 and yarn 4 ≡ yarn 2)

The yarn R results by yarns pair A, twisted S together with yarns pair B (Fig.4.b).




a) b)

**Figure 4**: Steps to produce the reinforced yarn R

The yarns 1, 2, 3 and 4 are textured yarns in range of 20 – 100 deniers. An example of reinforcing yarn composition is 100/39 denier textured nylon with 2 turns/inch, twisted together in the Z direction with 2 turns/inch. Then, the yarns pairs A and B are twisted together in the S direction, with 3 turns/inch.

The reinforcing of heel/toe section of the sock using the composite reinforcing yarn R, depending on the requirements, can be realized in different structure variants:

- body yarn F and reinforcing yarn R, knit in plated relationship in every second course (R2, R4 – Figure 5);

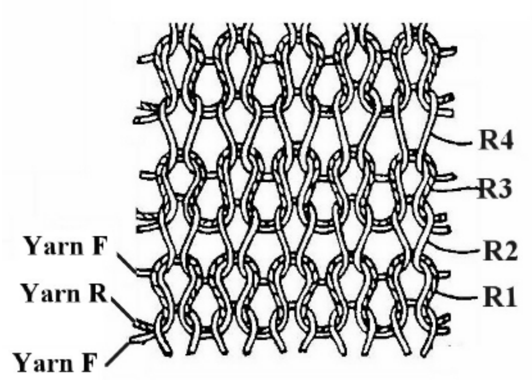



**Figure 5:** F and R yarns knit in plated relationship in every second course

- body yarn F and reinforcing yarn R, knit in plated relationship in every course (R1, R2, R3, R4 – Figure 6), when maximal abrasion resistance is required;
- reinforcing yarn R is knit in plated relationship with body yarn F in every course, but alternating its position relative to yarn R (Fig. 7), that is from inside the fabric to the outside, in every other course. This is achieved by changing the position in which the yarns R and F are fed into the needles of the machine. In this way, the reinforcing yarn R will appear on both sides of the fabric, thus resisting wear generated by the friction against the inside of the shoe and the skin of the sock wearer.

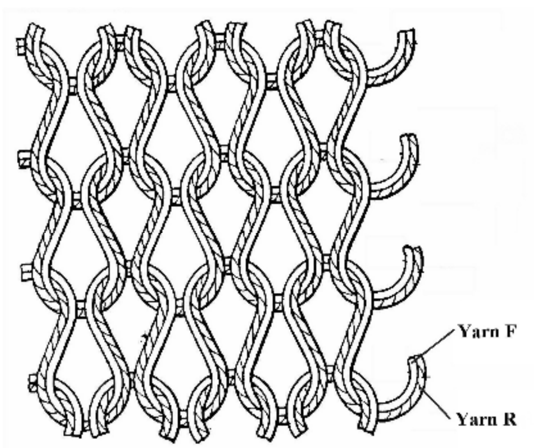



**Figure 6:** F and R yarns knit in plated relationship in every course

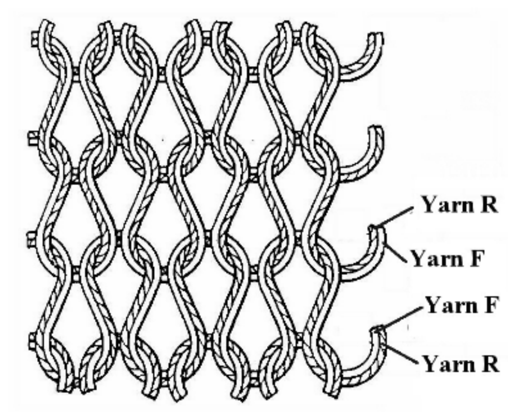



**Figure 7:** F and R yarns knit in plated relationship in every course, butt altering them positions

### 2.3. Terry athletic socks

Compared to ordinary dress socks, athletic socks are exposed to muc h grater stresses and strains, of particular importance for them being the cushioning effect, the moisture transport facility and the improve of blood circulation, resulting in good impact absorption and foot protection against blistering or ulceration.

Usually, for the athletic socks are used terry loops knitted in strategic portions of the foot of the sock.

However, the employed terry loops constructions are not entirely satisfactory because the terry pile is flattened in the course of repeated laundering s and gradual elongation of the sock.

A solution to improve the terry athletic socks [4] is based on:

- the use of a base yarn (F) comprises a Lycra spandex core and a nylon covering, the latter being air-entangled around the core. This yarn is knit in the f oot portion to ensure long lasting form fit, the spandex content of yarn F providing a flexible base to allow laundering and wear over prolonged period of time without flattening of the terry pile with its loops remaining in upstanding position.
- the disposition of terry loop pile in strategic sections of the foot portion (Fig.8), the terry loops containing, beside the base yarn (F), one, two or three terry yarns (P1 – a two-ply 30s spun acrylic, P2 and P3 – larger and bulkier than the base yarn F), in the structures illustrated in Figure 9.

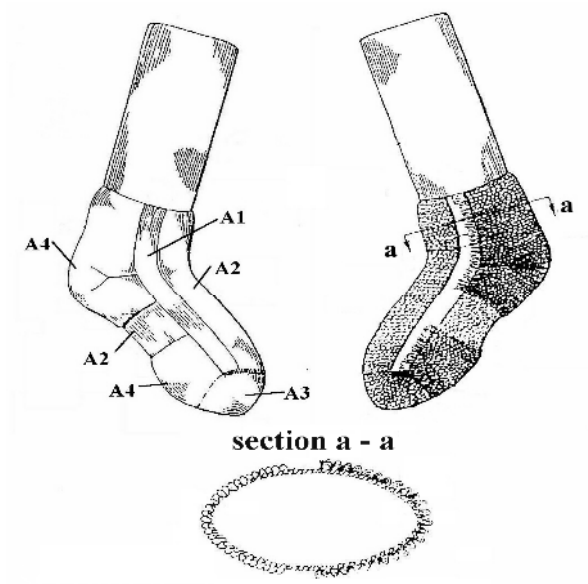



**Figure 8:** Disposition of terry loop pile in strategic sections of the foot portion

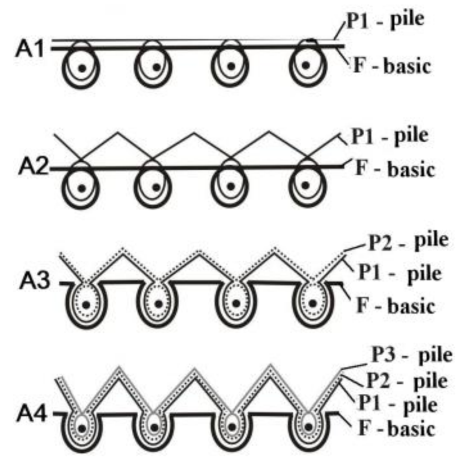



**Figure 9:** Structures in strategic sections of the foot portion

The strategic sections of the foot portion, illustrate in Figure 8 and Figure 9, are:

- section A1 – placed on the both sides of the sock; it is a plated fabric (by yarns F and P1) with reduce bulk and with permeability to ventilate the foot;
- section A2 – placed in the arch portion of the sole and in the instep; it contain s terry loops by the base yarn F and the terry yarn P1;
- section A3 – placed on the toe portion; it contains terry loops, each knitted by the base yarn F and by two terry yarns P1 and P2;
- section A4 – placed in the ball and in the heel portions; it contains terry loops, each knitted by the base yarn F and by three terry yarns P1, P2 and P3. This thick density of terry loops prevents the pile from being flattened, when a compress in made, providing a shock absorbing effect into the foot area.

To produce these sections, on the knitting machine are used three types of terry sinkers (Fig. 10), placed in the sinker ring as it is shown in Figure 11 [1]:

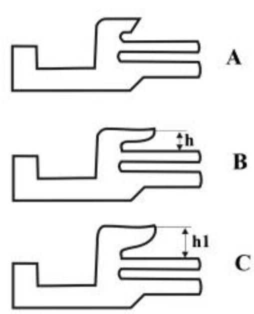



**Figure 10:** Types of terry sinkers

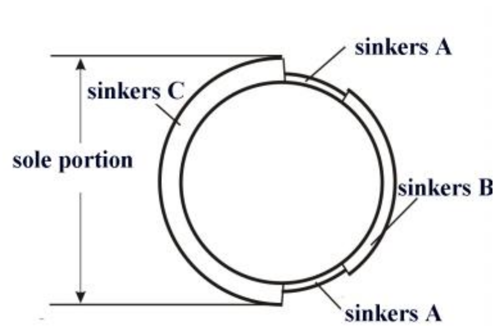



**Figure 11:** Place of terry sinkers on the sinker ring

- sinkers A, are left blank to form the side panels A1;
- sinkers B, are cut down to a lower height of the terry ledge (h), to reduce the density and bulk of the instep portion, so that the sock will fit more comfortable into the shoe;
- sinkers C, are of full neb height (h1), re sulting the highest pile in the heel, arch, ball and toe portions of the foot.

### 2.4. Double Layer sock

The sock knitting machine builder Busi realized a new cylinder and dial machine, named “Twin layer” which is producing a football sock with integrated k nitted pocket for housing shin guards [5]. The new machine, is based on the 404 Idea Terry machine, and has all the same knitting possibilities as the original machine.

The novelty of “Twin Layer”, based on the using of the dial needles and a special patented device which is integrated the dial itself, is the production of a double sock. On the “Twin Layer” it is possible to knit two fabrics at the same time, one inside the other:

- the external sock is produced, in the conventional way, on the cylinder needles;
- the internal sock is knitted on the dial needles.

The knitting of two separated fabrics gives the opportunity to use completely independent yarns, with different fiber content, for the inside and outside of the sock, which opens up new perspectives in the field of technical sport socks.

The double layer structure can be placed, on the sock, in different variants:

- it can be extended to the complete sock, the two fabrics being joined at the welt, at the heel and at the toe, so preventing the sliding of the inner layer in relation to the outer layer;
- it can be knit in a selected part of the sock, for example only in the sole and/or in the heel;
- it can be knit to create pouches inside the sock, like for example the shin-pad holding pouch attached inside a football sock, as it is illustrated in Figures 12 and 13, for the outside view respectively for the inside view;


**Figure 12**: outside view of the football sock with a shin-pad holding pouch


**Figure 13**: inside view of the football sock with a shin-pad holding pouch

- it can be knit to create reinforced areas having any desired shape which can be placed in any part of the leg and/or foot.

## 3. CONCLUSIONS

The great variety of athletic sports lead to design and produce socks adequate to the specific properties required to them, as:

- socks with no ride-down effect, indicated for every sport but with a greater importance in skiing where this effect is involved even in the safety of the wearer. Such a sock contains a stabilizing area as a band extended from the top of the instep to the apex of the heel portion, including an elastic yarn;
- reinforced socks with abrasion resistance, are largely useful, the solution being the plating of a special composite reinforcing yarn on the sock body yarn;
- double layer socks for football containing two separated fabrics resulting a knitted pocket for housing shin guards.

## 4. REFERENCES

1. Creţu, V., (2006). *Tehnologii şi utilaje pentru tricotarea ciorapilor*, Ed. Performantica, ISBN 973-730-264-8, Iaşi
2. Hanson, N.M. (1993). Split-Heel Socks, *Knitting Times,* May, pp.16-19.
3. Reinsfeld, A. (1995). Abrasion Resistant Reinforced Fabric, *Knitting Times,* February, pp.12-13
4. Reinsfeld, A. (1996). Producing Two-Ply Circular Knit Fabric, *Knitting Times,* April, pp.8-10.
5. www.knittingindustry.com (2009). Double Layer Sock

ANNALS OF THE UNIVERSITY OF ORADEA
FASCICLE OF TEXTILES- LEATHERWORK
Volume I, 2010, No. 2

# GENERALIZED ALGORITHM FOR CUSTOMIZED DESIGN OF THE SKIRT BASIC PATTERN

**M. Diaconu[1], M. Diaconu[1], C. Niculescu[2], S. Olaru[2]**

*[1] SC Diaman Art SRL, Iaşi, România*
*[2] National Institute of Research and Development for Textiles and Leather, Bucharest, Romania*

Coresponding author Manuela Diconu, office@diamanart.ro

***Abstract:*** The 3D body measurement method, as well as current design and calculus applications, allows the development of specific routines for the automatic design of garments. As basis for these routines stand either classic design algorithms, or construction systems following new d esign rules. This is the case of generalized algorithms which automatically generate a unique pattern, specific to the body for which the settings were established. The current paper pleads for finding the optimal set s of anthropometric parameters and design rules characteristic to each type of product, in order to eliminate the step of trying on the product on the real body, or draping in the 3D environment. The current paper introduces a generalized, original algorithm, for the skirt product, elaborated within the project EUREKA “A new clothing – CAD for 2D/3D geometrical modeling of clothing products”. The data base was provided by using the 3D scanner (Human Solutions) owned by INCDTP Bucharest.
***Keywords:*** customized design, 3D scanning, generalized al gorithms, logical schema, 3D draping.

## 1. INTRODUCTION

Any generalized algorithm, following the principles described in the paper, is a complex mathematical system, destined to dress correctly and aesthetically a certain body area, independent of the morphological variant and the allowance value**.** The final goal is to completely eliminate the trying on, or the 3D draping step. The mathematical constructions are elaborated for the basic patterns in any constructive variant, but they can also be extended to th e most difficult model patterns. The operating method is entirely automatic and the easiest possible, the only task of the user being to set the anthropometric parameters in a workspace**.** For each basic pattern a routine is generated, which analyses those anthropometric parameters and generates the unique pattern specific to the customer's body. Being portable, the pattern can be imported on the modern CAD-CAM platforms specialized in garment design. [3].

## 2. GENERALIZED ALGORITHM PRESENTATION

### 2.1. General characteristics

The operating method is very simple, as a result of the general simplification of the garments design process, having into consideration that the external shape of the human body manifests multiple and varied deviations from the ideal body. Within this work system the classic design rules must be met, but they are not sufficient. Because of this, new additional rules are introduced, so that , in the end, the unique pattern is generate d, a correct and aesthetic pattern which manifests precisely the allowance degree solicited by the user. In other words, the logic schema starts with a central decision block from which four working branches are developed, the pattern construction being placed on the branch corresponding to that particular body configuration. Each branch also contains other decision blocks, figures 1and 4.

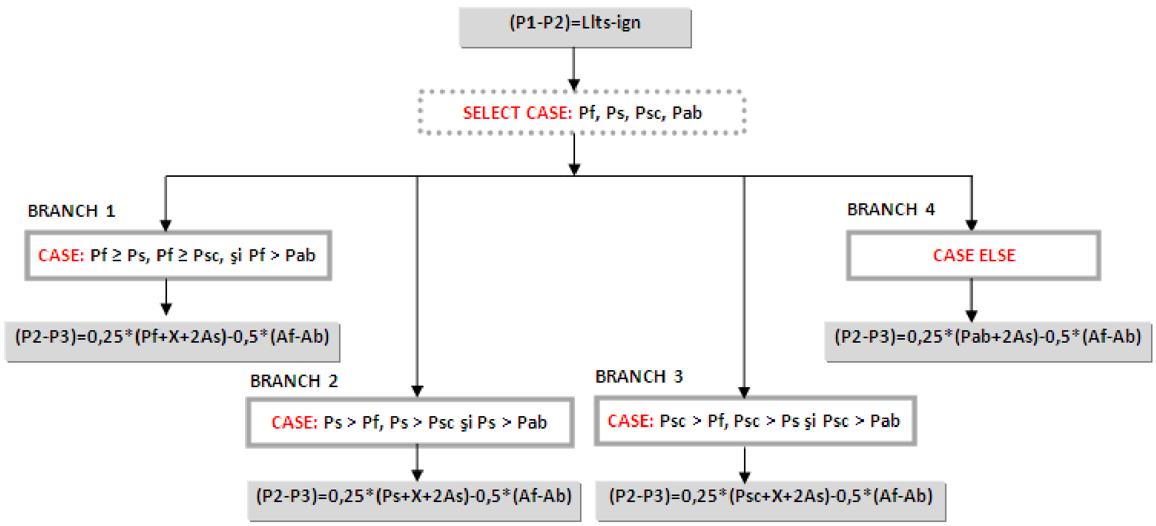



**Figure 1:** First part of the logic schema of the generalized algorithm

The anthropometric parameters set which is used has to contain the optimal dimensions for obtaining a complete description of the body area which will be dressed [4]. The anthropometric parameters are easily measured only between well defined anthropometric points, most of them being standardized, table 1.

As a natural consequence of design algorithm generalization we obtain oversized problems, even if the number of the calculus parameters provided by the 3D body model increases significantly. This is why it is necessary to formulate sub-problems of mathematic optimization with general restrictions (non-linear) – NLP and to solve them using robust optimization engines [2], [5].

**Table 1:** Anthropometric parameters

| NR.CRT | SYMBOL | PARAMETER NAME | OBSERVATIONS |
|---|---|---|---|
| 1 | ign | Knee height | |
| 2 | ips | Hip height | |
| 3 | if | Buttock height | |
| 4 | iab | Maximum belly circumference height | |
| 5 | dba | Distance between the front darts | |
| 6 | dbf | Distance between the back darts | |
| 7 | Aab | Maximum belly depth | max(0,Aab) |
| 8 | Al | Hip depth | max(0,Al) |
| 9 | Af | Buttock depth (2nd lumbar depth) | |
| 10 | Lats | Central front line at waist | |
| 11 | Llts, st./dr. | Side seam at waist left/right | min(Lltsst., Lltsdr.) |
| 12 | Lpts | Central back line at waist | |
| 13 | Pt | Waist girth | |
| 14 | Pab | Maximum belly circumference | |
| 15 | Pf | Buttock girth | |
| 16 | Ps | Hip girth | |
| 17 | Psc | Hip girth over the thighs | |
| 18 | As | Hip allowance | (0÷4) cm |

### 2.2. Design rules for the generalized algorithm

- The pattern width is set on the horizontal line that meets the condition of max (Pf, Ps, Pab , Psc). Each of the four girths can be larger than the other three. As a consequence, the logic schema of the generalized algorithm has four branches, figure 1, 3.

- The width of the pattern is supplemented with an X factor, which depends on the body parameters and varies inversely to As, thus:

$X = f(Pab, Pf, Pt, Af, Aab, Al, Af, Llts, Lpts, iab, if, As)$ Branch 1:
$Pf = max(Pf, Ps, Psc, Pab)$, (1)
$X = f(Pab, Ps, Pt, Af, Aab, Al, Af, Llts, Lpts, iab, if, As)$, Branch 2:
$Ps = max(Pf, Ps, Psc, Pab)$, (2)
$X = f(Pab, Psc, Pt, Af, Aab, Al, Af, Llts, Lpts, iab, if, As)$, Branch 2:
$Psmax(Pf, Ps, Psc, Pab)$, (3)

This rule is necessary in order to avoid the pressing and strangulation of the body in the abdominal area, for cases in which Pab is large and we want a very small degree of looseness.

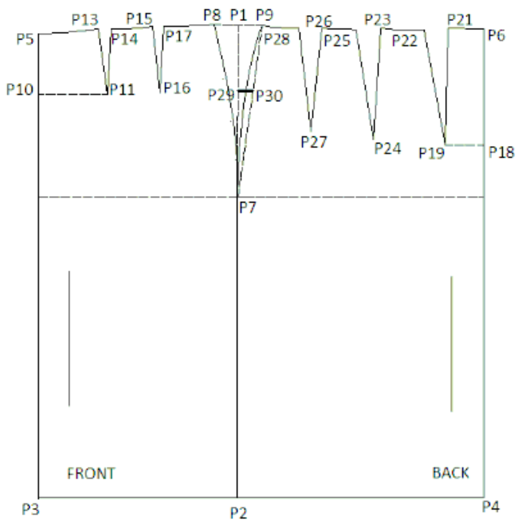



**Figure 2:** Geometrical construction , branch 1

- The waist line is generated according to the ratio between the three lengths Labts, Lpts, Llts. The waist curves are geometrically defined, have a common tangent in the darts ends, and when added they represent exactly Pt+1/2*Aş, figure 4, [4].

- The lateral seam line is dimensioned correctly by the Llts parameter.

- The darts width is dimensioned correctly depending on the body depth s [1], Aab, Al şi Af, as follows:
  ½ Total front darts width = $X1 * 0,5 * (Pi + X + As - Pt)$ (4)
  ½ Total lateral darts width = $X2 * 0,5 * (Pi + X + As - Pt)$ (5)
  ½ Total back darts width = $X3 * 0,5 * (Pi + X + As - Pt),\ in\ care$ (6)
  $X1 = \left(\frac{Aab}{Aab+Al+Af}\right), X2 = \left(\frac{Al}{Aab+Al+Af}\right), X3 = \left(\frac{Af}{Aab+Al+Af}\right)$ (7)

- Pi is Pf, Ps, Psc or Pab depending on the horizontal line that defines the width of the pattern, X=0 on branch 4.

- The routine establishes the number of darts on the frontal or back benchmark_of the pattern, by using some decision blocks based on the classic rule for determining the number of darts.

- The darts are disposed radially, due to purely aesthetic reasons, for inducing the impression of slenderness in the waist area. For finding the inclination degree of the darts, the inferior area of the torso is framed in a frustum of a cone.

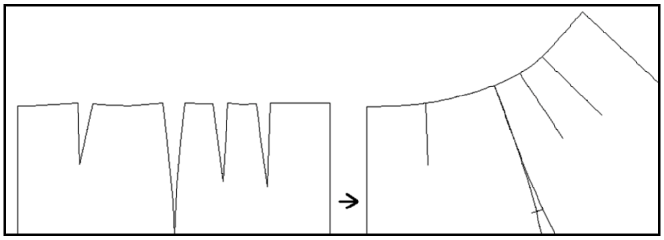


**Figure 3:** Waist line for Lab < Llts < Lpts

### 2.3. Logic schema of the generalized algorithm

As a following we present the logic schema of the generalized algorithm for the basic pattern of the customized skirt product. On grounds of space limitations, only branch 1 of the a lgorithm is illustrated and only the main mathematical relations and decision blocks.

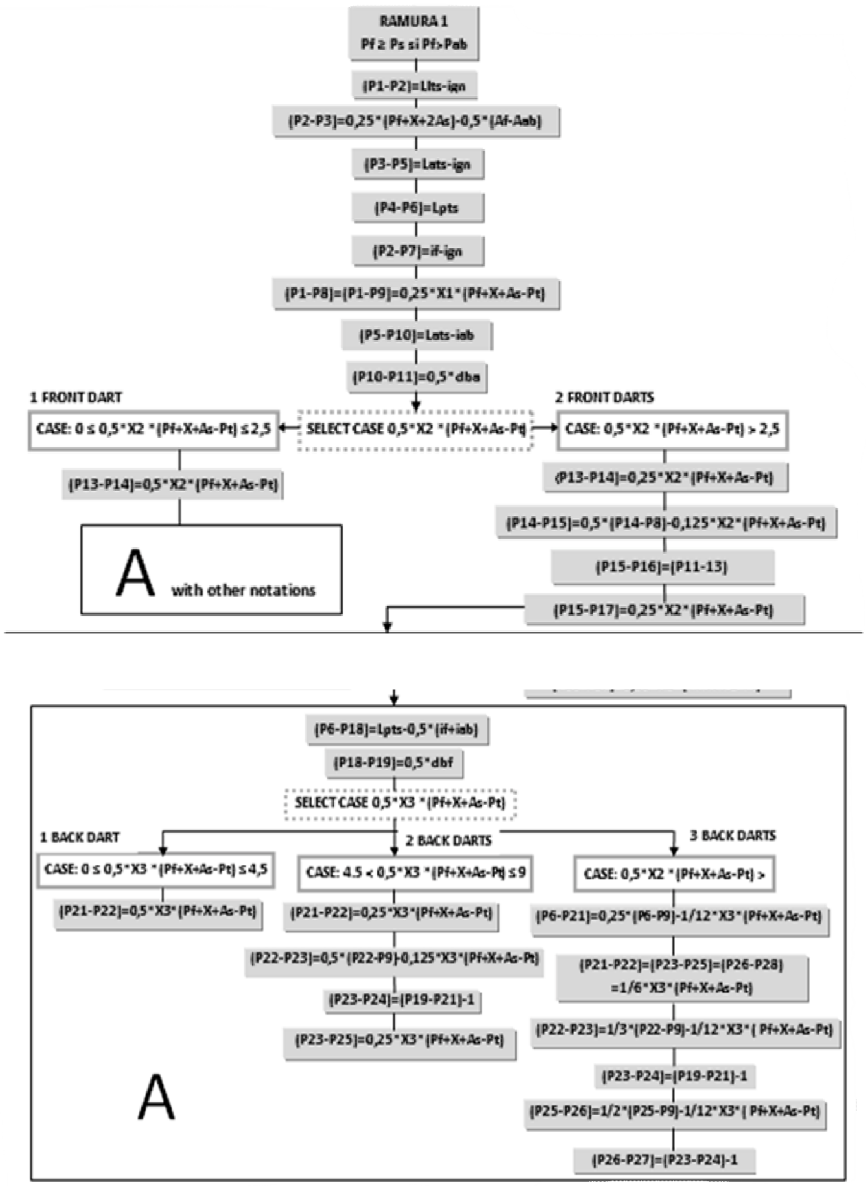



**Figure 4:** Branch 1 of generalized algorithm, skirt product

## 3. CONCLUSIONS

The generalized algorithms for customized products can also generate patterns for type bod ies, on condition that the measurements standard provides values for all the anthropometric parameters asked by the workspace. The additional design rules implemented in routines guarantee the generation of ready-to-wear patterns which are more accurate than those generated by using classic design algorithms.

If we want to generate algorithms only for ready-to-wear products, we use a minimum number of anthropometric parameters, the mathematical relations are simple and specific to the ready-to-wear variant. The advantage is that we automatically obtain patterns for the entire range of sizes and various body shapes, depending on the ratio between the anthropometric parameters.

The generalized algorithms destined to customized patterns were conceived with the purpose of creating another working system, focused on perfecting the body measuring operation (3D scanning), but also through the direct method, using a simple but professional set of measuring instruments. The goal is the elimination of the actual designing and trying on steps. This is possible by means of mathematic optimization, and provided that the generalized algorithms contain the best design rules and use the most appropriate anthropometric parameters **.**

Having into consideration the prohibitive prices of commercial optimization engines, implementing the algorithms must be as simple as possible. Thus, because the NLPs defined by this application have reasonable dimensions, we opted for the Excel Solver, which is a robust implementation of the well-known algorithm GRG2. The graphical user interface is ensured by an affordable AutoCAD clone, such as ZwCAD. For simplicity, integrating Excel within the AutoCAD clone is recommended. As a consequence, the pattern generating application runs inside the clone, and NLP resolve by automatically opening an invisible Excel sheet.

## 4. REFERENCES


1. Filipescu E. (2003) Structura şi proiectarea confecţiilor, Editura Performantica, ISBN 973-7994-33-7, Iasi
2. Diaconu, M., Pintilie E., Avădanei M.& Diaconu, M. (2007). DMM Pattern Design CAD/CAM, software de proiectare automată a îmbrăcămintei, *A XIII[a] Conferinţă Română de Textile şi Pielărie*, CORTEP 2007, Buletinul Institutului Politehnic, tomul LIII, fas.5, vol II, pag. 18-20,ISBN 978-973-730-401-8, Iaşi, septembrie 2007, Editura Performantica
3. Diaconu M., Pintilie E., Avădanei M., Diaconu M.,(2008). Sistem integrat de producţie a îmbrăcămintei personalizate pentru IMM-uri cu profil confecţii textile. *Revista industria textilă*, INCDTP Bucureşti, vol.59, nr.2, (2008), pag.63+68, ISSN 1222-5347 (49-96)
4. Diaconu, M., Mitu, S., Diaconu, M., (2008). Model de descriere geometrică a tiparelor pentru elaborarea aplicaţiilor de proiectare automată. *Revista industria textilă*, INCDTP Bucureşti, vol.59, nr.5, (2008), pag.205+212, , ISSN 1222-5347 (193-248)
5. Diaconu M., Mitu S., Pintilie E., Filipescu E. (2008). Modelarea matematică a construcţiei de bază pentru produsele cu sprijin pe umeri personalizate în vederea proiectării automate , *Simpozionul anual al specialiştilor din industria de tricotaje-confecţii*, Textilele Viitorului, Editura Performantica, pag. 343, Iaşi, noiembrie 2008, Iaşi

ANNALS OF THE UNIVERSITY OF ORADEA
FASCICLE OF TEXTILES- LEATHERWORK
Volume I, 2010, No. 2

# STUDY REGARDING THE INFLUENCE OF RAW MATERIALS ON THE BEHAVIOR OF FABRICS WHICH UNDERGO STRETCH STRESS

**Milena Dinu[1], Alina Floca[2], Costea Budulan[3]**

[1] *"Lucian Blaga" University, Faculty of Enieneering, Sibiu, România*
[2] *"Lucian Blaga" University , Faculty of Enieneering, Sibiu, România*
[3] *Faculty of Textile - Leather and Industrial Management, Iasi, România*

Milena Dinu, milena.dinu@ulbsibiu.ro
Alina Floca, alina_floca@yahoo.com
Costea Budulan, cbudulan@tex.tuiasi.ro

***Abstract:*** The purpose of the present paper is to analyze the behavior of fabrics undergoing stretch stress. The yarns used for knitting the samples undergoing stress have been: cotton, woolen spun yarn and worsted yarn. All samples have been knitted in single jersey geometry.
Tests have been performed with the Titan dynamometer. The obtained and discussed results point to the different influence of the raw materials on the samples undergoing tests.
***Key words:*** stretch stress, knitted fabrics, breaking strength, dynamometer

## 1. INTRODUCTION

The most frequent stress undergone by fabrics during wearing is traction. Tensile strain always results in a change of shape in the tensile direction. Traction forces acting on fabrics during wearing are often smaller than breaking forces. Nevertheless, they may cause irreversible damage. This kind of deformations may appear even after a first use but they are more visible after repeated stress. The size of deformations depends on stress type and duration, but it is also influenced by the raw materials used and the parameters of the knitting operation [1].

The breaking resistance is determined by the value of the breaking force or through specific indices, through the specific resistance, the tenacity or breaking length. The traction force also depends on the fabric structure. The breaking force represents the value of the breaking force which causes the breaking of the fabric sample when applied as axial strain [3,4].

## 2. METHOD

In order to determine the influence of fabric raw materials on the behavior related to tensile strain, there have been tested four type of knitted fabrics with single jersey geometry, 5 samples for every kind of knitted fabrics, made of cotton, woolen spun yarn and worsted yarn. Knitted fabrics specimens produced, were conditioned for 24 h, before testing, in standard atmosphere.

We studied two quality characteristics of the knitted fabrics, as: the breaking strength and the breaking elongation. All the tests on the stress-strain characteristic of the knitted fabrics, were done according to the standard method, grab method.

The breaking force and elongation of the samples, were investigated in direction of the wale, five samples were taken from the wale directions of each type of knitted fabric, tests were performed using the dynamometer TITAN2 [5]. Dimension of the tested specimens were 50x150mm, for each specimen were applied same pretension force, 2N [2].

The characteristics of the specimens which were chosen for the research are showed in (Table1).

**Table 1**:The characteristics of the tested specimens

| Sample code | Fibre constitution | Yarn linear density [tex] | Dh [wale/50mm} | Dv [rows/50mm] | Knitting geometry |
|---|---|---|---|---|---|
| 1 | cotton | 20x2 | 35 | 41 | single jersey |
| 2 | Woolen spun yarn | 33.3x2 | 32 | 42 | single jersey |
| 3 | Woolen spun yarn | 25x2 | 30 | 40 | single jersey |
| 4 | Worsted yarn | 55.5x2 | 24 | 33 | single jersey |

## 3. RESULTS

There are presented the results obtained for each specimen, tested on direction of the wale, for which reveal the influence of raw material on the stress strain behavior of the tested samples (Table 2).

**Table 2**: Tests results

| Sample code | Maximum breaking force [N] | | | | | Mean | Extension [%] | | | | | Mean | Mean of time to break [s] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 363.55 | 312.71 | 329.84 | 351.89 | 343.18 | 340.23 | 69.67 | 70.08 | 74.30 | 75.86 | 74.09 | 72.80 | 104.3 |
| 2 | 214.42 | 226.13 | 192.66 | 228.33 | 230.42 | 218.39 | 61.65 | 65.13 | 57.71 | 63.71 | 66.36 | 62.91 | 92.3 |
| 3 | 344.21 | 310.54 | 277.93 | 310.02 | 303.61 | 309.26 | 86.43 | 82.61 | 79.95 | 86.03 | 84.16 | 83.84 | 113.9 |
| 4 | 230.20 | 229.69 | 194.67 | 208.51 | 199.63 | 212.54 | 90.97 | 91.10 | 96.03 | 86.07 | 88.77 | 90.59 | 127.7 |

As it can be notice in table 2, there are considerable differences among values coming out from the specimens tested. The results showed that the tensile properties of knitted fabrics, vary depending by raw materials.

By comparing the obtained results, the following may be observed:

- the cotton knitted sample has the highest rupture resistance;
- in the case of the two samples knitted of woolen spun yarn, the one knitted of yarns with titre of 25x2 tex has a higher rupture resistance;
- the sample knitted of worsted yarn with titre of 55.5x2 tex had the lowest value for the rupture force and the highest value for rupture elongation, meaning that it had the lowest rupture resistance.

The stress-strain diagrams of the tested specimens are presented (Figures 1 -4).

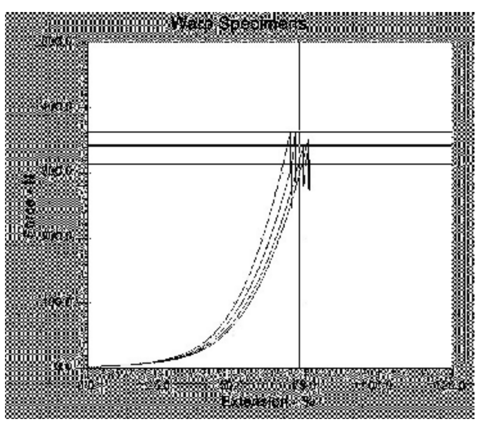



**Figure 1**: The stress-strain diagram for cotton samples (1)

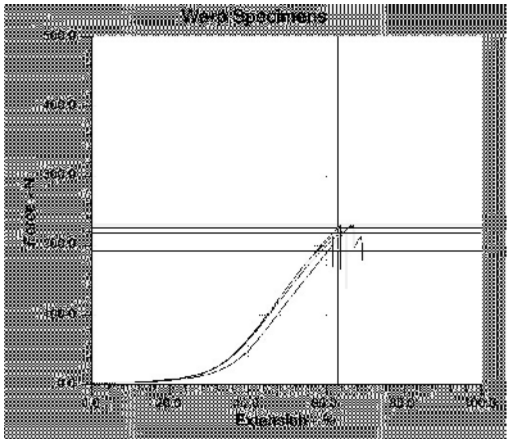



**Figure 2**: The stress-strain diagram for woollen spun yarn  samples (2)

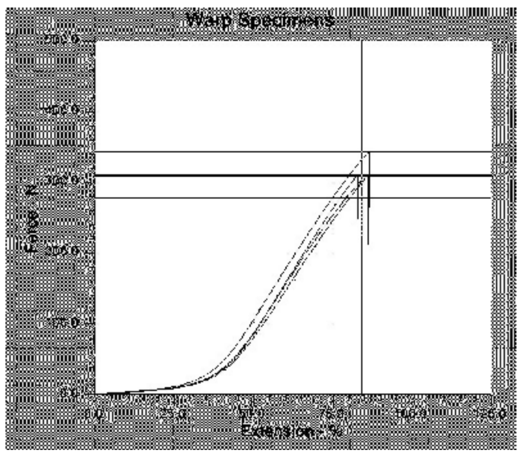



**Figure 3**: The stress-strain diagram for woollen spun yarn  samples (3)

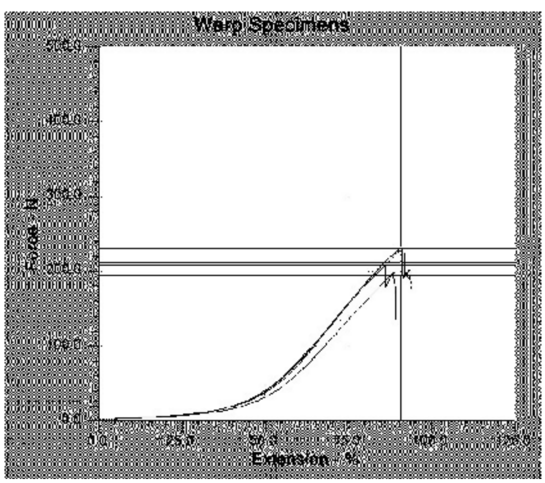



**Figure 4**: The stress-strain diagram for worsted yarn  samples (4)

## 4. CONCLUSIONS

From the obtained results the following can be gathered:

- the yarn titre represents a parameter influencing the behavior of fabrics under stretch stress; the higher the yarn thickness the higher the rupture resistance;
- the raw material used influences differently the rupture resistance and the elongation.

As a general conclusion of breaking strength, a hierarchy, beginning with higher strength and ending with the lowest strength is presented:

- knitted fabrics from cotton 20x2 tex
- knitted fabrics from woolen spun yarn 25x2 tex
- knitted fabrics from woolen spun yarn 33.3x2 tex
- knitted fabrics from worsted yarn 55.5x2 tex

In this study we concluded that the stress-strain behavior of knitted fabrics is influenced by raw materials of the knits.

## 5. REFERENCES


1. Asociaţia Generală a Inginerilor din România, Societatea Inginerilor Textilişti din România (2002), *Manualul inginerului textilist*, vol. III, Ed. AGIR, Bucureşti
2. EN ISO 13934-2/1999 *Tensile properties of fabrics* - Part 2: Determination of maximum force using the grab method.
3. Khondker O., Fukui T., Nakai A. Hamada H.(2004), Initial fracture behavior on the weft - knitted textile composites having welt-knit architectures, *Procedings of the Fourth Asian- Australasian Conference on Composite Materials*, University of Sydney, Australia
4. Markus O. Speidel,Peter J. Uggewitzer (1998), *Materials in Medicine*, ISBN 3 7281 2681, Zurich
5. Technical book of Titan2 – Universal Strength Tester, model 710

ANNALS OF THE UNIVERSITY OF ORADEA
FASCICLE OF TEXTILES- LEATHERWORK
Volume I, 2010, No. 2

# IMAGE ANALYSIS OF DYED MATERIALS

**M.S. Bucur[1], M. Dochia[1], M. Szabo[1], M.Stan[2]**

[1] *Aurel Vlaicu University, Arad, ROMANIA*
[2] *The Research-Development National Institute for Textile and Leather, Bucharest, ROMANIA*

Corresponding author: Mihaela Dochia, E-mail address: mihaeladochia@yahoo.com

***Abstract:*** Defects in aesthetic appel of textile materials are of particular importance, because they affect the aesthetic requirements, modifying properties and/or usability of materials provided for initial destinations. For defect term of visual image evaluation was used the unevenness or inequality term (equality = uniformity is 0). Faults assessment limits consist in the fact that different types of defects appeared in different technological stages present a similar image leading to the impossibility of determining the source and cause of defect by image analysis. A series of experiments has been made and various dyeing defects (oil, water, calcium chloride and dye spots) were simulated. Point defects were determined by image assessment (visual, photo camera, scanner and microscope) of samples.

***Key words:*** image analysis, dyed materials, point defects, unevenness, 100 % cotton knitted fabric, reactive dye.

## 1. INTRODUCTION

A uniform dyeing is the process which leading to a dyed material with the same intensity of color, the same hue of color and the same brightness. Uniformity is not itself a measurable quantity, what is measured is the degree of inequality, which can be expressed by the difference in dye concentration or by the color difference $\Delta E$.

In industrial practice, dyeing uniformity defects appear relatively frequently such as unevenness of hue, brightness and color intensity. May be listed some of the causes of dyeing uniformity defects: unevenness of row material, unevenness in woven fabrics caused by improper mechanical operations working parameters (spinning, weaving, knitting), improper parameters in material pretreatment operations caused by the malfunctioning of dyeing equipment, variable parameters of steam, poor quality of some dyes, chemicals and auxiliaries. Figure 1 presents three types of unevenness. These types of irregularity appear with different intensities but also with different shades to this material. They appear due to uneven dye sorption on certain portions of the material.

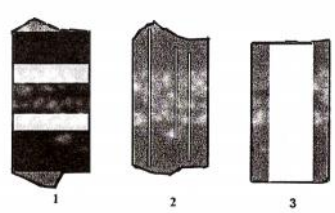



**Figure 1:** Types of uneven dyed materials

In case 1 sorption is cause by the mixed yarns from different batches and appears especially in materials woven on conventional looms. The unevenness presented in case 2 is caused by the different tensions apllied pretreatments of textile material or is caused by the presence of some yarn s with other origin in the warp. In case 3 the color unevenness usually appears when the pressure is uneven in the continuous preapering stage of the material or in dyeing process on the dyeing padder. [Huang, C.-C., Yu, W.-H., (2001). Fuzzy Neural Network Approach to Classifying Dyeing Defects. *Textile Research Journal*, Vol. 71, No. 2, (02.2001) 1074-1078, ISSN 0040-5175]

Dyeing uniformity may be achieved either by choosing a dyestuff with a good capacity for migration or by setting the optimal working parameters. The parameters that ensure the uniformity are: temperature-time program, the presence of the equalizer auxiliaries, pH of dyeing solution, addition of electrolytes. [Bucur, M.S., (2000). *Lecture Notes in Dyeing and Printing Technology*, "Aurel Vlaicu" University Publisher, ISBN 973-9361-34-X, Arad]

In defects grading may be found visible defects and invisible defects. For image analysis are important only visible defects. It is known in practice that about 60% of dyeing defects and a significant percentage of the printing defects are actually generated in earlier stages of pretreatment of textiles. Image and appearance of the defects varies depending on the type of material even if the technological process is similar (for example cotton against tercot) or identical (for example cotton against cotton + rayon or 100% rayon). The appearance of defects varies depending on the material. Type of defects can be generated by different material flow through the machine in preatreatment or dyeing process namely:

- Rope (stretched or free);
- Sheet (stretched or free).

Each of the processes presented generate different types of defects. The evaluation of defects by image analysis is based on the altering of optical properties of textile surface in the area were the defect is present.

This approach requires to taking into consideration the followings aspects:

- Lighting in material; flow regime;
- Lighting itself is dependent on the environmental conditions and is completely different in factory conditions and in laboratory conditions;
- Lighting in factory varies from day to day.

New variables appear in these conditions and these are difficult to control. Color difference $\Delta E$ have different values depending on the hue of dyed materials. Under these conditions must be specified for each color accepted $\Delta E$ value, color tolerance limits respectively. The limits of dyeing defects evaluation are caused by: types of defects, causes of defects, defects form, and appearance of defects.

Defects are generally determined by:

- Assessment by image;
- Assessment of laboratory tests and imaging;
- Only through laboratory assessment.

One can say that limiting of defects assessment system may be given by the behavior of dyes.[Rouette, H.K., (2002). *Encyclopedia of textile finishing*, Format: CD-ROM, ISBN-10:3540147659, ISBN-13:9783540147657]

For a pass/fail evaluation system that detect defects based on color difference is necessary to determine color differences $\Delta E$ allowed for each part shade. These practical aspects of the finishing may raise additional problems for the evaluation of defects by image analysis.

One aspect that limits the proper working system is as follows:

In case of continuous dyeing machine or printing machine this machine should stop for each defect and indicates where this defect appeared or where the defect may appear. In this case should be establishing which are the limits for the defect image and how different may be the image with defects from the image material without defects. These tolerances may be spot size (defect), the differences in hue, intensity or shape of the defect, and its frequency.

On the other hand at every stop of a continuous dyeing machine a large amount of material becomes damaged to greater or less intensity of color depending on the operation or where the material stays in the machine. In this case there is possibility that the material to be more deteriorate because of this stops than because of the preatretment defects that appears on dyeing padder. To avoid this situation one camera must be placed after each major phase which takes place on the machine and data-processing software have to be complicated for obtaining a solution in real time. [Shelton, M., (2004). Machine vision maps dyeing and finishing defects – reducing scrap and cost, Available from: http://www.sheltonvision.co.uk/vision/pdf/article4.pdf, Accessed: 28/04/2010.]

In case of discontinuous machine for verifying the hue through image analysis, machine must be stopped for sampling. Other type of defects could be evaluated during machine operation in case of processing machines in sheet, but it is very difficult to set up a camera in a corrosive environment with high temperature and very high humidity (steam). For these machines a possible solution is a rigorously control of material at the beginning of the process and a very strict control of all technological process parameters. Another kind of limitations is related to defects similarities from different stages of finishing technology. This similarity complicates the determination of precisely source of the defect. In these circumstances the system should be complemented by a specialized expert in assessing failures.

## 2. EXPERIMENTAL PART

In this paper, we are refering at the comparison of some initial samples with samples taken during the production process. A series of samples stained by different substances (oil, calcium chloride, water, dye liquor) for simulating different types of defects were dyed after that.

### 2.1 Materials and Method

Raw material used was 100% cotton knitted fabric with characteristics as follows:

- Plain structure; 60/1 (Nm) yarn fineness; $C_v$ = 4.4; $F_R$ = 150 cN; Irregularity $F_R$ = 16.2 %; Elongation at break resistance = 5 %; $\alpha_m$ = 112; $lm_o$ = 3.2 mm; $M/m^2$ = 120 $g/m^2$

A number of 20 samples with size of 10 cm/25 cm were prepared. Cotton knitted fabric samples were prepared by a degreasing treatment according to the following recipe:

- Bath ratio - 10:1;
- Sodium carbonate, $Na_2CO_3$ – 5 g/L;
- Low-foaming emulsifying agent, Felosan RG-N – 5 mL/L;
- Time of treatment – 1 h;
- Temperature – 70-80 $^oC$.

Degreasing treatment was performed in a thermostated bath with ultrasonic system, type TI-H-10 from Elma Company, Germany. After degreasing the samples were washed with hot water and cold water and then were dried in oven at a constant temperature of 80 ° C for 3 hours . The oven is from EKO-POL Company from Poland. For defects simulation, dried samples were stained with various agents as follows:

- water spots: 1 drop, 2 drops, 3 drops, 4 drops, 5 drops;
- oil spots: 1 drop, 2 drops, 3 drops, 4 drops, 5 drops;
- calcium chloride spots– $CaCl_2$: 1 drop, 2 drops, 3 drops, 4 drops, 5 drops;
- Bezaktiv Rot S-3B reactive dye liquor spots.

The stained samples were dried in the oven at the temperature of 80 Celsius degrees. After that, the samples were dyed with a reactive dye named Bezaktiv Rot S-3B from Bezema Company. Dyeing was done by bath exhaustion according to the diagram shown in Figure 2. [BEZEMA, (2002). *Dyestuff Catalog*]

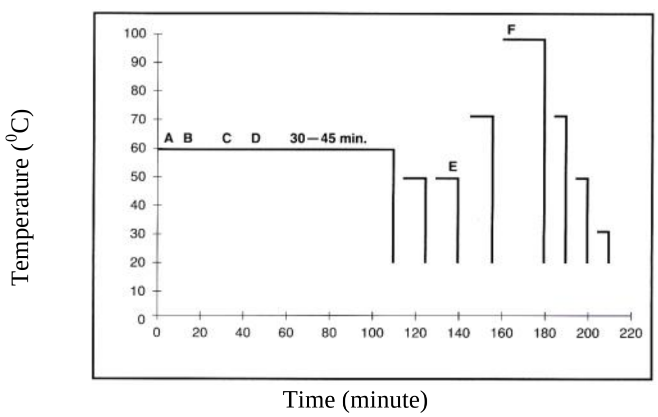



**Figure 2:** Dyeing diagram of Bezaktiv Rot S-3B

Where:

**A)** 2.0 g/L MEROPAN NX (protective colloid with sequestering properties, it has sequestering properties for Ca, Mg and Fe ions)
0.3 g/L BIAVIN 109 (emulsified fat compound)
80.0 g/L NaCl (sodium chloride)

**B)** 4 % dye BEZAKTIV Rot S-3B (reactive dye from Bezema);

**C)** 5.0 g/L $Na_2CO_3$ (sodium carbonate);

**D)** 3.0 mL/L NaOH 38 $^0$ Bé (sodium hydroxide solution);
**E)** 1.0 mL/L Acetic acid;
**F)** 0.5 g/L Felosan Rg-N (mixture of fatty alcohol ethoxylates, a low-foaming emulsifying agent)

Each sample stained by the method presented above was dyed in an individual dyeing bath. The quantities of reagents in dyeing baths are presented in Table 1.

**Table 1:** The dyeing baths

| | Mass (g) | Bath Ratio (5mL: 1g) | Meropan NX (mL) | Biavin 109 (mL) | NaCl (g) | Bezaktivrot S-3B (g) | $Na_2CO_3$ (g) | NaOH $38^0$ Be (mL) | Acetic acid (mL) | Felosan RGN (mL) | Water (mL) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Water spots** | | | | | | | | | | | |
| **1** | 5.317 | 26.585 | 0.053 | 0.0080 | 2.127 | 0.213 | 0.133 | 0.080 | 0.027 | 0.013 | 2.876 |
| **2** | 5.552 | 27.760 | 0.056 | 0.0083 | 2.221 | 0.222 | 0.139 | 0.083 | 0.028 | 0.014 | 3.004 |
| **3** | 5.509 | 27.545 | 0.055 | 0.0083 | 2.204 | 0.220 | 0.138 | 0.083 | 0.028 | 0.014 | 2.980 |
| **4** | 5.430 | 27.150 | 0.054 | 0.0081 | 2.172 | 0.217 | 0.136 | 0.081 | 0.027 | 0.014 | 2.938 |
| **5** | 5.118 | 25.590 | 0.051 | 0.0077 | 2.047 | 0.205 | 0.128 | 0.077 | 0.026 | 0.013 | 2.769 |
| **Oil spots** | | | | | | | | | | | |
| **6** | 5.378 | 26.890 | 0.054 | 0.0081 | 2.151 | 0.215 | 0.134 | 0.081 | 0.027 | 0.013 | 2.909 |
| **7** | 5.257 | 26.285 | 0.053 | 0.0079 | 2.103 | 0.210 | 0.131 | 0.079 | 0.026 | 0.013 | 2.844 |
| **8** | 5.241 | 26.205 | 0.052 | 0.0079 | 2.096 | 0.210 | 0.131 | 0.079 | 0.026 | 0.013 | 2.835 |
| **9** | 5.164 | 25.820 | 0.052 | 0.0077 | 2.066 | 0.207 | 0.129 | 0.077 | 0.026 | 0.013 | 2.794 |
| **10** | 5.207 | 26.035 | 0.052 | 0.0078 | 2.083 | 0.208 | 0.130 | 0.078 | 0.026 | 0.013 | 2.817 |
| **Calcium chloride spots** | | | | | | | | | | | |
| **11** | 5.336 | 26.680 | 0.053 | 0.0080 | 2.134 | 0.213 | 0.133 | 0.080 | 0.027 | 0.013 | 2.887 |
| **12** | 5.145 | 25.725 | 0.051 | 0.0077 | 2.058 | 0.206 | 0.129 | 0.077 | 0.026 | 0.013 | 2.783 |
| **13** | 5.386 | 26.930 | 0.054 | 0.0081 | 2.154 | 0.215 | 0.135 | 0.081 | 0.027 | 0.013 | 2.914 |
| **14** | 5.129 | 25.645 | 0.051 | 0.0077 | 2.052 | 0.205 | 0.128 | 0.077 | 0.026 | 0.013 | 2.775 |
| **15** | 5.422 | 27.110 | 0.054 | 0.0081 | 2.169 | 0.217 | 0.136 | 0.081 | 0.027 | 0.014 | 2.933 |
| **Reactive dye spots** | | | | | | | | | | | |
| **16** | 5.311 | 26.555 | 0.053 | 0.0080 | 2.124 | 0.212 | 0.133 | 0.080 | 0.027 | 0.013 | 2.873 |
| **17** | 5.341 | 26.705 | 0.053 | 0.0080 | 2.136 | 0.214 | 0.134 | 0.080 | 0.027 | 0.013 | 2.889 |
| **18** | 5.274 | 26.370 | 0.053 | 0.0079 | 2.110 | 0.211 | 0.132 | 0.079 | 0.026 | 0.013 | 2.853 |
| **19** | 5.572 | 27.860 | 0.056 | 0.0084 | 2.229 | 0.223 | 0.139 | 0.084 | 0.028 | 0.014 | 3.014 |
| **20** | 5.474 | 27.370 | 0.055 | 0.0082 | 2.190 | 0.219 | 0.137 | 0.082 | 0.027 | 0.014 | 2.961 |

After dyeing operation performed according to the diagram presented, samples were washed with hot water and cold water and after that dried at ambient temperature.

Samples image were captured with:

- HP-Officejet 5610 – All in one, a multifunction printer-scanner;
- HP Photosmart camera with 6,2 Megapixels R 717 and 3 X Optical zoom;
- Stemi 2000 – C Stereomicroscope from Zeiss Company, connected to the PC through a camera Canon PC 1200 Power Shot A640, 10 Megapixels.

### 2.2 Simulation of staining with calcium chloride solution

It was made by material dribbling with different amounts of $CaCl_2$ solution, as noted above. Scanned images of samples appear darker than those captured by photo camera, because of different lighting. Calcium stains have different shapes because of random scattering and different amounts of solution added. Scanned samples present a better image of calcium spots and unevenness of dye sorption.

For scanned images the folds formed during dyeing or pretreatment process are shown as differences in dye sorption. In case of photographed images these folds are like the folds caused by the material flow. The scanned images have a higher accuracy than those captured by camera because the lighting is the same for all scanned samples while for photographed samples appreciable differences in lighting and position appears if not using a fixing device camera (tripod) and a dark room in which samples are illuminated under the same conditions.

The scanned samples are closer than the photographed samples to visual perception.

Samples were also analyzed using a stereo microscope. The images were captured through a video camera and stored in the computer. Images were not increased to avoid highlighting other less important details to this case. In case of microscopic images the visualizing field is very small and this fact leads to similar images for all samples. For samples viewed under a microscope we can distinguish the separations between dyes caused by the different speed of dyes migration.The red dyestuff that was used have in composition a blue dye used for typification.

All samples made with different amounts of calcium solution presents only difference in size and shape of spots. The other observations made are the same with those made for calcium spot obtained with a single drop of solution.

### 2.3 Simulation of staining with water

Water spots are more visible as is known in practice, the sensitivity of some reactive dyes for such spots are quite large.

From image analysis performed for samples stained with different number of water drops we conclude that the differences consist only in size of stained surface and the shape of spots. Also in this case scanned images have a higher accuracy than those photographed.

### 2.4 Simulation of staining with oil

The oil spots compared with water spots presents differences not only in hue but also in color. The stains appear yellowish in the photographed images. Scanned images present darker and more delimitated stains.In case of bigger amount of oil the delimitation of oil spots is less clear.

### 2.5 Simulation of staining with reactive dye

Stains of reactive dye made and monitored through the methods described above, don't present any other particularities compared to the other types of spots. The conclusions are the same regarding the spots size, shape and differences between the scanned images, the photographed images and images captured by the microscope.

## 3. CONCLUSIONS

Any change in the nature of raw material, in textile material presentation, in texture, lighting conditions and manufacturing technology involves the adjustment of algorithm, additions to the database and changing the image analysis software.

Lighting is very important as shown by the images acquired through the methods described above, the lighting is different from one method to another.

The spots have shapes, sizes and different distributions.

For a simulation as close to reality, composition of the solutions and subsequent heat treatments have to be improved.

It is difficult to do assessments on the nature spots (defects), only through these images acquired because the spots are similar and it shows shapes and random distributions.

The simulations performed allows to establish some certain limits in the evaluation of defects and problems raised by the images interpretation methods.

We can draw also some conclusions about the problems that appear because of the various acquire images methods.

## 4. REFERENCES


1. Bucur, M.S., (2000). *Lecture Notes in Dyeing and Printing Technology*, "Aurel Vlaicu" University Publisher, ISBN 973-9361-34-X, Arad
2. BEZEMA, (2002). *Dyestuff Catalog*
3. Huang, C.-C., Yu, W.-H., (2001). Fuzzy Neural Network Approach to Classifying Dyeing Defects. *Textile Research Journal,* Vol. 71, No. 2, (02.2001) 1074-1078, ISSN 0040-5175
4. Rouette, H.K., (2002). *Encyclopedia of textile finishing*, CD-ROM Format, ISBN-10:3540147659, ISBN-13:9783540147657
5. Shelton, M., (2004). Machine vision maps dyeing and finishing defects – reducing scrap and cost, *Available from:* http://www.sheltonvision.co.uk/vision/pdf/article4.pdf , Accessed: 28/04/2010.

ANNALS OF THE UNIVERSITY OF ORADEA
FASCICLE OF TEXTILES- LEATHERWORK
Volume I, 2010, No. 2

# APPLICATION OF TEXTILE TECHNOLGY FOR THE PREVENTION OF UVR-INDUCED SKIN CANCER

**MD. ERSHAD KHAN**

***Ahsanullah University of Science & Technology, Dhaka. Bangladesh***

**Corresponding author: Md. Ershad Khan, Email:** ekhantex@yahoo.com

***Abstract:*** A marked increase in the incidence of skin cancer in fair-skinned populations worldwide is strongly associated with excessive UV radiation exposure from the sun. Textiles are intrinsically suited for use as UV radiation protection, as they are able to offer particularly good protection against intense radiation from the sun if suitable materials and constructions are properly engineered. There are many factors to be considered to design a UV protective cloth. In this study, some facts about the ultraviolet radiation, skin cancer & effect of UVR on skin cancer has been discussed briefly at the very beginning. Later the influencing factors as well as the some feasible and effect ways for the improvisation for the UV protection of textile with the assessment system of their performance have been extensively discussed.
***Key Words***: Ultraviolet Radiation (UVR), Erythema, Skin Cancer, UV Index, UPF, UV Absorber

## 1. INTRODUCTION:

The sun which affects our everyday life has both beneficiary and harmful effect. Skin cancer is one the examples of direct harmful effect on human. Though there are many reasons for skin cancer, the Ultraviolet radiation (UVR) of the solar spectrum causes the majority portion of the skin cancer. But people cannot avoid the sun exposure due to their leisure or professional purpose. Before a decade people relied on so-called sunscreen alone to prevent UVR exposure. But this concept has been changed due to the increase of skin cancer at alarming rate globally. Sun screen can provide certain level of protection against UVR but that is not sufficient to prevent UVR at all. Recently, considerable attention has been paid to the barrier properties of textiles design for clothing as a protection against UVR, while also taking into consideration the trend of current fashion.

## 2. WHAT IS UVR?

Ultraviolet (UV) light is electromagnetic radiation with a wavelength shorter than that of visible light, but longer than x-rays, in the range 10nm to 400 nm. It is so named because the spectrum consists of electromagnetic waves with frequencies higher than those that humans identify as the color violet [1]. Solar radiation above the earth's atmosphere consists of a very broad range of wavelengths from the very shortest gamma rays (< 0.03 nm) to the thermal infrared band (> 5000 nm). Between these extremes lie the UV (10-400 nm) wavebands [2].

**Table-1:** Classification of UVR

| Wavelength | Description | Notes |
|---|---|---|
| 10-200 nm | XUV or Extreme UV | Absorbed in the upper atmosphere |
| 200-280 nm | UVC or Vacuum UV | Absorbed in the upper atmosphere |
| 280-320 nm | UVB or medium UV | Partially absorbed in the atmosphere |
| 320-400 nm | UVA or near UV | Penetrate atmosphere but with much scattering |

## 3. SKIN CANCER:

Skin cancer is the most common of all cancer types. Between two and three million non-melanoma skin cancers and approximately 1,32,000 melanoma skin cancers occur globally each year [3].

### 3.1 Types of skin cancer

Because they behave differently, skin cancers are divided into two major groups.

1. Melanoma Skin Cancer
2. Non-melanoma Skin Cancer

#### 3.1.1. Melanoma Skin Cancer

Cancers that start from the pigment-making cells of the skin (the melanocytes) are called melanomas. Melanoma most often starts on the trunk of fair-skinned men and on the lower legs of fair-skinned women, but it can start in other places, too. Having dark skin lowers the risk of melanoma. But it does not mean that a person with dark skin will never get melanoma. Melanoma can almost always be cured in its early stages. But it is likely to spread to other parts of the body if it is not caught early. Melanoma is much less common than non-melanoma cancer.

#### 3.1.2. Non-melanoma Skin Cancer

It is called keratinocyte carcinomas or keratinocyte cancers because their cells look a lot like keratinocytes (the cells found most often in normal skin). Carcinoma is a medical word for a cancer that starts in a lining layer of cells such as the skin or the lining cells of the digestive system. There are many types of keratinocyte cancer, but two types are most common -- basal cell carcinoma and squamous cell carcinoma [4].

## 4.TEXTILES FOR UVR PROTECTION

The best technique for reducing UV exposure is to avoid the sun, this is an unacceptable solution in our global society. Human can protect him/herself from UVR by covering his/her skin with such a material that will not transmit the UVR. Besides so called sunscreen or sun blocking cream, lotion or gel, the most effective way to protect from UVR is only the textiles. Though Medical organizations such as the American Cancer Society recommend the use of sunscreen because it prevents the squamous cell carcinoma and the basal cell carcinoma, the use of sunscreens is controversial for various reasons. Many do not block UVA radiation, which does not cause sunburn but can increase the rate of melanoma, so people using sunscreens may be getting too much UVA without realizing it. Additionally, sunscreens block UVB, and if used consistently this can cause a deficiency of vitamin D. Long overlooked, sun-protection strategies have recently focused on sun-protective clothing, designed to block ultraviolet-A (UV-A) and ultraviolet-B (UV-B) radiation. UV protection through textiles including various apparels, accessories such as hats, shoes, shade structures such as umbrellas, awnings, and baby carrier covers and the fabric materials to produce these items gives consumers a crucial, proactive, effective path to prevent skin diseases. The term that is used to express the UVR protection ability is called ultraviolet Protection factor (UPF). Sometimes Solar Protection factor (SPF) is also used but it is mainly used for sunscreen cream [5].

### 4.1 Affecting Factors of UPF of a Fabric:

#### 4.1.1 Nature of Fibre:

In textiles, UPF is strongly dependent on the chemical structure of the fibres. The nature of the fibres influences the UPFs as they vary in UV transparency. Natural fibres like cotton, silk and wool have lower degree UVR absorption than synthetic fibres such as PET. Cotton fabric in a grey state provides a higher UPF because the natural pigments, pectin, and waxes act as UV absorbers, while bleached fibres have high UV transparency. Raw natural fi bres like linen and hemp possess a UPF of 20 and 10 to 15 respectively and are not perfect UV protectors even with lignin content. However, the strong absorption of jute is due to the presence of lignin, which acts as a natural absorber [ 6].

#### 4.1.2 Moisture and Swelling

In case of moisture, the influence largely depends on the type and hygroscopicity of fibres, well as conditioning time, which result in swelling phenomena. The RH and/or moisture content affect the UPF of the fabric in two ways, namely the s welling of fibres due to moisture absorption, which reduces the interstices, and consequently the UV transmittance. On the other hand, the presence of water reduces scattering effects, as the refractive index of water is closer to that of the textile polym er and hence, there is a greater UV transmission vis-à-vis a lower UPF. A typical cotton fabric could transmit 15-20% UVR, rising to more than 50% if the garment is wet [6]. A recent paper by Crews and Zhou examined the effect of different water type on U VR transmission and UPF values. After wetting with distilled water, sea water, or chlorinated pool water, results showed that water type had no significant effect on the UPF [7].

#### 4.1.3 Fabric Construction:

Fabric openness or porosity is mentioned by many scientists as another important parameter influencing the sun-blocking ability of a fabric. Researchers have referred to fabric porosity by a variety of terms including cover, cover factor, compactness, and tightness of weave as well as fabric openness or porosity. Pailthorpe, an Australian textile scientist who has spent many years examining textile parameters and their influence on UVR transmission, in collaboration with other colleagues defined a theoretical relationship between percent UVR transmission and fabric porosity for an idealized fabric as follows:

% UVR transmission = 100 - Cover factor & UPF = 100 / (100 - Cover factor) [9]

A cotton T-shirt might have a UPF of less than 10 while cotton denim can have a UPF greater than 1000; denim is both closely woven and heavy. A trade-off in this situation is that a high cover factor often results in a fabric less comfortable because of poor air transfer and the cover factor must be balanced with wearing comfort [9].

#### 4.1.4 Weight & Thickness:

The UPF is strongly correlated with the structural parameters- weight per surface unit and thickness of the fabrics. The UPF increases when any of these parameters increases. A higher correlation is found for the parameter weight. Therefore, from a statistical point of view, this parameter is the best and can be used to predict the UPF [10].

#### 4.1.5 Dyes & Colour:

The colour or shade of a fabric is a very significant factor in preventing UV radiation transmission through a textile. The colour of a dye is dependent on the absorbing properties of the dye in the visible band of the electromagnetic spectrum (380±770 nm). The absorption band for all dyes, however, extends into the UVR radiation band (290±400 nm) and hence dyes act as effective UVR absorbers. Gies et al. who stated that for fabrics of identical weight and construction, darker coloured fabrics scored higher UPF ratings than lighter shades. In a subsequent report, the spectral transmission of fabrics dyed in different colours was illustrated [11]. It must be remembered that while colour can dramatically increase a fabric's protective ability, the dyestuffs responsible for the protection must be colourfast to washing, perspiration, sunlight, crocking, and bleaching for the life of the fabric.

#### 4.1.6 Presence of Optical Brightening Agent:

Optical brightening agents or fabric whitening agents are used at the finishing operations, as well as in the wash cycles. Optical brightening agents are often applied to enhance the whiteness of textiles by UV excitation and visible blue emission. OBA can improve the UPF of cotton and cotton blends, but not of fabrics that are 100% polyester or nylon. The presence of OBA in the P/C blends (67/33) to the extent of 0.5% can improve the UPF from 16.3 to 32.2. Washing the fabrics leads t o a loss of UPF in the case of OBA-treated fabrics, and the UPF reaches the level of that in untreated fabric after 10 washes which shows the semi-permanent nature of the finish and protection. Another limitation of many OBAs is that they mostly absorb in the UVA part of the day light spectrum (93%)

but have a weak absorption in UV absorption around 308 nm (92%), which plays an important role in skin disease [8].

#### 4.1.7 Tension & Stretch:

When a textile material is stretched, the porosity increases accompan ied by a decrease in fabric thickness thereby allowing increased levels of UVR transmission. Minor changes in tension state have a dramatic influence on UV transmittance through the fabric. People tend to buy elastane type fabrics under size and stretch th em by 15% during use thereby negating significant UV protective properties of the material. For example, the UPF of 50 denier stockings decreased from 18 to 2 when stretched 30% larger than their original size [12].

#### 4.1.8 Laundering:

Post-laundering, a majority of the fabrics showed a decrease in UVR transmission with thicker fabrics exhibiting a higher decrease. The researchers surmised that the process of laundering led to compaction due to shrinkage presumably decreasing porosity and hence resulting in an improvement in UV protection. Stanford et al.[11] subjected five jersey-knit cotton T-shirts to a total of 36 washes. Fabric UPF was measured after one wash and after 36 washes. Mean fabric UPF approximately doubled for all T-shirts after the first wash and further additional change after another 35 washes was not significant. In practical terms, the results of this limited study meant that the protective ability of a new cotton T-shirt could be expected to last the lifetime of the T -shirt [7].

## 5. CHEMICAL PROCESS TO IMPROVE THE UPF OF TEXTILES:

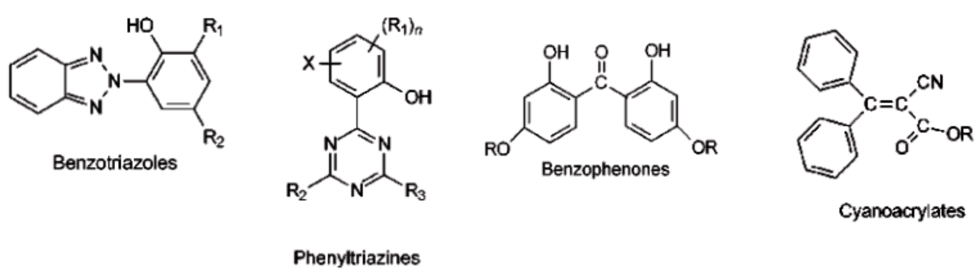
UV transmission through the fibres can be effectively reduced by use of selected dyes, fluorescent whitening agents and by means of UV absorbers. These products have chromophoric systems that absorb very effectively in the UV region, enabling them to maximise the absorption of UV radiation on textiles. Besides the selected dyes and FWAs (discussed in the section 4.1.6), UV absorber is the most effective way to improve the UPF of a fabric.

### 5.1 UV absorber

UV absorbers are organic or inorganic colourless compounds with strong absorption in the UV range of 290 – 360 nm. UV absorbers incorporated into the fibres convert electronic excitation energy into thermal energy, function as radical scavengers and singlet oxy gen quenchers. The high-energy, short-wave UVR excites the UV absorber to a higher energy state; the energy absorbed may then be dissipated as longer-wave radiation [5]. UV absorbers to the extent of 0.6 – 2.5% are sufficient enough to provide UVR protecti on fabrics.

### 5.2 Chemistry of UV absorbers

#### 5.2.1 Organic UV Absorber:




[$R_1$= Alkyl, Alkoxy, Halide, Sulphoalkoxy], [$R_2$ = Hydroxy, Alkoxy, Alkylthio, Substitute Alkyl, Substitute Phenyl, o-hydroxyphenyl], [$R_3 = R_2$ (Identical or different)], [X=H, $SO_3^-$ ], [n=0,1,2]

**Fig-2:** Chemical structures of UV absorbers

Organic UV absorbers are mainly derivatives of o -hydroxy benzophenones, o-hydroxy phenyl triazines, o-hydroxy phenyl hydrazines. Some of the substituted benzophenones penetr ate into synthetic fibres much like disperse dyes. Commonly -used UV absorbers are 2-hydroxy benzophenones, 2-hydroxy phenyl benzotriazoles, 2-hydroxy phenyl-Striazines and chemicals such as benzoic acid esters, and hindered amines [6]. Organic products like benzotriazole, hydro benzophenone and phenyl triazine are primarily used for coating and padding processes in order to achieve broad protection against UV rays. Benzophenone derivatives have low energy levels, easy diffusibility and a low sublimation fastness. Orthohydroxy phenyl and diphenyl triazine derivatives have an excellent sublimation fastness, and a self-dispersing formulation can be used in high temperature dyeing in pad baths and also in print pastes.

### 5.2.2 Inorganic UV Absorber:

Inorganic UV blockers are more preferable to organic UV blockers as they are non-toxic and chemically stable under exposure to both high temperatures and UV. Inorganic UV blockers are usually certain semiconductor oxides such as $TiO_2$, ZnO, $SiO_2$ and $Al_2O_3$. Among these semiconductor oxides, titanium dioxide ($TiO_2$) and zinc oxide (ZnO) are commonly used. It was determined that nano-sized titanium dioxide and zinc oxide were more efficient at absorbing and scattering UV radiation than the conventional size and were thus better able to block UV. This is due to the fact that nano-particles have a larger surface area per unit mass and volume than the conventional materials, leading to the increase of the effectiveness of blocking UV radiation. In order to scatter UV radiation between 200 and 400 nm, the optimum particle size will be between 20-40 nm. Various research works on the application of UV-blocking treatment to fabric using nanotechnology were conducted. UV-blocking treatment for cotton fabrics was developed using the sol-gel method. A thin layer of titanium dioxide is formed on the surface of the treated cotton fabric which provides excellent UV-protection; the effect can be maintained after 50 home launderings. Apart from titanium dioxide, zinc oxide nano-rods of 10-50 nm in length were applied to cotton fabric to provide excellent UV protection [13].

### 5.3 Application of polymeric coatings:

Recently, several Japanese companies have come out with specialized coatings for providing UV protection. Epposha Oil Industries of Japan has developed a homopolymer/copolymer based high molecular weight coating for imparting prolonged light resistance and UV screening to fabrics. Toyota R&D Lab have also used polymers to impart improved UV shielding and abrasion resistance properties to textiles. The process is based on dispersing organic alkoxy silanes, inorganic or organic salts or alkoxides of Ti, Mg, Al, Si etc, and inorganic or organic polar solvents followed by moulding [14].

### 5.4 Troubleshooting for UV protection finishes and combinability:

UV absorbers have the same need for wash fastness and light fastness as dyestuffs. One concern is specific to the use of UV absorbers in combination with optical brightening agents (OBA). These brightening agents function by absorbing UV radiation and re-emitting visible light. If a UV absorber is also present in the fibre, the brightening effect from the OBA can be greatly diminished or even absent. Proper choice of an appropriate OBA can minimise this problem [13].

### 5.5. UPF Testing Standard &Care labeling:

Care labeling similar to fabric and garment care labels has been developed for UV protection, and standard procedures have been established for the measurement, calculation, labeling methods and comparison of label values of textile products. Since 1981, the Skin Cancer Foundation, an international body, has offered a Seal of Recommendation for the photo-protective products which includes sunscreens, sunglasses, window films and laundry detergent additives, in accordance with AATCC TM 183 or AS/NZS 4399; the products recommended are reviewed annually. The ultraviolet radiation protection ability of a fabric is graded as Table-2.

**Table-2:** Grade & Classification of UPF [6]

| UPF | Transmission (%) | Classification | Grade |
|---|---|---|---|
| >40 | <2.5 | Excellent protection | III |
| 30-40 | 3.3-2.5 | Very good protection | II |
| 20-29 | 5.0-2.4 | Good protection | I |

## 6. CONCLUSION:

The various features discussed above show that the transmission spectra of textiles are fabric specific as are their UPFs. It is possible, thus to engineer textiles with the required degree of sun protection depending on the end user requirements. Using the correct fibre, fabric weave and construction, but above all the right finish, it is now possible to make UV safe materials for even light summer outerwear applications. People can reduce the UVR exposure as well as the skin cancer by implementing their behavioural changes such as avoiding sunlight as its maximum, using protection such as hats, sunscreens, sun glass and above all the perfect protective clothin g against UVR.

### 7. REFERNCES:


1. http://en.wikipedia.org/wiki/Ultraviolet. Accessed: 24/03/2010
2. Tim L Dawson (2005),, Beyond the Visible , *Colouration Technology, Review Progress of Colouration,* Vol. No-35, page 31-4. ISSN: 1472-3581.
3. UV Index, A practical guide, World Health Organisation, 2002 Available from: http://www.who.int/uv/en. Accessed: 25/03/2010
4. http://www.cancer.org. Accessed: 27/03/2010
5. Richard F. Edlich, Mary Jude Cox, Daniel G. Becker, Jed H. Horowitz, M D, Larry S. Nichter,, L.D. Britt, Theodore J. Edlich III, & William B. Long (2004), Revolutionary Advances in Sun-Protective Clothing—An Essential Step in Eliminating Skin Cancer in our World, *Journal of Long-Term Effects of Medical Implants,* Vol. No.-14(2),Page 95–105. ISSN: 1050-6934.
6. D. Saravanan (2007), UV protection textile materials, *AUTEX Research Journal*, Vol. No.-7(1), Page 53-61, ISSN: 1470-9589.
7. A K Sarker (2005), Textile for UV Protection, in "*Textiles for protection*" Richard A. Scott (Ed), Page 355-377, CRC Press, ISBN: 0-8493-3488-8, USA,
8. Patricia Cox Crew. Stephen Kacman and Andrea G. Beyer (1999), Influences on UVR transmission of undyed woven fabric, *Textile Chemists and Colourists*, Vol. No.-31(6) , page 17-26, ISSN: 1532-8813
9. Stanford, D.G., Georgouras, K.E. and Pailthorpe, M.T. (1995), The effect of laundering on the sun protection afforded by a summer weight garment, *Journal of the European Academy of Dermatology and Venereology*, Vol. No.-5, page 28-30, ISSN: 0929-0168.
10. Inés M. Algaba, Montserrat Pepió, Ascensión Riva (2008), Correlation between the ultraviolet protection factor and the weight and thickness of undyed cellulose woven fabric, *Fibres & Textiles in Eastern Europe*, Vol. No.-16(1), page 85-89. ISSN: 12303666
11. C.A. Wilson, P.H. Gies, B.E. Niven, A. Mclenan and N.K. Bevin (2008), The relationship between UV transmittance and colour visual description and instrumental measurement, *Textile Research Journal*,Vol. No.-78(2), , page 128-13, ISSN: 0040-5175
12. Warick L. Morison (2003), Photo protection by clothing, *Dermatologic therapy*, Vol. No.-16, page 16-22, ISSN: 1396-0296
13. Y. W. H. Wong, C. W. M. Yuen, M. Y. S. Leung, S. K. A. Ku, and H. L. I. Lam ( 2006), Selected applications of nanotechnology in textiles , *AUTEX Research Journal*, Vol. No.-6(1), page 1-8, ISSN: 1470-9589.
14. Gupta D., "Developments in the Field of UV Protection of Textiles" through http:/textiles articles.co.cc/192_05.htm. Accessed: 24/03/2010

ANNALS OF THE UNIVERSITY OF ORADEA
FASCICLE OF TEXTILES- LEATHERWORK
Volume I, 2010, No. 2

# DETERMINING THE TAKE – DOWN TECHNOLOGICAL PARAMETERS

**Lecturer PhD. Eng. Liliana Lutic**

*"Gh. Asachi" Technical University, Faculty of Textile and Leather, Ia şi, România*

***Abstract:*** Quality insurance of the knitting process results from determining the values (the intervals) for the technological and functional process parameters because an accurate initial adjustment and its maintenance over a longer period of time represent a guarantee for the product quality. In the industry, the structural parameters of relaxed fabrics are difficult to predict taki ng into consideration the adjustments of technological parameters. In order to eliminate this problem, the real variation intervals were determined for the take -down technological parameters. This paper brings contributions to the design of the technologic al parameters of the knitting process following its quality insurance in order to obtain pre -set structural parameters.
***Key words:*** technological parameters, real variation intervals, take -down technological parameters.

## 1. INTRODUCTION

The take – down technological parameters (take–down speed and tension) influence the knitting process, as well as the quality characteristics of the fabric.

To ensure uniformity and proper execution knit training phase mesh is required to accurately determine the value of take–down tension, but also keeping it steady on the circumference of the knited fabric.

În vederea asigurării uniformităţii tricotului şi executarea corectă a fazelor de formare a ochiurilor se impune să se stabilească cu acurateţe valoarea forţei de t ragere, dar şi menţinerea constantă a acesteia pe circumferinţa tricotului.

**The paper objectives** are determinating the take-down tension and speed in the case of rib structures 1:1 made of 100% cotton ya rns produced on a Metin machine.

Both take-down parameters can be calculated knowing:

- The take-down mechanism, and the dimensions of the take-down mechanism (the diameter of the take-down rollers);
- The speed of the take-down rollers;
- The technical characteristics of the knitting machine (knitting speed, nu mber of feeders);
- The fabric structure.

With regard to the adjustment of the take -down force, in practice this is done based on personal experience, with no scientific support.

## 2. DETERMINING THE TAKE - DOWN TENSION FOR 1X1 RIB FABRICS

Similar to the knitting zone, the take-down perimeter is difficult to access in order to measure the take-down force and speed.

Considering the importance of the take – down parameters in producing knitted fabrics with pre – set quality characteristics, and in ensuring the quality of the knitting process, this paper presents two methods (one is original) of determining the take – down tensions at yarn, wale and fabric level, as well as the take – down speed.

Bath methods required laboratory tests, using a tensile testing machine.

**The methodology** took in to consideration:

- the use of different types of fabrics;
- a large number of measurements (n > 20);
- statistical processing;
- the establishment the values of take–down parameters.

**In the first method,** the determination of the take-down force and speed requires the following stages:

- Measurement of the vertical stitch density Dv for the fabrics under take -down strain, as closest as possible to the take-down rollers and after a longer period of relaxation;
- Calculus of stitch height in strained state (Bi) and relaxed state (Bo) using relation (1) :

$$B = \frac{50}{Dv} \text{ mm} \qquad \textbf{(1)}$$

- Calculus of elongation ε using relation (2):

$$\varepsilon = \frac{Bi - Bo}{Bo} \cdot 100 \ (\%) \qquad \textbf{(2)}$$

- The tensile testing of fabrics (samples dimensions) on a testing machine and in the moment the testing machine measured the calculated elongation, the corresponding tensile force was recorded;
- The vertical stitch density was measured on the strained fabric in order to verify its correspondence to the value determined while the fabric was on the knitting machine ;
- The calculus of the take-down force per wale (Tt/wale) and per yarn (Tt/yarn);
- The take-down force per yarn (Tt/yarn) was compared with the elastic domain (specific to each yarn) so to determine if the take-down force is within this domain or not;
- The take-down speed was calculated with relation (3):

$$Vt = V_D = n \cdot \frac{S}{z} \cdot Bi \cdot 10^{-3} \ \text{(m/min)} \qquad \textbf{(3)}$$

**The second method** is original and it simulates the take-down process of the knitted fabric. This method has two stages; the second one practically verifies the results obtained through the first method.

The first stage contained:

- The measurement of the vertical stitch density Dv for the fabrics under take -down strain, as closest as possible to the take-down rollers;
- The measurement of the force and elongation, as well as the fabric stitch density Dv , in different moments of the test;
- The breaking force and elongation were recorded.

In the second stage the verification of the results obtain in the first stage was conducted in reverse, determining for another set of samples (with the same dimensions) and strained in the same conditions the value of the take - down force, related to the elongation and its vertical stitch density.

The results obtained with the second method were used to present graphically the variation of vertical stitch with the tensile force and elongation (figures 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12).

The take–down tension and fabric elongation can be determined based on these graphics.

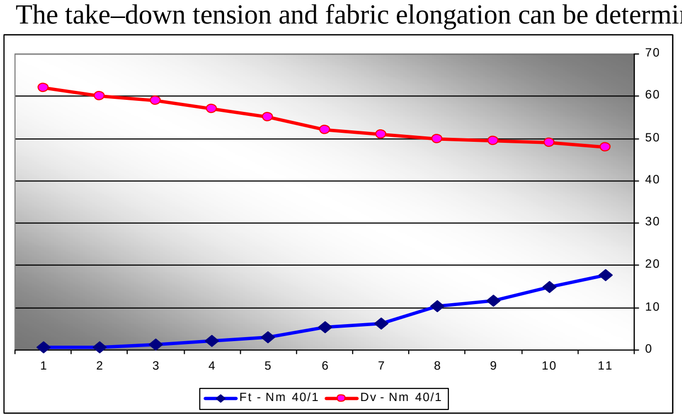



**Figure 1** Variation of the take-down force and the vertical stitch density, for 1x1 rib fabrics made of cotton yarns, Nm 40/1

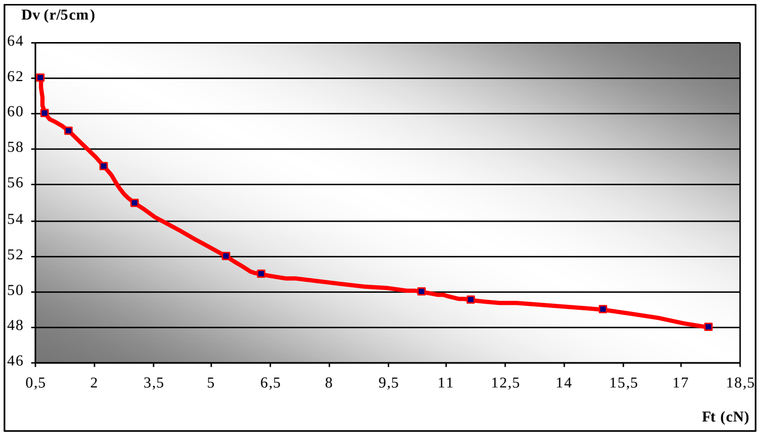



**Figure 2** Variation of the vertical stitch density with the take-down force for 1x1 rib fabrics made of cotton yarns, Nm 40/1

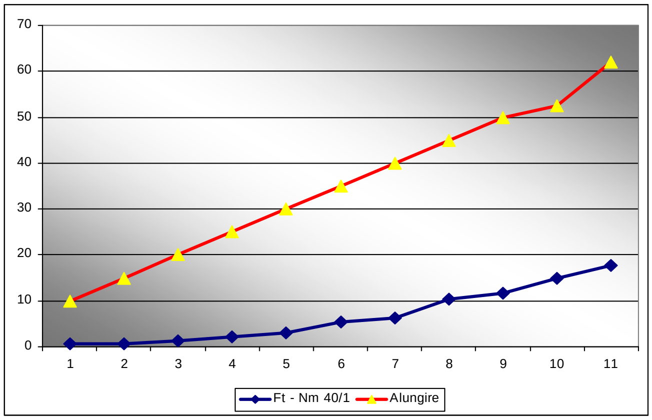



**Figure 3** Variation of the take-down force and the fabric elongation, for 1x1 rib fabrics made of cotton yarns, Nm 40/1

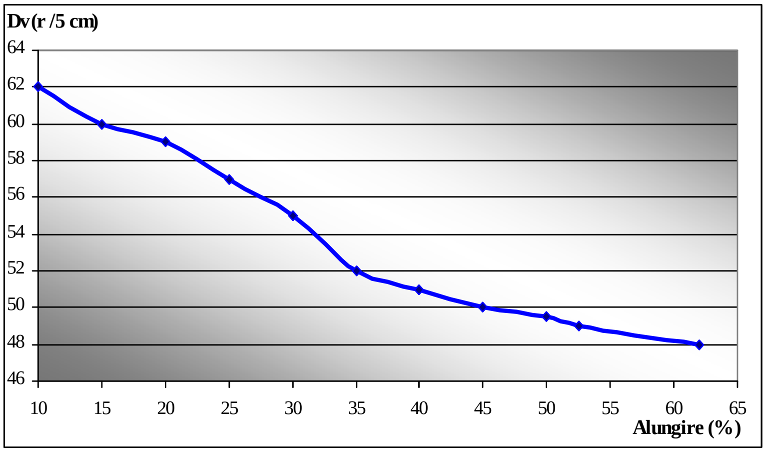



**Figure 4** Variation of the vertical stitch density with the fabric elongation for 1x1 rib fabrics made of cotton yarns, Nm 40/1

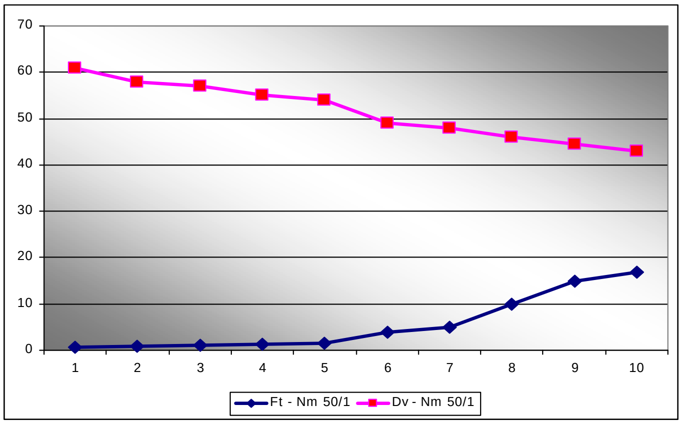



**Figure 5** Variation of the take-down force and the vertical stitch density, for 1x1 rib fabrics made of cotton yarns, Nm 50/1

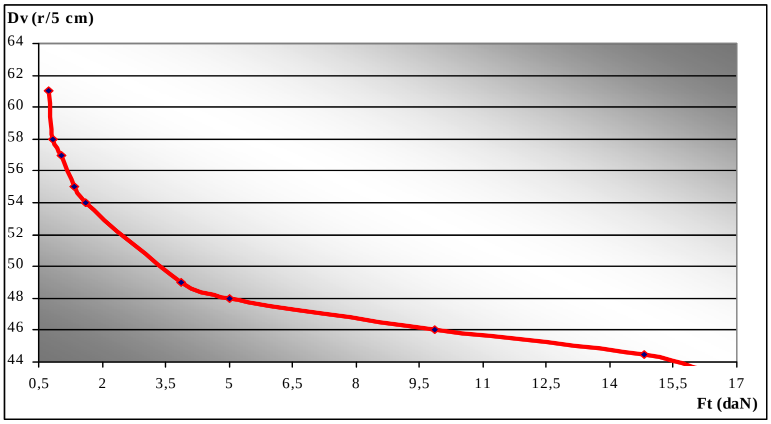



**Figure 6** Variation of the vertical stitch density with the take-down force for 1x1 rib fabrics made of cotton yarns, Nm 50/1

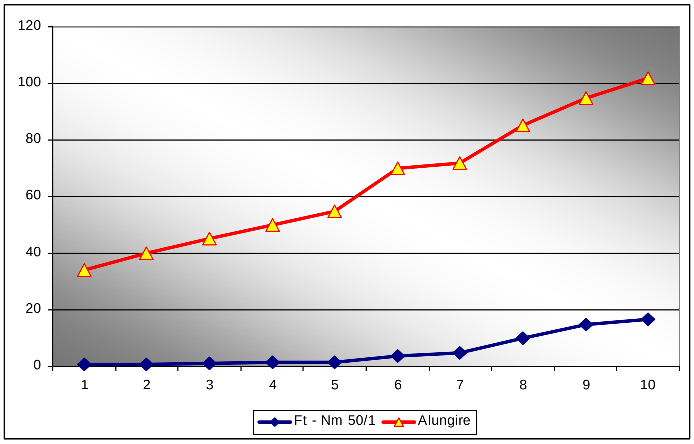



**Figure 7** Variation of the take-down force and the fabric elongation, for 1x1 rib fabrics made of cotton yarns, Nm 50/1

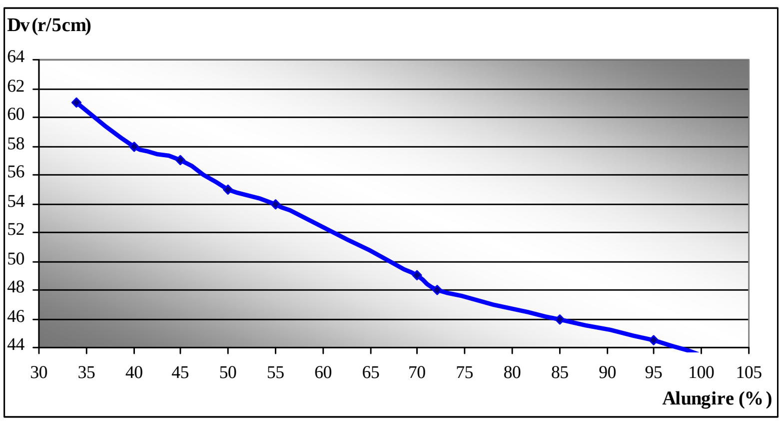



**Figure 8** Variation of the vertical stitch density with the fabric elongation for 1x1 rib fabrics made of cotton yarns, Nm 50/1

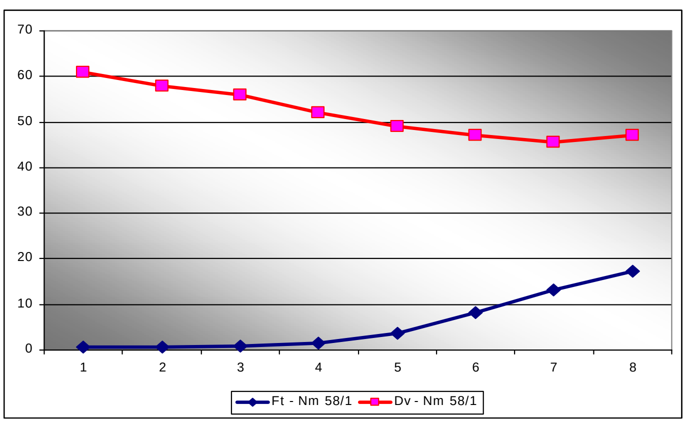



**Figure 9** Variation of the take-down force and the vertical stitch density, for 1x1 rib fabrics made of cotton yarns, Nm 58/1

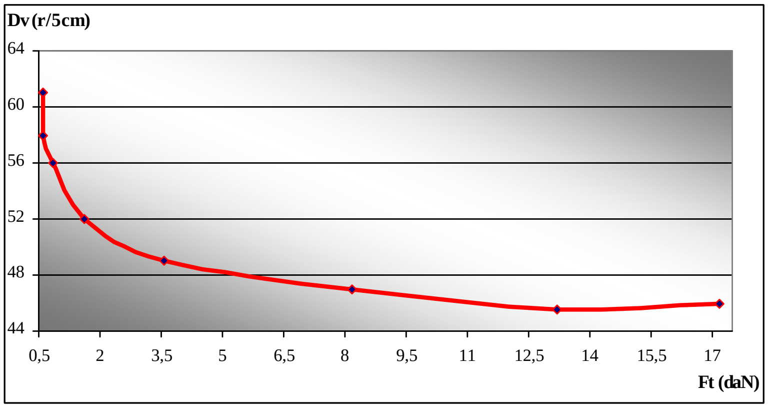



**Figure 10** Variation of the vertical stitch density with the take-down force for 1x1 rib fabrics made of cotton yarns, Nm 58/1

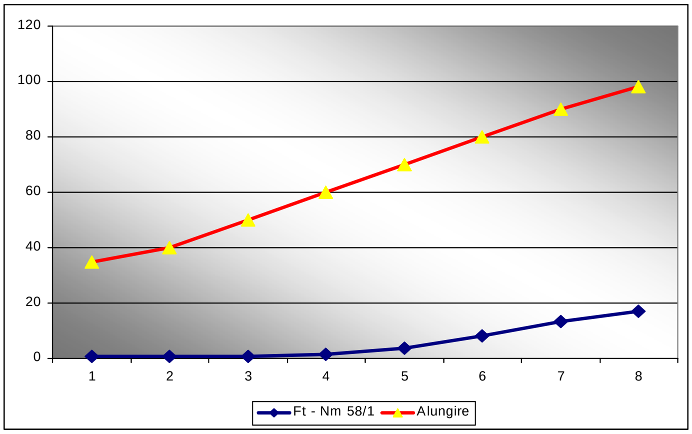



**Figure 11** Variation of the take-down force and the fabric elongation, for 1x1 rib fabrics made of cotton yarns, Nm 58/1

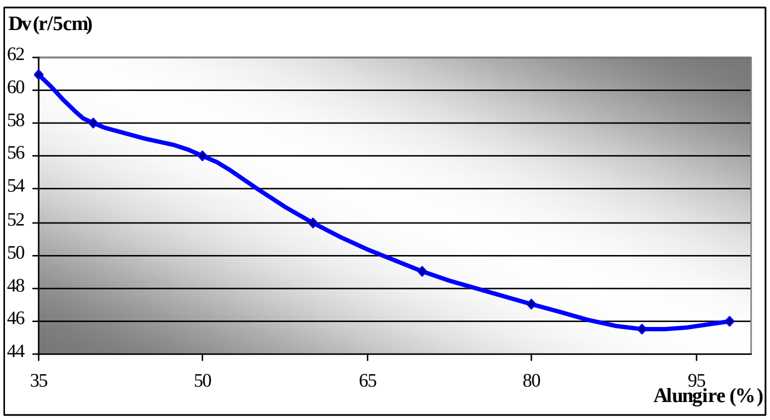



**Figure 12** Variation of the vertical stitch density with the fabric elongation for 1x1 rib fabrics made of cotton yarns, Nm 58/1

The results obtained using the two methods were compared, establishing the values of the take–down technological parameters. These are presented in Table 1.

**Table 1** Take – down technological parameters

| Fabric structure | Yarn count (Nm) | Take – down technological parameters | | | | | |
|---|---|---|---|---|---|---|---|
| | | Tt/yarn (cN) | Tt/wale (cN) | Tt/ fabric (daN) | Take – down speed Vd (m/min) | | |
| | | | | | n =8,5 rot/min | n =10 rot/min | n =11 rot/min |
| 1x1 Rib | **40/1** | 3,18 | 6,35 | 24,4 | 0,41 | 0,48 | 0,53 |
| | **50/1** | 3,28 | 6,55 | 25,2 | 0,42 | 0,49 | 0,54 |
| | **58/1** | 2,78 | 5,55 | 21,3 | 0,42 | 0,49 | 0,54 |

By comparing the take-down tension in the yarn within the stitch with the stress -elongation curves (determined for the yarns) it is possible to verify if this tension is still in the elastic domain.

Only in this case the yarn and subsequently the fabric are protected. If not, a series of defaults can appear or previous defaults can increase, while the fabric can sustain permanent strains.

In the case of the 1x1 rib fabrics produced using the yarns presented in the Table, the comparison between the take-down tension per yarn value and the yarn elastic domain determined experimentally showed that for all variants the take-down tension is within the elastic range and therefore there is no risk of breaking the yarn due to take-down mechanism and the knitting process is conducted in correct conditions.

It was also established corresponding ratio of the take-down tension per yarn (Tt/yarn) and its breaking force (Fr), expressed in percentages – table 2:

**Table 2** Ratio of tension yarn (Tt/yarn) and its breaking force (Fr)

| Fabric structure | Yarn count (Nm) | Raportul Tt/Fr (%) |
|---|---|---|
| **1x1 Rib** | **40/1** | 1,4 |
| | **50/1** | 1,5 |
| | **58/1** | 1,1 |

It is possible to conclude that the physical mechanical properties of the yarns are not affected in any case, the conditions of the knitting process protecting the yarn and fabric.

## 3. CONCLUSIONS

Quality insurance of the knitting process results from determining the values (the intervals) for the technological and functional process parameters because an accurate initial adjustment and its maintenance over a longer period of time represent a guarantee for the product quality.

The use in practice of the real variation intervals for the knitting technological parameters has a significant importance due to the fact that it allows:

- The correct adjustment of the technological parameters and knitting machines ;
- The shortening of the time spent to adjust these parameters .

## 4. REFERENCES


1. Lutic, L., "Contributions to the Design and Quality Evaluation of Weft Knitted Fabrics", Doctoral thesis, Iaşi, România, 2005
2. * * *, ISO 9000-1987 "Quality Management and quality assurance standard Guidelines for selection and use"
3. * * *, ISO 9001-1987 "Quality systems or quality assurance in design/development, production, installation and service
4. * * *, STAS ISO 9001 (XI-1991) "Model for quality assurance in design/development, production, installation and service"
5. Iyer, C., Mamme I.B., Schach, W., "Circular Knitting", Meisenbach, Bamberg, Germany, 1995

ANNALS OF THE UNIVERSITY OF ORADEA
FASCICLE OF TEXTILES- LEATHERWORK
Volume I, 2010, No. 2

# SMART TEXTILE, REALITY OF OUR DAYS

**Laura Macovei.[1], Viorica Cretu [2], Elena Moisescu[3]**

[1] *Technical University"Gheorghe Asachi", Iaşi, ROMANIA*
[2] *Technical University"Gheorghe Asachi" , Iaşi, ROMANIA*
[3] *Technical University"Gheorghe Asachi" , Iaşi, ROMANIA*

Corresponding author: Laura Macovei, E-mail address: lmacovei@tex.tuiasi.ro

***Abstract:*** The specialty literature mentions that the industrial textile materials are a general term used for the materials achieved from any type of fibers, that do not have a clothing or decorative role. The technical textiles are defined as being textile products used especially for their functional characteristics, especially in high -tech purposes Smart textiles have incorporated properties of responding to various stimuli and change their size, shape, color or behavior. According to functional activity smart textiles can be classified in three categories: passive smart textiles which can only sense the environmental conditions or stimulus, active smart textiles has both actuators and sensors and ultra smart textiles which can sense, react and adopt themselves to environmental conditions or stimuli.

***Key words:*** smart textile, passive smart textile, active smart textile, ultra smart textile,

## 1. INTRODUCTION

Over the last twenty years, the market and the needs for technical or smart textiles has been constantly growing offering more technical developments and innovations of advanced textiles for new functionalities of the products. Innovation is necessary at every phase of the textile industry chain, from material to final finished fabrics and products.

The changes in textiles regard: consumer demands for comfort and performances, advanced technologies influencing product process innovations, compliance with eco-rules, safety and health and aesthetics.

Textiles which are still growing passed through 3 development stages:

- functional textiles which are characterized through certain physical-mechanical and physical-chemical properties/characteristics as well as structure characteristics in accordance with use field;
- multifunctional textiles are characterized through a complex of characteristics/ properties which provide the ability of meeting certain multifunctional requirements to the textile support;
- smart textiles are used for creating new smart structures which can complete the following functions: detection, action and control. Innovation regarding the structure of smart textile for security and protection equipments can be stimulated through a unique set of economical, scientific, technological and human qualities based on knowledge.

The specialty literature mentions that the industrial textile materials are a general term used for the materials achieved from any type of fibers, that do not have a clothing or decorative role. The technical textiles [1] are defined as being textile products used especially for their functional characteristics, especially in high-tech purposes. In addition, the technical textiles are presented as textile structures especially designed to be used in products, processes or services from non -textile fields [2].These special structures accomplish three main function:

- as a component part of another product, having a direct contribution to the resistance, performance and other product properties;

- as an instrument used in a process for the fabrication of anot her product;
- as a product that can be used independently to accomplish one or several specific functions.

Smart textiles have incorporated properties of responding to various stimuli and change their size, shape, color or behavior. Smart Textiles are one way of winning back lost position of textiles in world trade and are seen as the future of textiles

## 2. SMART TEXTILE.DEFINITIONS AND CLASSIFICATIONS

Smart textiles are defined as textiles that can sense and react to environmental conditions or stimulus, from mechanical, thermal, chemical, electrical, magnetic sources.

Three components may be present in smart materials - sensors, actuators and controlling units. The sensors provide a nerve system to detect signals. Some of the materials act only as sensors and some act as both sensors and actuators. Smart clothing is a combination of electronics and clothing textiles. New fibre and textile materials and miniaturized electronic components make it possible to create truly usable smart clothes. These intelligen t clothes are worn like ordinary clothing providing help in various situations according to the designed application Smart textiles are able to sense and respond to external stimulus in predetermined way.

According to functional activity smart textiles ca n be classified in three categories.

*Passive smart textiles* represent the first generations of smart textiles, which can only sense the environmental conditions or stimulus. A piece of clothing usually dries hanging, it requires a certain time to dry, so this means a passive drying. Optical fibre -embedded fabrics and conductive fabrics are
the good examples of passive smart textiles.

*Active smart textiles* are the second generation has both actuators and sensors. The actuators act upon the detected sign al either directly or from a central control unit. Active smart textiles are shape memory chameleonic water -resistant and vapors permeable (hydrophilic/non porous), heat storage, thermo regulated, vapor absorbing, heat evolving fabric and electrically heat ed suits.

*Ultra or Very smart textiles* are the third generation of smart textiles, which can sense, react and adopt themselves to environmental conditions or stimuli. A very smart or intelligent textile essentially consists of a unit, which works like t he brain, with cognition, reasoning and activating capacities. The production of very smart textiles is now a reality after a successful marriage of traditional textiles and clothing technology with other branches of science like material science, structural mechanics, sensor and actuator technology, advance processing technology, communication, artificial intelligence, biology etc

## 3. SMART TEXTILE APPLICCATIONS.

The different kinds smartness can be incorporated in textile at three stages:

- at fibre spinning level;
- during row material formations (yarns or fabric textiles from different technologies);
- at finishing stage.

Smart or functional materials [3] usually form part of a smart system that has capability to sense its environment and respond to the ext ernal stimulus through an active control mechanism. Smart textile includes also ensembles with sensors and actuators.
Products including smart textile find their applications in many fields:

- clothing textiles;
- protective textiles ;
- sport textiles ;
- special textiles;
- medicine textiles with different applications;
- technical textiles, construction textile, industrial textile, transportation textile;
- home decorating

***Ultraviolet Protective Clothing*** has an ability to absorb or reflect the harmful ultraviolet rays in terms of passive heat retention by numerous pores in textile product by means of bulked and micro - fibre constructions and use of UV absorbing chemicals. UV protective clothes can ascent the Ultraviolet Protection Factor (UPF) for wearer [3]. *Multi-layer composite yarns and textiles* have other physical possibility for achieving wear comfort in terms of absoring sweat released from the human skin surface by an internal sweat absorbent layer. *Plasma treated clothing*. Plasma treatment is a

textile surface treatment technology. The plasma treatment effects the wetting behavior of coating agents, adhesives and ageing resistant adhesion of applied plastics by increasing surface energy of the treated fabrics.. The plasma treated fabric results drastically improv ed adhesion of plastic applied.
***Ceramic Coated Textile***.The use of polymer materials for technical purposes in textiles is increasing constantly. The fluid ceramics is applied currently as ceramic coating for thermo ceramic construction and heat protection simultaneously. The material composition of the dispersion coating (formulation for adhesives filling agents, pigments and the exclusive ceramic bubble state) can be tuned to each other in conjunction with bubble partial vacuum in such a way that new and m ore advantages characteristics features are produced. The following are particularly included for: the far -reaching effect of the technical and physical causes of heat loss (throttling of heat exchange by the ceramic bubble vacuum), extreme sunlight reflec tion, chemicals resistance of partially ceramic thin layer, soiling tendency reduced due to rough coating surface.
***Optical fibre sensors*** has offered both sensing and signal transmission facilities. Optical fibre sensors are devices for measuring strain, te mperature, displacement, chemical concentration, acceleration, pressure, electric currents, magnetic fields and virtually any other material or environmental property.
The optical fibre sensors are able to sense the various battlefield hazards like chemica l, biological and other toxic substances warfare threats.
***Conductive fibre or fabric***. Many conductive fibres and yarns: metallic silk organza, stainless steel filament, copper, silver and gold or stainless steel wire -wrapped polymer filament, metal-clad aramid fibre, conductive polymer fibre, conductive polymer coating and special carbon fibre/fabric, have been applied to the manufacture of fabric sensors.
***Phase Change Materials*** (PCM) contein electric conductive materials and graphite particules, being used for termoregulations. In the production process, PCM is introduced into the textile fibre matrix in microcapsule form. These capsules prevent temperature variations by discontinuing temperature increases when the so-called phase change temperature is rea ched. The continuous energy fed from environment or form human body to PCM is stoared in it, increasing its thermal capacity. Inversely PCM materials give up their stored heat again as the environment cool down. Paraffins in particular find use for this function in the textile section. [6]
***Shape memory materials*** .There are different types of shape memory materials [ 4],[5]. Shape memory alloys are materials stable at two or more temperature states. In these different temperature states, they have the potential to assume different shapes, when their transformation temperatures have been reached The ather types (Figure 1) of shape memory materials are shape memory polymers (SMPs) which can change shape to external stimuli such as temperature, lighting, stre ss and field and can be utilized in various ways in smart systems. In the last years there have been significant developments in electroactive polymers (EAPs) to produce substantial change in size or shape and force generation for actuation mechanisms in a wide range of applications. Electro active polymers are generally made up of high functionalised polymer. One of the most famous EAPs is the “gel robots” that is fully researched for applications in the replacement of muscles and tendons [7].

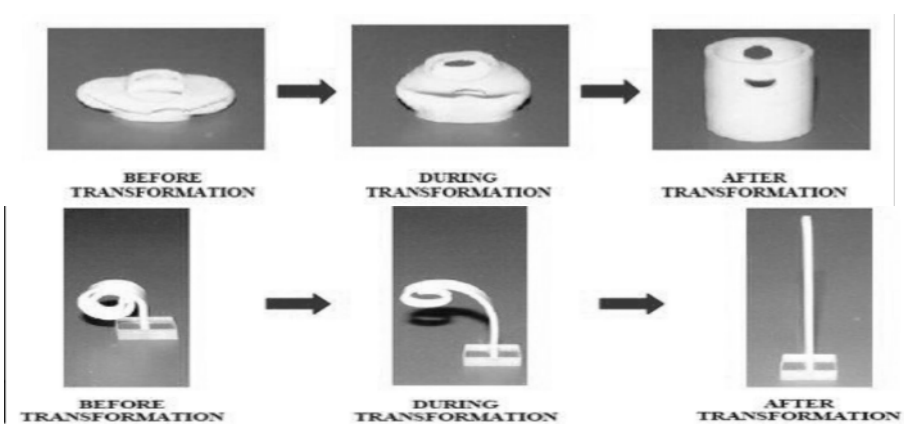
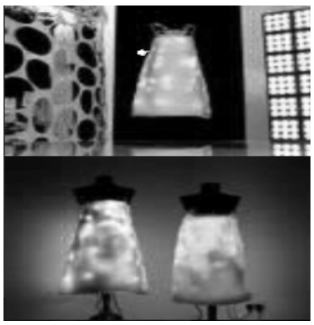



**Figure 1.** Shape Memory Materials

Shape memory alloy wire and shape memory polymer films are already finding applications in clothing (in order to protect wearers against heat or cold).
***Chromic Materials*** represent other types of intelligent textiles and are those which change their colour reversibly according to external environmental conditions, for t his reason they are also called

chameleon fibres. Chromic materials are the general term referring to materials which radiate the colour, erase the colour or just change it because its induction caused by the external stimulus, as "chromic" is a suffix that means colour. Therefore we can classify chromic materials depending on the stimulus affecting them (in italic are indicated those used in textile)
*Photochromic*: external stimulus is light (Figure 2.a).
*Thermochromic*: external stimulus is heat (Figure 2.b,c).
Electrochromic: external stimulus is electricity.
Piezorochromic: external stimulus is pressure.
*Solvatechromic*: external stimulus is liquid or gas.

**a.** Chameleon handbag



**b.** Chameleon dress (change the color because of internal feeling or temperature)

**c.** Chameleon chemise (its color depending on the external temperature)

**Figure 2.** Chromic textile product

***Conductive materials***

There are two strategies to create electrical or thermal conductive fabrics and two types of materials, the metals and the polymers. The same materials could be used for the both conductivity (thermal and electric), because the two processes are similar and results o f an electronic agitation/conduction.

The first strategy uses high wicking finishes (ink) with a high metallic content that still retains the comfort required for clothing. The second strategy consists in the direct use of conductive yarns. Two of the main applications for conductive materials are electromagnetic interface (EMI) shielding and conducting thanks to their particular properties,

There are other applications for conductive materials such as heated clothes for extreme winter conditions or heated diving suits to resist very cold water. In these cases an electrical energy source is needed in order that the material generates energy due to the Joules effect. There are also some applications for conductive garments in the domain of the antenna due to their capacities to receive electromagnetic waves.

Finally, some of the main applications of conductive textile materials are their uses for the power supply of electronic devices in the garments (Figure 3 - represent a schematic view of an electrically active textile article and an electronic circuitry included) .

***Luminescent Materials***

The difference between chromic and luminescent materials is that the first one changes colour when the second one emits light thanks to a stimulus. There are several types o f luminescent effects (in italic are indicated those used in textile):

- *Photoluminescence*: external stimulus is light. There are two types of photoluminescent materials the fluorescent and the phosphorescent. The only difference between the two is the time of emission.
- *Opticoluminescence*: conduction of light. (Figure 4)
- *Electroluminescence*: external stimulus is electricity.

- Chemioluminescence: external stimulus is a chemical reaction.
- Triboluminescence: external stimulus is friction.

There are two types of photoluminescent materials, the organic and the mineral. Photoluminecent materials are generally used in textiles for application in dress for a night club and more interestingly in the marking of labels with UV revelation materials for the detection of imi tation goods and the security label. Phosphorescent materials have been applied in inks which can store light and are used in working clothes for road works/repairs in bad -light situations, or for marking arrows on carpets to guide people during a power fa ilure. The obtained effect is generall y known as glow in the dark.

Opticoluminescence is the typical effect encountered in optical fibres, textiles that emit light.

**Figure 3.** T-shirt electronic circuitry included

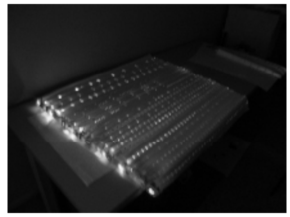


**Figure 4.** Opticoluminiscent curtains

***Membranes***

Multi-disciplinary research led to the successful development of the cutting -edge technology of laminating a variety of microporous or hydrophilic membranes. Membranes are deposited on textiles in order to add new properties on theirs sur faces.

One of the main applications of membranes is in the field of sportswear for the manufacture of breathable and impermeable clothes. Indeed, with a simple system of membrane, fabrics possessing an excellent water exchange are obtained with a good el imination of the sweat at the garment interface (breathability) and the creation of an external barrier with extreme water repellence. For example, the best provider of textile membranes is Gore -tex a bi-component membrane.

Another successful application of the membranes in intelligent textiles is self -cleaning garments (the garment does not have an affinity with any products so that it can not be dirtied).

***E-textile***

The main application of solar cells in textile is the electric alimentation of integrat ed electronic devices, e-textile. The alimentation could be made directly from the solar cell to the devices but the majority of encountered solutions are using of solar for charging batteries that could deliver energy to the appropriate device (recharging mobile phone, Mp3 player).

**Figure 5.** Solar cells on textile substrate

***Monitoring smart textile***

This kind of ultra smart textile have a large area of applications being used in different fields:

- medical monitoring;
- disease monitoring;
- infant monitoring;
- sportsman monitoring (Figure 6);
- military uses.

In this group all the textile integrate electronic as sensor and microchips in order to detect and analyze stimuli and provide the adequate response.


**Figure 6.**Sport monitoring

***Smart textile in home decorations***

For this produce may be used approach all types of smart textile, in order to have for different effects and for different purposes (Figure 7).

Inactive state Active state

**Figure 7.**Home decoration

## 4. CONCLUSIONS

All man and woman, especially the youngest are carrying around more and more electronic products: mobile phones, laptops, and more one the way. There fore, the preoccupations of specia list go to start integrating smart products into clothes. Smart clothing is a combination of electronics and clothing textiles. New fibre and textile materials and miniaturized electronic components make it possible to create truly usable smart clothes. Th ese intelligent clothes are worn like ordinary clothing providing help in various situations according to the designed application. Though a lot of new products have come but still there is vast scope to utilize developed smart technologies or evolve new technologies for smart applications

## 5. REFERENCES

1. Horooks, A.R., Anand, S.C. *Handbook of Technical Textiles*. Woodhead Publishing Ltd, UK, 2000, ISBN 1 85573 385 4. Ollenhauer-Ries C.,: *IHE 2000*, Knitting Technology, 4/2000

2. J Rupp, A Bohringer, A. Yonenoga " High performance textiles or Smart Textiles" International TextileBulletin, 3/2001, pg.6-24

3. P. Stenton, http://www.smartextiles.co.uk/_wearcomp.htm

4. S. Hayashi, " Properties and application of Polyurethane-based shape Memory Polymer" US-Japan workshop on Smart Materials and Structures held at University of Washington. Dec.3 -4 , 1995

5. D.A.Russel " Potential uses of Shape Memory films in clothing Technical Textile International October,1999,17

6. http://en.wikipedia.org/wiki/Phase_change_material

7. M. K. Singh, *Pakistan Textile Journal*, available on line, http://www.ptj.com.pk/Web%202004/08-2004/Smart%20Textiles.html.

ANNALS OF THE UNIVERSITY OF ORADEA
FASCICLE OF TEXTILES- LEATHERWORK
Volume I, 2010, No. 2

# NEW DEVELOPMENT IN THE CORE YARNS MANUFACTURE

**F. Marsal[1], D. Palet[1] , M. Riera[1] , A. Serra[2] , L. Indrie[3], M. Ratiu[3]**

[1] *Technological Innovation Centre CTF . Technical University of Catalonia, Terrassa, SPAIN*
[2] *Pinter, S.A. Santpedor, SPAIN*
[3] *Faculty of Textiles and Leatherwork. University of Oradea, Oradea, ROMANIA*

Corresponding author: Feliu Marsal, marsal@etp. upc.edu

***Abstract*** : A new mechanism for the regulation of feeding tension of elastic filaments has been de veloped, in cooperation with a reputable manufacturer of textile machinery, to obtain “core spun” yarns. This device reduces, of a very significant form, the coefficient of variation of the elongation of the yarn and, consequently, the fabrics obtained with this yarns are more regular appearance. This mechanism is fundamental when the new spools of T-400, with diameter and weight superiors to the standard size, are processed.
***Keywords:*** Core yarn. New device. Feed tension control. T-400.

## 1. INTRODUCTION

In the manufacture of “core spun” yarns (1), or the yarns constituted by a nucleus of elastic filament or elastomer, surrounded by a natural or chemical staple fibres, nowadays has originated a problem due to the tendency, every day increased, to use elastomer spools of dimensions and weights superiors to the standard size. (Figure 1).

**Figure 1:** Left: standard spools. Right: New spool

On the one hand an increase of productivity, in significant form, is obtained due to the reduction of number of changes of elastomer spool during the spinning process; but on the other hand the high diameter and weight of these new spools, 260 x 150 mm and 4400 g of weight, in front of the 600 g and 57 x 165 mm of the conventional spools cause problems for the control of the feeding tension, mainly when the diameter of the spool is reduced due to its consumption during the spinning operation.

It causes, especially, irregularities in the yarn that will give rise to faults in the weaving process, mainly bars and differences of color in the dyeing. These problems are more importants when is processed the elastomultiester (EME) designated commercially as T-400, that offer in a same filament the properties of the polyester and the advantages of an elastic filament.

These new fabrics made by T- 400, just appeared in the world-wide textile market, offers more durability of the elastic behavior, low shrinking, good resistance in front of chlorine and the lye, good resistance to wrinkling and good dimensional stability.

## 2. A NEW DEVICE

In order to solve the problems before exposed, the Technological Innovation Centre CTF, in cooperation with the Pinter, S.A., Spanish company manufacturer of spinning machinery and its accessories, came to the design and construction of a new device that contributed at the tension control and the supply regulation of elastomer spools.

In the conventional ring spinning machines, for manufacturing elastic covered yarns, the development of the filament is carried out by two cylinders, wich ones in contact with the filament spool, move it by friction.

By means of the control of the relation of speeds between the feed rollers and the drafting rollers of the drawing train in the spinning machine, can be obtained yarns with different elasticity .

When we works with hight draw ratio (between 3 and 5), the contact force generated by the weight of the elastomer spool is not sufficient to avoid false drawing, which will cause bars in fabrics made with these yarns. By the twisting given to the yarn, the elastic nucleus remains covered by the staple fibers.

Two different mechanisms were designed, one for the production of elastic yarns surrounded by short fibre and the other for elastic yarns surrounded by long fibre.

Both mechanisms were installed in two "Merlin" spinning machines (2), manufactured by Pinter, S.A., type *spa* for short fibre and type *spl* for long fibre.

Figure 2 shows the spinning machine for short fiber, indicating the main work areas for the “core spun” yarn production. Figure 3 shows the situation of creels and the guide device of the elastomer.

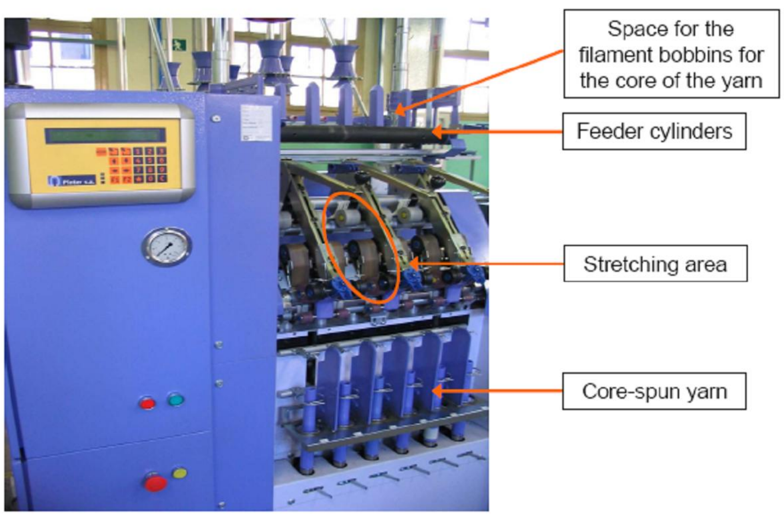



**Figure 2:** Merlin spa spinning machine for manufacture of surrounded elastic yarns

The new device can be applied to all the machines existing in the market, made in the last five years. This new mechanism, with a totally mechanical structure, has a sensor that detects the tension in each phase of the feeding of the filament spool of T-400, from the origin, when the spool is full at to the end of the spool. Each elementary tension is translated in a signal, that properly codified and treated, is transformed into a stimulus to the regulator of the feeding tension.(Pending patent).(3).

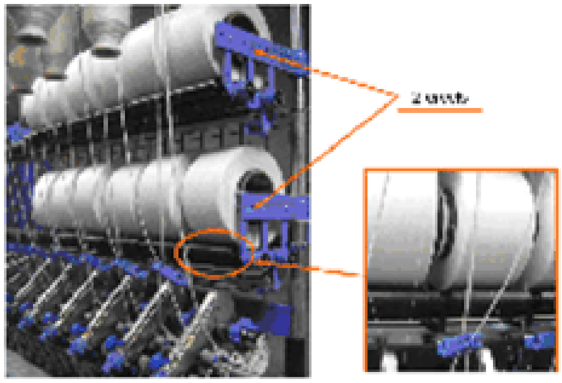


**Figure 3:** Situation of creels and the supply device of the elastomer

To the being the device totally mechanic, its maintenance is easy and is free of failures.
All investigations carried out in our laboratories about the deviations of the feeding tension, between the different spindles of the ring spinning that they work with different d iameters of T-400 spools, do not offer significant differences to 95% of confidence level.

## 3. EXPERIMENTAL PART

With the mechanism already described we carried out to manufacture diverse yarns, in industrial conditions, for validate the effectiveness o f the new development. (4).

We have made "core spun" yarns of cotton and "core spun" yarns of wool, using like elastomer the T-400 filament made by Invista.

For each spinning system they were obtained, respectively, five yarns of different count, representative of commercial market and that cover the long range of yarns. In table 1 are indicated the count of the "core spun" yarns surrounded of cotton and wool, respectively. The cotton yarns have received an alpha twist coefficient of 4 and the wool ya rns a twist coefficient K of 85.

**Table 1:** Count of core spun yarns of T- 400 surrounded by cotton (Ne) and surrounded by wool (Nm)

| | | | | | |
|---|---|---|---|---|---|
| Cotton<br>Yarn count (Ne) | 8 | 10 | 12 | 14 | 16 |
| Wool<br>Yarn count (Nm) | 20 | 25 | 30 | 35 | 40 |

In the tables 2 and 3 are exposed the main parameters of the yarns obtained.

**Table 2:** Main parameters of core spun yarns of T- 400 surrounded by cotton

| Parameters | | 8 Ne | 10 Ne | 12 Ne | 14 Ne | 16 Ne |
|---|---|---|---|---|---|---|
| Mass evenness | CV (%) | 9,4 | 9,4 | 9,3 | 9,1 | 9,1 |
| | Thin parts (-50%) | 0 | 0 | 0 | 1 | 1 |
| | Thick parts (+50%) | 5 | 6 | 6 | 5 | 5 |
| | Neps (+200%) | 0 | 1 | 1 | 0 | 1 |
| | DR (%) | 6,9 | 7,0 | 7,4 | 7,5 | 7,3 |
| Tensile strength | Breaking load (cN) | 1238 | 1254 | 1318 | 1403 | 1498 |
| | CV breaking load (%) | 4,5 | 3,9 | 4,2 | 4,7 | 4,4 |
| | Elongation (%) | 7,2 | 7,1 | 6,9 | 7,0 | 7,0 |
| | CV of elongation (%) | 8,8 | 9,6 | 12,8 | 13,5 | 16,1 |
| Friction Coefficient | | 0,210 | 0,210 | 0,210 | 0,215 | 0,220 |

**Table 3:** Main parameters of core spun yarns of T - 400 surrounded by wool

| Parameters | | 20 Nm | 25 Nm | 30 Nm | 35 Nm | 40 Nm |
|---|---|---|---|---|---|---|
| Mass evenness | CV (%) | 14,3 | 14,5 | 14,6 | 14,9 | 15,6 |
| | Thin parts (-50%) | 10 | 10 | 14 | 8 | 6 |
| | Thick parts (+50%) | 24 | 20 | 16 | 22 | 17 |
| | Neps (+200%) | 45 | 32 | 38 | 26 | 34 |
| | DR (%) | 18,4 | 14,1 | 11,6 | 12,7 | 9,5 |
| Tensile strength | Breaking load (cN) | 1047 | 1104 | 1235 | 1287 | 1294 |
| | CV breaking load (%) | 4,7 | 5,2 | 5,8 | 4,3 | 4,9 |
| | Elongation (%) | 8,3 | 8,1 | 8,2 | 8,0 | 8,1 |
| | CV of elongation (%) | 12,4 | 14,1 | 15,3 | 16,8 | 17,7 |
| Friction Coefficient | | 0,220 | 0,225 | 0,220 | 0,235 | 0,230 |

The DR (Deviation Rate) is a new coefficient of deviation of mass, that is very related to the aspect of finished fabrics. This parameter was completed, some years ago, by the technical services of Keisokki jointly with our Technological Innovation Centre CTF.

A DR index of 40% indicates that 40% of the tested metres, taking like reference a length of 1,37 metres in each reading of evenness tester, surpass the established limits corresponding to the average mass plus 5% and the average mass minus 5%.

From obtained yarns we made knitting fabrics, with a structure of smooth knitt in a circular machine of laboratory, of small diameter, for verify the possible presence of aspect irregularities. These knitted fabrics are dyed to three intensities of colour (low, medium and high) with specific and sensitive dyes for show the bar faults.

A team of experts has evaluated the aspect of dyed fabrics, by the Spearman technique. The correlation coefficient between the aspect of fabrics made with yarns obtained with the new mechanism and the fabrics considered as reference patterns has been of 0,98.

This correlation coefficient lowers to 0,34 when the calculation is repeated with fabrics made with conventional guide device of the elastomer, available in the market, used before developing the device exposed in this work.

For the range of cotton yarns studied, when they are made with conventional guide devices, the coefficient of variation of the elongation varies between 14 to 23%. In the variability of the elongation to the breakage by traction, a significant smaller dispersion is appraised, to 95% of confidence level. It will cause a better aspect of finished fabrics.

The same tendency is obtained for wool yarns. When they have made with the conventional mechanism the variability of the coefficient of variation of elongation to the breakage by traction oscillates between the 16,5 to 27%.

The coefficient of variation of mass, determined in a digital evenness meter, is reduced of the order of 1 point in all the tested yarns. The variations oscillate between 0,7 to 1 point in the value of the CV (%), depending of the thickness of the yarn.

The other evaluated parameters, showed in tables 2 and 3, for cotton and wool "core spun" yarns, do not offers significant differences at the 95% of confidence level.

## 4. CONCLUSIONS

The main parameters of the cotton elastic yarns studied, of a comparative form, with yarns of identical characteristics elaborated with the conventional device available in the market, offers significant differences, to 95% of confidence level, in the evennes of mass, in the coefficient of variation of the elongation at break by traction and in the aspect of the obtained fabrics with this yarns.

For all the range yarns studied, the new supply device of the elastomer represents a significant improvement in the manufacture and in the quality of these “core spun” yarns, specially for the more thin yarns.

In the elastic yarns obtained with the worsted system, the same tendencies enunciated for cotton yarns have been observed.

## 5. ACKNOWLEDGEMENTS

The authors want to give thanks to Pere Picado, Montserrat Guerrero and Isabel Castro by their contribution in the experimental work.

## 6. REFERENCES

1. Denton, M.J. & Daniels, P.N.(2002). *Textile Terms and Definitions,* The Textile Institute, ISBN: 978 1 87037 244 2, Manchester (UK).
2. Pinter, S.A. (2009). Documents about Spinning Machine *Merlin spa* and *spl*.
3. Pinter. S.A.(2010). Pending patent.
4. Technological Innovation Centre CTF (2009 -2010). Private documents.

ANNALS OF THE UNIVERSITY OF ORADEA
FASCICLE OF TEXTILES- LEATHERWORK
Volume I, 2010, No. 2

# THE CORRELATION BETWEEN COMFORT PARAMETERS OF GARMENT STRUCTURE WITH VELOUR FUR

## Part I

**Matenciuc Cristian-Constantim, Mitu Stan,**
Faculty of Textiles-Leather Engineering and Industrial Managementl, Doctoral School, Iasi

***Abstract:*** In the fur industry, the optimal technological processes of processing, upgrading and man ufacturing that are applied differ according to the breed and origin. In fact, the problems that arise are so complex that many competitive companies that are widely known at international level have diminished from the very beginning the activity of proce ssing and manufacturing to a single branch, producing clothes made of natural furs that come from the same breed of animals. The paper comprises experimental research referring to the way the natural sheep fur, processed as suede leather, from which men ja ckets are made and intended for being worn during the cold weather, influence the main sanogenetic functions. Taking into account all these, one can notice their importance as regards the creation of the so -called "social comfort" that corresponds to the m ajor requirements of the population.

As the contents also suggests, the research was also extended to the sanogenetic indicators, which involved great research regarding the establishment of the research variants, the choice of fabrics, products and clothi ng structures with appropriate uses. Under these circumstances the graphical model of calculus is presented with the main research variant for a clothing item intended for the cold season as the graphical representation from the paper also indicates. For simplification reasons, the drawings present some calculus conditions if the climogramm aspect of the representations is being considered. Relying on the working methodology also used for the previous research, the calculi were centralized in tables, while for 11 variants there was the specification that for each variant it was used the appropriate relation of calculus, the weather conditions and the compliance with the use of the clothing items conceived according to the reference model. Although all is foc used on the three insulations (thermal, air permeability and vapour permeability), the research includes great workload and the establishment of at least 15 textile and physical characteristics, useful when calculating the main parameters of comfort influence. The optimization consisted in the mathematical modeling in the 2D and 3D systems, the figures suggesting both the interdependence mathematical model between the parameters and the appropriate correlation coefficient. The paper details and the results obtained are meaningful in this respect.
**Keywords**: natural fur, comfort, mathematical modeling, 2D system, 3D system, optimization, clothing item, microclimate, comfort indicators.

### 1. INTRODUCTION

The furs have been used as clothing products of primiti ve people, at first worn as hunting trophees, and later on as protection against weather factors or with defense and physiological role.

At first people wore big animal furs, because they coresponded more to body protection needs. At the same time with mankind evolution, the needle appeared and also the possibility to produce clothing products made of smaller pieces of fur that were first cut out, then sawn, obtaining products that had initial shapes specific to human body.

During mankind history, clothing products made of fur were replaced by clothing products made of different raw materials such as: wool, flax, hemp, cotton, silk and even synthetic fibers.

Furs haven’t entirely lost their field of use, on the contrary, being rarer and rarer, at present luxury articles are made of them. Of some types of furs, by means of special skill, with patience and with high cost manual labour, there are made even works of art in the clothing field. Technique and creation development has played an important part in supporting fur clothing products designers and producers, which also supposes the appearance of adequate equipments.

Finished fur consisting of derm and pilous coating has multiple destinations, considering its multiple functions in clothing products and structures.

Concerning the functions of the pilous coating, it represents an elastic extension of the external coating of a mammal animal. Thus the functions of the pilous coating are effectively completed by those of the derm.

Therefore, the fur functions are:

- Protection against external mechanical influences and strains. At the same time with the increase of the pilous coating density the protection degree or capacity also increase. Also, the smoother the hairs are, the easier impurities such as sand, dust and water reach the animal surface.

-Protection against weather influences. Among the individual pilous follicles that are very numerous there appear innumerable air compact spaces, which contribute to creating the proper climate;

-The hairs emulsified by the sebaceous glands don't allow water penetration to the skin surface, phenomenon especially observed at animals living in water such as: nutria, otter, muskrat, and mink;

-The animal colour, more precisely the pilous coating, may have a camouflage or ornament function, this way differentiating the sexes belonging to the same breeds.

The natural fur has to correspond to certain esthetic, technical and economic requirements. These requirements are given by physical properties such as: tenacity, malle ability, extension capacity that is extensibility, elasticity and specific weight.

Suede leather is made of medium-size sheep skin, by painting with colouring agents that adhere to the leather, because the pilous coating is in this case as natural lining.

In order to reduce the specific weight of leather, after dying, there shall be made two-stage polishing, then hair cutting up to 1-3 cm high.

The raw material, the natural fur comes from domestic animals, or wild animals, or from farms. We cannot produce from all skins with pilous coatings furs corresponding to the esthetic and technical requirements for a clothing product. The main requirements and conditions a natural fur has to comply with are:

- low specific weight;
- increased malleability of pilous coating;
- good elasticity of pilous coating;
- increased thickness of pilous coating;
- proper fineness, etc.

Due to the great number of fur animals, due to the diversity of species, races, geographical origin areas, of their food, the furs of each animal breed comply differently with these requirements.

All furs coming from the same animal breed tend to have the same properties, so that we may talk of a resemblance only of furs belonging to the same animal breeds. We cannot talk about structure uniformity of fur skins coming from different animal breeds, so the mere name of natural fur should not appear as a restraint field

This may be also justified by the fact that, in the fur industry, the optimum technological processes of fur processing, of rendering them of a higher quality, of manufacturing methods applied differ depending on the race and origin of the natural furs. In fact, the problems raised are so complex that many companies that imposed themselves worldwide, competitive companies, have restrained their processing and manufacturing activity to a single branch, producing clothes made of naturals furs coming from the same animal breed. The study includes experimental researches concerning the way sheep natural fur processed as suede leather, men jackets are made of, intended for the cold season, influences the main sanogenetic functions. From what we have presented, it results their importance concerning the so-called „social comfort", corresponding to the major requirements of the population.

The adult sheep skin types of various fur breeds that due to pilous coating enrichment become imitations of expensive furs, such as otter, cat, leopard etc. Young skins with short and uniform hair covering their entire surface, subjected to special treatment are called suede furs;

## 2. PROCESSING MODE, RESULTS AND INTERPRETATIONS

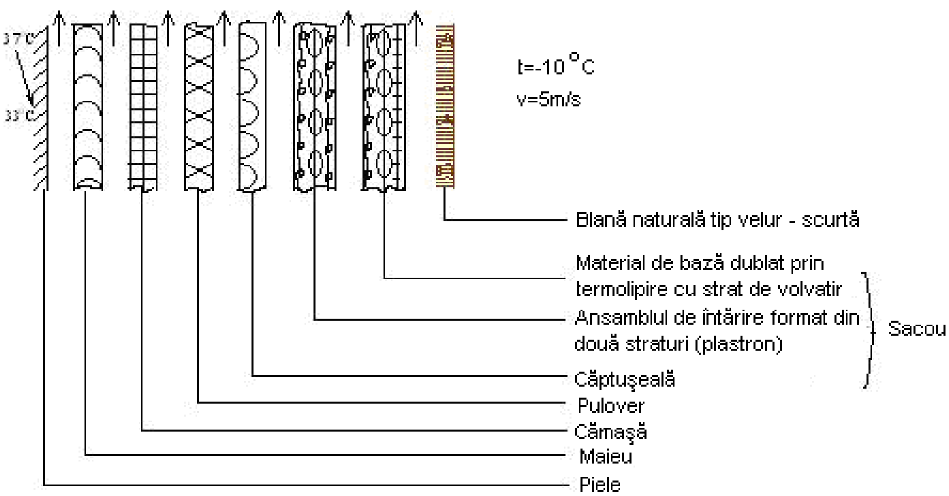
As we have already mentioned, the research extended to the sanogenetic indicators, which supposed extended researches concerning the establishment of research variants, the choice of fabrics, products and clothing structures with proper destinations. In this context we show the graphic calculus model with the main study variant for clothing structures intended for the cold season the way it also results from the graphic representation of figures 1. For exemplifying, in the drawings there are also presented some calculus conditions, but the climogramm aspect of the representations is also analyzed. Being based on the work technology also used for the previous researches [ 1 ,5 ], the calculi were centralized in table 1, for 11 variants with the mention that for each variant it was used the adequate calculus relation, the weather conditions and the consistency with the destination of the clothing structures conceived according to the model represent ed in figure 1. Although everything is concentrated on the three resistances, the study includes a great workload and the establishment of 15 textile-physical characteristics, useful for the calculus of the main parameters of comfort influence .

Under these circumstances comparative analyses should also be made considering the values of sanogenetic indicators for the classic clothing structures specific for the cold season for men have to comply with regulations in force within the following limits:

- Total thermal resistance 0.5 – 1 $m^2h.^0C/kcal$;
- Resistance to vapour passage 1 – 2 $mm.h.m^2/g$ ;
- Resistance to air passage 0.1 – 0.5 $mm.h.m^2/kg$

We should mention that the experimental researches show that natural fur has a reference thermal resistance of 0.4 -0.5 $m^2h^0C/kcal.$, which leads to essential modifications of these limits.

The derm leads to a considerable increase at air passage, and the pilous coating, due to the large air contents and to the great thickness results in the increase of the thermal equivalent and totalized thermal resistance. The natural fur is characterized by good vapour permeability, which also results in comfort improvement.




Jacket – Suede-type natural fur – jacket
Basic fabric lined by heat filing with volvatir coating
Consolidation aggregate made of two layers (dicky)
Lining
Pull-over
Shirt
Undershirt
Skin

**Figure 1.** Clothing structure intended for the cold season - Natural fur jacket

The experimental data base centralized in table 1, for v ariants of clothing structures allowed 2D processing (figures 2, 3, 4, ……8) and 3 D processing (figures 9 and 10).

If the 2D processing were made in Excel the 3D charts representation was made by means of ***TableCurve 3D v2*** application, designed by the company ***Jandel Scientific Softwaew.*** The data may be directly introduced in the window *TableCurve 3D editor* or may be imported from table computation programmes such as *Excel*, *Quattro Pro Windows* sau *Lotus Windows.* Based on them there were established the following interpretations.

In the current stage, recognized by the explosion of the new raw materials and fabrics, it is important the collaboration between textilists, chemists and people working in the field of textile ready-made clothes who have to take into account the new orientations concerning clothing standardization and compliance with the framework design regulations by scientific criteria.

Considering the results of the previous researches [2,3,4,5], after the elaboration of the present study, we draw the general conclusion that we need comparative analyses that should certify the veracity of the theoretical foundations with the experimental results for the new variants. To this purpose there are conclusive the limits of the parameters of comfort i nfluence written in table 1 and represented in the figures, from where it results the optimum interval for each characteristic, analyzed compared to the standard variant, consisting of a clothing structure with overcoat and that has the same destination.

The research veracity has been also certified by the mathematical modeling established and verified based on average values, both for standard variants, and for average values specific for the studied variants.

For comparative analyses, the research may be extended, that is the fur imitation may be replaced by 10 -30 mm thick natural fur and with 0.022 kcal/m.h $^0$C or 0.025 w/m.$^0$C thermal conductibility.

The specific modifications of the biologic constant parameters, especially concerning energetic waste, heat flow and thermal efficiency index should also be taken into account, because the mass of the clothing product has to be correlated especially with the thermal insulation capacity, and in other words its reduction shouldn't affect the thermo -insulating properties imposed to the clothing structure, conditioned by the strain status and the micro and macroclimate factors. We have noticed that even with mass reduction, with good effects on the organism, the thermal resistance maintains within the specific limits of the reference variant and at the present stage we have almost given it up. This is certified by the experimental results written in the centralizing table.

The organism effort associated with the elementary heat flow is diminished, this being in fac t in range with the present trend concerning clothing standardization.

The limits written in table 1 may be analyzed in parallel with those written in figures 2...8, from where it results the mathematic model and the correlation coefficient, taking into ac count that it is about the interdependence between the comfort parameters and some complex structure characteristics.

If air permeability and air passage resistance have the same values both in environment conditions, and in laboratory conditions and the representations of figures 2 and 3 are conclusive in this respect, the thermal resistance, the vapour passage resistance and the total heat transfer coefficient have slightly corrected values. This also results from the graphic representations in figures 4 ...8.

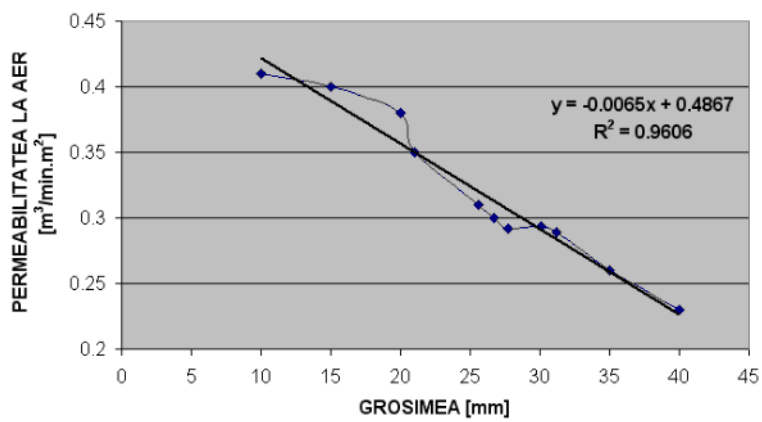
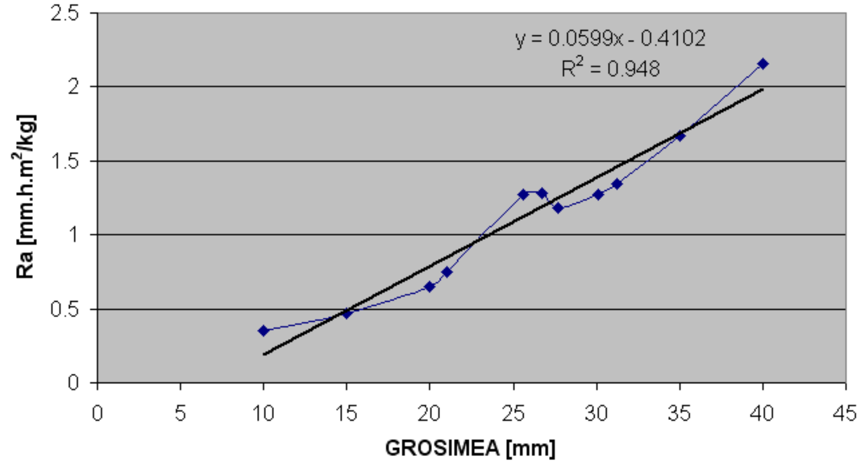
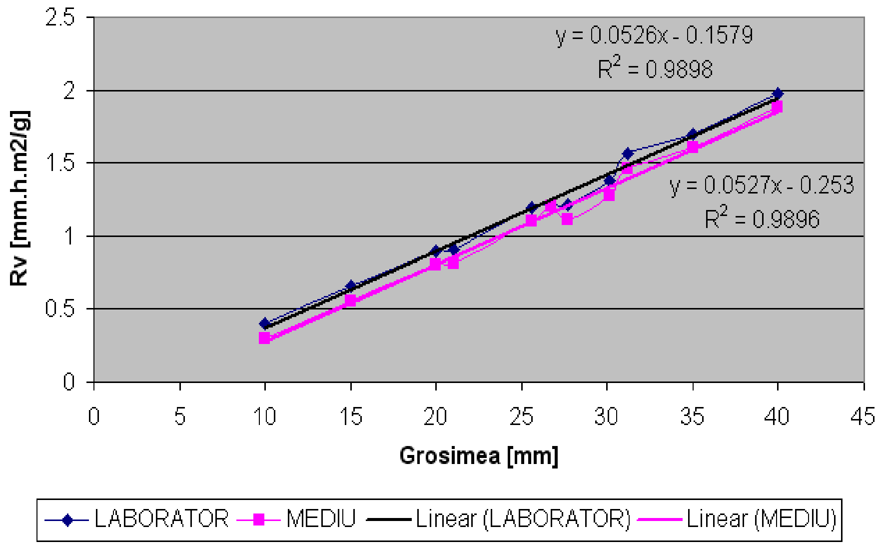



**Figure 2.** Relation between Air and Thickness Permeability




THICKNESS

**Figure 3.** Relation between Air Passage Resistance and Thickness




LABORATORY - ENVIRONMENT – Linear (LABORATORY) Linear (ENVIRONMENT)

**Fig.4.** Relation between Vapour Passage Resistance and Thickness

**Tabelul 1**

| Nr. Crt. | Thickness d*$10^{-3}$(m) | | | Air Permeability Pa $\frac{m^2}{min*m^2}$ | Air Passage Resistance Ra $\frac{m^2*h*mm}{kg}$ | Vapour Passage Resistance Rv $\left(\frac{mm*h*m^2}{g}\right)$ | | Equalized Thermal Resistance $R_E$ $\left(\frac{m^2*h*c^{\circ}}{k_{cal}}\right)$ |
|---|---|---|---|---|---|---|---|---|
| | $d_m$ | $d_a$ | $d_t$ | | | Laboratory | Environment | |
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 1 | 16.44 | 14.21 | 30.10 | 0.294 | 1.27 | 1.3803 x | 1.2803 | 1.286 |
| 2 | 15.13 | 12.88 | 27.71 | 0.292 | 1.179 | 1.2155 | 1.1155 | 1.255 |
| 3 | 17.04 | 14.68 | 31.20 | 0.289 | 1.343 | 1.5637 x | 1.4637 | 1.3762 |
| 4 | 13.99 | 1.63 | 25.62 | 0.250 | 1.27 | 1.1981 x | 1.0981 | 1.203 |
| 5 | 14.6 | 12.13 | 26.73 | 0.259 | 1.28 | 1.2095 | 1.1995 | 1.21 |
| 6 | 11.5 | 9.5 | 21.0 | 0.35 | 0.745 | 0.91 | 0.81 | 0.995 |
| 7 | 19.5 | 17.5 | 35.0 | 0.26 | 1.67 | 1.70 | 1.6 | 1.55 |
| 8 | 22 | 18 | 40.0 | 0.23 | 2.16 | 1.98 | 1.88 | 1.75 |
| 9 | 11 | 9 | 20.0 | 0.38 | 0.654 | 0.9 | 0.8 | 0.99 |
| 10 | 8.5 | 6.5 | 15.0 | 0.4 | 0.466 | 0.66 | 0.56 | 0.75 |
| 11 | 7 | 5 | 10.0 | 0.35 | 0.355 | 0.4 | 0.3 | 0.55 |

**Tabelul 1 (continuare )**

| Nr. Crt. | Totalized Thermal Resistance (Rsum) | | | | Total Transfer Coefficient K | | Heat Flow Q Kcal/h | | Thermal Equivalent Condition $\lambda_E$ Kcal/m.h$^0$C | Thermal Efficiency N=0,78.U/100 |
|---|---|---|---|---|---|---|---|---|---|---|
| | Laboratory | | Environment | | Laboratory Kcal/m$^2$.h$^o$C | Environment Kcal/m$^2$.h$^o$C | Laboratory $\Delta t=12^0C$ | Environment $\Delta t=43^0C$ | | |
| | $\left(\frac{m^2 * h * c}{k_{cal}}\right)$ | | $\left(\frac{m^2 * h * c}{k_{cal}}\right)$ | | | | | | | |
| 0 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
| 1 | 1.425 | 7.91 | 1.3374 | 7.43 | 0.70 | 0.747 | 26.31 | 100.37 | 0.0234 | 0.78 |
| 2 | 1.394 | 7.74 | 1.307 | 7.26 | 0.71 | 0.765 | 26.13 | 102.81 | 0.0220 | 0.8019 |
| 3 | 1.5152 | 8.41 | 1.4282 | 7.93 | 0.65 | 0.70 | 24.74 | 94.086 | 0.0226 | 0.73 |
| 4 | 1.342 | 7.45 | 1.3374 | 7.43 | 0.745 | 0.747 | 27.93 | 100.47 | 0.0234 | 0.783 |
| 5 | 1.365 | 7.55 | 1.348 | 7.65 | 0.73 | 0.741 | 27.375 | 99.68 | 0.0220 | 0.777 |
| 6 | 0.91 | 5.05 | 0.81 | 4.94 | 1.09 | 1.123 | 40.87 | 150.98 | 0.0211 | 1.28 |
| 7 | 1.7 | 9.44 | 1.65 | 9.06 | 0.58 | 0.60 | 21.75 | 81.43 | 0.0255 | 0.635 |
| 8 | 1.95 | 10.83 | 1.8 | 10 | 0.512 | 0.55 | 19.2 | 73.50 | 0.0228 | 0.576 |
| 9 | 0.9 | 5 | 0.8 | 4.44 | 1.11 | 1.25 | 41.62 | 167.96 | 0.0202 | 1.31 |
| 10 | 0.7 | 4.16 | 0.6 | 3.33 | 1.33 | 1.66 | 49.87 | 223.06 | 0.020 | 1.73 |
| 11 | 0.45 | 2.5 | 0.40 | 2.22 | 1.22 | 2.5 | 83.25 | 335.93 | 0.018 | 2.62 |

Concerning the 3D system representation, compared to 2D system representation, it points out the interdependence between three parameters by means of complex mathemat ical modeling, marked on the response surface in the three-dimensional representation of figures 9 and 10.

All 2D and 3D representations correspond to certain selected combinations, whereas the data written in table 1 and that include a large workload, all ow extending the mathematical modeling, which may represent an important element in the framework normative proposals for designing according to scientific criteria these clothing structures, too.

Analyzing the results obtained, in comparison to the clothi ng structures with the same destination, we have noticed an obvious decrease of air permeability, doubling the thermal resistance, as well as the air passage resistance, whereas vapour permeability maintains within the same limits.

The mass of clothing structures with natural fur jacket significantly decreases compared to that of the classic variants, therefore the values for the total heat flow Q decrease and implicitly for the elementary heat flow q.

The study points out that the natural fur offers high thermal resistance, which may result in simplifying the clothing structure, by reducing the mass and favorable modifications of the biological constant parameters of the organism.

It is still due to the high thermal resistance that the research may be ext ended, that is the clothing structure in figure 1 may be simplified by eliminating the jacket, so the mass modification, which has a remarkable influence on the elementary heat flow, that may be associated with the fundamental principles of thermal calculus and the thermal adjustment or which imposes in normal conditions, a balance between the thermolisys and thermogenesis.

If the 1st part of this study presents the research variants, the work mode and the research results, in the 2nd part we present their extended interpretation taking into consideration models representation both in 2D and in 3D systems.

**BIBLIOGRAPHY**


1. Mitu,S. Confortul şi funcţiile produselor vestimentare. Editura "Gh. Asachi" Iaşi 2000.
2. Mitu,S.,Mitu M. Modificarea parametrilor fiziologic i la diferite condiţii de stare şi structuri vestimentare cu sacou.Industria textilă nr.2/ 12003.
3. Mitu,S., Mitu M. Noi criterii privind standardizarea îmbrăcămintei .Industria textilă nr.3/2003.
4. Mitu,S.,Hâncu ,S.,Matenciuc C. Limitele indicatorilor sanog enetici pentru ansambluri vestimentare cu noi particularităţi structurale . Industria textilă nr.1/2008.
5. Mitu,S., Hoblea ,Z., Filipescu,E., Loghin C. Parametrii de confort pentru produsul sacou bărbaţi şi structuri vestimentare cu sacou. Industria textilă nr. 4/1991 .

ANNALS OF THE UNIVERSITY OF ORADEA
FASCICLE OF TEXTILES- LEATHERWORK
Volume I, 2010, No. 2

# THE CORRELATION BETWEEN COMFORT PARAMETERS OF GARMENT STRUCTURE WITH VELOUR FUR

## Part II

**Matenciuc Cristian-Constantim, Mitu Stan,**

*Faculty of Textiles-Leather Engineering and Industrial Managementl, Doctoral School, Iasi*

***Abstract:*** In the fur industry, the optimal technological processes of processing, upgrading and manufacturing that are applied differ according to the breed and origin. In fact, the problems that arise are so complex that many competitive companies that are widely known at international level have diminished from the very beginning the activity of processing and manufacturing to a single branch, producing clothes made of natural furs that come from the same breed of animals. The paper comprises experimental research referring to the way the natural sheep fur, processed as suede leather, from which men jackets are made and intended for being worn during the cold weather, influence the main sanogenetic functions. Taking into account all these, one can notice their importance as regards the creation of the so-called "social confort" that corresponds to the major requirements of the population.
As the contents also suggests, the research was also extended to the sanogenetic indicators, which involved great research regarding the establishment of the research variants, the choice of fabrics, products and clothing structures with appropriate uses. Under these circumstances the graphical model of calculus is presented with the main research variant for a clothing item intended for the cold season as the graphical representation from the paper also indicates. For simplification reasons, the drawings present some calculus conditions if the climogramm aspect of the representations is being considered. Relying on the working methodology also used for the previous research, the calculi were centralized in tables, while for 11 variants there was the specification that for each variant it was used the appropriate relation of calculus, the weather conditions and the compliance with the use of the clothing items conceived according to the reference model. Although all is focused on the three insulations (thermal, air permeability and vapour permeability), the research includes great workload and the establishment of at least 15 textile and physical characteristics, useful when calculating the main parameters of comfort influence. The optimization consisted in the mathematical modeling in the 2D and 3D systems, the figures suggesting both the interdependence mathematical model between the parameters and the appropriate correlation coefficient. The paper details and the results obtained are meaningful in this respect.
***Keywords****:* natural fur, comfort, mathematical modeling, 2D system, 3D system, optimization, clothing item, microclimate, comfort indicators.

### 3. EXTENTION OF RESEARCH RESULTS INTERPRETATION

Taking into account the great number of research variants, we estimate that both part I and part II are analyzed as a whole, and this while the graphic part is extended to the 2nd part.
From the representations in 2D and 3D systems, we also obtain the mathematical modeling, and with it the proper correlation coefficient is also written. We mention that the way the comfort indicators may be coupled to establish interdependences may be extended for the values calculated either in laboratory conditions, or in environment conditions.

Analyzing the 2D representations, we notice that some representations correspond to certain linear functions, and others to polynomial functions, because we considered best to choose the variant for which the correlation coefficient has the highest value. In case of 3D system representations, to each point of the representation in orthogonal axes, it corresponds a point in three orthogonal axes, and the great number of variants allowed the generation of the response surface, the analytical relation and the correlation coefficient corresponding to the selected variant.

In figure 9 it is represented the relation between the thermal r esistance, the air passage resistance and the vapour passage resistance, with values obtained in laboratory conditions, and in figure 10, the same representation with values obtained in environment conditions. The theoretical foundation the experimental va lues were based on is the one selected from the specialized literature [ 1,2,3,4,5,].

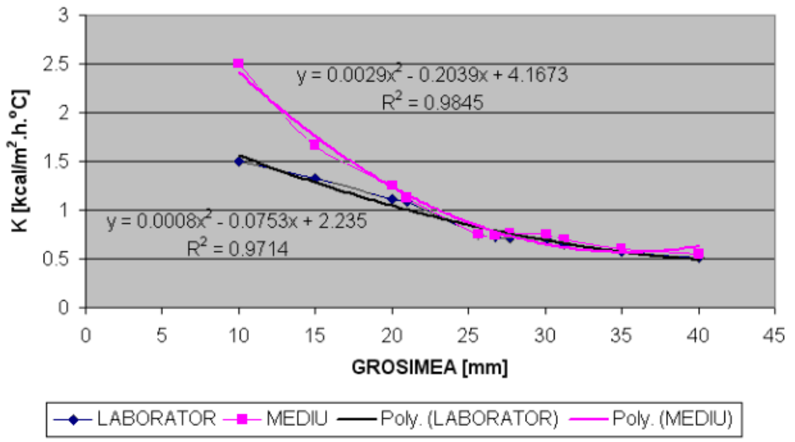



**Fig.5.** Relation between total transfer coefficient and thickness

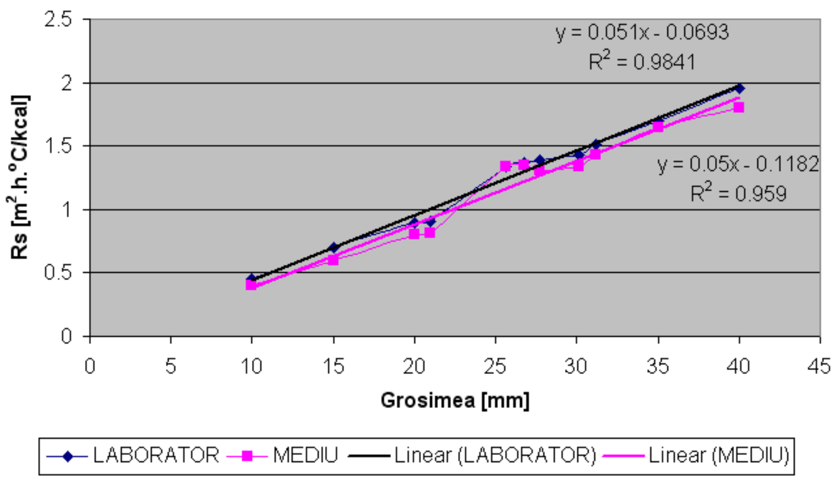



**Fig.6.** Relation between thermal resistance and thickness

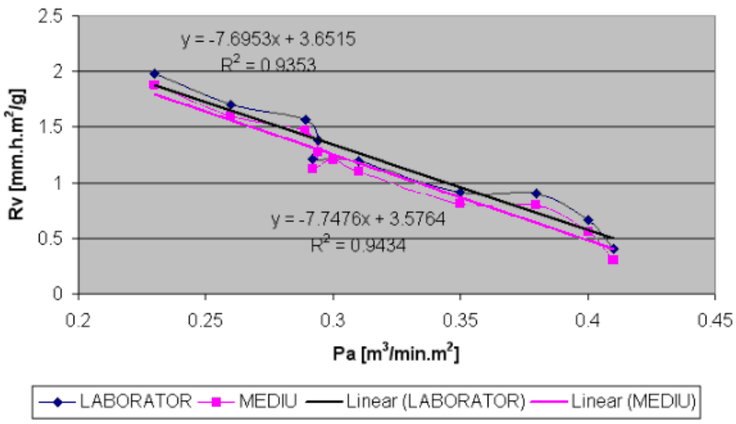



**Fig.7.** Relation between air permeability and air permeability

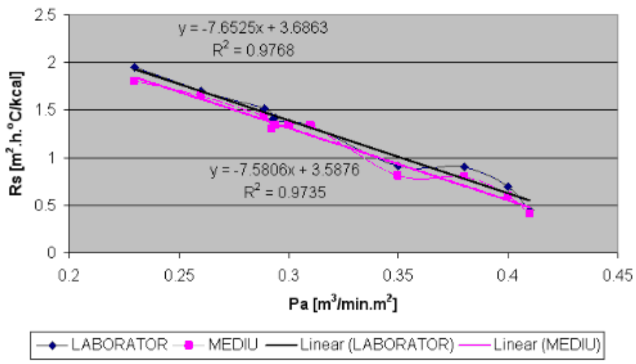



**Fig.8.** Relation between thermal resistance and air permeability

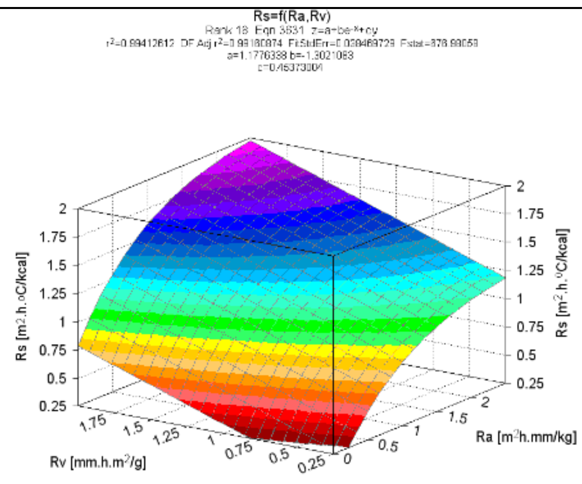



**Fig.9** Relation between thermal resistance to vapour passage and thermal resistance to air passage (laboratory)

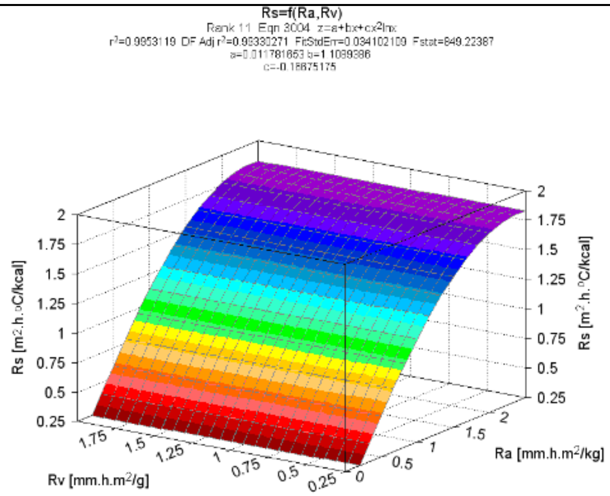



**Fig.10** Relation between thermal resistance to vapor passage and thermal resistance to air passage (environment)

## 4. CONCLUSIONS

The research points out that the natural fur offers a high thermal resistance, which may result in simplifying the clothing structure, by reducing the mass and in favorable modifications of the biological constant parameters of the organism.

It is still the due to the high thermal resistance that the study may be extended, that is the clothing structure of figure 1 may be simplified by eliminating the jacket, so mass modification, which has a remarkable influence on the elementary thermal flow, that may be associated with the fundamental principles of thermal calculus and the thermal adjustment or which imposes in normal conditions, a balance between the thermolisys and thermogenesis.

If the 1st part of this study presents the research variants, the work mode and the research results, in the 2nd part we present their extended interpretation taking into consideration models representation both in 2D and in 3D systems.

In the present stage, the use of natural furs in clothing products and structures extends, precisely due to encouraging animal breeding and the development of small and medium-sized industry specialized both in the tanning sector, and in the clothing manufacturing sector.

The improvement of natural furs and their use in clothing products and structures plays an important part not only concerning the improvement of the thermo-physiological and sensorial comfort, but also concerning the so-called "social" comfort, and the fashion industry also has an important role in this domain.

## 5. BIBLIOGRAPHY

1.Mitu,S.(2000). Confortul şi funcţiile produselor vestimentare. Editura "Gh. Asachi" Iaşi.
2.Mitu,S.,Mitu M.(2003). Modificarea parametrilor fiziologici la diferite condiţii de stare şi structuri vestimentare cu sacou.Industria textilă nr.2/ 12003.
3.Mitu,S., Mitu M.(2003). Noi criterii privind standardizarea îmbrăcămintei .Industria textilă nr.3/2003.
4.Mitu,S.,Hâncu ,S.,Matenciuc C.(2008). Limitele indicatorilor sanogenetici pentru ansambluri vestimentare cu noi particularităţi structurale . Industria textilă nr.1/2008.
5Mitu,S., Hoblea ,Z., Filipescu,E., Loghin C. Parametrii de confort pentru produsul sacou bărbaţi şi structuri vestimentare cu sacou. Industria textilă nr. 4/1991 .

ANNALS OF THE UNIVERSITY OF ORADEA
FASCICLE OF TEXTILES- LEATHERWORK
Volume I, 2010, No. 2

# THE EXTENSION OF CLOTHING PRODUCTS WITH THE USE OF "SMART" MATERIALS

**Elena Moisescu[1], Viorica,Creţu[2], Laura Macovei[3]**

[1,2,3]*Technical University "Gh. Asachi" Iasi*

Elena Moisescu: moisescu@tex.tuiasi.ro

***Abstract:*** Inovation in this field has reached, in the last couple of years, unsuspected shares. It's not only about advanced textiles, with multifunctional destinations (clothing, environment protectio n, geo-textiles etc.) or the ones with special features (antiballistic, chemical protection, biological etc. ), that are considered passive systems, but about materials or structures that "feel" and react to external stimulus of mechanic, thermo, chemical, magnetic nature etc.
Their existence has been made possible thanks to the progress not only in the field of textile technologies but also in other fields that deal with bio-technologies, nano-technologies, informatics, micro- electronics, etc.
***Key words****:* special functions, intelligent materials, Knitted electrod **.**

## 1.INTRODUCTION

In the present, the demands of clothing consumers are going throw a series of changes, like:

- The direction to a type of clothing with a high level of functionality ( comfortable, easy to wear, easy to manage
- A particular accent on the cultural requirements, as a manifestation to the belonging of a certain socio-cultural group, or in order to respect certain customs or taboos.
- The direction towards the quality- price rate, as a consequence of the fact that a large variety of products are required, at a unitary low price.
- The formulation of certain requirements in report with clothing products with special destination.

These directions are determined by the next factors:

- The growth of the competition on the internal and international markets
- The tendency of personalization of the products
- A more flexible production – the producer must be in all times ready for change
- The adoption zonal and international standardization
- Extension in the fields used by the clothing products
- the arrival of new high technical materials.

All these directions lead to the appearance of new functions and characteristics of materials and products.

## 2.THE FUNCTIONS OF CLOTHING PRODUCTS

The main functions of clothing products and their divisions are in table 1 .

**Tabelul 1.** The main functions of clothing prducts

| Nr. crt. | Funcţiile function | Definirea funcţiilor The definition of the function | Diviziuni ale funcţiilor Divisions of the funtions |
|---|---|---|---|
| **1.** | Constructive-ergonomic function | Represents the mean where the product throw materii prime and the component materials; also thow the constructive solution shaped to correspond to the shape and dimensions in which it is at a certain point in time ( static or dynamic) | - it has a certain fibred composition<br>- presents a specific structure of the type of the product<br>- has the auxiliary materials needed<br>- has the right dimensions<br>- has product elements<br>- easiness in dressing and undressing |
| **2.** | Comfort function | Is the function throw which the product is perceived by the user; when this function is not fully or partially fulfilled, the user feels discomfort; the sensation or comfort/discomfort cand be: type tactil, termofiziologic or the combined type | - guaranties psycho-sensorial comfort<br>- allows humidity absorption (water, vapors)<br>- allows the transfer of humidity<br>- ventilation option<br>- assures thermo isolation |
| **3.** | Protection function | Reflects the capacity of a clothing product to protect the body from negative external factors: in the case of protection clothing, this function's role is of extreme importance | - covers the body<br>- protects the face from external factors |
| **4.** | Esthetic function | Is of main importance for clothing products, because of the visual effect that is created; throw it's general aspect, croiala line, colour or combination of clorours, a certain product can create the a good or a bad impression. This function cand be subdivided to the sensorial comfort function | - shows aspect and carriage<br>- it stands in the fashion's lines<br>- brings brand new elements<br>- is in direct relation with the way of life and outfits<br>- presents an aspect of the technological processing |
| **5.** | Diponibility function | Reflects the capacity of the product to be apt for use; the main subdivisions are viability and mentenabiliy. | - resistance at mechanical solicitation<br>- maintains its characteristics for an estimated time ( viability)<br>- maintains the aspect, shape and dimensions ( dimensional stability)<br>- cleaning feature<br>- remedy and recondition in clearly stated conditions (mentenability) |
| **6.** | Ecologic function | The capacity of the product not to disturb life and health. Also the environment. It's determined by the nature of the materials used, as well as treatments for special finishing | - struggle against contamination<br>- resistance against kindling<br>- resistance at biological factors<br>- capacity of degradation in the natural environment |
| **7.** | Technologic function | The capacity of the product not to disturb life and health. Also the environment. It's determined by the nature of the materials used, as well as treatments for special finishing | - capacity for technological processing<br>- power for modulation<br>- it can deform itself and come back to the original form |
| **8.** | Knowledge function | The capacity of the product to make itself known to potential users; any product can be known from its own characteristics and also from the information from labels, logo, package | - advertising<br>- has information about the product<br>- allows the producers identification |

The level of importance of common functions is different. This difference is determined by the destination of the product (casual clothing, for special occasions, for protection, for sport or free time etc.), the age and sex of the user (new born, children, teenagers, women, men, etc.), season (summer, winter, spring- autumn).

Any mean used to project, evaluate or improve the quality of a product, is based on the settings for the technical dimensions of the functions of that certain product, that represents its quality characteristics. They are taken into consideration in the designing stage as well as in the actual making of the product and the testing faze.

### 3. SPECIAL FUNCTIONS CREATED FROM INTELIGENT TEXTILE PRODUCTS

One problem that the industry is dealing with today is the extremly big competition and one of the solutions is finding some ways in witch certain development oportunities. A lot of the specialised companies have dedicated a lot of time to the imp rovement of products and processes, witch now is not enough. In thins context, after the technical and functional textiels, the most recent developments in this aerea indicate the emergence of intelligent textiles, that represent a group of products with numerous inovative aplications.

Inovation in this field has reached, in the last couple of years, unsuspected shares. It's not only about advanced textiles, with multifunctional destinations (clothing, environment protection, geo - textiles etc.) or the ones with special features (antiballistic, chemical protection, biological etc. ), that are considered passive systems, but about materials or structures that "feel" and react to external stimulus of mechanic, thermo, chemical, magnetic nature etc.

Their existence has been made possible thanks to the progress not only in the field of textile technologies but also in other fields that deal with bio -technologies, nano-technologies, informatics, micro- electronics, etc.

***Intelligent materials***

The concept of intelligent materials (orig. "smart materials") first appeared in 1989 in Japan , being used to define materials that show a dinamic behavior, modifing it's properties under the influence of an external factor. ( figure 1).

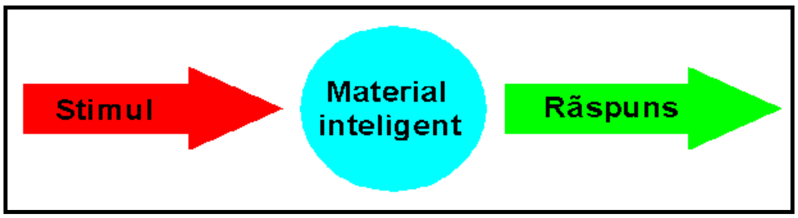



**Figura 1.** Comportamentul dinamic al materialelor inteligente

Based on some recommendations from specialists, the smart textile materials, based on thei behavior, from the moment of receiving the stimulus until the moment of the answer, can be grouped in:

- passive "smart materials" , that act only as sensors for the environmental factors or external stimulus
- active "smart materials" , that" feel" the stimulus and react( controllably) to o be their action
- adaptable "smart materials" considered to be very intelligent, that have the pow er to perceive impulses or external signals and react to them, adapting their behavior to the given circumstances.

Any kind of smart material requires the existence of a sensor and up to now, the biggest progress is made in the field of the passive smart m aterials, type sensors.
In some cases the modifications are visible but sometimes, they are made at a molecular level, making them completely invisible for the human eye.

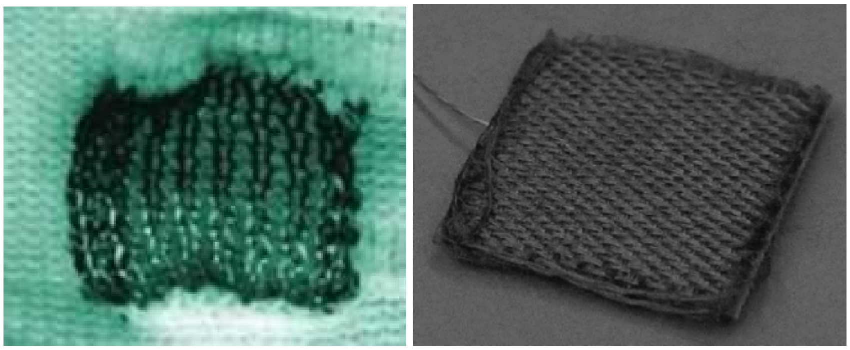
***The use of sensors included in the smart materials from the medical field***

One of the fields in which these materials find their use is the medical one and can represent an alternative to the conventional medical equipment that exists today.

With the integration of textile sensors in the clothing products, can serve for the monitoring of vital signs and the position or moves of the body, measurement/registration, of parameters, like: and temperature, heart beat, brain function, digestive system, joints, ultrasounds( that can characterize sanguine flow), biologic and chemical parameters, r adiations, smells, sweat ,mechanic and electric parameters of the skin.

One of the smart clothing materials that have textile sesnors was made during the "Intellitex" project that took place at the Gent University (Belgium) with the colaboration of special ists in textiles, electronics and paediactrics. It's final result was the "Intellitex" costume for long term monitoring of babies.

The textile material, that is a knitted structure, encompasses sensors and acts as a signal carrier. The sensors have been p rojected to monitor the cardiac rhythm, electrocardiogram and respiration. These biosensors, called “textrods” represent the different zones and are made from steel fibers (Figure 2.)



a) Knitted electrod b) Textrode ( 3cm x 3cm)

**Figure 2.** Knitted electrod and Textrode

The “intarsia” knitted technique makes their incorporation in the knit to lead at a corresponding contact with the skin, so that the signals can be taken directly. Also, the costume is considered to be comfortable, safe, wearable, with maintenance possibilities.

**4.CONCLUSIONS**

- “smart materials” are e main objective in research, that have various applications
- this tendency represents an answer to the requirements concerning the continuous improvement of quality from materials with special destination( medical,protection equipment, technical articles)
- until the present, the biggest progress were made in the passive smart products from the sensors type.

**5. REFERENCES**


1. Brad, R. (2001). *Îmbrăcămintea inteligentă*, Rev Română de Textile – Pielărie, nr.2/2001, ISSN 1453-5424
2. Mărculescu, D. (2002). Challengesand Opportunities in Electronic Textile Modeling and Optimization” Proc. ACM/IEEE Desing Automation Conference (DAC), New Orleans .

ANNALS OF THE UNIVERSITY OF ORADEA
FASCICLE OF TEXTILES- LEATHERWORK
Volume I, 2010, No. 2

# TESDG3 – PROGRAM FOR CALCULATING FABRIC WEIGHT WITH LONGITUDINAL STRIPES

**Oana Dorina, Oana Ioan, Kenyeres Florentina, Simon Anca**

*University of Oradea, Romania*

Corresponding author: oanaioanpavel@yahoo.com)

***Abstract:*** The program for design striped of woven fabric specialized in design of fabrics, that stripes are obtained by combination of wires groups with density, fineness and different links.
***Key words:*** program, program TesDG3, displays a window

## 1. INTRODUCTION

After startup program that can run on any compatible PC, a computer with a Windows operating system, on a desktop wallpaper will be displayed on the main window of the program window that contains the main program options (Figure 1).

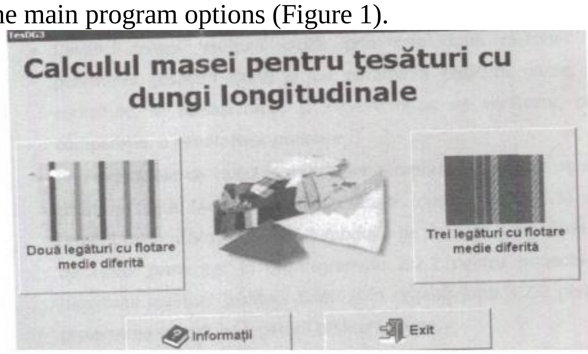



**Figure 1** The calculation of fabric weight with longitudinal stripes

After loading the main program window, the user can select options offered by the program wants to achieve their purpose. These options will be presented in logical order of selection but may be selected by pressing the displayed buttons. Return to the main window will be, generally by displaying an OK button, if the results of operations performed in the current window will be retained, or by pressing a button to drop the noted case the results of operations performed i n the current window will be kept , or by pressing a button denoted by abandonment, where the results of performed operations in the current window will be ignored. To make easier this work, it has been tried a standardization of operations (each window h ave an OK button and eventually an abandonment button, having similar effects).

The main options of the program, which can be accessed by pressing the four buttons are:

1. two links with different average float - will perform calculations for a fabric produce d by the combination of the two links, one for background and one for stripes;
2. with three floating-ups with different average float - will perform calculations for a fabric produced by the combination of three links, one for background and the other two fo r striped background;

3. information - selection by clicking Information button, this option will cause the screen to display a window containing information about program authors and year of development program, by pressing the OK button to return to the mai n window;
4. exit - selecting this option by clicking Exit button, will take affect the end of the implemented program TesDG3.

## 2. THE TWO FLOATING LINKS WITH DIFFERENT AVERAGE OPTION

By selecting this option, the user can enter initial data and calculations for a fabric, composed from two links. By pressing the button which select that option on the screen, will appear a next window (Figure 2).

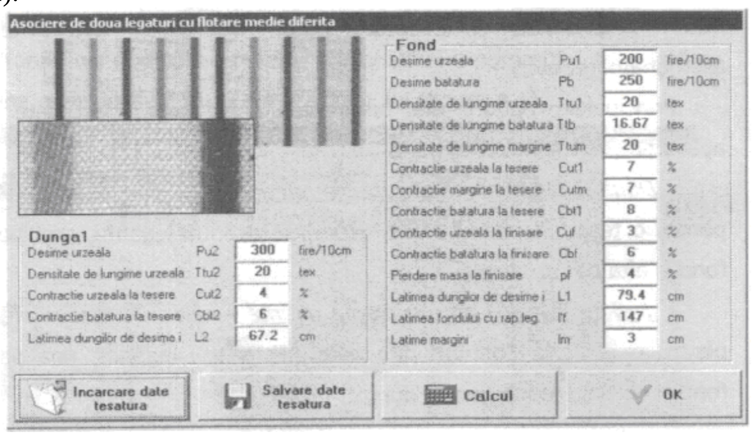



**Figure 2.**

The displayed window will be introduced the necessary data calculations after:

- pressing the data saving button, for fabric, the entered data will be saved in a file on disk. This displays a window (Figure 3) with which the users can assign a file name and select the directory where the data saving will take place.

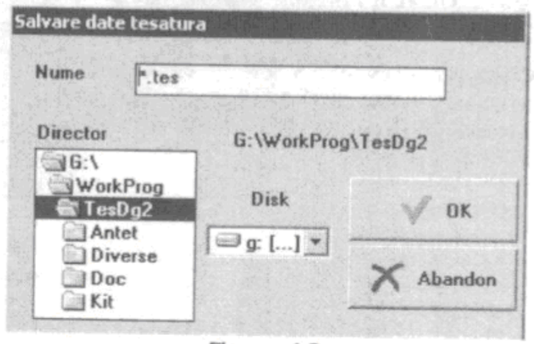



**Figure 3**

- pressing the Upload button of fabric data, previously entered data will be recharged. This displays a window (Figure 4) with which the user can select the file, containing the data they wish to upload

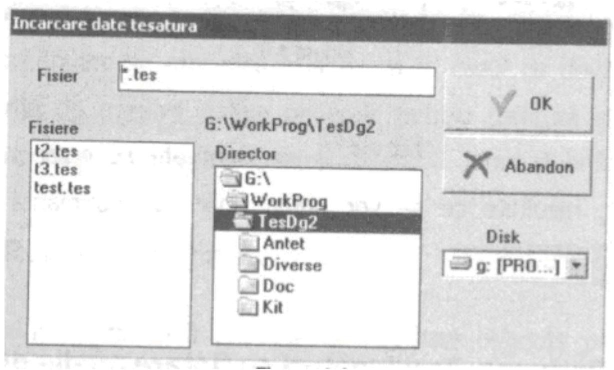



**Figure 4.**

To make the calculations, the required data must be loaded from a previ ously saved file from the disk. Pressing the Calculation button, it will display a window (Fig. 5) containing the information necessary to perform calculations.

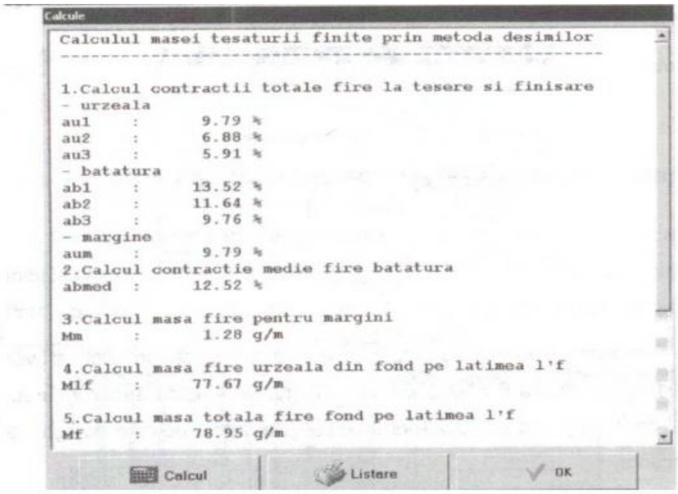



**Figure 5**

Pressing the calculation button, will be displayed on computer screen the calculat ion results, which we will be able to be printed with the printer by pressing Print button.

## 3. THE THREE LINKS WITH DIFFERENT AVERAGE FLOATING OPTIONS

By selecting this option, the user can enter initial data and calculations for a fabric composed from three links, in a similar manner to the previous. By pressing the button which select the option on the screen will appear the following window (Fig ure 6).

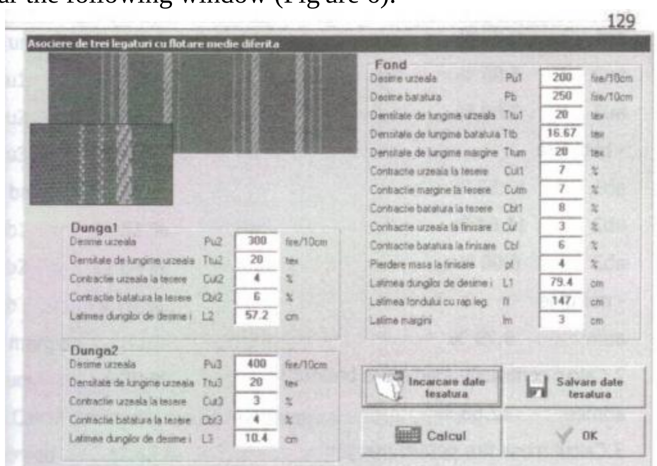



**Figure 6**

Continuously is still proceeding as in the case of the two links, making sure to save fabr ic general data and reload them for calculations

.

## 4.RESULTS

We present two examples of obtained results for the two types of fabrics. Original data used are those displayed in the windows above these options.

Result no. 1 (two links)

Finished fabric wei ght calculation by densities method.

1. calculating the total contraction in weaving and finishing yarn

- texture

au1=9,79%

au2=6,88%
au3=3.00%

- callosity
  ab1=13,52%
  ab2=11,64%
  ab3=6,00%
- border
  aum= 9,79%

2. calculating the average shrinkage yarn callosity
   abmed: 12,66%
3. calculations of the leads mass to edges
   Mn:1,28g/m
4. calculating the mass of warp threads run across the width l ′f
   M1f: 75,37g/m

5. calculating the total mass of substantive wire width l ′f
   Mf: 76,64g/m

**5.** calculating total mass of warp yarn
Mu: 77,92 g/m

**6.** callosity yarn mass calculation
Mb: 68,71 g/m

**7.** calculation of total tissue mass
Mt: 146,63 g/m

Result no. 2 (3 links)

Finished fabric weight calculation by densities method

1. Calculating the total contraction in weaving and finishing yarn

- texture
  au1=9,79%
  au2=6,88%
  au3=5,91%
- callosity
  ab1=13,52%
  ab2=11,64%
  ab3=9,76%
- border
  aum= 9,79%

5. calculating the average shrinkage yarn callosity
   abmed: 12,52 %
6. calculation of the leads mass to edges
   Mn:1,28g/m
7. calculating the mass of warp threads run across t he width l′f
   M1f: 75,67g/m

8. calculating the total mass of substantive wire width l ′f
   Mf: 78,95g/m

**8.** calculating total mass of warp yarn
Mu: 80,22 g/m

**9.** callosity yarn mass calculation
Mb: 68,60 g/m

**10.** calculation of total tissue mass
Mt: 148,83 g/m

## 5. CONCLUSIONS

The program contains two options:

1. programming with two striped fabrics with different links;
2. programming fabrics with three stripes with different bands links.

so that the program is interactive, the data entry replacement is necessary in case, is amended automatically and others, maintaining the correlation between them permanently establishment in the algorithm calculation and design.

The algorithm calculation is conceived such all technical parameters and structure, both basic and those who are auxiliary related, through a mathematical relationship which describes the internal structure of the fabric components and their interdependence in connection determinative type.

## 6. REFERENCES


1. Chinciu,D. – Bazele proiectării ţesăturilor, ediţia a II-a, Editura MEGA – MIX, Iaşi, 2003
2. Chinciu,D., Chinciu, G.C. – proiectarea ţesăturilor, vol.I, Editura MEGA – MIX, Iaşi 2003
3. Leites, L.G., - crearea modelelor pentru ţesături lucrate pe războiul cu iţe, Editura tehnică, Bucureşti 1960
4. Chinciu, D., Chinciu G.C., - metoda corelaţiei desimilor pentru proiectarea ţesăturilor cu dungi longitudinale, publicat în revista Română de textile nr.1 -2, 1997, p.49
5. Chinciu, D., Ciubotaru, G., Chinciu G.C., - Proiectarea asistată de calculator a desenelor de îmbinare legătură – culoare. Publicată în volumul: -(6#)
6. Chinciu,D., Oana D., - Proiectarea ţesăturilor cu dungi longitudinale obţinute prin asocierea de dungi, Editura MEGA – MIX Iaşi, 2004
7. Chinciu,D., Oana D., - contribuţii la stabilirea corelaţiilor între compon entele raportului legăturii pentru ţesături cu dungi longitudinale. Buletinul Universităţii Tehnice Gh. Asachi Iaşi fascicola 1-2/2005
8. Coiară, L. – Structura ţesăturilor, Editura Performantica, Iaşi 2001

ANNALS OF THE UNIVERSITY OF ORADEA
FASCICLE OF TEXTILES- LEATHERWORK
Volume I, 2010, No. 2

# GENERAL ASPECTS BETWEEN PARAMETERS AND TEXTILE MATERIALS DURING ULTRASONIC WELDING

**Aurel POPP**[1]

[1] *Technical University"Gheorghe Asachi" , Faculty of Textile and Leather Industrial Management, Iaşi, ROMANIA*

Corresponding author: Popp Aurel E-mail address: aurelpopp@yahoo.com, apopp@tex.tuiasi.com

***Abstract*** The welding ability of a thermoplastic polyethylene material with ultrasound was investigated after determination of its properties. It was shown that at 22.72 kHz, maximum heating occurred at 50°C. Subsequent tests were thus carried out at this temperature. Temperature needs to be measured continuously during the welding operation as the integrity of the weld depends on the core temperature. Since conventional methods using probes or adhesive indicator strips are disrupted by ultrasound (US) vibration, the integrity of the weld obtained by US was compared to that obtained by friction welding at a given temperature under the same conditions of pressure with the same peeling performance and with the same temperature variation after welding, measured by the infrared (I.R.) thermometer. The highest peeling forces were found when the welding temperatures exceeded that of the melting point (150°C) of the hard segments in the polymer.
The interactions occurring during welding were found to depend on the temperature. At temperatures below 150°C, the peeling resistance only derived from entanglements of flexible segments at the interface of the fabric. At temperature of 150°C and above, melting and mixing of hard segments produced total cohesion of the two fabrics resulting in an enhanced peeling force.

***Keywords:*** ultrasonic welding; thermoplastic polyethylene material; friction welding; temperature; stress distribution.

## 1. THE INFLUENCE OF PARAMETERS DURING WELDING

### 1.1. Temperature distribution in the welded materials

As presented in the abstract sections of this paper, a study was carried out and the results are presented in this paper. The interface temperature obtained in study is 156.816 °C for a clamping force of 20N for polyethylene work piece at the end of weld time ( Fig.1). It shows that heat affected zone is more on the deformation area which is below the sonotrode. Also, it shows the distribution of temperature at the end of weld time on the anvil and sonostrode.

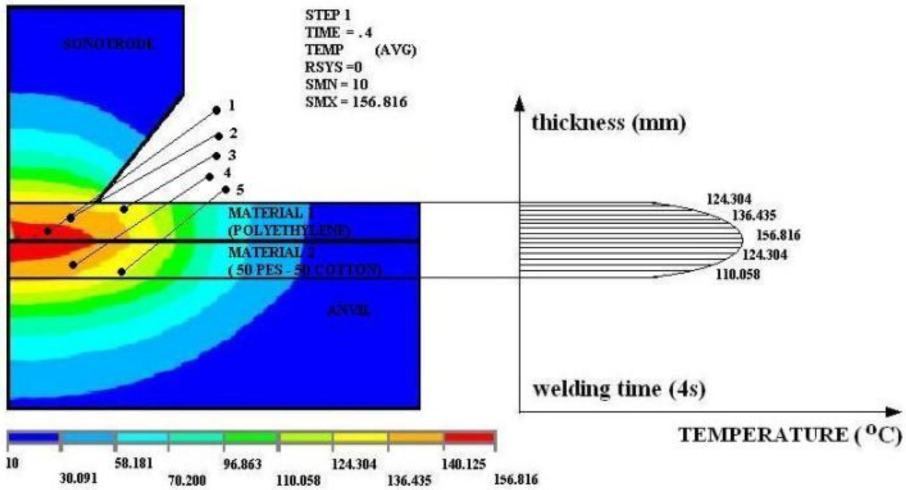



**Figure 1.** Temperature distribution in the textile material at 20N clamping force and 0.4 s weld time (Polyethylene).

In the (Fig.2) is shown the variation of temperature with thickness of the textile materials. It is observed that the variation of temperature from weld interface to top surface of the textile materials is around 58 °C along the vertical direction. This observation can be used to predict the ar ea in Y-direction.

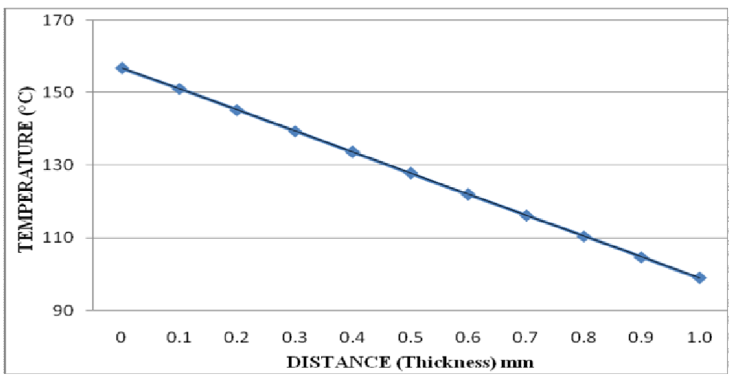



**Figure 2.** Variation of temperature with thickness of the textile material.

Variation of temperature along the interface of the textile material at the end of the welding time is plotted in (Fig.3). From this, it can be concluded tha t the heat affected zone in the weld is u p to a distance of 30 mm in X-direction. This depends on the thermal conductivity of the material and the gap between the work materials. In the (Fig.4) is shown the temperature generation at the weld interface in each time step during welding. From this, it can be concluded that the variation of temperature during welding is proportional to the weld time.

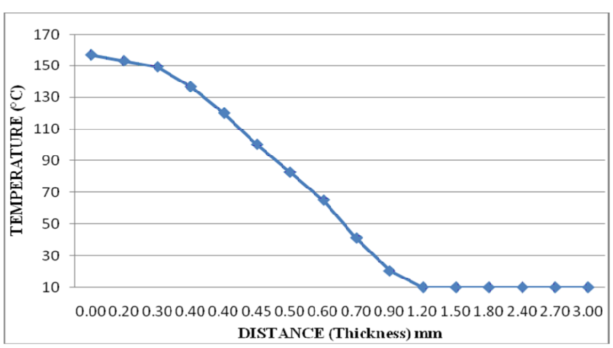



**Figure 3.** Variation of temperature at the interface along X-direction.

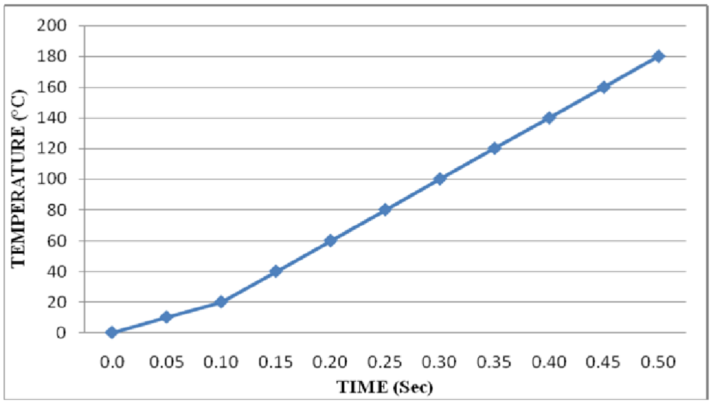



**Figure 4.** Variation of temperature depending on the welding time.

### 1.2. Stress distribution during ultrasonic welding

The stress distribution in the anvil, sonotrode and work materials is shown in (Fig.5) for polyethylene. It can be seen that the work materials are moving away from the anvil during welding. It is due to the inappropriate pressing method followed to hold the work piece on the anvil. So, proper fixture design is needed depending on the geometry of the work piece and the type of the joint.

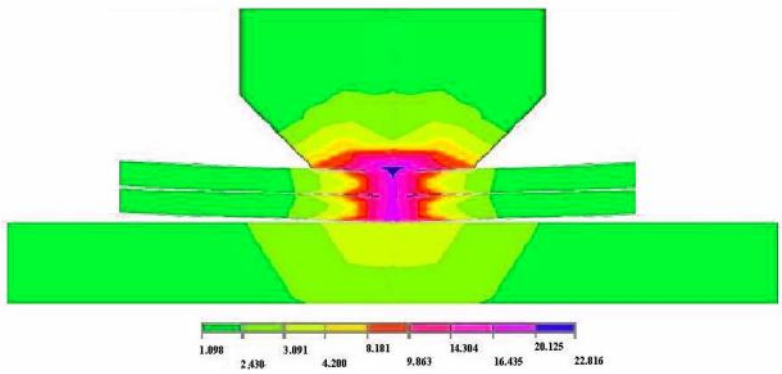



**Figure 5**. Stress distribution for Polyethylene material at 20N pressing force and 0.4 s weld time.

## 2. THE EFFECTS OF PARAMETERS DURING THE WELDING PROCES

### 2.1. The effect of the pressing forces during ultrasonic welding

The temperature generated for different pressing forces for polyethylene work piece at the end of weld time (0.4 s) is shown in (Fig.6). The temperature generated at the interface depends on the weld force, and it is a function of yield strength and pressing force. Increase in pressing force results in decrease in weld force which leads to low heat generation. In other words, when clamping force is higher, materials will be pressed rather than welded.

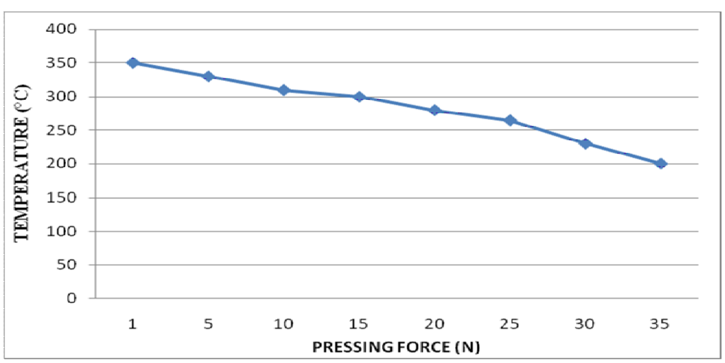



**Figure 6.** Variation of temperature in material with pressing forces during ultrasonic welding.

### 2.2. The effect of material thickness during the ultrasonic welding

A work piece whose thickness is more than 3 (mm) is difficult to weld using ultrasonic material welding because of poor heat generation at the weld interface. Increased power is necessary to vibrate the welding machines parts. The heat generation at the interface for different thickness values of the materials is shown in (Fig.7). It can be inferred that the temperature generated decreases depending on the thickness of work piece. Diffusion of heat also may be attributed to this observation.

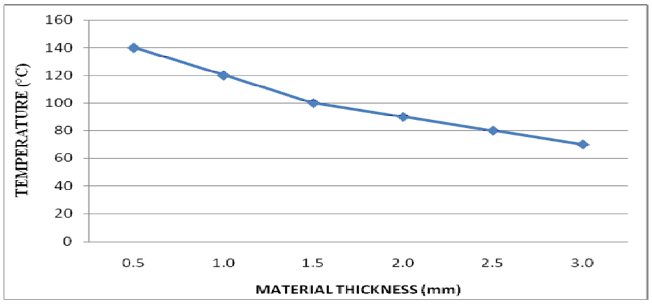



**Figure 7.** Variation of temperature in material with different thicknesses during ultrasonic welding.

### 2.3. The effect of the coefficient of friction during ultrasonic welding

The variation of temperature with coefficient of friction is shown in (Fig.8). This variation seems to be linear, different coefficients of friction are taken into account for a thickness of 1 mm (polyethylene materials) to analyze the variation in temperature. The coefficient of friction depends on the surface roughness of material used for welding. Presence of films on the surface which reduce friction may lead to poor generation of heat.

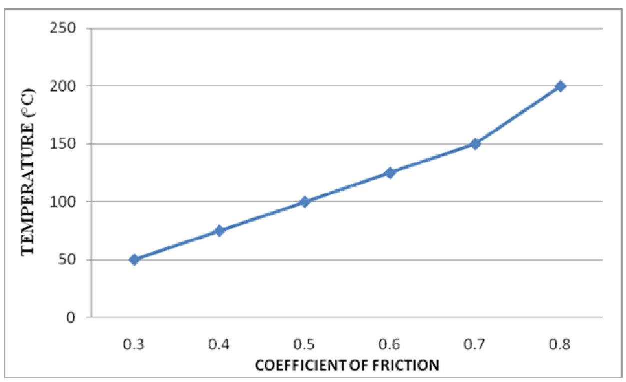



**Figure 8.** Variation of temperature in materials with different coefficient of friction during ultrasonic welding.

### 2.4. The effect of temperature and stress distribution in the sonotrode

The temperature during welding and the behavior of temperature distribution in sonotrode is shown in (Fig.9). From this it can be inferred that heat affected area on the sonotrode is small, because of the poor conductivity of the sonotrode material (steel), compared to the thermal conductivity of the textile materials.

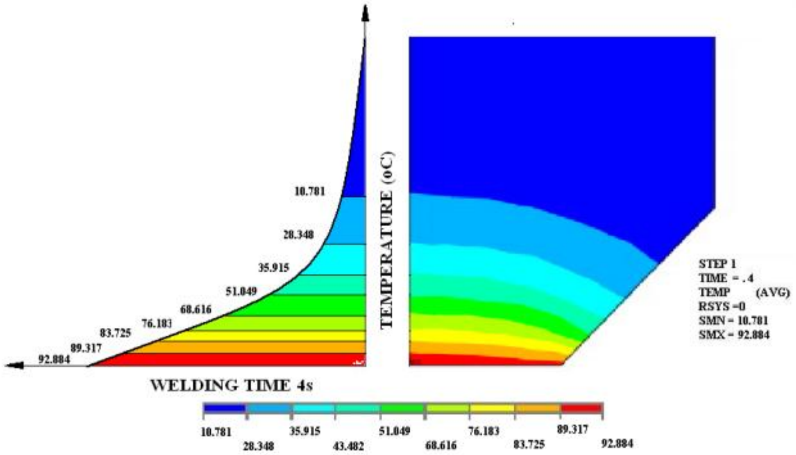



**Figure 9.** Temperature distribution in the sonotrode at 20N pressing force and 0.4s weld time.

Variation of temperature in the sonotrode tip at the end of the weld time is shown in (Fig.10). From this, it can be noticed that the temperature difference along the vertical direction of sonotrode is about 20°C. The difference between the maximum and minimum te mperature in the sonotrode tip area is less because of the smaller tip area of the sonotrode. The stress variation at the sonotrode is shown in (Fig.11).

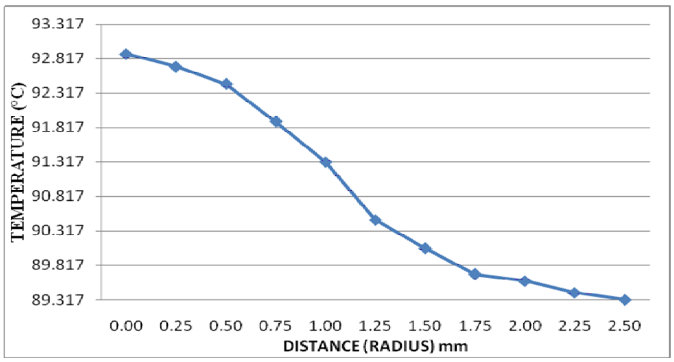



**Figure 10.** Variation of temperature in sonotrode along the radius.

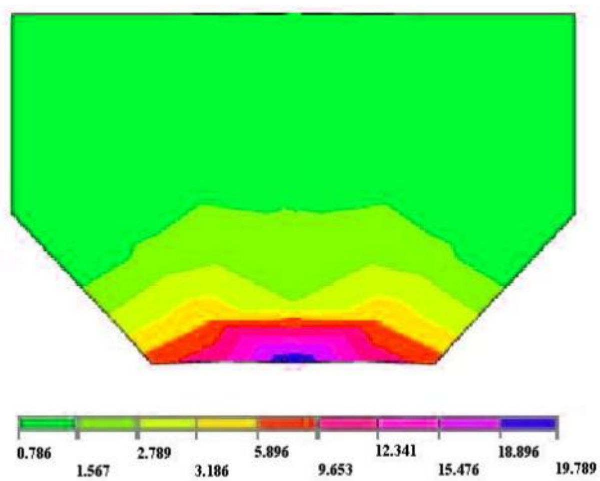



**Figure 11**.Stress distribution in sonotrode at 20N pressing force and 0.4 s weld time.

## 3. CONCLUSIONS

This experiment based on a model for ultrasonic textile welding has been developed, because it can predict the temperature developed during welding process with parameters like material thickness, pressing force, weld time and coefficient of friction. This experiment, based on the forces and temperatures that occur during welding is applicable for a wide variety of ultrasonic welding problems. The limitations are given by the particular geometry of the sonotrode surface. In this case, a knurled flat sonotrode was used, which made it possible to use the stress states to calculate the yield condition.

This model explains the influence of material properties and surface conditions as well as process variables such as amplitude of vibration and normal force on the weld behavior. It can also be understood from the study that concentration of temperature is more near to the material than the sonotrode, owing to the fact that more heat is generated in the material where ultrasonic energy is focused. This temperature distribution decreases progressively as the periphery of the material is reached. It is clear that as the weld time increases the temperature at the weld interface also increases. It may be inferred that increased weld time is needed for joining materials of more thickness as the vibration of heavier parts needs more energy.

It is noticed that pressing force plays a major role in the deformation area resulting in increasing the force in weld area. As pressing force increases the temperature generated at the interface decreases, leading to deformation on the work piece interface rather than welding. There fore, optimum selection of pressing force is necessary for obtaining good weld without deformation.

## 4. REFERENCES


1. Daniels, H.P.C.(1965). *Ultrasonic welding*, J. Ultrason, 1965.
2. Hazlett, T.H. & Ambekar, S.M.(1970). *Additional studies on interface temperatures and bonding mechanisms of ultrasonic welds*.
3. Preda, C (1971). *Cercetari privind sudarea cu ajutorul ultrasunetelor a tesaturilor din fibre poliesterice in amestec cu celofibra*, Buletinul IP,tomul XXI, fasc.1-4, Iasi.
4. Iosif, I. (1982). *Ultrasunete si utilizarea lor*, Ed.Stiintifica si enciclopedica, Bucuresti.
5. Ford, J.E. (1987). *Plastics and Textile,* Textiles, vol.16, nr.2.
6. Loghin, C., Mitu, S. (1998). *Thermal Analyses for the Welding Process of the Lamineted Fabrics*, International Conference TEXSCI'98, Liberec.
7. J.H. Lienhard, I & J.H. Lienhard V.(2006). *A Heat Transfer Text Book*, Phlogiston Press, Massachusetts, U.S.A.

ANNALS OF THE UNIVERSITY OF ORADEA
FASCICLE OF TEXTILES- LEATHERWORK
Volume I, 2010, No. 2

# METHODS FOR MEASURING GARMENTS COMFORT AND INFLUENCE FACTORS IN TACTILE COMFORT

**Viorica Porav, Liliana Doble**

*Oradea University, Textile and Leather Faculty* viorica.porav@gmail.com

*Oradea University, Textile and Leather Facutly* liadoble@yahoo.com

***Abstract**:* comfort properties of apparels can be quantified in an objective manner in terms of the properties of non-sensorial comfort characteristics, and an subjective manner of sensorial comfort characteristics. In this paper, is presented a method witch help to bridge the gap between material testing measurements and human measurements and, micro-environment influence. The state of physical comfort experienced by wearer under a given environmental condition is greatly influenced by the tactile, thermal and moisture transport properties of the fabric. The analyses of the transport attributes ( air, permeability and mois ture and thermal transport ) of the fabric has been derived to grade and use efficiency of the fabric juxtaposing with would finally decide the overall quality of the apparel fabric. The clothing comfort is a multicriteria phenomenon that requires the simu ltaneous satisfaction of several criterion measured by " Fabric Assurance by Simple Testing " instruments to optimize the combination of primary handles.
***Keywords***: Clothing comfort, Clothing comfort perception, Mechanical comfort, tactile comfort, influenc es factors in comfort.

## 1. INTRODUCTION

With all protection characteristics being equal, however, the garment comfort becomes a key factor in gaining wearer compliance and in guarding heat stress injuries. Because, again, a garment that is modified to be more comfortable, or a garment that is not wrong because it is uncomfortable, creates a dangerous situation. There are numerous methods for measuring the protection garment offers, but the issue of comfort has been more difficult to measure quantitatively. Some researchers are now using a new method for measuring garment comfort. This method measures the micro - environment inside the protective suit, assessing the humidity and temperature of the thin layer of air that closely surrounds the body. The micro -environment is a more useful indicator of how a user perceives comfort when wearing a suit, than other analytical method traditionally used to study the materials breathability.[1,2]

Clothing comfort, being a fundamental and universal need for consumers, is defined as a pleasant state arising out of physiological, psychological and physical harmony between a human being and the environment .

Clothing comfort is classified into three broad categories : (a) aesthetic comfort, (b) thermo - physiological comfort and (c) tactile comfort. Aesthetic appeal or psychological comfort is mainly based on subjective feelings and fashion trends that influence customer preferences .On the other hand, thermo-physiological comfort relates to the ability of the fabric to maintain thermal equilibrium between the human body and the environment. Thermal moisture and air resistance properties of the clothing material collectively contribute to the state of thermo -physiological comfort of the wear.

The tactile comfort is related to mechanical interaction between the clothing material and the human body is an intrinsic and essential performance requirement in clothing. Although the fabric tactile properties have long being evaluated by a subjective method called fabric handle, it has bee n demonstrated in recent years that these are quantifiable in terms of physical measures. Most recently, major upsurge on research on friction of fabric has taken place, as friction plays an important role on the hand of fabrics. Hence, the hand value toge ther with the measured transport properties will determine the true quality of apparel fabrics.[3]

Because the comfort is a subjective notion it is difficulty to find an efficient method permitting to optimize this perception in spite of attempts of some r esearchers. In fact the textile industry lacks an objective approach for determining the comfort level.[4]

Besides, it is generally easier to determine the different physical properties that affect the comfort separately. These measured properties separate ly do not give a lot of information to the consumer when using the textile product, from where the necessity of a global optimization method by the measure of different components of the clothing comfort.

The role of thickness and fabric mass per unit area on comfort characteristics of fabrics is very important for tactile comfort.[1,4]

Fabric is an assembly of yarns and/or fibers and is composed of fibers. Textile fabrics can be grouped into three categories : woven, knitted and non -woven. Woven and knitt ed fabrics are made from yarns, and the hand and the comfort of these fabrics are determined by the properties of yarns and the structure of the fabric.[1,4]

The comfort is considered as fundamental property when a textile product is valued.

## 2. GENERALS INFORMATIONS

The comfort characteristics of fabrics mainly depend on the structure, types of raw materials used, weight, moisture absorption, heat transmission and skin perception. The clothing comfort can be divided into three groups: psychological, tactile and thermal comfort. Psychological comfort is mainly related to the aesthetic appeal, which includes size, fit, colour, luster, style, fashion compatibility, etc. Tactile comfort has a relationship with fabric surface and mechanical properties. Thermal co mfort is related to the ability of fabric to maintain the temperature of skin through transfer of heat and perspiration generated with the human body. There are two aspects of wear comfort of clothing: thermo physiological wear comfort which concerns the h eat and moisture transport properties of clothing and the way that clothing helps to maintain the heat balance of the body during various level of activity, and skin sensorial wear comfort which is based on the mechanical contact of the fabric with the ski n, it is softness and pliability in movement and its lack of prickle, irritation and cling when damp. (fig.nr.1)[1,5]

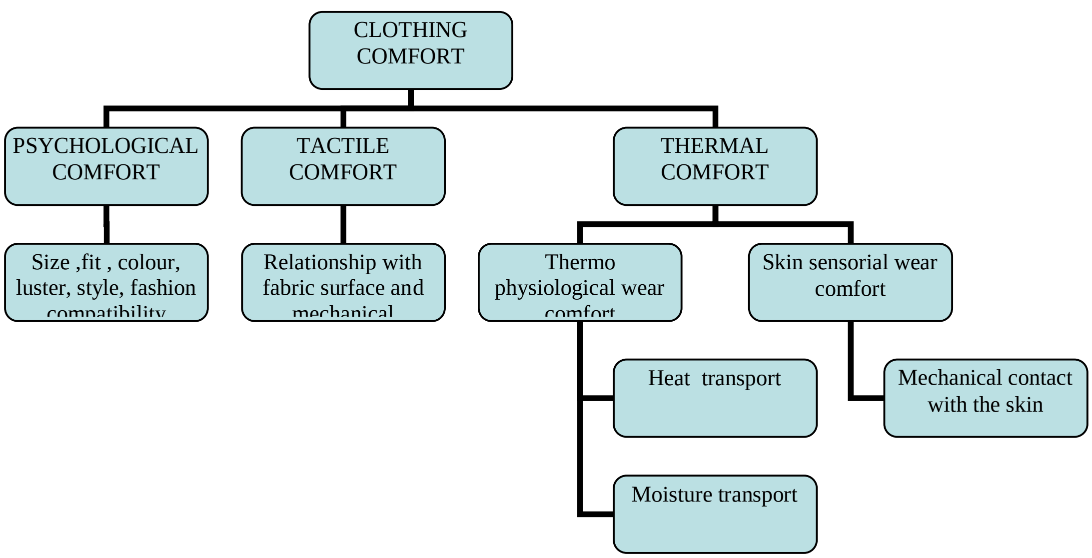



**Figure 1.** Clothing confort

Basically, clothing comfort ca be categorized under two broad components: sens orial comfort and non-sensorial comfort.[1,5]

### 2.1 SENSORIAL COMFORT

Sensorial comfort is a perception of clothing comfort which is sensory responses of nerves ending to external stimuli including thermal, pressure, pain, etc. producing neuro -physiological impulses which are sent to the brain. This signals are responded suitably by adjusting the blood flow, sweating rate or heat production by shivering. These sensory signals are processed by the brain to formulate subjective perception of sensations, which are clustered as follows:(fig.nr.2 SENSORIAL COMFORT)

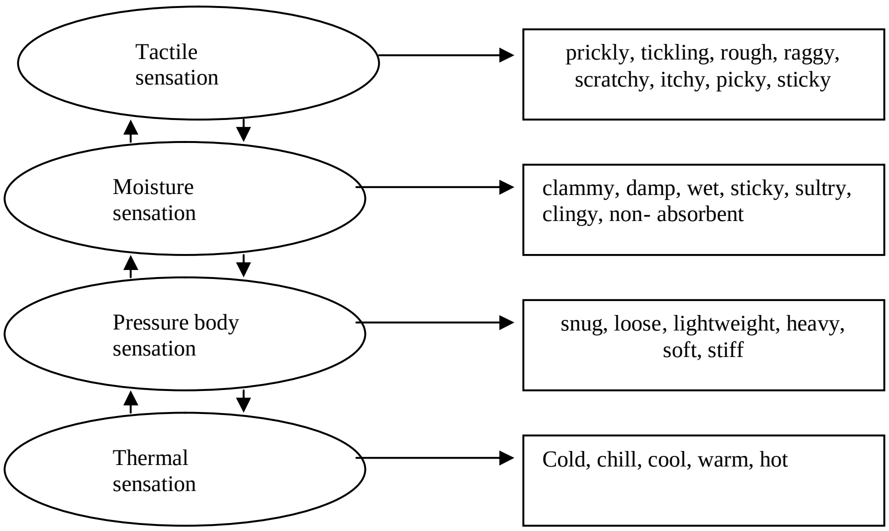



**Figure 2.** Sensorial confort

The skin sensorial wear comfort is based on the mechanical contact of the fabric with the skin . In the literature [4] , the two terms "f abric hand" and "comfort" are used with the following definition are given:

- Hand can be defined as * the perceived aesthetic quality of a fabric.
  * the quality of a fabric assessed by the sense of t ouch concerned with the subjective judgment of roughness, smoothness, harshness, pliability, thickness, etc.
  * implies evaluation of fabric reaction to different modes of low stress deformations imposed by the human hand.
  * those components, qualities, attributes, dimensions, properties or impressions which make the sensation of touching one fabric different from that of touching.
- Comfort can be defined as: * phenomenon connected to individual and psychic sensitivity.
  * freedom from pain and from discomfort, a neutral state.
  * a performance parameter relati ng to the wearability of the garment, encompassing such properties as wicking, stretch, hand.

### 2.2 NON – SENSORIAL COMFORT

Non-sensorial comfort basically deals with physical processes which generate the stimuli like heat transfer by conduction, convection a nd radiation, moisture transfer by diffusion, sorption, wicking, and evaporation. It also includes mechanical interactions in the form of pressure, friction and dynamic irregular contact. [1]

Non-sensorial comfort is not only comprised of thermal and moist ure transmission but also includes air permeability, water repellency and water resistance.

The resistance that a fabric offers to the movement of heat through it is of critical importance to its thermal comfort. The thermal insulation properties of garmen ts during wear, it is reported that thermal resistance to transfer of heat of the body to the surrounding air is the sum of three parameters: the thermal resistance to transfer heat from the surface of the material, the thermal resistance of the clothing material and the thermal resistance of air interlayer.

Air permeability describe the property of fabric to let through air. In outdoor clothing it is important that air permeability is as low as possible because it should function as a wind protection.

The water vapour permeability of fabrics is an important property for those used in closing systems intended to be worn during vigorous activity. The clothing must be able to remove the moisture in order to maintain comfort and reduce the degradation of therma l insulation caused by moisture build-up in cold environment.

## 2.3. TRADITIONAL GARMENT COMFORT MEASUREMENTS

Material comfort characteristics are typically measured by two methods: 1) "Air Permeability", who measure the rate and volume of air flow through fabr ic. Under controlled conditions, a suction fan draws air through a known area of fabric ( the volume of air that passes through the fabric over the duration of the test), and 2) " Moisture Vapor Transmission Rate", who determine the rate of vapor movement through a fabric sample.

However, some tests involving human subjects. Traditionally, testing garment on human subjects, requires measure core temperature and heart rate.

## 3. INFLUENCE FACTORS – YARN AND STRUCTURE

Keeping all the yarn and fabric paramet ers the same and by only changing the fiber properties viz micronaire value, the changes brought about in the low stress mechanical properties of the yarn and fabric were extensively studied.[3].

As yarn are woven into fabric, flexibility remains one of th e most important attribute of the fabric. Analysis of the bending properties showed that yarns and fabrics made up of finer fibers exhibited lower bending rigidity (B ).( fig.nr.3) In other words, yarns and fabrics stiffened with increase in coarseness (hi gher micronaire value) of the fibers. The ratio of the coercive couple to the bending rigidity (B), represent the curvature remaining in a yarn when the bending couple has been removed Thus a smaller value of the bending rigidity would imply better recover y. With increasing micronaire value of the fiber used, fabrics (cotton) showed a decrease in the ratio of coercive couple to bending rigidity and a better bending recovery. A lively fabric is expected to have low bending rigidity value. Therefore fabrics w oven using finer fibers would be less lively and would not recover quickly from gentle crushing. Thus, fineness of single fibers stands out as an important factor contributing to yarn and fabric bending properties. The resiliency of the yarn and fabrics (R ) Improved with increase in fineness of the fibers.[3]

The yarn parameters that influence the aesthetic elegance, handle and comfort performance of the fabric are mainly yarn twist and yarn count. It was observed that changing only the yarn twist, keeping all other properties of the yarn and fabric the same, was able to bring about significant changes in the low stress mechanical properties of the fabric.

The measure of fabric "formability" is equal to the product of fabric bending rigidity and longitudina l fabric compressibility and extensibility.

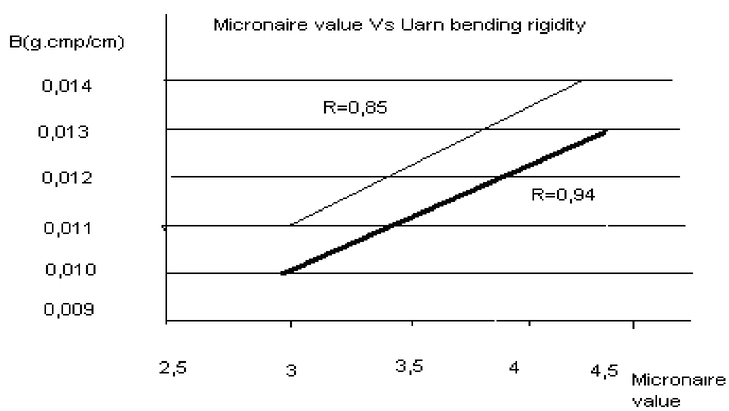



**Figure 3.** Fiber micronaire value vs. yarn bending rigidity

Change in weave from plain to will was observed to bring about significant changes not only in the low stress mechanical properties, of fabric thereby influencing the Primary and Total hand values but also played a deciding role in transport behavior of fabrics such as air permeability, moisture permeability and thermal properties.[3]

## 4. CONCLUSIONS

Comfort is purely a subjective criterion. However, it can be quantified in an objective manner in terms of the properties of non-sensorial comfort characteristics. Both, the sensorial and non-sensorial fabric comfort depends on various factors including the type of the material, method of construction of textile substrate, feeling of wearer, impacts due to climatic condition of the environmental and its variations.

A garment with superior micro-environmental characteristics, will minimize the potential for heat stress and result in higher productivity.

That finer fibers converted into yarns of finer count with optimum twist and then into fabrics, would improve the feel in terms of smoothness and softness and hence would provide a better overall grading of the fabric when assessed for garments.

A lively fabric is expected to have low bending rigidity, that means fineness of single fibers stands out as an important factor contributing to yarn and fabric bending properties.

## 5. REFERENCES


1. Mitu Stan (1993) "Confortul si fiziologia produselor vestimentare "Ed. Gh. Asachi Iasi
2. Kimberly Dennise (2003) Garment Comfort-inside the Micro-Environment
3. Sheela Raj, Ssreenivasan, (2009) Journal of Engineered Fibers and Fabrics - India
4. A. Hadj Taieb, S. Msahli, F. Sakli "A New Approach for Optimizing Clothing Tactile Comfort. Journal of Advanced Research in Mechanical Engineering.
5. Dhinakaran M; SundaresanS; Dr.Dasaradan, B.S. (2007) Knitting and Hosiery - "Comfort properties of apparels

ANNALS OF THE UNIVERSITY OF ORADEA
FASCICLE OF TEXTILES- LEATHERWORK
Volume I, 2010, No. 2

# MEASUREMENT OF TEXTILE FIBERS STRUCTURAL CHANGES DURING TECHNOLOGIC PROCESES

**Monica Pustianu, Magdalena Fogorasi, Adina Bucevschi, Alexandru Popa, Erzsebet Airinei**

*University "Aurel Vlaicu" of Arad, Romania*

Corresponding author: Pustianu Monica, pustianumonica@yahoo.com

***Abstract:*** The paper studies the degradation of cellulose materials during technologic processes. Microscopic and chemical analyses were effectuated to establish the cellulose material degradation (qualitative and quantitative methods).
***Keywords****:* degradation, microscopic methods, chemical methods, colour ways, indicating copper.

## 1. INTRODUCTION

Textile fibres may suffer some physical and chemical structure changes during technologic processes. They may appear latent and be detected only in the finished product, or may occur immediately, following a hard treatment, prolong exposure to high temperature, chemical, umido - thermal or photochemical actions.

Degradation may be mechanical or chemical. Depending on degradation and on intensity of damage, the analysis may be microscopic or by chemical reactions.
Mechanical degradation of the fibre caused by processing, such as: stretching, twisting, friction, winding, stowage can be detected by microscopic appearance changing of the fibres and by its behaviour in micro swelling or micro solubilisation.

The mechanical properties of a textile product depend not only on fibre characteristics but also on the product structure. So, using the molecular weight, as process control index is useful for accurate correlation with the mechanical properties of the product, so far as it aims molecular weight variation from raw material to finished product. This parameter can be expressed on a quality scale for raw materials or finished products control or can be used to establish the causes of accidental damage.

Average degree of polymerisation can be used as industrial parameter, as an indicator of quality and allows characterizing the usefulness of the fibres.

## 2. EXPERIMENTAL PART

To establish the cellulose fibre degradation were made microscopic methods and chemical methods.

### 2.1. Materials:

There were used the following wastes for tests:

1. flax tow;
2. flax willow
3. flax tow
4. cottonized-bleached hemp and pre-opend
5. cottonized -bleached hemp
6. weaves waste of jute
7. yarns waste, jute string
8. rests of gunny sack
9. jute fiber down

### 2.2. Reagents:

- 0.02% metiloranje solution in 50% etilic alcohol;
- Nessler reagent;
- RGN Felosan solution 2g / l ;
- acetic acid;
- I Fehling's solution containing 60g of copper sulphate in one liter distilled water;
- II Fehling solution containing 200g/l potassium sodium double tartrate and 100g/l sodium hydroxide;
- Ferric sulfate or alum solution feriamoniacal containing 50g/l respectively ferr ic sulphate 100g/l alum feriamoniacal and 200g/L sulfuric acid.

### 2.3. Microscopic methods

Microscopic results are presented in table 1.

**Table 1.** Microscopic results

| | | |
|---|---|---|
|  flax tow |  flax willow |  flax tow |
|  cottonized-bleached hemp and pre-opend |  cottonized -bleached hemp |  weaves waste of jute |
|  yarns waste, jute string |  rests of gunny sack |  jute fiber down |

### 2.4. Chemical methods

Chemical degradation of cellulose fibers can be investigated by some qualitative methods, quantitative method and average degree of polymerisation method..

Chemical methods are used to determine changes of c ellulose molecule, to determine the causes that produce the damage and to give indications about the degradation degree.

### 2.5. Procedure.

Before determining the presence of modified cellulose is established if it can be identify the presence of foreign substances on fibre or on degraded weave, capable to produce chemical degradation.

For this, we made an aqueous extract (60-70$^{0}$C) of degraded material; we determined the pH, acid and alkali traces and active chlorine traces.

After pH measurement with indicator paper was found that the pH of aqueous extract was from 7.5 to 8.

To detect the presence of acid or alkalis traces on fibre, we use a 0.02% solution of metiloranje in 50% alcohol. This analysis shows that we haven't find acid or alkali traces on fibre, which could contribute at fibre degradation.

Bleached samples have shown no traces of active chlorine.

#### 2.5.1. Qualitative methods

For qualitative determination of cellulose degradation was used the colour reaction with Nessler reagent.

Reaction is based on the property of oxycelluloses with aldehyde groups of reducing complex mercury salts tetraiodomercurat to release the iodine. The presence of oxiceluloses is indicated by the appearance of yellow, orange-brown depending on the degradation intensity. The hydrocellulose become brown only after a very advanced attack. Yellow to orange colour, passing into grey indicates this chemical degradation.

**Procedure**

The samples were first degreased with Felosan RGN solution 2g/l at a temperature of 50 $^{0}$C for 30 min., Hm = 1:20.

After degreasing, the samples and standard samples were dipped in Nessler reagent and were kept on boiling water bath for 10 min. Then samples were washed with water and acidified with dilute acetic acid solute.

The results are presented in table 2.

**Table 2.** Color tests

| Waste | Color | Observations |
|---|---|---|
| flax tow; | Yellow, then gray | Chemical degradation |
| flax willow | Yellow-green, then gray | Chemical degradation |
| flax tow | Orange, then gray | Chemical degradation |
| cottonized-bleached hemp and pre-opend | Yellow-green, then gray | Chemical degradation |
| cottonized -bleached hemp | Yellow-green, then gray | Chemical degradation |
| weaves waste of jute | Orange, then gray | Chemical degradation |
| yarns waste, jute string | Orange, then gray | Chemical degradation |
| rests of gunny sack | Yellow, then gray | Chemical degradation |
| jute fiber down | Orange, then gray | Chemical degradation |

Qualitative tests have shown the degradation in waste samples analysed. This aspect must be considered at process parameters choose.

### 2.5.2. Quantitative methods

Quantitative methods are based on determination of carboxylic groups resulting from oxidative degradation of cellulose. In this case we used the method of determining the index of copper with Fehling's solution.

Copper index is the amount of copper in grams reduced by 100g of cellulose material. The method consists in determination of the number of final aldehyde groups in the fabric, knowing that high content shows a strong degradation of the material.

These groups have the capacity to oxidize with a copper-ammonia solution obtaining a precipitate of cuprous oxide. Cuprous oxide is dissolved in a solution of alum feriamoniacal when monovalent copper goes again in bivalent copper and trivalent iron is reduced to bivalent iron. The ferrous sulphate is titrated with a solution of potassium permanganate.

**Procedure**

One gram of analysed material, weighed with 0.0002 grams precision, is placed in 80 $cm^3$ solution obtained from the mixture of 40 $cm^3$ Fehling I solution and 40 $cm^3$ Fehling II solution, and boil about 3 min. in a beaker of 150 $cm^3$. Then filter the content of the glass with filter paper and wash with hot and cold distilled water.

Well-drained material with the filter paper is bringing back into the cup and adds 25 $cm^3$ solution of ferric sulphate. The glass was shake until all the copper oxide was dissolved and no red spots of cuprous oxide were noticed. If dissolution is not complete it adds a few $cm^3$ of ferric sulphate solution. The glass content is filter and wash again with hot and col d water, then filtrate is titrating with potassium permanganate solution 0.1 n.

The copper index is calculated:

$$I_{cu} = \frac{A \cdot 0,00636 \cdot 100}{m} \ (\%) \qquad \textbf{(1)}$$

were:
- A-the number of $cm^3$ of potassium permanganate solution consumed for titrating 0.1 N
- 0.00636 - is amount of copper in g corresponding to 1cm3 of potassium permanganate solution 0.1 N
- m - the mass in g of material taken in the analysis.

The results are presented in table 3.

**Table 3.** Copper index values

| Sample | sample mass (g) | A (ml) | Copper index (%) |
|---|---|---|---|
| flax tow; | 1,0023 | 4,2 | 2,665070338 |
| flax willow | 1,1001 | 4,5 | 2,601581674 |
| flax tow | 1,0021 | 4,3 | 2,729068955 |
| cottonized-bleached hemp and pre-opend | 1,0056 | 6 | 3,794749403 |
| cottonized -bleached hemp | 1,1003 | 5,8 | 3,352540216 |
| weaves waste of jute | 1,1054 | 4,5 | 2,589108015 |
| yarns waste, jute string | 1,1234 | 4,8 | 2,717464839 |
| rests of gunny sack | 1,0981 | 4,6 | 2,66423823 |
| jute fiber down | 1,1005 | 5 | 2,889595638 |

## 3. CONCLUSIONS

Becouse of the structure of macromolecular chain, cellulose degradation is attributable to:

• reduced stability of the glucosidic linkages between macromolecules elementary rings at chemical action;

• transformation of carbonyl groups or ca rboxylic groups alcohol by oxidation;

• influence of the new functional groups obtained by oxidation about the glucosidic link stability.

## 4. REFERENCES

1. Rusanovschi, M., Dragnea, A. , (1980), *Textile chemical analysis*, vol I, II, Technical Printing House, Bucharest.
2. Iliescu, E., Muresan, R., Muresan, A., (1997), *Quality control process of preparing and superior finishing of textiles*, Dosoftei Printing House, Iassy.
3. Butnaru, R., Bucur, M.S., (1996), *Physical-chemical finishing of cellulose texti les*, Dosoftei Printing House, Iassy.
4. Mihuţa, S., (2000), *Fibers*, Aurel Vlaicu University Printing House, Arad.

ANNALS OF THE UNIVERSITY OF ORADEA
FASCICLE OF TEXTILES- LEATHERWORK
Volume I, 2010, No. 2

# ANALYSIS OF SEAM STRENGTH ON DIFFERENT NEEDLE SIZE

**Mohammad Rafiqur Rashid**[1] **Mohammad Faizur Rahman**[2]

[1] *Department of Textile Technology, Ahsanullah University of Science and Technology (AUST), Dhaka, Bangladesh, rafiqurrashid@yahoo.com*

[2] *Department of Textile Technology, Ahsanull ah University of Science and Technology (AUST), Dhaka, Bangladesh, rashedtex@gmail.com*

Corresponding author: Mohammad Rafiqur Rashid , e-mail: rafiqurrashid@yahoo.com

**Abstract:** Seam is a joint consisting of a sequence of stitches uniting two or more pieces of material and is used for assembling parts in the production of sewn item. In this study different types of seam such as superimposed seam, Lapped seam, Bound seam & Flat seam have been produced using different needle size and ASTM 434 was followed to determine the seam strength. By analyzing all data (e.g. different seam strength, different needle size and different count of yarn) it was found that seam strengt h is higher for Lapped seam but in many cases it exceeds the actual fabric strength. Seam strength is highest for needle size 18 but fabric appearance is not better. It can also be said that needle size 16 is considerable comparing yarn count, needle size & fabric appearance.
**Key words**: seam strenght, needle size,

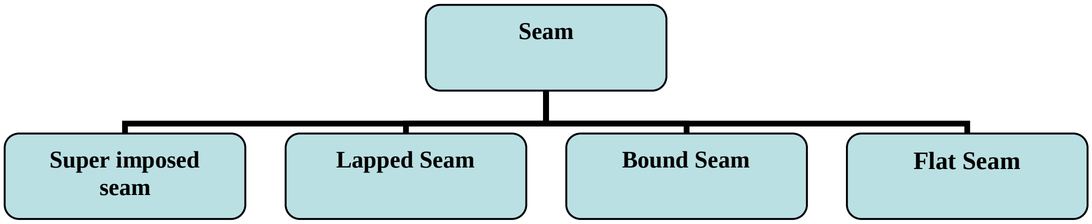
## 1. INTRODUCTION

Seams are formed by sewing two or more pieces of fabric together, but the basis of seam classification is the position of the pieces relative to each other. Many variations in fabric position and treatment are responsible for many different types of seam in each classification. The characteristics of a properly constructed sewn seam are strength, elasticity, durability, security, and appearance. These characteristics must be balanced with the properties of the material to be joined to form the optimum sewn seam. The end use of the item will govern the relative importance of these characteristics. The selection of the seam type and stitch type should be based upon these considera tions. The seam strength of the sewn seam should be as high as possible. This will produce sewn seam strength with a balanced construction that will withstand the forces encountered in the use of the sewn item. The elements affecting the strength of a sewn seam are fabric type and strength, seam type, stitch type, stitch density, threads tension and thread strength. Effect of needle size on seam strength has been studied in this work.

### 1.1 Types of seam:

2. U.S. Federal Std. No. 751a
3. British Standard

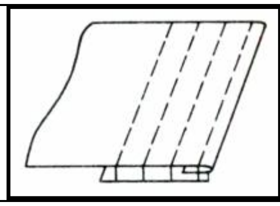
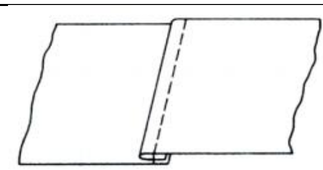
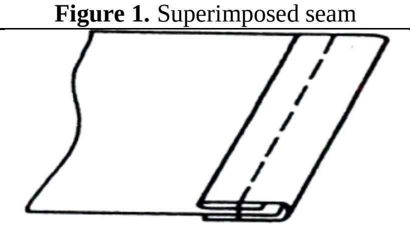
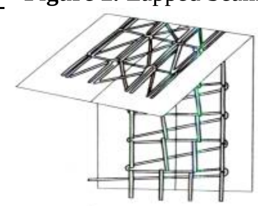
1 .U.S. Federal Std. No. 751a has categorized seam classes into four:




**According to British Standard**

| No of Class | Seam types |
|---|---|
| Class 1 | Superimposed seam |
| Class 2 | Lapped seam |
| Class 3 | Bound seam |
| Class 4 | Flat seam |
| Class 5 | Decorative seam |
| Class 6 | Edge neatening |
| Class 7 | Like as lapped seam |
| Class 8 | Final seam |

Figures of Superimposed, Lapped, Bound and Flat seam are given below –

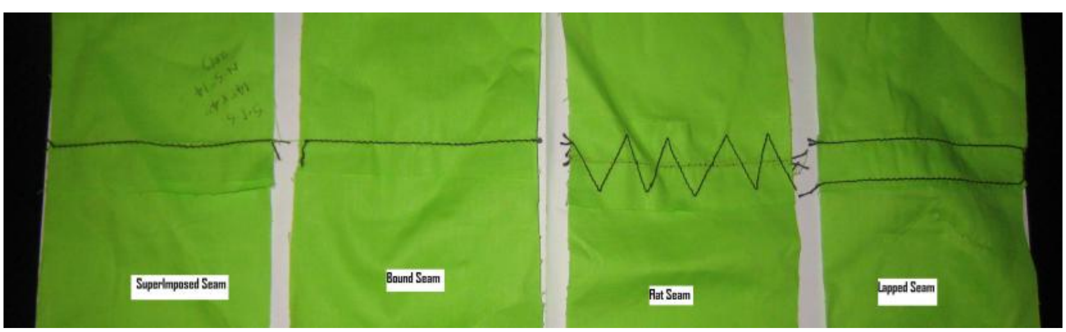
| | |
|---|---|
|  |  |
| **Figure 1.** Superimposed seam | **Figure 2.** Lapped Seam |
|  |  |
| **Figure 3.** Bound Seam | **Figure 4.** Flat Seam |

**2. SAMPLE PREPARATION**

The fabric of $\frac{50 \text{ X } 50}{104 \text{ X } 62}$ X 50″ was used as sample.

For seam production using different needle size (Singer needle size 14, 16 &18) lock stitch machine (BUTTERFLY, China) and for Seam strength test Universal TITAN Strength Tester (James H. Heal and Co. Ltd Halifax, England) were used. ASTM 434 used for seam strength and ASTM D5034 for fabric strength were used. Sample size 14″ X 4″ for seam and 100mm±1mm × 150mm for fabric strength were followed.

The following digital image shows different produced samples i.e. seams –



## 3. EXPERIMENTAL DATA

### 3.1.Data analysis for fabric strength test:

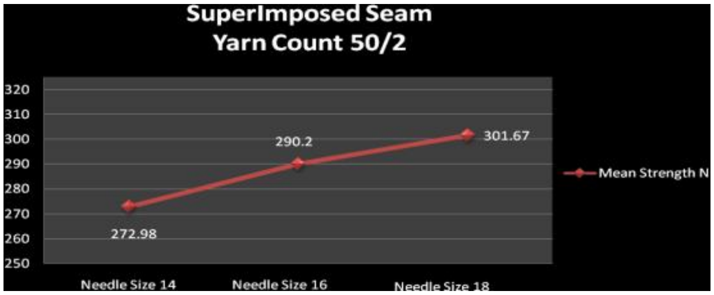
| Observation no | Strength (N) | Mean |
|---|---|---|
| 01 | 431.84 | 435.158 |
| 02 | 439.55 | |
| 03 | 425.96 | |
| 04 | 440.69 | |
| 05 | 437.75 | |

### 3.2 Seam Strength using different Needle and Thread size:

| Seam type | Yarn count | Needle size | Strength(N) |
|---|---|---|---|
| Superimposed seam | 50/2 | 14 | 272.98 |
| | | 16 | 290.2 |
| | | 18 | 301.67 |
| | 20/3 | 14 | 363.86 |
| | | 16 | 388.9 |
| | | 18 | 404.4 |
| Bound seam | 50/2 | 14 | 439.93 |
| | | 16 | 377.45 |
| | | 18 | 352.76 |
| | 20/3 | 14 | 382.11 |
| | | 16 | 359.53 |
| | | 18 | 368.81 |
| Lapped seam | 50/2 | 14 | 439.93 |
| | | 16 | 377.45 |
| | | 18 | 352.76 |
| | 20/3 | 14 | 478.94 |
| | | 16 | 489.52 |
| | | 18 | 487.94 |
| Flat seam | 50/2 | 14 | 318.23 |
| | | 16 | 320.25 |
| | | 18 | 339.4 |
| | 20/3 | 14 | 413.39 |
| | | 16 | 419.88 |
| | | 18 | 434.03 |

## 4.RESULT AND DISCUSSION

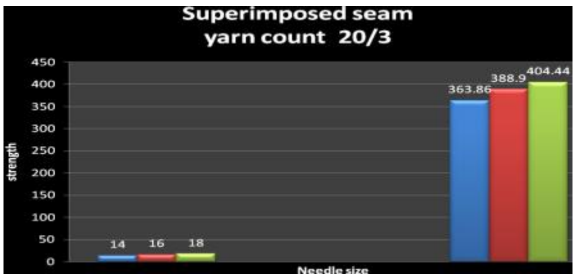
**<u>Graphical presentation:</u>**

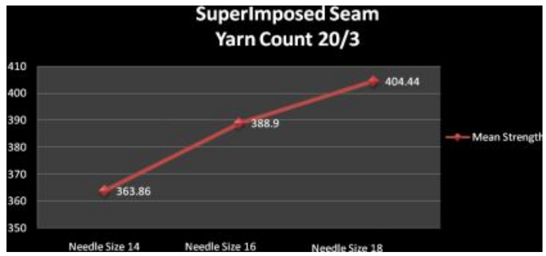



**Discussion**

The above diagram represents the strength of seam on different types of needle with the fixed yarn count 50/2 .From this graph its depicts that

1. Seam strength increase gradually with the increas e of needle size.
2.Seam strength is lowest in needle size 14 and highest at needle size 18.
3.Seam strength increase rapidly from needle size 14 to needle size 16 and seam strength increase from needle size 16 to needle size 18 but not as needle size 14 t o 16.

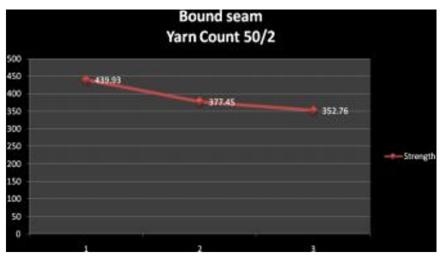



**Discussion:**

The above diagram represents the strength of seam on different types of needle with the fixed yarn count 20/3 .From this graph its depicts that

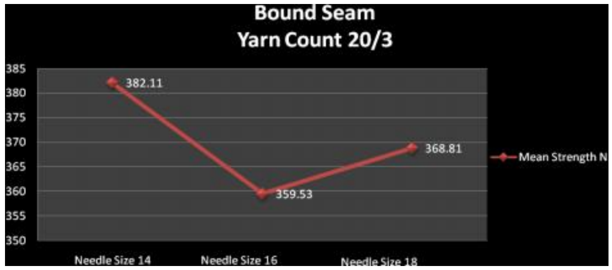
1. Seam strength increase gradually with the increase of needle size.
2.Seam strength is lowest in needle size 14 and highest at needle size 18.
3.Seam strength increase rapidly from needle size 14 to needle size 16 and seam strength increase from needle size 16 to needle size 18 but not as needle size 14 to 16.


**Discussion**

The above diagram represents the strength of seam on different types of needle with the fixed yarn count 50/2 .From this graph its depicts that

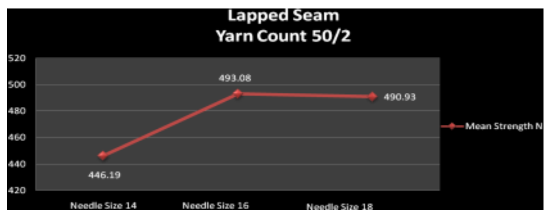
1.Seam strength decrease gradually with the increase of needle size.
2.Seam strength is highest at needle size 14 and low est at needle size 18.
3.Seam strength decrease drastically from needle size 14 to needle size 16 and seam decrease from needle size 16 to 18 but not like as needle size 14 to 16.


**Discussion:**

The above diagram represents the strength of seam on diffe rent types of needle with the fixed yarn count 20/3 .From this graph its depicts that

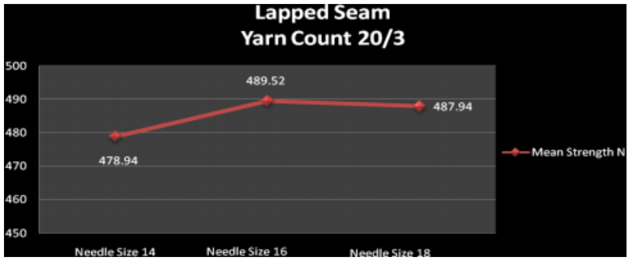
1. Seam strength fall and increase with the increase of needle size.
2. Seam strength is highest at needle size 14 and lowest at needle size 16.
3. Seam strength decrease drastic ally from needle size 14 to needle size 16 but increase from needle size 16 to needle size 18.


**Discussion**

The above diagram represents the strength of seam on different types of needle with the fixed yarn count 50/2 .From this graph its depicts that

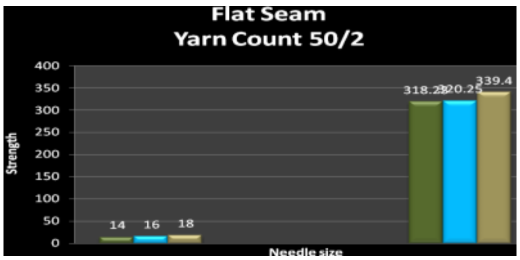
1. .Seam strength rise and fall with the increase of needle size
2. Seam strength is lowest at needle size 14 and highest at needle size 16
3. Seam strength increase rapidly from needle size 14 to needle size 16 but decrease gradually from needle size 16 to need le size 18.

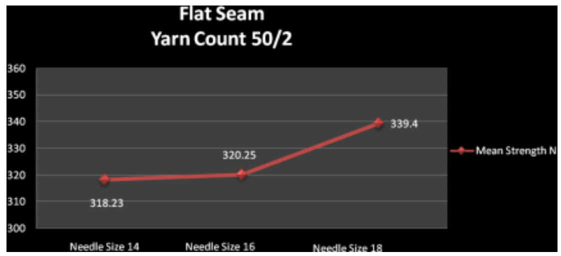



**Discussion**

The above diagram represents the strength of seam on different types of needle with the fixed yarn count 20/3 .From this graph its depicts that

1. Seam strength rise and fall with the increase of needle size.
2. Seam strength is highest at needle size 16 and lowest at needle size 14.
3. Seam strength increase from needle size 14 to 16 but decrease slowly from needle size 16 to 18.

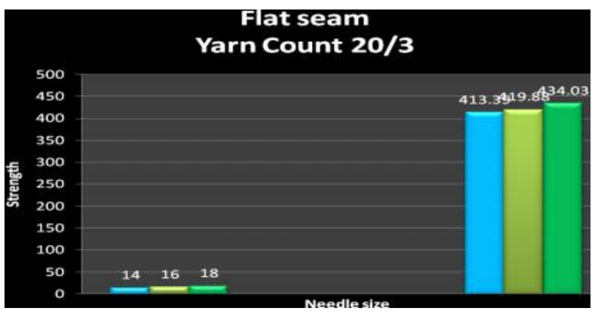


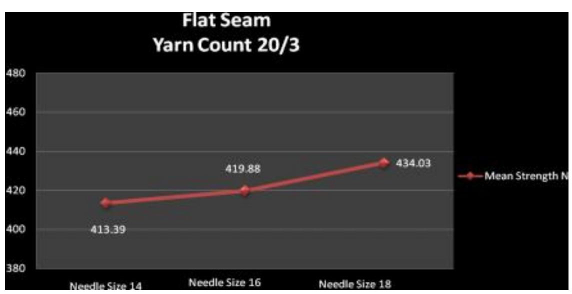




**Discussion**

The above diagram represents the strength of seam on different types of needle with the f ixed yarn count 50/2 .From this graph its depicts that

1. Seam strength incrase gradually with the increase of needle size
2. Seam strength is lowest at needle size 14 and highest at needle size 18
3. Seam strength increase slowly from needle size 14 to needle siz e 16 and seam strength increase rapidly from needle size 16 to needle size 18.

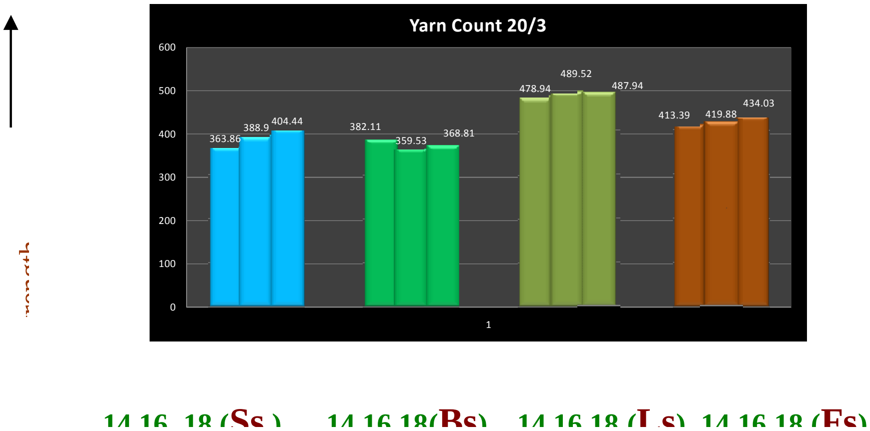


**Discussion**

The above diagram represents the strength of seam on different types of needle with the fixed yarn count 20/3 .From this graph its depicts that

1. Seam strength incrase gradually with the increase of needle size
2. Seam strength is lowest at needle size 14 and highest at needle size 18
3. Seam strength increase slowly from needle size 14 to needle size 16 and seam strength increase rapidly from needle size 16 to needl e size 18.




**Comments:** Comparing the above diagram, seam strength is highest on Lapped seam & lowest on Bound seam. Seam strength for lapped seam exceed fabric strength. Though seam strength is lower both for Superimposed seam & Bound seam but fabric appreance is better for these two seam.

## 5.CONCLUSION

As a result of the statistical evaluation it was established that seam strength is higher for Lapped seam but in many cases it exceeds the actual fa bric strength. Seam strength is highest for needle size 18 but fabric appearance is not better. A conclusion can be drawn that needle size 16 is considerable comparing yarn count, needle size & fabric appearance.

## 6. REFERENCES


1. R.M. Laing & J. Wedsten, Seam & Stitch.
2. A.J. Chuter, Introduction to Clothing Production Management.
3. M.A. Kasem , Garments & Technology
4. ASTM Method, D5034, standard Test method for Breaking strength and elongation of Textile Fabrics (Grab Test)
5. ASTM Method, D434, stan dard Test method for Seam strength of garments.
6. Pradip V mehta ," An introduction to Quality control for the apparel industry",.
7. www.fibretofashion.com

ANNALS OF THE UNIVERSITY OF ORADEA
FASCICLE OF TEXTILES- LEATHERWORK
Volume I, 2010, No. 2

# FEMININE UNDERWEAR: SOME HYGIENIC PRINCIPLES

**Rita Salvado[1], Joana Malheiro[1]**

[1] *University of Beira Interior, Covilhã, PORTUGAL*

Corresponding author: Rita Salvado, rita.salvado@ubi.pt

***Abstract:*** The vulva-vaginal infections are common in women. The textile materials, used in underwear and absorbent hygienic products, are identified as risk factors, but their influence on the emergence of these infections is not yet clear. Bacterial adhesion is associated with persistence of microorganisms in the material that is related to the recurrence of infections. This paper is an initial attempt for the elucidation of these questions. Some of the main features involved in this phenomenon are identified and characterized.
***Key words:*** underwear, textile fibres, bacterial adhesion, liquid absorption.

## 1. INTRODUCTION

The vulva-vaginal infections are among the most common gynecologic conditions affecting women, and in more severe cases can lead to infertility. Several factors have been pointed out as promoting these infections (pregnancy, diabetes, diet disorders ...) including the use of synthetic fibre underwear, absorbent hygienic products and tight-fitting clothing [1,2-4]. However the influence of textile materials in the emergence of infections is not yet consensual [1,2 -4,5]. Furthermore there is a contradiction in the generalized intimate hygienic attitude of women. On one hand, underwear made of cotton is preferred [6] and advised [7] because it has properties considered hygienic, on the other hand, an increasing usage of daily panty-liners, made of synthetic fibres, have been observed, in order to increase absorption and hygienic function of underwear [1,8,9]. In fact, these structures are in close contact with vulvo-vaginal region, constituting a factor that may potentially affect this surface over time. However, the hygienic function of underwear has been neglected in favor of aesthetic, social and psychological functions, being their design led by fashion and not by medical or hygienic principles [10]. The hygienic function of underwear has a double function of protection: protect vaginal tract from external aggressions and protect outer clothes from fluids and odors. Moreover, it should maintain the dynamic equilibrium of the vaginal ecosystem through preservation of an healthy microflora, acid pH (< 4,7), moisture and temperature (≈ 34ºC) [1,9,11,12]. Microorganisms persistence in materials is associated to bacterial adhesion and has been pointed out as an important factor on re-infection [13,14]. Furthermore, the use of textile materials leads, inevitably, to an effect of occlusion, of greater or lesser extent depending on the lesser or greater permeability to air, respectively. In general, this effect increases pH, moisture and microorganisms density, leading to a physiological imbalance of the region [1,8,9,11,12]. In this way, it is necessary to consider the vaginal microflora, studying the persistence of microorganisms in textile materials through bacterial adhesion, their interdependent relationship with the acid pH, which is influenced by moisture, which is associated to the absorption and transport of moisture in materials.

## 2. THE PHENOMENUM

### 2.1 Bacterial Adhesion

In the phenomenon of bacterial adhesion, bacteria behave as living colloidal particles. This phenomenon depends on the physicochemical characteristics o f the suspension medium, bacteria and substrate, all together [15,16]. Thus, considering [15]: 1) suspension medium, will depend on the type of medium (viscosity, chemical composition, ...), flow shear stress, temperature, exposure time, concentration of bacteria and surface tension; 2) bacteria, will depend on bacteria specie (shape, external appendages, ...), surface hydrophobicity (surface energy) , surface charge (zeta potential) and multiplicity of species (presence of biofilm); 3) substrate, will depen d on the chemical composition (reactive groups, type of connection formed, ...), surface roughness, morphological configuration (flat, cylindrical, net ...), surface charge and hydrophobicity.

### 2.2 Absorption

The absorption results from the interaction bet ween a solid surface and a liquid, which depends on the properties of the solid substrate, the liquid and the characteristics and conditions of the medium. The absorption can be observed through different phenomena, including wettability and capillarity [17-19]. Wettability is generally described by Young equation, through the contact angle. It depends on roughness and morphology of the surface, solid surface energy and liquid surface tension [17-19]. On the other hand, capillarity depends on porous geometr y, contact angle and liquid properties. For porous systems is, generally, expressed by Lucas -Washburn equation [17-19]:

$$\frac{dh}{dt} = \frac{r\gamma_{LV}\cos\theta}{4\eta h} - \frac{r^2\rho_L g}{8\eta} \quad (1)$$

where, $\rho_L$ - liquid density; $r$ - capilar radius; $\theta$ - contact angle between solid and liquid; $\gamma_{LV}$ - liquid surface tension; $\eta$ - liquid viscosity; $h$ - height of liquid rise in the capillary; $g$ - gravity acceleration [17-19].

## 3. MATERIALS AND METHODS

### 3.1 Materials

In this work two groups of substrate were analysed: raw fibres and knitted structures, to characterize morphology and absorption properties, respectively. Table 1 summarizes their characteristics.

**Table 1:** Characteristics of Jersey knitted structures produced and analysed

| | Composition | Cotton | Bamboo Viscose | Lyocell | Polyester (PET) | Coolever® (PET) | Polyamide 6.6 |
|---|---|---|---|---|---|---|---|
| **Fibre** | **Thikness [dtex]** | 0.75 | 1.4 | 1.4 | 1.4 | 1.4 | 1.7 |
| | **Density [g/cm³]** | 1.55 | 1.52 | 1.53 | 1.39 | 1.39 | 1.14 |
| **Yarn** | **Thikness [tex]** | 19.7 | 19.7 | 29.5 | 24.6 | 19.7 | 19.7 |
| **Knit** | **Mass/m² [g/ m²]** | 198.3 | 155.2 | 256.1 | 192.1 | 150.7 | 202.6 |
| | **Thickness [mm]** | 0.98 | 0.50 | 0.84 | 0.76 | 0.68 | 0.95 |
| | **Porosity [-]** | 0.870 | 0.796 | 0.801 | 0.814 | 0.837 | 0.813 |

The group of fibres was defined considering the wide range of fibres normally used in underwear and also the relevant substrate properties for bacterial adhesion and absorption phenom ena. It includes fibres of cotton, bamboo viscose, lyocell, polyamide and polyester (circular cross -section and Coolever®).

### 3.2 Materials Morphological Characterization

SEM (Scanning Electron Mycroscopy) technique was used for morphological characterizati on of the fibres and for that fibres were dehydrated by the method of Critical Point Drying before SEM analysis.

### 3.3 Absorption Properties

Several properties of knitted structures were studied: 1) Wettability was analyzed by measuring the contact angle by the sessile drop method; 2) Capillarity was determined by vertical wicking methods, measuring the time the rising liquid takes to reach defined heights of 1, 2.5, 5 and 7 cm; 3) Liquid Transfer was assessed overlaying a dry knit structure in a wet one and applying a defined pressure. After a certain time, the amount of water transferred was determined weighting the dry sample. This experiment was performed for all combinations of samples.

## 4. RESULTS AND DISCUSSION

### 4.1 Morphological Characterization

The surface roughness and shape irregularity of the substrate might greatly influence the deposition and adhesion of microorganisms, because it increases the physical protection of bacteria and surface area in contact. Considering the scale and the size of bacteria, eg Staphylococcus aureus, (which have approximately 5µm of diameter and produce slim to attach to surfaces), and the irregularities of the morphological configuration of fibres is clear the approximation in scales between the size of bacteria and irregularities of the fibres (Fig. 1).

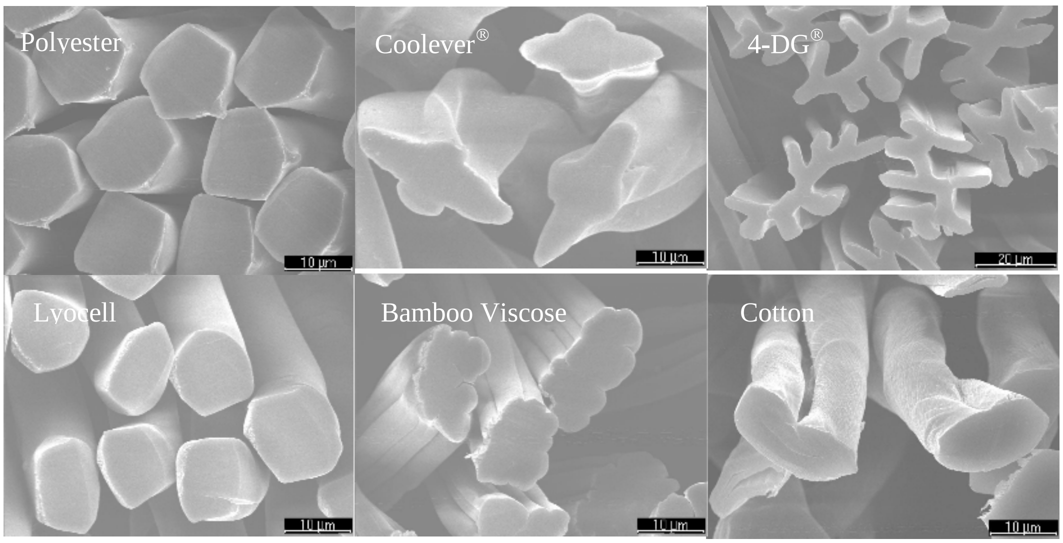



**Figure 1:** SEM images of the cross-section of fibers showing their irregularities.

In the same way, considering the size of nanometric extracellular appendages of bacteria, eg Escherichia coli, (which have nanometric extracellular appendages – fimbria, to attach to surfaces) and cotton surface microroughness (Fig.2), there is also a great proximity of the scales. The cotton fibres microroughness increases surface area, providing a largest number of potential locations for adhesion.

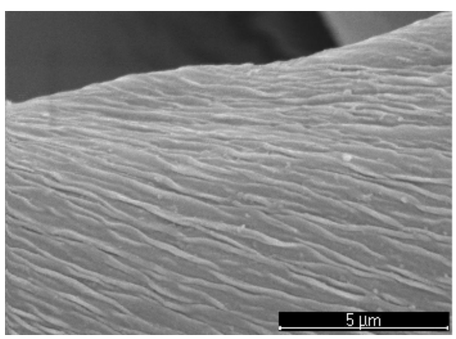



**Figure 2:** SEM image of the surface of cotton fibre showing microroughness.

### 4.1 Absorption Properties.

**Wettability.** The angle of contact was not determined for the hydrophilic fibres because the liquid drop was quickly absorbed by the material. Fig. 3 (left) shows the results obtain ed for hydrophobic fibres. As one can see, only the circular cross -section polyester presented a stable angle, which is much higher than that found in literature. Moreover, the absorption of liquid is faster in irregular polyester (Coolever®) than in circu lar cross-section one. This result is also supported by Fig. 3 (right) which illustrates the gradual decrease in the volume of the liquid drop on the surface of the knit structure in irregular polyester (Coolever®) knit structure.

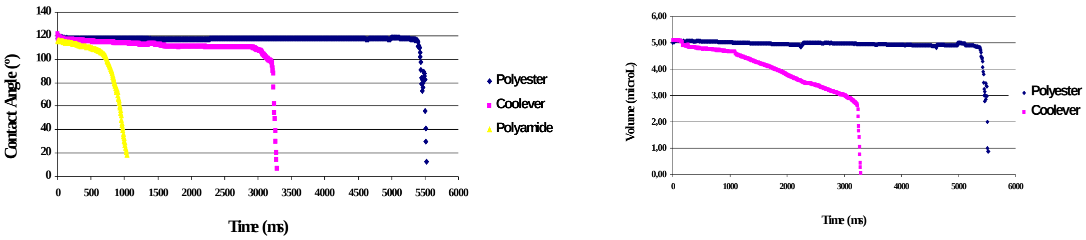



**Figure 3:** Left: contact angle (degree) for the hydrophobic fibres; Right: volume of liquid drop (microliter) in the surface of polyester fibres over time (milliseconds).

**Capillarity.** As shown in Fig. 4 (top), and comparing fibres with similar chemical composition such as both polyesters, it was found the liquid rising rate was higher for fibres with irregular cross sections (Coolever®) than for the circular ones. The same, is higher for cotton and viscose than for lyocell,

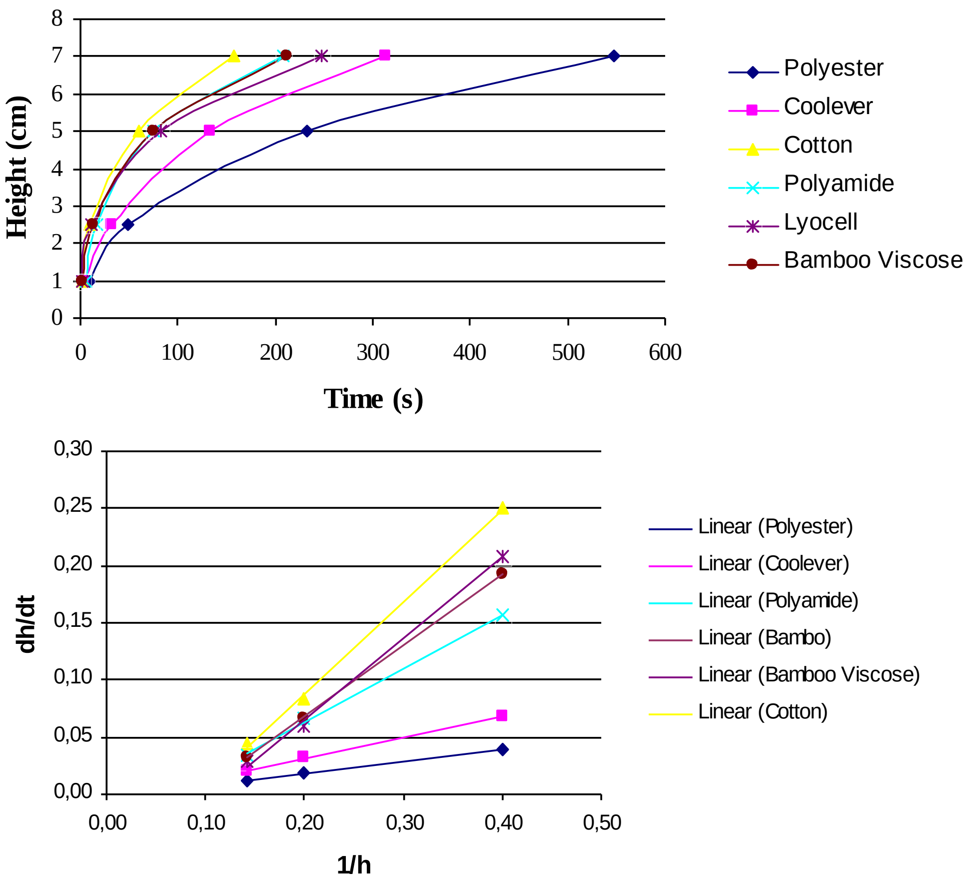
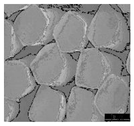
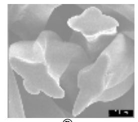


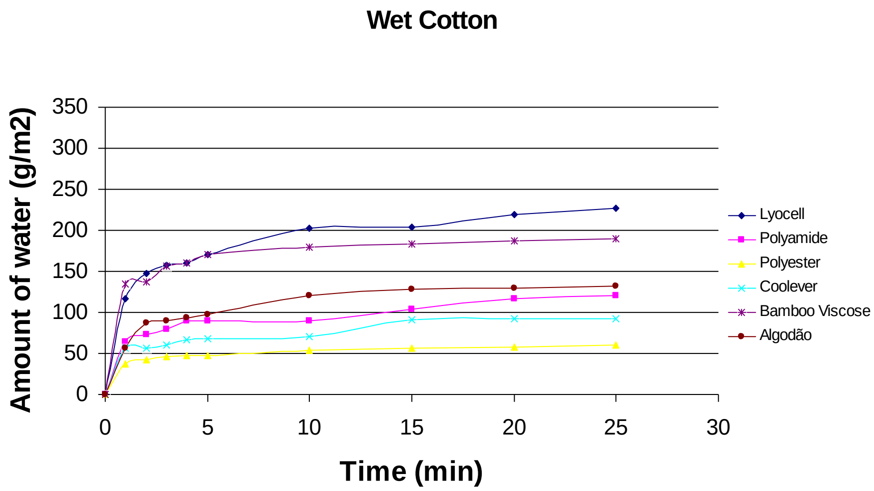

**Figure 4:** Top: capillary rise; bottom: plots of liquid rising rate v.s. inverse of rising height, for equivalent radius determination.

The pores in the structure of the knit structure have different sizes: pores in the fibre (irregularities of cross section), yarns (between fibres) and knitted struct ure (between yarns). Applying Lucas-Washburn equation (eq. 1) and considering the point (0, y) of the plot dh / dt versus 1 / h (Fig. 4, bottom) an equivalent radius, *r*, is obtained, which gives the relationship between the volume filled with liquid and the wetted area, characterizing an average irregular pore (Table 2).

**Table 2:** Knit structures porosity

| | | | |
|---|---|---|---|
| <br>**Circular polyester** | **Equivalent radius (r)**<br>**55µm**<br><br>**Knit porosity (ε)**<br>**0.814** | <br>**Coolever® polyester** | **Equivalent radius (r)**<br>**65 µm**<br><br>**Knit porosity (ε)**<br>**0.837** |

**Liquid Transfer.** In liquid transfer experiments was found that, for all wet knit structures (hydrophilic and hydrophobic) the transfer of water is higher to hydrophilic dry knit structures, as shown for the case of cotton and polyester presented in Fig. 5. It was also observed that hydrophobic wet knit structures transfer greater amounts of water to dry knit structures (hydrophilic and hydrophobic) than hydrophilic wet fibre knit structures.



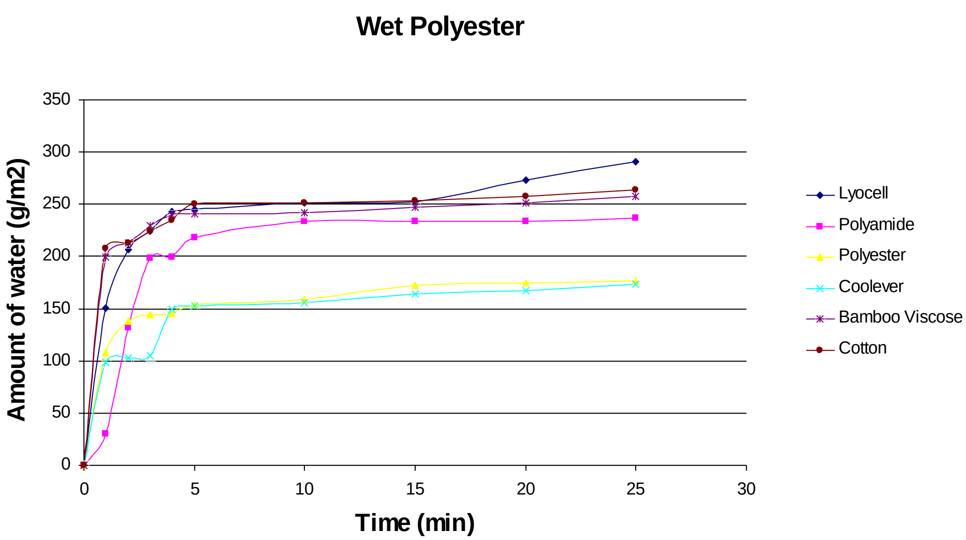




**Figure 5:** Liquid transfer results for cotton (top) and polyester (bottom) knit structures.

## 5. CONCLUSIONS

Considering only the morphology of fibres with the same chemical composition, one expects that higher irregularities and microroughness will promote the deposition and adhesion of bacteria, and subsequent biofilm formation, because these morphological characteristics provide physical protection to bacteria and increased surface area [15,16]. However, the effect of the morphology of the substrate can be reduced or even avoided when other factors are considered, such as the suspension medium [20]. The results show that, for fibres with the same chemical composition, the wicking rate into the knit structures increases when cross-section irregularities increase. Note that the bacteria are suspended in fluid, and fluid transport will also promote the transport of bacteria into the structure, making difficult their removal in subsequent laundry and consequently an even more effective formation of biofilm [15]. Regarding the liquid transfer, it is minimal when dry hydrophobic knit structures are superposed on wet hydrophilic knit structures. This result is particularly important for the conservation of the acidic pH at the skin, which is essential in monitoring the healthy population of microorganisms. Some recommendations for the design of women's underwear could be: fibres morphologically regular contacting the skin; knit structure consisting of two hydrophobic layers separated by a hydrophilic one. This structure is in accordance to the principles of absorbent hygiene products construction. In this case, the high porosity of the knit structure may reduce the effect of occlusion. These guidelines should, however, be verified experimentally, because the effect o f the factors evolved, such as chemical composition, surface charge and others, and the influence of the suspension medium. Also, the commitment with other properties, such as liquid absorption, should be studied.

## 6. REFERENCES


1. Runeman, B.et al, “The vulva skin microclimate”, Acta Derm-Vener, Vol. 83, No.2, p.88-92, 2003.
2. Geiger, A. M., Foxman, B., “Risk factors for vulvo-vaginal candidiasis: a case-control study among university students”, Epidemiology, Vol. 7, pp. 182-187, 1996.
3. Runeman, B.et al,“The Vulvar Skin Microenvironment”, Acta Derm Venereol, Vol. 85, pp. 118 – 122, 2005.
4. Mardh, P.-A., Nokova, N., Stukalova, E., “Colonisation of external sites by Cândida in women with recurrent vulvovaginal candiosis”, BJOG: International Journal of Obstetric and Gynaecology, Vol. 110, pp. 934-937, 2003.
5. Per-Anders M. et al, “Colonization of extragenital sites by Candida in women with recurrent vulvo-vaginal candidosis” Int. J. of Obst. Gynaec.,Vol. 110,pp.934-937, 2003.
6. Mardh, P.A. et al, “Facts and myths on recurrent vulvo-vaginal candidosis – a review on epidemiology, clinical manifestations, diagnosis, pathogenesis and therapy”, Int. Journal of STD & AIDS, Vol. 13, pp. 522-539, 2002.
7. Foxman, B., “The Epidemiology of Vulvovaginal Candidiasis: Risk Factors”, Am J Public Health, Vol. 80, pp. 329-331, 1990.
8. Farage, M. A. et al, “Labial and Vaginal Microbiology: Effects of Extended Panty Liner Us”e, Infectious Diseases in Obst. and Gyneo., Vol. 5, pp. 252–258, 1997.
9. Runeman, B. et al, “The Vulva Skin Microenvironment”, Acta Derm Venereol, Vol. 84, pp.277 – 284, 2004.
10. Renbourn, E. T., Rees, W. H.,” Materials and Clothing in Health and Disease. History, Physiology and Hygiene”, Merrow, 1972.
11. Faro S.; “Vaginitis: Diagnosis and management”, International Journal of Fertility and Menopausal Studies, Vol. 42, No. 2, pp. 115-123, 1996.
12. Schafer, P., Bewick-Sonntag, C., Capri, M. G., Berardesca E.; “Physiological changes in skin barrier function in relation to occlusion level, exposure time and climatic conditions”, Skin Pharm and Appl Skin Physi, Vol. 15, No. 1, pp. 7-19, 2002.
13. Ossowski, B. et al, “Disinfecting treatment of textiles to prevent reinfection in vulvovaginal candidiasis”, Gebur. und Frauenheil., Vol. 59, No. 4, pp . 175-179, 1999.
14. Wilkoff, L. J., Westbrook, L., Dixon, G. J.,” Factors Affecting the Persistence of Staphylococcus aureus on Fabrics”, Applied Microbiology, pp. 268-274, 1969.
15. Yuehuei, H., Friedman, R. J.,Handbook of Bacterial Adhesion: Principles, Methods and Applications, Human Press, 2000.
16. An, Y. H., Friedman, R. J., “Concise Review of Mechanisms of Bacterial Adhesion to Biomaterial

Surfaces", Journal of Biomedical Materials Research, Vol. 43, pp. 338–348, 1998.
17. Pan, N., Gibson, P., "Thermal and moisture transport in fibrous materials", Woodhead Publishing Limited, 1st Edition, 2006
18. Patnaik, A. et al, "Wetting and Wicking in Fibrous Materials", The textile Institute - Textile Progress, Woodhead Publishing Limited, Vol. 38, No. 1, 2006.
19. Holmberg, K., "Handbook of Applied Surface a Colloid Chemistry - Volume 2", John Wiley & Sons, 2002.
20. Morgan, T. D., Wilson, M., "The effects of surface roughness and type of denture acrylic on biofilm formation by Streptococcus oralis in a constant depth film fermentor", J. of Appl. Microb, Vol. 91, pp. 47-53, 2001.

ANNALS OF THE UNIVERSITY OF ORADEA
FASCICLE OF TEXTILES- LEATHERWORK
Volume I, 2010, No. 2

# STUDY ON THE EFFECT OF STITCH LENGTH ON BURSTING STRENGTH OF KNIT FABRIC

**Sheikh Abdullah Shadid[1], Mohammad Faizur Rahman[2]**

[1]*Department of Textile Technology, Ahsanullah University of Science and Technology (AUST),*
sheikhshadid@gmail.com
[2]*Department of Textile Technology, Ahsanullah University of Science and Technology (AUST) ,*
rashedtex@gmail.com

Corresponding author: Sheik Abdullah Shadid, E-mail address sheikhshadid@gmail.com

***Abstract:*** The strength to resist against the breakage due to any force or tension is termed as tensile strength for woven fabric whereas bursting strength for knit fabric which is the main factor that settles serviceability, life etc of garments made from knit fabric. So bursting strength is an important quality parameter and great values of it are recommended by the renowned buyers. Stitch length/loop length is a major factor in a knit fabric which influences almost all other parameters less or more. So logically stitch length should influence the bursting strength. In this research the effect of stitch length on bursting strength is observed and analyzed for finding any relation or trend between this two. For doing this only plain fabric has been taken and for a certain count of yarn only stitch length has been change keeping other parameters constant e.g. yarn tension, machine speed etc. the fabrics for specimen were produced in knitting section of Aboti Colour Tex and the bursting tests were performed in AUST testing laboratory. Though no certain equation or tr end was developed, the bursting strength can be predicted with the change of stitch length for a certain yarn count where the deviations of predicted values are under tolerance limit.
***Keywords:*** Bursting strength, kilopascal, regression, $R^2$ etc.

## 1. INTRODUCTION

Textile fabrics are manufactured for many different end uses, each of which has different performance requirements. The chemical and physical structures of textile fabric determine how it will perform, and ultimately whether it is acceptable for a pa rticular use. Fabric testing plays a crucial role in gauging product quality, ensuring regulatory compliance and assessing the performance of textile materials. It provides information about the physical or structural, chemical and performance properties of the fabrics.

It is very important to predict the textile fabric's performance by testing. Fashion merchandisers, apparel designers, interior designers and textile scientists who have an understanding of textile properties and testing are equipped to make decisions that will benefits their clients and enhance profits for their businesses. Knowledge of fabric testing and its performance analysis can be contributed to efficiency in solving consumer problems with textile products, and to the development of products that perform acceptably for consumers.

There are various types of testing method for different test of different types of fabrics.

For knitted fabric bursting strength is tested instead of tensile/tearing strength. Bursting strength is the strength of a fabric against a multidirectional flow of pressure.

The bursting test measure a composite strength of both warp and weft yarns simultaneously and indicate the extent to which a fabric can withstand a bursting type of force with the pressure being applied perpendicular to the surface of the fabric.

The reason for this method of testing may be due to the material in use is stretched in many directions simultaneously. Filter cloths, sacks, nets, and parachute cloths are example for fabrics stressed in all directions. Also, knitted fabrics can not be easily tested in stripe form and without well defined direction like felted cloth or bonded fabrics may be conveniently tested on a bursting strength tester.

## 2.ORGANIZATION OF THE RESEARCH

This research is done on 14 fabric sample with different count, different stitch length but the structures of all are same plain knitted single jersey and all are grey fabric without lycra attached. And all of the fabrics come from same knitting mills ( Abonty Textile, BSCIC area, Narayangonj ) , and almost same machine. The yarn used to make the fabric also come from same spinning mill and same lot number. So it can be can say that yarn properties were same.

Among this fabric sample:-

- Four are made by 24/1 cotton yarn.
- Five are made by 26/1 cotton yarn.
- Five are made by 30/1 cotton yarn.

### 2.1 Name of machine

"*MESDAN LAB*"
Bursting strength tester
Made in Germany

### 2.2 Standards

As per DIN 53861/01-03, ASTM D774

## 3. EXPERIMENTAL DATA

### 3.1 Resultant data 24/1 plain single jersey fabrics:

| No. of obs. | Stitch length (mm) | Bursting strength (100*kpa) | Average bursting strength (100*kpa) | Coefficient of variation $= \frac{\sigma}{\bar{x}} * 100$ |
|---|---|---|---|---|
| 1. | 2.70 | A)7.90<br>B)7.86<br>C)7.85<br>D)7.91 | 7.88 | .37 |
| 2. | 2.74 | A)7.38<br>B)7.32<br>C)7.37<br>D)7.33 | 7.35 | .37 |
| 3. | 2.80 | A)7.30<br>B)7.22<br>C)7.23<br>D)7.25 | 7.25 | .49 |
| 4. | 2.90 | A)7.18<br>B)7.23<br>C)7.17<br>D)7.20 | 7.20 | .37 |

**3.2 Resultant data for 26/1 plain knitted fabric:**

| No of obs. | Stitch length (mm) | Bursting strength (100*kpa) | Average bursting strength (100*kpa) | Coefficient of variation $= \frac{\sigma}{\bar{x}} * 100$ |
|---|---|---|---|---|
| 1) | 2.70 | A)7.35<br>B)7.29<br>C)7.38<br>D)7.38 | 7.35 | .49 |
| 2) | 2.72 | A)7.18<br>B)7.20<br>C)7.25<br>D)7.15 | 7.20 | .59 |
| 3) | 2.78 | A)6.44<br>B)6.48<br>C)6.42<br>D)6.46 | 6.45 | .40 |
| 4) | 2.90 | A)6.29<br>B)6.23<br>C)6.23<br>D)6.25 | 6.25 | .45 |
| 5) | 2.94 | A)5.33<br>B)5.26<br>C)5.31<br>D)5.30 | 5.30 | .55 |

**3.3 Resultant data for 30/1 plain knitted fabrics**

| No. of Obs. | Stitch length (mm) | Bursting strength (100*kpa) | Average bursting strength (100*kpa) | Coefficient of variation $= \frac{\sigma}{\bar{x}} * 100$ |
|---|---|---|---|---|
| 1) | 2.68 | A)6.60<br>B)6.52<br>C)6.51<br>D)6.57 | 6.55 | .48 |
| 2) | 2.77 | A)6.20<br>B)2.28<br>C)2.28<br>D)2.24 | 6.25 | .61 |
| 3) | 2.80 | A)5.71<br>B)5.81<br>C)5.81<br>D)5.75 | 5.77 | .84 |
| 4) | 2.84 | A)5.47<br>B)5.44<br>C)5.49<br>D)5.42 | 5.45 | .58 |
| 5) | 2.96 | A)5.17<br>B)5.23<br>C)5.22<br>D)5.18 | 5.20 | .56 |

## 4. DATA ANALYSIS

### 4.1 Bursting strength variation due to change in s titch length in 24/1 count

- For increasing 0.04 mm stitch length, bursting strength value decrease 53 KPa.
- For increasing 0.06 mm stitch length, bursting strength value decrease 10 KPa .
- For increasing 0.10 mm stitch length, bursting strength value decre ase 15 KPa.

Here, the bursting strength is clearly reduced with the increase of stitch length. But the reduction of bursting strength is not in uniform way.

### 4.2 Bursting strength variation due to change in stitch length in 26/1 count

- For increasing 0.02 mm stitch length, bursting strength value decreases 15 KPa
- For increasing 0.04 mm stitch length bursting strength value decreases 95 KPa
- For increasing 0.06 mm stitch length, bursting strength value decreases 75 KPa.
- For increasing 0.12 mm stitch length bursting strength value decreases 20 KPa.

Here, also the bursting strength is clearly reduced with the increase of stitch length. But the reduction of bursting strength is also not in uniform way.

### 4.3 Bursting strength variation due to change i n stitch length in 30/1 count

- For increasing 0.03 mm stitch length bursting strength value difference is 58 KPa ,
- For increasing 0.04 mm stitch length bursting strength value difference is 32 KPa
- For increasing 0.05 mm stitch length bursting strength value difference is 30 KPa.
- For increasing 0.12 mm stitch length bursting strength value difference is 25 KPa.

Here, also the bursting strength is clearly reduced with the increase of stitch length. But the reduction of bursting strength is also not in uniform way.

### 4.4 Bursting strength variation for different fabrics for same amount of stitch length variation

- For increasing .04mm stitch length , Bursting strength increase of 24/1 is 53KPa
- For increasing .04mm stitch length , Bursting strength increa se of 26/1 is 73KPa
- For increasing .04mm stitch length , Bursting strength increase of 30/1 is 32KPa

Here is not any significant trend.

- For increasing 0.06mm stitch length , Bursting strength increase of 24/1 is 10KPa
- For increasing 0.06mm stitch length , Bursting strength increase of 26/1 is 75KPa

### 4.5 Bursting strength variation due to change in count

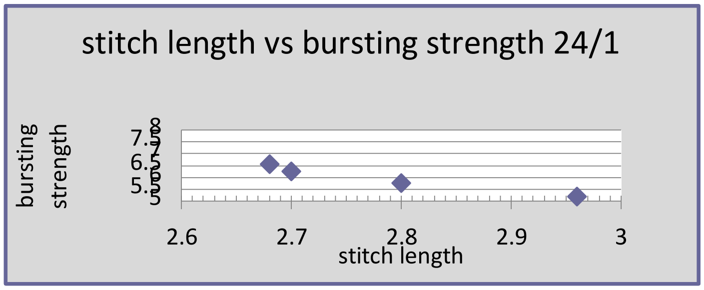
For 2.70mm stitch length, 24/1 count has bursting strength 7.88x100 KPa
For 2.70mm stitch length, 26/1 count has bursting strength 7.35x100 KPa
Here the difference of bursting strength value is 53 KPa.

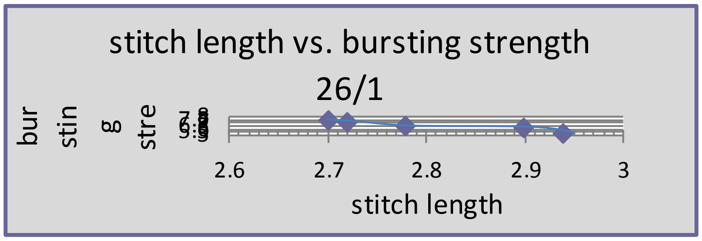
For 2.90mm stitch length, 26/1 count has bursting strength 6.25x100 KPa
For 2.90mm stitch length, 24/1 count has bursting strength 7.20x100 KPa
Here the difference is 95 KPa.

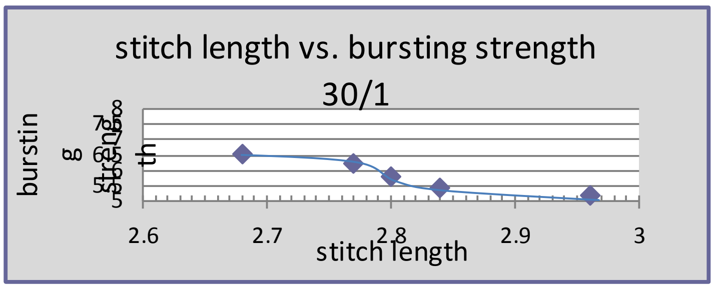
So here bursting strength is inc rease with the increase of coarseness of yarn. But the increasing of bursting strength is not in uniform pattern.

**5. RESULT AND DISCUSSION**

**5.1 Graphical Representation:**




**5.2 Regression analysis:**

For the fabric made from 24/1 Ne yarn regression equation is y= 14.48223 -2.53237x and coefficient of determination $R^2$ =0.708741.

For the fabric made from 26/1 Ne yarn regression equation is y= 26.82656 -7.23524x and coefficient of determination $R^2$ = 0.887824

For the fabric made from 30/1 Ne yarn regression equation is y= 20.27536 -5.13571x and coefficient of determination $R^2$ = 0.894272.

**5.3 Key findings**

1) For same count, bursting strength decreases with increasing of stitch length. But the reduction of bursting strength for different stitch length is not in uniform way.

2) For same stitch length, bursting strength increases with the increase of coarseness of yarn. But here also the increase of bursting strength is not in uniform pattern.

3) For same amount of stitch length increase bursting strength decreases for various counts but the decreases are not same and do not show any trend.

**6. CONCLUSION**

Though no certain equation or trend has found in this research, va lue of co-efficient of determination of bursting strength of plain knit fabric is not less. So, the bursting strength can be predicted with the change of stitch length of knit fabric made from certain yarn count.

**7.REFERENCES**

1. David J Spencer, Knitting Technology, Edition-III
2. J. E. Booth, Principles of Textile Testing.
3. Manual of Mesdan Bursting Strength Tester.
4. Levin and Rubin, Business Statistics.

ANNALS OF THE UNIVERSITY OF ORADEA
FASCICLE OF TEXTILES- LEATHERWORK
Volume I, 2010, No. 2

# CREATING THE 3D IRREGULAR SHAPES OF THE SHOE LAST USING BICUBIC B-SPLINE CURVES

**Drişcu Mariana**

[1]*Faculty of Textile, Leather and Industrial Management "Gh. Asachi" Technical University, D. Mangeron, 53, 700050 - Iasi, Romania*

Corresponding author: Drişcu Mariana, mcocea@tex.tuiasi.ro

***Abstract:*** For using a specialized footwear CAD s ystem it's imperative to know the analytical expression of the outlines of the footwear patterns. This brings us to the field of mathematical modeling. Mathematic modeling is based on the equation of the function defining the outline of the model contour. This allows the designer to process or alter the outlines: grading, changing the shape, optimizing the consumption of materials, making economic estimates and so on.
***Key words:*** forms, curve, contour

## 1. INTRODUCTION

Geometrical shapes 3D commonly use d in **Computer Aided Design** (**CAD**) systems can be defined by several points obtained through the digitizing process. The co -ordinates of the points situated between two nodes can be approximated through both analytic and graphic methods, with interpolation curves. Thus, the analytic expression of the curve that approximates the points will be a interpolation function. The graphical form will be represented by a curve that crosses all the co - ordinates of the digitized points, without bringing any mutations of the initial curve.

## 2. PARAMETRICALLY REPRE SENTED

Shapes, contours cannot be identified, in designing, by simple function of the form y=f(x) or z=f(x,y), because most of them have irregular forms, with many concavities and convexities, which explains why their form is intrinsically dependent on the coordinates system. For example, if we want to plot a curve, it is absolutely necessary that we choose the right set of contour points in a system of coordinates, but the important factor in determining the f orm of the object is the relation between these points, not that between the points and the randomly chosen coordinates system.

In CAD the shapes are parametrically represented using a set of functions:

$$x = x(t); \qquad y = y(t); \qquad z = z(t)$$

In order to do that, we will attach three supplementary systems of co -ordinates – *tOx*, *tOy* and *tOz* – to the present one – *xOyz*. We select the variation domain of parameter t. Then, we solve the three independent problems of the oretical interpolation for the three variables, x, y and z using many methods.

Thus, we will approximate the set of points $(x_0, y_0, z_0), (x_1, y_1, z_1)\ldots (x_{n-1}, y_{n-1}, z_{n-1})$ by the aid of three variables *x(t, y(t))* and *z(t)*, defined by three parametric interpolation equations:
In order to do that, we will attach three supplementary systems of co -ordinates – *tOx*, *tOy* and *tOz* – to the present one – *xOyz*. We select the variation domain of parameter t. Then, we solve the three independent problems of theoretical interpolation for the thre e variables, x, y and z.

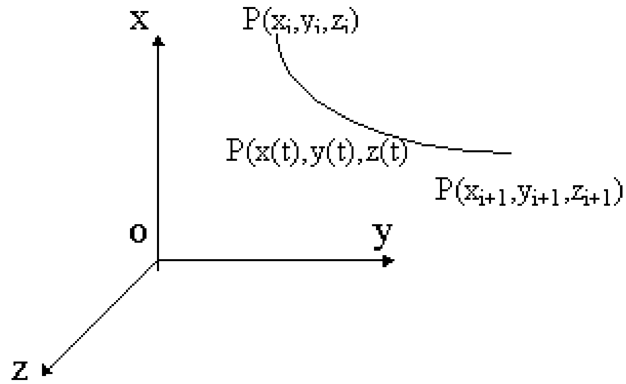



**Figure 1**, The points between $P(x_i, y_i, z_i)$ and $P(x_{i+1}, y_{i+1}, z_{i+1})$ are defining for the coordinates P(xt),y(t),z(t) with $t \in (t_i, t_{i+1})$

## 3. DEFINING B-SPLINE INTERPOLATING POLYNOMS

Let's take into consideration a nethreerk of points called $t_0<t_1<.....t_n$ whose nodes have known values given by $\{f_i\}$, $i\in[0,n]\rightarrow R$, where $\{f_i\}$ is an interpolating B-spline function that fulfills the following conditions:

- g(t) is continuous on the $(t_0,t_n)$ interval, together with its first and second rank derivates.
- on each $[t_{i-1},t_{i+2}]$ interval, the function is a third degree polynomial, $i\in[1,n-1]$
- in the nodes of the $\{t_i\}$, $i\in[0,n]$ nether, the following conditions are fulfilled:
  $g(t_i)=f_i$ , $i\in[0,n]$; $g'$ fulfills the conditions of the limit: $g'(t_{i-1})=f'(t_{i-1})$
  $g'(t_{i+2})=f'(t_{i+2})$ $g''$ fulfills the conditions of the limit: $g''(t_i)=f''(t_i)$

### 3.1 The mathematical expression of the coefficients of the b icubic polynomial B-Spline functions

The B-spline functions are thirdy degree polynoms on portions defined by the pointes $t_{i-1},t_i,t_{i+1},t_{i+2}$. By applying the same methodology as presented in the previous paragraph, the third degree polynomial representing the interpolating B-spline function looks like:

$$x(t)=a_xt^3+b_xt^2+c_xt+d_x$$
$$y(t)= a_yt^3+b_yt^2+c_yt+d_y$$
$$z(t)= a_zt^3+b_zt^2+c_zt+d_z$$

where:

| | | |
|---|---|---|
| $a_x=(-x_{i-1}+3x_i - 3x_{i+1} + x_{i+2})/6$ | $a_y=(-y_{i-1}+3y_i - 3y_{i+1} + y_{i+2})/6$ | $a_z=(-z_{i-1}+3z_i - 3z_{i+1} + z_{i+2})/6$ |
| $b_x= (3x_{i-1}-6x_i+3x_{i+1})/6$ | $b_y= (3y_{i-1}-6y_i+3y_{i+1})/6$ | $b_z= (3z_{i-1}-6z_i+3z_{i+1})/6$ |
| $b_x= (3x_{i-1}-6x_i+3x_{i+1})/6$ | $c_y = (-3y_{i-1} + 3y_{i+1})/6$ | $c_z = (-3z_{i-1} + 3z_{i+1})/6$ |
| $b_x= (3x_{i-1}-6x_i+3x_{i+1})/6$ | $d_y = (y_{i-1} +4y_i + y_{i+1})/6$ | $d_z = (z_{i-1} +4z_i + z_{i+1})/6$ |

when $i\in[1,n-1]$ and $(x_{i-1},y_{i-1},z_{i-1})$, $(x_i,y_i,z_i)$, $(x_{i+1}, y_{i+1}, z_{i+1})$, $(x_{i+2}, y_{i+2}, z_{i+2})$ are the points.

And the form matricial is:

$$x(t) := \begin{bmatrix} t^3 & t^2 & t & 1 \end{bmatrix} \cdot \begin{bmatrix} -1 & 3 & -3 & 1 \\ 3 & -6 & 3 & 0 \\ -3 & 0 & 3 & 0 \\ 1 & 4 & 1 & 0 \end{bmatrix} \cdot \begin{bmatrix} x_{i-1} \\ x_i \\ x_{i+1} \\ x_{i+2} \end{bmatrix}$$

$$y(t) := \begin{bmatrix} t^3 & t^2 & t & 1 \end{bmatrix} \cdot \begin{bmatrix} -1 & 3 & -3 & 1 \\ 3 & -6 & 3 & 0 \\ -3 & 0 & 3 & 0 \\ 1 & 4 & 1 & 0 \end{bmatrix} \cdot \begin{bmatrix} y_{i-1} \\ y_i \\ y_{i+1} \\ y_{i+2} \end{bmatrix}$$

$$z(t) := \begin{bmatrix} t^3 & t^2 & t & 1 \end{bmatrix} \cdot \begin{bmatrix} -1 & 3 & -3 & 1 \\ 3 & -6 & 3 & 0 \\ -3 & 0 & 3 & 0 \\ 1 & 4 & 1 & 0 \end{bmatrix} \cdot \begin{bmatrix} z_{i-1} \\ z_i \\ z_{i+1} \\ z_{i+2} \end{bmatrix}$$

for $i \in [1, n-1]$.

The expressions lead to the conclusion that the interpolating B-spline function can be determined only by four successive coordinates of the shape.

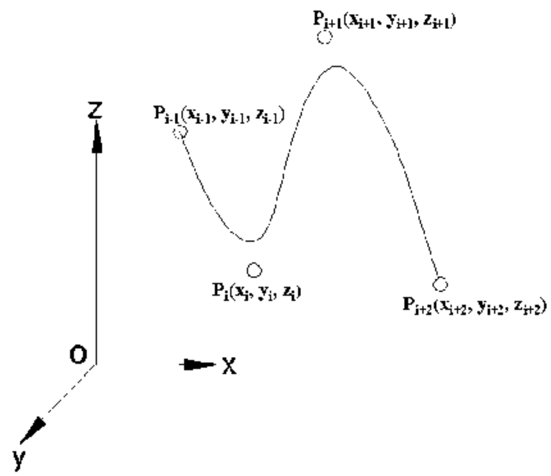



**Figure 2**, Four successive coordinates determined a curves 3D B-Spline

#### 4. DISCUSSION

After those presented, it can be noticed that a point belonging to a B-spline polynomial depends on the coordinates of its neighboring points, but it doesn't depend at all of all the poi nts defining the shape. In the words of specialists, this means that "a B-spline approximation has a local scheme".

The characteristic of being able to decrease the variation and the local character of the approximation when using a B-spline function can be explained by looking at the geometrical behavior of the B-spline curves.

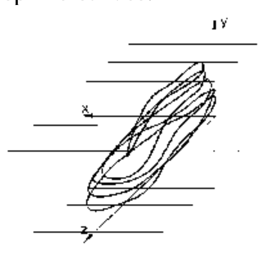


**Figure 3,** The last is define for section cros

a point on such a curve is a convex combination of K neighboring nodes of the polygon and thus the curve can very well "fit" with the polygon.

if one node of the polygon is moved, the curve will only be modified locally, in the neighborhood of the node. This characteristic is essential in design, because it allows the creator to modify a curve he is not satisfied with, without having to re-make the whole outline.

#### 5. RESULTS

Geometrical shapes commonly used in Computer Aided Design (CAD) systems can be defined by several points obtained through the digitising process. The co-ordinates of the points situated between two nodes can be approximated through both analytic and graphic me thods, with B-spline curves.

The mathematical modeling of the shapes establishes the object's numerical shape by means of some interpolation methods. For that, points are picked from the shapes establishes the object's numerical shape by means of some interpolation methods. For that, points are picked from the shape's surface or from near by, in a xOyz axis system. These points belong to some cross or longitudinal section, and/or cross, longitudinal sections (fig. 3). The points are joined with lines or curve arcs to obtain suggestive representations of the object.

### 5.1 The construction of the spatial shoe last's form

Geometrical last's shapes can be defined by several points obtained through the digitising process (fig. 4).

The co-ordinates of the points situated between two nodes can be approximated through both analytic and graphic methods, with B-spline curves. The graphical form will be represented by a curve that crosses all the co-ordinates of the digitised points, without bringing any mutations of the initial curve.

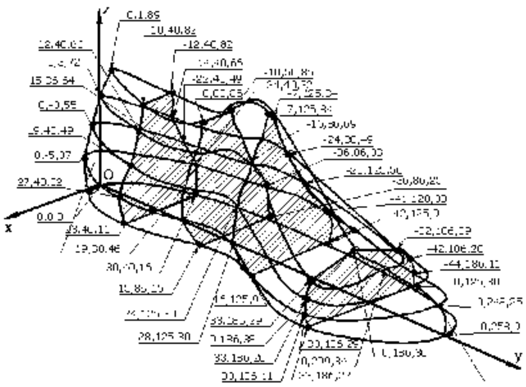


**Figure 4**, The points of the last can be defined in the digitising process

In the picture 5, the shapes of the last is defined by longitudinal section whose points are joined with 3D curves. The points are intrpoled by the B-spline method. The achieved image is suggestive. It can be understand not only by fottwear specialists, but also by any computer user.

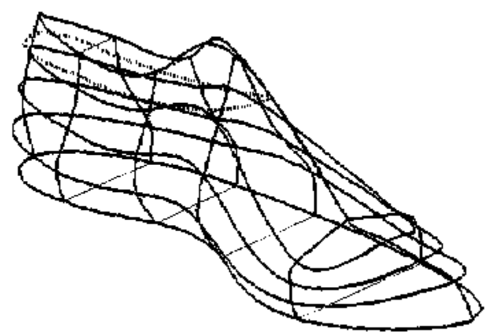


**Figure 5**, The model spatial shape of the last

## 6. CONCLUSIONS

1. Graphic visualisation assisted by computer materialises through suggestive images that can be easily understood by any user.
2. The methods we used allow the casting of footwear products straight on the last.

## 7. REFERENCES


1. Burden, R., L., Faires, J., D., *Numerical Analysis*, PWS-KENT Publishing Comp., Boston, 1985
2. Popa M., Popa A., Militaru R. - *Notiuni de analiza numerica*, Ed. Sitech, Craiova, 2001.
3. Ralston A., Rabinowitz P. - *A First Course in Numerical Analysis*, McGraw-Hill, New York, 1978.

ANNALS OF THE UNIVERSITY OF ORADEA
FASCICLE OF TEXTILES- LEATHERWORK
Volume I, 2010, No. 2

# APPROACHES ON THE CONSTRUCTIVE DEVELOPMENT OF THE ZIPPER HANDBAG

**Florentina Harnagea, Marta Catalina Harnagea**

*"Gh. Asachi" Technical University of Iaşi, Faculty of Textile – Leather and Industrial Management*

harnagea@tex.tuiasi.ro

***Abstract:*** The aim of the footwear producer is to use his leather as economically as possible by avoiding wastes. The paper presents the influence of the master pattern layout of a zipper handbag on the average nesting factor. The wastes that appear at cutting influence significantly the consumption norm. Therefore it is recommended to design the patterns so that they interlock closely.
***Key words:*** handbag, leather, development, nesting factor, specific consumption

## 1. INTRODUCTION

The development process is an important component in design. The techniques for product development follow up obtaining a sufficient number of models in the same family, as to define the variants both for the manufacturer as for the consumer.

The development of a product starts from the assumption that in the conceiving phase of a base model there have been taken into consideration and respected the general criteria that are the base of the design process: functional, esthetical socio-economic and technologic.

The model is defined as a sum of characteristics (material, shape and color), components, manner of detailing-assembling and decoration that make the difference between similar objects or between the same group objects.

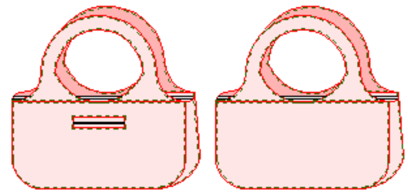
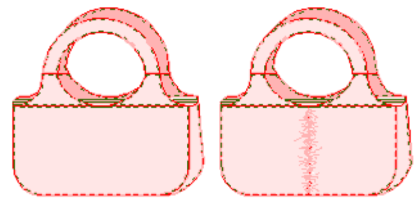
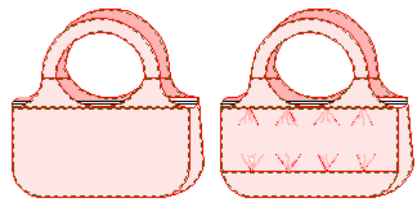
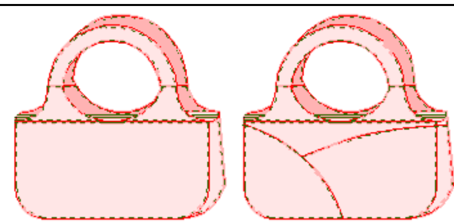
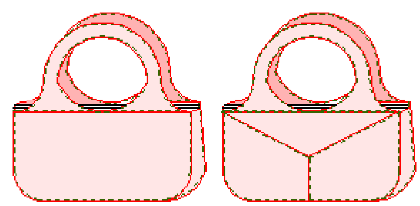
A series of criteria are used in leather goods development such as: combination of materials, changing the pattern's shape, ornamentation, the way of detailing the master pattern of the exterior patterns, the manufacturing- assembling process, the closing system.

The development of the exterior patterns through detailing the base sketch is frequently used in leather goods industry. Thus starting from a base model for a zipper handbag there are presented the constructive variants developed through detailing the anterior part.

## 2. PRESENTING THE MODEL VARIANTS

The base model (the zipper handbag) has as components the following patterns: anterior side (1), posterior side (1), base side, lateral side (2), handles (2), interior side of the handle, collar for zipper (2). The model variants have been obtained through detailing the anterior side and the handles and keeping their shape.

**Tab.1** The model variants

| Nr. crt. | Number of patterns | The master pattern |
|---|---|---|
| 1. | ns=11<br>anterior side-1<br>posterior side-1<br>base side -1<br>lateral side (2)<br>handles (2), double side of the handle (2)<br>collar for zipper (2) | <br>Master pattern |
| 2. | ns =13<br>anterior side (1), posterior side (1), lateral side (2), handle 1 (2), handle 2 (2), the double side of the handle (2), base side (1), collar for zipper (2) | <br>Model 1 |
| 3 | $n_s$ =16<br>anterior side (pattern 1+ pattern 2), posterior side (1), lateral side (2), handle1+ the double side of the handle (4), handle 2+ double side of the handle 2 (4), base side (1), collar for zipper (2) | <br>Model 2 |
| 4 | $n_s$ =17<br>anterior side (pattern 1+ pattern 2+ pattern 3), posterior side (1), lateral side (2), handle 1+ the double side of the handle (4), handle 2+ the double side of the handle 2 (4), base side (1), collar for zipper (2) | <br>Model 3 |
| 5 | $n_s$ =17<br>anterior side (pattern 1+ pattern 2+ pattern 3), posterior side (1), lateral side (2), handle1+ double side of the handle (4), handle 2+ the double side of the handle 2(4), base side (1), collar for zipper (2) | <br>Model 4 |

For each component of the model variants there have been done theoretical nesting in parallelogram, fig.1, then there has been calculated the nesting factor and the size of wastes.
The nesting factor of each pattern from set is calculated using the following relation:

$$F_a = \frac{n_s \cdot A_r}{A_p} \cdot 100 \qquad (1)$$

where: $A_r$ - pattern's area, in $dm^2$;
$n_s$ - number of similar patterns included in parallelogram.

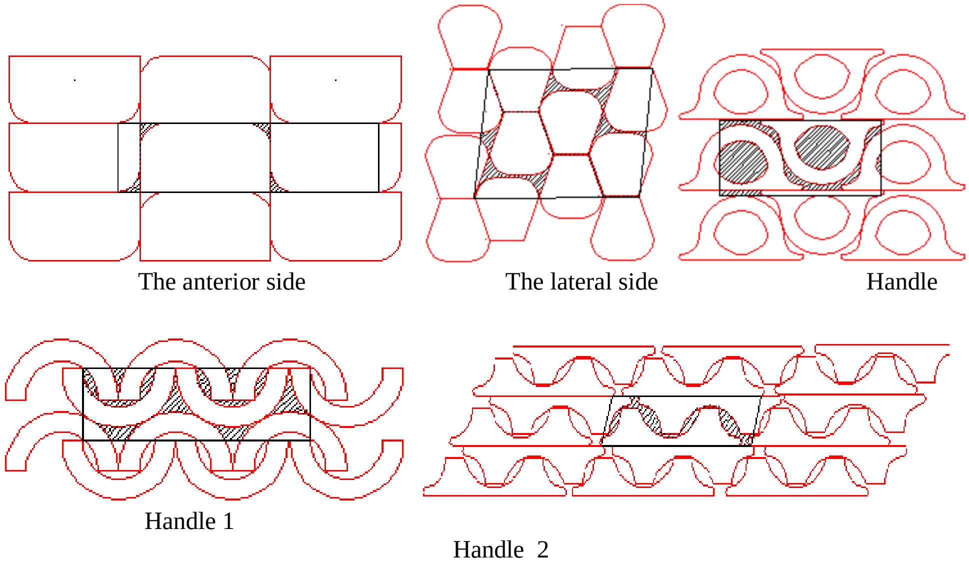



**Figure 1** Parallelogram nesting of the handle

The average nesting factor was calculated using the relation:

$$\overline{F_a} = \frac{A_{set}}{A_{parale\log ram}} \cdot 100 \quad , \quad [\%] \qquad (2)$$

where: $A_{set}$ – sum of set areas;

$A_{paralelogram}$ – area sum of parallelograms that include each pattern from the set.

In tab.2 there are presented the values of the nesting factor, the patterns area and the parallelogram's area, the percentage values for all category of wastes ($D_n$, $D_p$, $D_{m+t}$).

In order to calculate the wastes there is used the following relation:

$$a_{DN} = 100 - \overline{F_A} \text{, in \%} \qquad (3)$$

The following relations are used as well:

$$a_{Dp} = \frac{A_{Dp}}{A_S} \cdot 100 \text{, in \%} \qquad (4)$$

$$a_{Dm+t} = \frac{a}{\sqrt[4]{f_A}} \text{, in \%} \qquad (5)$$

There has been taken into consideration a skin of 100 dm $^2$ area for estimating the wastes.

**Tabable 2** The utilization index

| Model | $n_S$ | $A_{set}$, $dm^2$ | A parallelogram, $dm^2$ | $\overline{F_A}$ % | $D_n$ % | $D_p$ % | $D_{m+t}$ % | $D_t$ % | Iu [%] | $N_c$ [$dm^2$/buc] |
|---|---|---|---|---|---|---|---|---|---|---|
| $M_b$ | 11 | 32.53 | 40.96 | 79.44 | 20.56 | 2.15 | 16.17 | 38.88 | 61.12 | 53.22 |
| $M_1$ | 13 | 39.77 | 45.83 | 86.78 | 13.22 | 2.41 | 16.31 | 31.94 | 68.06 | 58.43 |
| $M_2$ | 16 | 35.61 | 38.64 | 92.16 | 7.84 | 3.4 | 15.06 | 26.30 | 73.7 | 48.32 |
| $M_3$ | 17 | 33.54 | 37.29 | 89.94 | 10.06 | 3.64 | 14.62 | 28.32 | 71.68 | 46.79 |
| $M_4$ | 17 | 33.78 | 36.83 | 91.72 | 8.28 | 3.55 | 14.64 | 21.47 | 78.53 | 43.01 |

Table 2 presents the utilization indexes resulted with the theoretical nesting and the consumption norms for second quality leathers.

The utilization index at cutting was calculated with the following relation:

$$U = 100 - a_{Dt}, [\%] \qquad (6)$$

In order to assess the consumption norm, the following relation was used:

$$N_C = \frac{A_s}{U} \cdot 100 \text{, [dm}^2\text{/pair]} \qquad (7)$$

where:

$A_s$ – set area (the area of the patterns that compose a pair of footwear);

U – leather utilization index, in %.

## 3. RESULTS AND DISCUSSIONS

Figure 2 presents the variation of the nesting factor for each model variant with a number of patterns comprised between 11 and 17.

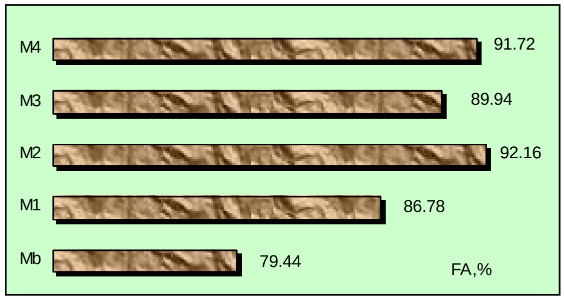



**Figure 2.** Variation of the nesting factor

For the model base Mb there has been obtained the smallest value of the nesting factor. The model variants obtained through developing the base model of the uppers present higher values of the average nesting factor in comparison to the base model.

The percentage variation of the total wastes, compared to normal wastes is illustrated in fig. 3. As there can be noticed in fig 3 the base model presents the biggest percentage of the total wastes. Detailing the base model and increasing the number of patterns from set, the value for the $D_n$ and $D_{m+t}$ wastes decreases and the base model has the best values. The model variant M4 with 17 patterns presents the smallest value of the total wastes, respectively of 21.47%.

In figure nr 4 it is illustrated the variation of the consumption norm compared to the value of the total wastes.

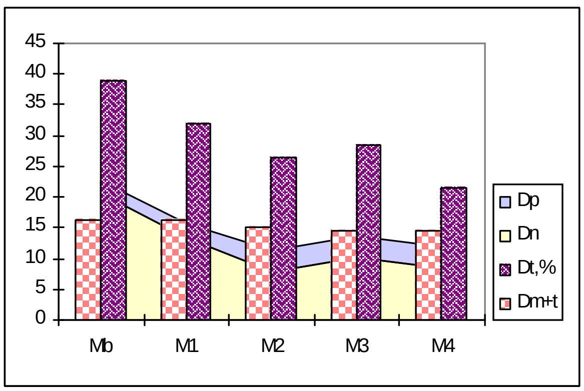



**Figure 3.** Variation of the wastes, as function of the model variant

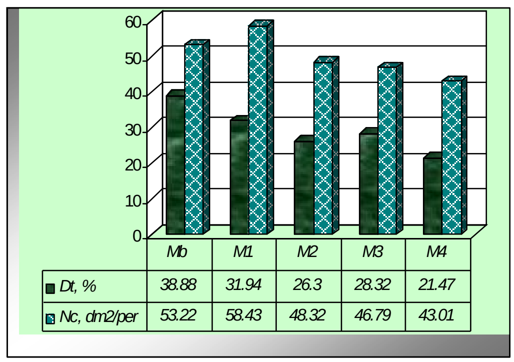



**Figure 4.** Variation of theoretical consumption norm

The master pattern has the highest value of the nesting facto r. The model variants obtained present proximate values of the nesting factor.

Figure 3 presents the variation of the total wastes, in %, as sum of $D_n$, Dp and $D_{m+t}$. As it can be observed the highest value corresponds to $D_{m+t}$. Once the number of patterns is bigger, the $D_{m+t}$ wastes decrease.

The $V_4$ variant with 13 patterns presents the highest value of the wastes (5 .84%). Figure nr 4. illustrates the variation of the consumption norm in comparison to the total technological wastes.

The variation of the utilization index of the leather is illustrated in figure 5.

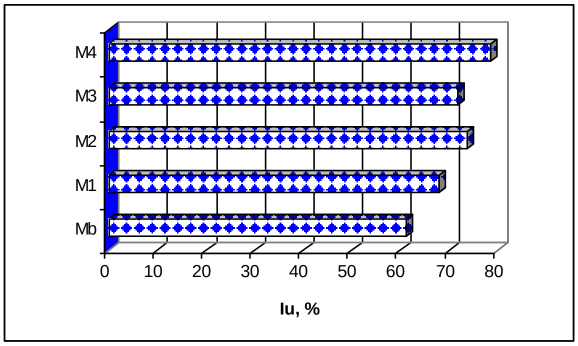



**Figure 5**.Variation of the utilization index

From all the variants the highest value of the utilization index has resulted for V5 (72.05%).

## 4. CONCLUSIONS

The development of the base pattern of uppers (anterior side and handles) results in a diminished value of the consumption norm, respectively of 10,20dm$^2$ / pairs and the best utilization index of the leather for M4 model.
The percentage values of each category of waste is calculated so that they are minimized. Therefore it is recommended the use of those skins with a bigger surface and a combined interlock of the small patterns of leather goods.

## 5. REFERENCES

1. Malureanu G., Cociu V., (1991), *Bazele tehnologiei produselor din piele şi înlocuitori*, Rotaprint, Iasi
2. Harnagea F.,(2002), *Tehnologia articolelor de marochinãrie*, Ed. Performantica, Iaşi , 2002
3. Harnagea F., (2006), Aspect Concerning the Economical Consumption of the Leather During Footwear upper Cutting, *International Scientific Conference Unitech*[06] *Gabrovo Proceeding vol.II*, Gabrovo, Bulgaria 24-25 November 2006,pg. 298-301, ISBN 10: 954-683-352-5
4.Secan C., Harnagea F., The influence of the pattern's configuration on the waste amount during leather cutting, Buletinul I.P.Iaşi, tomul LIII (LVII), fasc. 5, Secţia Textile-Pielãrie, vol II, 2007, Papers presented at "The XIII Romanian Textile and Leather Conference, CORTEP 2007, p.247 -252
5. Aura Mihai, Antonela Curteza (2005), *Designul produselor din piele şi înlocuitori*, Performantica, Iaşi, ISBN 973-730-061-0

ANNALS OF THE UNIVERSITY OF ORADEA
FASCICLE OF TEXTILES- LEATHERWORK
Volume I, 2010, No. 2

# CHOOSE OPTIMAL VARIANT STRUCTURES MATERIALS UPPER OF FOOTWEAR FOR THE PERSON WITH DIABETES

**Ischimji Nicolae[1], Mitu Stan[1], Mărcuș Liviu [1]**

[1] *Gh. Asachi University, Iaşi, ROMANIA*

Corresponding author: Ischimji Nicolae, E-mail: ischimjinicola@yahoo.com

***Abstract:*** In this study was select like classic materials for upper shoes namely different types of leather, so special propose footwear for the person with diabetes namely Spandex, Lycra, foam lining intermediate and SympaTex lining inner. From this materials whose create ten structures with different type of combination. In basis for this combination whose thickness of material and his place in layer position. The comfort parameters who's determined with analytic and experimental method (laboratory testing). For these structures were determined next parameters: thermal resistance - Rt, resistance to vapour passage - Rv, resistance to air flow - Ra. For these parameters with maximal values was attributing 100 points and determinate global index of comfort - Ig. Thus Ig max = 294, 91 corresponding structures S4 and Ig min = 247, 01 corresponding structures S1. For show influence of layer lining was building physiological triangles in faces etalon structures. The results indicate that structures with diverse foam lining have influence positive on thermal resistance and resistance to air flow due to the fact that persist air spices. Optimal structures the materials upper destination for diabetic footwear's to season winter include SympaTex lining or other season recommends structures with leather lining. Using the special materials in face structure upper footwear adduce to improve thermo - physiological comforts and in results raise quality of footwear for person who ill with diabetes
***Key words:*** upper structures, footwear, comfort, diabetes

## 1. INTRODUCTION

Diabetes is a multi-system condition leading to multiple end organ complications. Peripheral neuropathy is the key factor leading to the lower extremity complications of diabetes. These lower extremity complications include loss of protective sensation which leads to ulcerations, Charcot changes and there may also be associated neuropathic pain.

The health care provider must be familiar with the various aspects of footwear so as to best guide their patient. The basic concepts of the footwear management of the person with diabetes, with or without a lower extremity complication, include the basic anatomy of the footwear, the type and features thereof, as well as the principle of obtaining appropriately fitted footwear. The footwear serves as a container designed to cover the foot, providing protection from external forces and debris. The upper must comply with the morphology of the foot. The lining should be smooth and free of seams which may create unanticipated pressure points within the shoe.

For persons with diabetes, the following features of footwear would be inappropriate as they do not provide adequate support and protection, thus, putting the foot at risk of trauma: backless, open toe or slip on shoes, rigid upper that would allow inversion and that would flex at points other than the location of the metatarsal heads. A common problem witnessed by shoe fitters is that persons with diabetes may independently obtain footwear which is of an inappropriate size as they may be unable to appreciate whether it is too tight or too loose.

Properly fitted footwear is one of the key elements for the successful foot management of the person with diabetes. Footwear for persons with diabetes serves an important purpose, specifically, protection and support allowing for individuals to perform their activities of daily living. Ideally the selected footwear should be fitted by an experienced provider and include the full range of appropriately fitted conventional footwear with or without modifications to custom made/molded based upon the Carville criteria.

Various studies have shown that feet are one of the most sensitive parts of the human body when referring to body comfort for persons with diabetes. The feet are consistently cooler than other parts and their protection and comfort becomes an important aspect concerning human comfort. The study of shoe comfort is of great importance to leisure footwear manufactures, because in these applications, moisture disposal over a number of hours is a main issue. The aim of the present study is the development and testing of functional knitting which can be used with success in the interior of footwear for persons with diabetes.

## 2. MATERIALS AND METHODS

### 2.1 Select materials

In this study was select like classic materials for upper shoes namely different types of leather , so special propose footwear for the person with diabetes namely Spandex, Lycra, foam lining intermediate and SympaTex lining inner. From this materials whose create ten structures with different type of combination. In basis for this combination whose thickness of material and his place in layer position see Table 1.

**Table 1:** Types of materials

| Layers component | Materials name | Thickness (di),mm |
|---|---|---|
| Upper | Nappa leather | 1,0 |
| | Nubuck | 1,2 |
| | Split leather | 1,2 |
| | Spandex neoprene upper stretches | 1,0 |
| | Upper made with Lycra | 0,9 |
| Lining intermediate | Rubberfoam | 2,0 |
| | Algeofoam | 2,5 |
| | Foamcushion | 3,0 |
| | Thermo fabric | 0,6 |
| | Knitted thermoadhesive | 0,8 |
| Lining inner | SympaTex | 1,5 |
| | Pigskin leather | 0,8 |
| | Calfskin leather | 0,9 |
| | Leather lining perforated | 0,6 |

### 2.2 Procedures

The comfort parameters who's determined with analytic and experimental method (laboratory testing according to ISO 17705:2003, ISO 17229:2002).

From this materials whose create ten structures with different type of combination. In basis for this combination whose thickness of material and his place in layer position. Create structures this formatted systems for experimental testing show the Table 2 .

**Table 2:** Create structures

| No. | **Layers 1.** Upper | Thickness (di),mm | **Layers 2.** Lining intermediate | Thickness (di), mm | **Layers 3.** Lining inner | Thickness(di), mm | Σ (di), mm |
|---|---|---|---|---|---|---|---|
| **S1** | Spandex neoprene upper stretches | 1,0 | Knitted thermoadhesive | 0,8 | Leather lining perforated | 0,6 | 2,4 |
| **S2** | Nubuck | 1,2 | Thermo fabric | 0,6 | Pigskin leather | 0,8 | 2,6 |
| **S3** | Split leather | 1,2 | Rubberfoam | 2,0 | Calfskin leather | 0,9 | |
| **S4** | Nappa leather | 1,0 | Foamcushion | 3,0 | SympaTex | 1,5 | 4,5 |
| **S5** | Upper made with Lycra | 0,9 | Algeofoam | 2,5 | Leather lining perforated | 0,6 | 4 |
| **S6** | Nappa leather | 1,0 | Knitted thermoadhesive | 0,8 | Calfskin leather | 0,9 | 2,7 |
| **S7** | Nubuck | 1,2 | Rubberfoam | 2,0 | Leather lining perforated | 0,6 | 3,8 |
| **S8** | Split leather | 1,2 | Thermo fabric | 0,6 | SympaTex | 1,5 | 3,3 |
| **S9** | Spandex neoprene upper stretches | 1,0 | Rubberfoam | 2,0 | Calfskin leather | 0,9 | 3,9 |
| **S10** | Upper made with Lycra | 0,9 | Thermo fabric | 0,6 | SympaTex | 1,5 | 3,0 |

Intermediate and inner lining whose application with upper then constitution sum thickness. For structures calculate resistance to vapor passage Rv, resistance to air flow Ra, thermal resistance Rt and determinate global index of comfort.

## 3. PARAMETER OF COMFORT

Resistance to vapor passage Rv;

$$Rv = \sum_{i=1}^{n} R^i v \quad , \text{(mm.h.m}^2\text{/g)} \quad \textbf{(1)}$$

Resistance to air flow Ra;

$$R_a = \frac{\delta}{i} , \text{(mm.h.m}^2\text{/kg)} \quad \textbf{(2)}$$

Thermal resistance Rt;

$$Rt = \frac{1}{K} , \text{(m}^2\text{°C/W)} \quad \textbf{(3)}$$

Thesis parameters that's determined partial in registration and calculated.

## 4. RESULT

Maximum value of thermal resistance Rtmax.=0,31617 who's registrations in the structures S4, and minimum value Rtmin.=0,31617 in the structured S1. Resistance to air flow Ra have maximum value Ramax=0,7237 who's registrations in the structures S7 and minimum value Ramin.=1,00178 in the structured S2. Resistance to vapor passage Rv have maximum value Rvmax=0,5434 who's registrations in the structures S5 and minimum value Rvmin.=0,7223 in the structured S2 Table 3 .

**Table 3:** Result and value the global index of comfort Ig

| **Structures** | **Rt,** m²°C/W | **Point** | **Ra,** mm.h.m²/kg | **Point** | **Rv,** mm.h.m²/g | **Point** | **Ig** |
|---|---|---|---|---|---|---|---|
| S1 | 0,25385 | 79,665 | 0,90626 | 80,18 | 0,66277 | 87,164 | 247,01 |
| S2 | 0,27532 | 86,404 | 1,00178 | 72,602 | 0,7223 | 79,981 | 263,767 |
| S3 | 0,28128 | 88,567 | 0,88357 | 82,212 | 0,6728 | 87,247 | 272,461 |
| S4 | 0,31617 | 100 | 0,74832 | 98,325 | 0,5747 | 96,585 | 294,91 |
| S5 | 0,28673 | 89,466 | 0,7325 | 99,263 | 0,5434 | 100 | 288,729 |
| S6 | 0,29315 | 92,629 | 0,8964 | 88,254 | 0,58246 | 97,52 | 278,403 |
| S7 | 0,31287 | 99,358 | 0,7237 | 100 | 0,68125 | 85,813 | 285,171 |
| S8 | 0,30856 | 96,836 | 0,7495 | 97,382 | 0,63523 | 90,658 | 284,876 |
| S9 | 0,29138 | 91,621 | 0,7514 | 96,647 | 0,59459 | 96,86 | 285,128 |
| S10 | 0,30391 | 98,629 | 0,7694 | 93,254 | 0,65246 | 89,52 | 281,403 |

### 4.1 Global index of comfort

For determinates global index of comfort that's stabilization the variants etalon for three parameters calculate, consideration special requirement the footwear.
Structures choose the etalon to agree 100 point and other this calculate proportional.
In figure 1 shows histogram the global index of comfort for all structures.

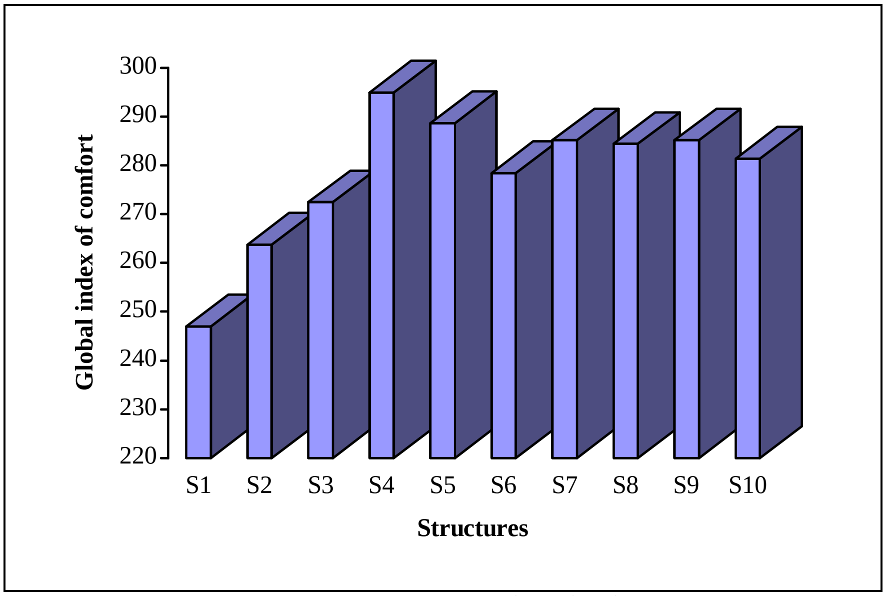



**Figure 1:** Histogram the global index of comfort for all structures

Thus Ig max = 294, 91 corresponding structures S4 and Ig min = 247, 01 corresponding structures S1.

### 4.2 Construction physiological triangles

Structures etalon choose S4 after the include upper nappa leather, foam lining intermediate and SympaTex lining inner.
In figure 2 show presentation physiological triangles corresponding the global index of comfort Ig maximum, minimum and ideal.

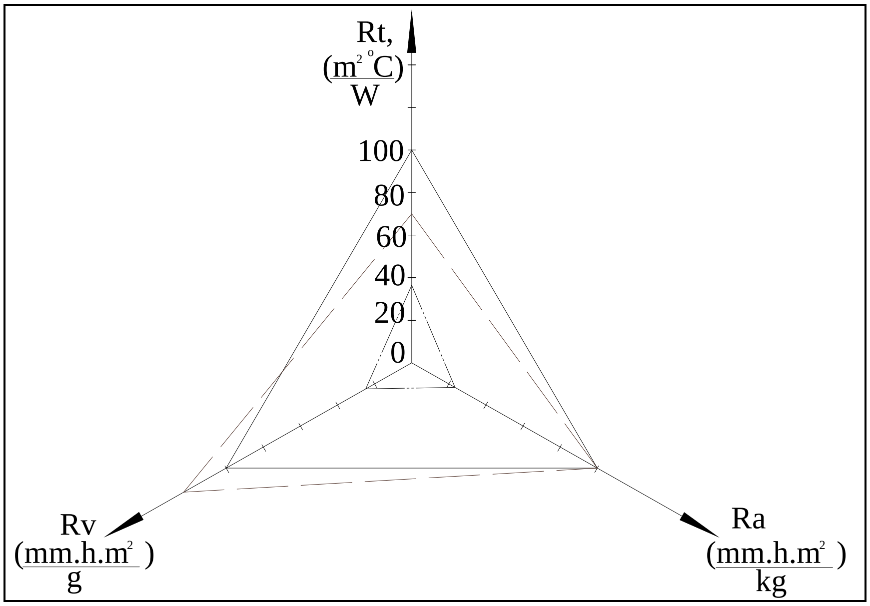



**Figure 2:** Physiological triangles corresponding Ig maximum, minimum and ideal

For represent influence dieses lining materials to become utilization unitary scale, 5 units for value etalon.

**Influence intermediate lining of comfort parameters**

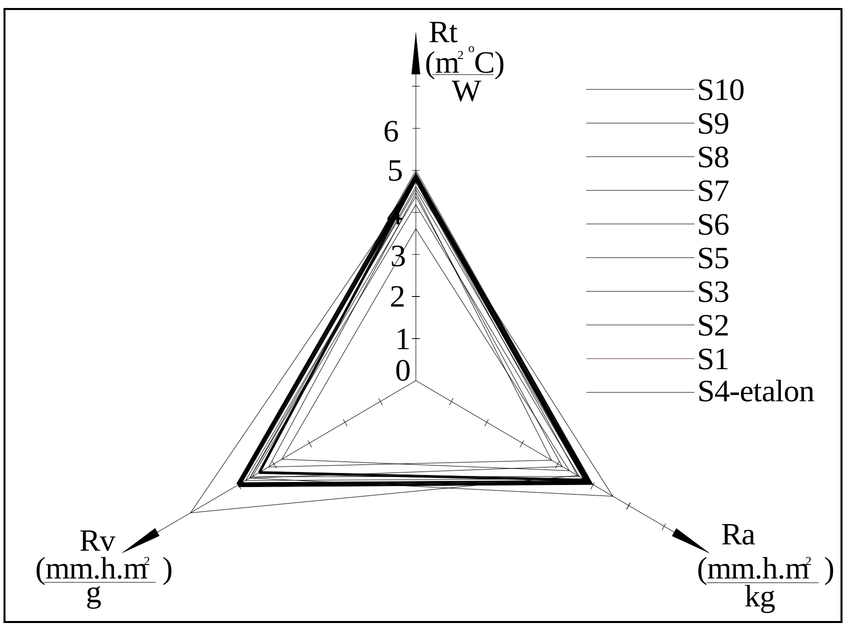



**Figure 3:** Physiological triangles of structures with intermediate lining

In figure 3 presented influences intermediate lining of comfort parameters in special abate the triangles for structures S5 and S7 who have good parameters Rv and Ra.

**Influence inner lining of comfort parameters**

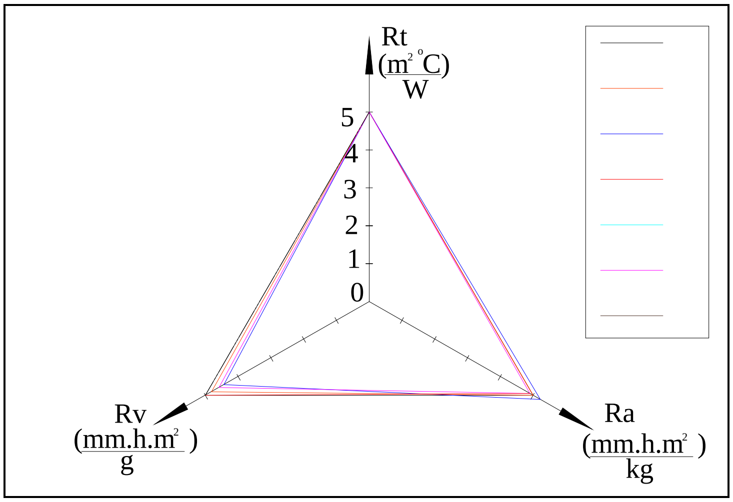



**Figure 4:** Physiological triangles of structures with inner lining

For show influence of layer lining was building physiological triangles in faces etalon structures.

## 5. DISCUSSION

The results indicate that structures with diverse foam lining have influence positive on thermal resistance and resistance to air flow due to the fact that persist air spices. Very soft upper of three layers from inner to outer: cloth, foamcushion, leather without and kind of toe cap.

## 6. CONCLUSIONS

Optimal structures the materials upper destination for diabetic footwear's to season winter include SympaTex lining or other season recommends structures with leather lining. Using the special materials in face structure upper footwear adduce to improve thermo - physiological comforts and in results raise quality of footwear for person who ill with diabetes.

## 7. REFERENCES

1. Dragomir A., Porav V., Mitu S. (2006). Analysis of the load variation at unsoldering after heat sealing. *Industria Textila,* Vol. 57, No. 4, pp 245-252, ISSN 1222-5347;
2. Ischimji N., Mitu S., Mărcuş L. (2008). New types of materials used for special propose shoes manufacturing, *Symposium annual of specialist the industries textiles, Iasi, 13-15 November,* Ed. Performantica, pp. 132-138.;
3. Mitu S. (2000). *Komfort and functions vestment product,* Stan Mitu- Iași; Edition "Gh. Asachi", pp 291-380, ISBN 973-8050-10-3;
4. Murariu C., Butnaru R., Harnagea M., A.Murariu, F.Harnagea (2009). New polymeric composite materials, based on regenerated cellulose for diabetic foot diseases - *Industria Textila,* Vol. 63, No 2, pp 137-143, ISSN 1222-5347.

ANNALS OF THE UNIVERSITY OF ORADEA
FASCICLE OF TEXTILES- LEATHERWORK
Volume I, 2010, No. 2

# SHOES AESTHETIC DESIGN STAGES

**Marcela Iuhas, Florentina Kenyeres**

*University of Oradea, Romania*

Corresponging author: Iuhas Marcela, e -mail: marcelaiuhas@yahoo.com

***Abstract:*** Whatever are the fashion vagaries, who put their mark on the shape, color and material from what it is made the shoes, we tend to choose shoes that fit exactly the same tastes, nature and our habits.
Shoes say a lot about the personality of the wearer, e specially with how often are enhancements that we put into consideration the least when we try to arrange the dress
***Key words:*** Shoes, fashion house

## 1. AFTER SHOES, IN STORES

The vestimentary accessories by excellent shoes complement your style and enrich your dress. They can put in evidence, making that all eyes are fixed on your feet. For many of us, shoes are just a hobby. No matter how many pair I have always considered that there are not enough.

Sometimes, shoes are the ones that define your style. Th us, high heels are associated outfits and the sexy elegant evening. Even though there are also disadvantages, such as your tired feet and that prevents you to go faster, their benefits are more and more convincing.

When you pick your shoes to keep in mind that high heels will not go out again. But be careful to match your dress to them! Although, lately, many of us choose to wear slippers, ballet, sneakers, sandals or shoes with no heel, have every reason not to give up her .

The first clues about a person we can offer instead of buying their shoes. Usually, those who seek second-hand shoes at stores people are greedy but in the current living conditions, such an option shows that the person concerned is an ordinary man with low incomes who are trying to dev ote onself better money just can not live otherwise. People who visit luxury shops and threw only exorbitant sums for the same shoes that I could buy cheaper across the street are high, convinced that the power lies in money and eager to show their great w ealth. Those who did not seem too rich, opt for leather shoes, good work and relatively costly, are used to plan the future and know how to appreciate the real value of work well done. Those who instead prefer cute shoes from lightweight materials, regardl ess of price, are people who live moment, fall prey to the temptations of the moment, take quick decisions without thinking too much and are able to give something quickly on something what them not satisfying.

Those who opt for fashionable footwear, whet her or not its advantages in aesthetics terms, are eager to be remarked. Usually people are very sociable and willing social ascent without effort. Unaccompanied men who buy women's shoes are slaves of love: whether capricious swain of a lady or feel very guilty in front of his wife and trying to improve with an expensive and practical gift. Young women who buy men's shoes have a family spirit developed. Usually, they are married or have a stable relationship, which they want materialized through marriage, but in some cases are simply loving sisters or daughters, eager to handle carefully the other family members .

## 2. WHAT SAYING THE FORM OF THE SHOES?

Womens who often bear the fine shoes with high heels are not used to travel as a pedestrian, and most conceive no otherwise than to travel by car. Those who opt for a comfortable day footwear without heels or low heels and flat even if not fashionable, or have health problems which require them to such shoe or are modest, calm and you have a current occupati on obliged to walk or move much more time to stand upright.

Men who prefer comfortable, sports shoes, are active and energetic people, accustomed to dress in jeans and shirt, which feels weird in festive clothes.

Conversely, men opt for classic, very stylis h, sophisticated and sporty shoes are always well situated financially or wish to be considered. If they choose shoes with round tip, are romantic and gentle, and if opting for the square-tipped, are tougher and independent natures.

Those who choose the same color shoes to handbags and assorted clothing items are one of the people with good taste, which, if they allow, can be elegant even without to be moder n and young


**Christian Louboutin** is certainly the master of transparent shoes. He created more transparent styles of shoes, from elegant shoes, to tempt rock models.

First class, second-hand shoes, were made of very fine veils, creating a visual effect very feminine and delicate. In terms of frames designer has been not limited to the high but made shoes with lower heels are more comfortable so that another choice that made a shoe designer in terms of transparency will be on May rebellious personalities taste. A first model wou ld not mesh and the second material silicon with metal targets.


**Prada** is another fashion house that relied transparency on shoes in summer. Their shoe models are enriched with applications of transparent plastic, pl astic combined with textile straps and go on a medium frame, wholesale shoes is and whether or not clump. Shoe colors have varied widely so that we could see only white models, black or gray. Prada shoes in the collection was not only transparent but also the handbags.


Ladies always opting for dark shoes are practical and peaceful natures, modest and not very sociable. Instead, the flamboyant shoes bearing will necessarily stand out, are happy and nonconformist, like who does not hesitate to paint their hair green if it went through their head and they think it is advantageous.



To shoes are usually given little attention and no matter how ex pensive and quality, not showing any leg perfectly. A person can sometimes be weighed as well as maintain their shoes. Who has always well polished shoes is calculated, attention to detail and very concerned leaves the impression of others. If shoes are el egant, the person in question does not really run away and usually has a job that is required to show impeccable. Anyone who has ever dusty shoes, no matter how beautiful, more customary to go on land and pay little attention to aesthetic small things. A v ery elegant pair of shoes, but down at heel, lady in question shows that, is no matter how well dressed, is careless, comfortable, indifferent and has no sense of aesthetic form. How about shoes that are clearly old and outdated, but still looks impeccable bearer, especially if it is a woman, they show a good housewife, a calculated woman that, even when it is rich, knows how to show care and keep their "shields" in any circumstances.

## 3. REFERENCES


1. Mălureanu, G., Mihai, A. (2003). *Bazele proiectării încălţă mintei*, Editura "PERFORMANTICA" IAŞI.
2. Luca, C. I., Volocariu, R. S. (2005) *Materii prime pentru confecţii din piele şi înlocuitori* Editura Universităţii din Oradea, Oradea.
3. Luca, C. I. (2002). *Asigurarea şi controlul calităţii încălţămintei pe fluxul de fa bricaţie* ;Editura Universităţii din Oradea.
4. Mălureanu, G., Cociu, V.(2003). *Bazele produselor din piele şi înlocuitori* , Rotaprint I. P. Iaşi
5. Harnagea, Fl.(2000) Proiectarea şi tehnologia articolelor de marochinărie, Editura Cermi Iaşi.
6. Luca, C. I.(1995). Matriţe şi procese de formare în matriţe din industria de încălţăminte Editura Cronica Iaşi.
7. Harnagea, Fl.(2002) Tehnologia articolelor de marochinărie, Editura Performantica Iaşi.

ANNALS OF THE UNIVERSITY OF ORADEA
FASCICLE OF TEXTILES- LEATHERWORK
Volume I, 2010, No. 2

# WATERPROOF FOOTWEAR

**Cornelia Ionescu Luca[1], Elena Chirilã[1]**

[1]"Gheorghe Asachi" Technical University of Iasi, ROMANIA

Corresponding author: Cornelial Ionescu Luca, E-mail: cionescu@tex.tuiasi.ro

***Abstract**:* The waterproof footwear is a footwear assortment which does not allow the water penetration to the footwear interior and which, in the same time, allows a high respiring of the foot. The base components of this footwear assortments are the linings conceive as waterproof membranes which stop water penetration from the exterior to the interior of the footwear. These membranes have, in the same time, proprieties in water vapors removing from the interior to the exterior of the footwear. The paper presents some manufacturing technological particularities of the waterproof footwear used in wet working environments. It presents some structures and properties of the waterproof fabrics used in the manufacture of these designs as well, the testing methods of the waterproof, from the exterior to the interior, of the footwear and water vapor re moval from the interior to the exterior of the footwear.

**Key words:** waterproof footwear, waterproof lining, testing method

## 1. INTRODUCTION

The waterproof footwear is a footwear assortment which does not allow the water penetration to the footwear interior but allows, in the same time, a high level of the foot breathing. These assortments are used in wet conditions wearing such as: raining, snowing, etc.

The waterproof footwear or its components are made by big international companies. These companies through their research compartments had introduced their own materials, technologies or testing methods which have been patented, getting in this way, the exclusivity of their manufacturing. The paper presents some aspects about the manufacturing techn ological particularities of the waterproof footwear assortments and some characteristics of their structure waterproof materials.

## 2. TECHNOLOGICAL PARTICULARITIES OF THE WATERPROOF FOOTWEAR MANUFACTURING OF THE PATENT "GORE TEX"

The base components of waterproof footwear assortments are the linings, which are conceived as some waterproof membranes which stop the water penetration from the footwear exterior to its interior, considering the manufacturing specific technological particularities, too. The ma nufacturing of the superior ensemble and its assembling with the inferior ensemble can be realized using different methods then the classic footwear manufacturing methods.

This manufacturing process was patented by Gore Tex [1] and it belongs to the public domain, now.

As this technology shows, the upper sides and the linings are realized separately. The lining markers are sewing assembled using a classic sewing machine. All the borders which were sewing assembled are waterproofed using waterproof slivers. The inner sole which is made using a waterproof material, will be assembled together with the inners [2, 3] using the sewing machine Strobel, as Figure 1 shows. In this case, the lining must be larger then the normal Strobel one, with 13 -15 mm, depending on the foot height of the shoe last. The designing of the lining must realize an important condition: the lining must not generate folds on its swinging zone on the planting area. The designing of the inner must realize the following condition: it must joi n perfectly on this kind of lining. This so obtained stock is put on the shoe last, as Figure 2 shows, [2, 3].

**Figure 1:** Strobel seam

**Figure 2:** Lining sock on Last

The planting area of the stock is smeared with a polyurethanes adhesive and the go-between sole is smeared with a polyurethanes adhesive, too or with ă thermo-adhesive. After the drying period, the two surfaces become in use, the go-between sole is fitted, as Figure 3 shows, then they are pressed, as Figure 4 shows, [2, 3]. The "sealed" minimum breadth between the boundary of the go-between sole and the Strobel seam between the stock and the lining must be minimum 10 mm.

**Figure 3:** Appling of the Gasket

**Figure 4:** Pressing of the Gasket

After all these operations were done the stock will be put off from the shoe last and it will be waterproof tested. If the stock passes the test, the vamps and the linings are joined toget her using the classic assembly methods. The footwear drawing and soling go on using classic technologies but without using adhesives like thermo-cement.

The manufacturing process patented by Gore Tex presents the following advantages: it is well known by almost all Asiatic producers; the waterproof test is made before the footwear finishing; it can be used also other types of waterproof membranes, [4]. But there are a few restrictions, too, such as: the necessity of some double assembly operations, more sew ing operations and the missing of the patenting exclusivity.

## 3. WATERPROOF MEMBRANES, STRUCTURE, PROPERTIES

The main components of the waterproof footwear are the linings which are made from fabrics which are like footwear membranes. These membranes work as a barrier against the water penetration. The membranes and the waterproof slivers are made by drafting covering of one thin polyurethanes layer or of one polyethylene phenyl ethylene layer on a textile support. One structure of this kind of fabric is represented [1, 2, 6, 7] in Figure 5.

There are two kinds of processes for the obtaining of laminated membranes [2, 3]: by extrusion as Figure 6 shows and by transfer described in Figure 7.

In Figure 6, the membrane is laminated on a textile support an d the protection film is deposited by polymer extrusion.

In Figure 7 the membrane is a textile applied on a paper film and the drafting takes place on another textile support.

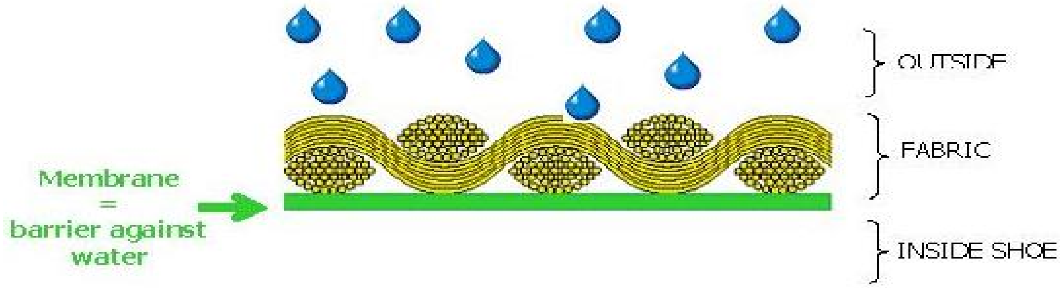



**Figure 5**: Membrane laminated on the fabric generally used for shoe

These membranes are waterproof tested according to ISO 811, Smerber test [5]. The results are expressed in mm water. The minimum requirement for the waterproof lining is 3000 mm water and 2000 mm water after 5 washings.

At the same time, these membranes must hav e breathing proprieties, so they must allow the passing of the water vapors from the inside to the outside of the footwear.

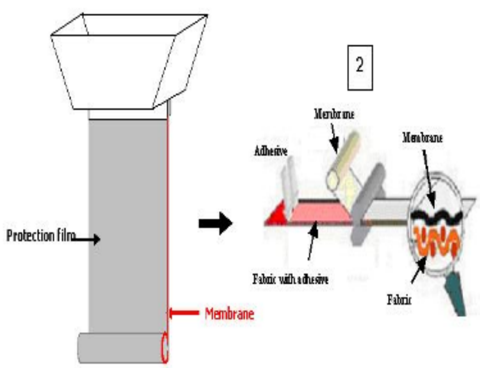



**Figure 6:** Extruded membrane

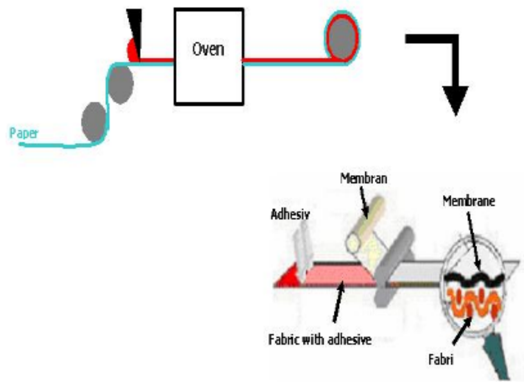



**Figure 7:** Transfer lamination

Figure 8 presents this phenomenon in the case of a hydrophilic polymeric film [4, 5]. To reach the outside environment, the water vapors pass from a hydrophilic molecule of the film to another hydrophilic molecule, when the first one is already wet. The process i s better because of the pressure and temperature differences between the inside and the outside of the footwear.

In another variant, the water vapors removing process from the inside to the outside of the footwear is better because of the porous structur e of the polymeric film [3, 4].This variant is presented in Figure 9. The process is based on that the polymeric film, the membrane or the textile support are porous structure having open pits.

The water vapors goes through this porous structure because of the pressure difference between the inside and the outside of the footwear.

As the test of water vapors permeability finding shows in [7] standard EN ISO 20344:2004 [9] the minimum condition for these membranes is 40 $mg/cm^2$ 8 h.

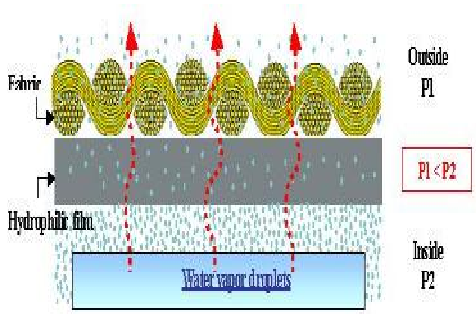



**Figure 8:** Hydrophilic process transfer

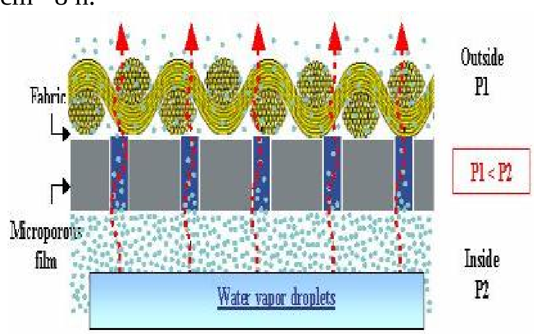



**Figure 9:** Micro porous process transfer

## 4. WATERPROOF TESTING METHODS

For the waterproof footwear homologation takes place using waterproof footwear homologation and respiration tests for the fabrics, the marks, the component sub-assemblies and for the final footwear, too.

The footwear components which will make these tests are the waterproof membranes and then, the sub-assemblies which are made using these membranes. The waterproofing main test to which the waterproof membranes are submitted is stated in the standard ISO 811 2004 [8]. The test uses the equipment presented in Figure 10 and it is name the Smerber test [3, 4].

The results are expressed in mm water. The minimum requirement for the membranes used in waterproof footwear Novadry type is 3000 mm at the initial test and 2000 mm at the waterproof test after 5 washes.

The other tests for the waterproof membranes are the tests for the water vapour permeability. For the footwear Novadry type, there are homologated two methods, the test standard NFG 5201 and the test standard EN ISO 20344:2004. The test NFG 5201 is realized in the laboratories certificated Satra, by the method of water vapour permeability determination of one complex made of 8 samples, as Figure 11, [3,4], shows.

**Figure 10 :** Smerber water test

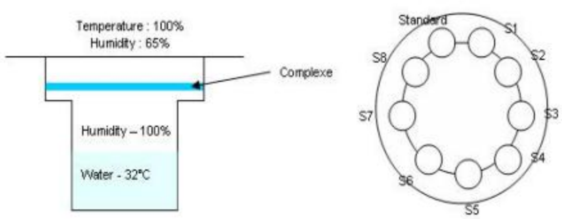



**Figure 11:** Water vapors permeability test

There are used minimum 9 circular samples one of which is the standard one . These samples are attached to a capsule full of water at 32 $^{0}$C temperature, as Figure 11 shows. The capsule is assembled into a rotating machine. After 2h, 4h, 6h and respectively 8h each sample will be weight controlled. The water vapors permeability is expressed in mg/cm$^2$8h. The minimum requirement for the waterproof membranes of the Novadry type footwear is 40 mg/cm$^2$ 8h for the total complex [3].The determination method standard EN ISO 20344:2004 is equivalent to the method [10] standard NFG 5201 but the difference is that for the measuring of the same parameters two different equipments must be used. This method is used by Sympatex [3, 4, 5].

In the manufacturing technology patented by Gore Tex, the linings have a sock design. The assembling of the linings together with the vamps will be made after the linings waterproofing test. The sock is tested with 0, 4 bar pressure using a special equipment as Figure 12 shows.

The waterproof footwear testing at waterproofing will be made in static and /or dynamic conditions [3, 4]. The waterproof test in static conditions [4] and in dynamic conditions use the equipment shown in Figure 12. The finished footwear is placed in the inside of the equipment, bonded with an air propeller system into the footwear inside, in standard pressure conditions, in a process like a vulcanization tube pressurization verifying process. If the air checks will not be observed on the footwear surface, the footwear will be considered waterproof.

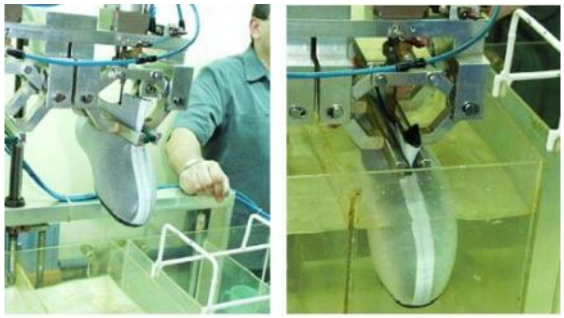


**Figure 12:** Waterproofing Test

**Figure 13:** Working diagram for testing final Novadry footwear in static and dynamic conditions

In dynamic conditions the footwear is submitted to one cycle of repeated flexions in water between 2000 and 25000 flexions. After a certain number of flexion s, the footwear will be manually checked. The water presence in the inside and the localization of wet areas allow the identification of the defects and their improvement. The results are compared with the internal standard Novadry DS171. The final footwear breathing test is showed in Figure14. A lining sock type made from a drafting fabric is full of water at 34 $^{0}$C temperature and then it is introduced in the inside of the footwear. The breathing will be estimated measuring successively the weight of the s ock. Then using the average of the weight differences measured from 10 to 10 seconds, 5 minutes time the breathing is calculated.


**Figure 14:** Waterproof footwear breathing test

The temperature and the testing time may be different depending on the test ing laboratory. For comparative tests the footwear will be tested in the same laboratory.

## 5. CONCLUSION

- For the waterproof footwear homologation it will make waterproofing and respiration tests for the materials, the markers, the components sub-assembles and the finished footwear, too.
- The basic components of the waterproof footwear designs are the linings designed as textile waterproof membranes which stop water penetration from the outside to the inside of the footwear. These textile waterproof membranes have, at the same time, properties in water vapors removing from the inside to the outside of the footwear.
- Submitting them to waterproof testing, these membranes must have a minimum 3000 mm water, water resistance and 2000 mm water after 5 washes.
- Submitting them to waterproof testing, these membranes must have a minimum 40 $mg/cm^2$8 h, waterproofing.
- The footwear vamps and the other component fabrics are waterproofed.
- These footwear designs have different manufacturing technological particularities in comparison to the usual footwear.

*Acknowledgements. The paper is a part of an extended research undertaken under the SIMSANO Grant no.401064/2007, finance by CMMP Bucarest.*

## 6. REFERENCES

1.Ionescu Luca C., Volocariu R., "Raw Materials for Leather and Substitutes", Editura Universitãţii din Oradea, 2005
2. Ionescu C., Assurance and Control of Footwear Quality on Manufacturing, Editura Universitãţii din Oradea, 2002.
3. http://www.gore-tex.com
4. http://www.decathlon.com
5. http://novadry.com
6.http://www..sympatex.com
7. http://www.outdry.com
8.ISO 811:2004
9. EN ISO 20344:2004
10.NFG 5201

ANNALS OF THE UNIVERSITY OF ORADEA
FASCICLE OF TEXTILES- LEATHERWORK
Volume I, 2010, No. 2

# ANALYSIS OF ORGANIZATIONAL FORMS OF EXISTING TECHNOLOGICAL FLOWS IN FOOTWEAR/LEATHER ENTERPRISES

**M. Malcoci[1], I. PASCARI[1], R. S. VOLOCARIU[2], E. ODOCHICIUC[1]**

*[1] Tehnical University of Moldova, Chisinau*
*[2] "Gh. Asachi„ Technical University of Iasi*

Corresponding author: M. Malcoci, E-mail: mmalcoci2005@yahoo.com

***Abstract:*** This paper analyses the organizational forms of technological flows in footwear/leather enterprises of the Republic of Moldova. The following organizational forms are known at present: organization of production in discontinuous flow lines, without mechanical transport (PROD SINCRON; in carts; train carts, sliding bands; RINK system; boxes); organization of production in discontinuous flow lines, with inter-operational mechanical transport (vertically closed transporting band with free rhythm; vertically closed transporting band with free rhythm and order from the dispatcher; stock bridge); organization of production in continuous flow lines, with inter-operational mechanical transport (horizontally closed transporting band with imposed rhythm; automated lines. Analysing the footwear/leather enterprises of the Republic of Moldova we can state, that the most of ten used organizational form is that on carts, followed by horizontally closed transporting band with imposed rhythm, while the least often used organizational form is that the automated lines; while sliding band , RINK system and cart trains organizational forms are completely missing. Correct selection of the organizational form will permit the enterprises: to reduce the time necessary for manufacturing the products; to increase the labour productivity; to keep the order of products' launching; to reduce the volume of unfinished production; to improve the quality of footwear processing; to raise the culture of work.
***Key words:*** organization of production, technological flow, footwear/leather enterprise, organizational form .

## 1. INTRODUCTION

Organization of production in footwear/leather industry can be under different forms: differentiated with respect to the manner of implementation and level of mechanization of inter-operational transport.

Together with registered technical progress, after a period of time, the following organisational forms appeared in footwear/leather industry [1, 2, 3, 4, 5]:

I. Organization of production in discontinuous flow lines, without mechanical transport (PROD SINCRON); in carts; train carts, sliding bands; RINK system; boxes);

II. Organization of production in discontinuous flow lines, with inter-operational mechanical transport (vertically closed transporting band with free rhythm; vertically closed transporting band with free rhythm and order from the dispatcher; stock bridge);

III. Organization of production in continuous flow lines, with inter-operational mechanical transport (horizontally closed transporting band with imposed rhythm;

IV. Automated lines.

## 2. ORGANIZATION OF PRODUCTION IN DISCONTNUOUS FLOW LINES, WITHOUT MECHANICAL TRANSPORT

The following variants are included in this organizational form: PROD SINCRON; in carts, train carts, sliding band, RINK system, boxes.

### 2.1. PROD SINCRON organizational form

The characteristics of PROD SINCRON organizational form are the following:

- placement of operations is made under the technological process;
- intermediary tables are put between operations on which semi products are placed;
- movement of semi products from one place to another is performed by workers, using the depositing tables, the worker takes the product from the table next to him/her or in front of him/her and puts the semi product to the table behind or next to him/her, after finishing the processing;
- if there is an operation with several work places every worker can produce as many units as he/she can, based on own speed;

Disadvantages of this form:

- big width for industrial buildings;
- depositing semi products on tables can be at random or one on the other, thus resulting in mutual deterioration of products.

PROD SINCRON represented an important stage before switching to continuous technological flows, with mechanical transportation and permitted to the workers to get acquainted with the organizational problems specific to the work in continuous flow.

### 2.2. Organization of production based on CARTS

This organizational form derived from PROD SINCRON replacing fixed depositing tables by manually moved carts. These carts are provided with devices for fixing the semi products or other stored components of a lot of footwear/leather products. The placement of work places for the operations of the process is made in linear/chess order respecting the initially established operations. The carts are moved by being pushed by workers, from one work place to the other.

Due to the fact that the time for organizational servicing is rarely consumed, the labour productivity, in general, is higher and the application of this organizational form implies large surfaces of zones for job place servicing.

Similarly with PROD SINCRON the organization of production using CARTS can't maintain the order of launching the set of reference of semi products for processing within the manufacturing process because the workers are getting stuffs from multiple points – for some operations from inside of the process and the corridor for carts' circulation of sometimes gets stuck.

### 2.3.Organization of production based on TRAIN OF CARTS

The carts should move similar to a train with wagons, without being connected with one another. Work places are situated on one and the other side of the route depending on the rails of carts, placed in chess order – avoiding forming shadow for the work zone and other inconveniencies for the workers during the working process – respecting the succession of operations during the process. The carts are numbered: 1, 2.... n and are put on rails one after the other. The volume of work is equally distributed among the workers doing the same operation (several places).

This organizational form has the following characteristics:

- time for organizational servicing of moving the semi products becomes equal for all workers involved in the processing;
- in operations with one work place are involved all carts with semi products put on rails;
- there is a condition for situating the work places – the minimum space occupied by the work table or equipment and worker along the route should be at least equal with the length of one cart;
- order of carts placement should be respected and at the end of the route the carts shall leave the rails in the same order that they entered.

In this case a greater physical effort is necessary due to the necessity to respect the route imposed by the existence of rails and position of workers along this route.

### 2.4. Organization of production based on SLIDING BAND

This form derived from the form of carts train after it was replaced by boxes. The movement of boxes is made using a sliding pass made of wood or metal, either a pass formed of cylinders or rolls to reduce the friction coefficient.

Organization of production with SLIDING BAND is characterized by the following:

- placing the operation in strict order of the technological process – with unilateral or bilateral display with respect to the pass of boxes' movement;
- processing is made to a reduced number of pieces/pairs;
- transportation of details/semi products is done by pushing the boxes on the movement pass by every worker involved in the process;
- workers eye follow the boxes with semi products;
- physical effort necessary for pushing the boxes is becoming smaller by reducing the capacity of the box (1-5 pairs/pieces) but in this case the frequency of pushes to move the boxes from one work place to the other is growing;
- time for evacuation of semi products from the work place becomes equal for all workers.

The disadvantage of this organizational form is the necessity of one fixed construction, placed in the workshops, a large size construction in terms of its length.

### 2.5. RINK organizational system

Within RINK system traditional transportation means are not used. The movement of semi products is made by transmitting them from hand to hand and from one worker to the other and by using some connection elements of the type of apparatuses operations. The equipment is displayed close one near the other in the form of a ring, ringlet or „U" and it requires a reduced surface for its placement. The unfinished production is reduced, it appears on: conditioning, thermo stabilizing and drying the faces, etc. The workers should be poly – qualified and very well trained to service 2 - 4 devices placed in succession. The quality of product becomes the responsibility of each worker separately. The usage of RINK system allows for the following:

- to reduce the number of manipulations;
- small investments in SDV;
- reduction of necessary labor force;
- direct saving of productive space;
- high productivity for every worker involved in the system;
- totally clean work places.

The repairing team should be available at the smallest alarm: the technician waits until the device stops and repairs the defect on the spot. The equipment with major defects is immediately replaced by other from the reserve stuffs. Eliminating the defects is immediately done, on the place where it happened.

The organizational system RINK also has some disadvantages that can't be neglected:

- it requires perfect training of workers and their accurateness;
- devices involved in the system can't be used at their maximum capacity because they depend on one another;
- absence of a worker from the team paralyses the whole production process.

### 2.6. Organization of production using boxes

The following are the characteristics of the organizational form using boxes:

- placement of operations is made in the order of the technological process;
- movement of details/semi products from one work place to the other is made through boxes.

Disadvantages of this organizational form are:

- rapid depreciation of boxes (carton ones);
- big effort made by workers on transporting boxes because they have to bring the box with details /semi products themselves for their later processing.

## 3. ORGANIZATION OF PRODUCTION IN DISCONTINUOUS FLOW LINE BY INTER-OPERATIONAL MECHANIZED TRANSPORTATION

### 3.1. Vertically closed transporting band with free rhythm

The characteristics of transporting band are as follows:

- placing the semi products on the work place is done automatically;
- situating the work places along the band should not respect the order of the technological process operations;
- worker works according to his/her own capacity;
- worker not being pressed by time can check the operation that he/she has performed, which is a positive feature influencing the quality of products.

The disadvantages reside in the fact that the order of launching of sets is not respected; time is lost while putting the boxes on the band.

### 3.2. Vertically closed transporting band with free rhythm and orders from the dispatcher

Vertically closed transporting band with free rhythm and orders from the dispatcher are formed of two flexible independent bands, vertically closed, situated one above the other. The upper band, on the level of work places, is destined for transportation of details from the initial point to the work place situated along the band and the lower band, situated on the level of floor ensures the returning of semi products from the work place to the initial point.

The dispatcher puts in action the superior band and sends boxes with semi products to the workers. On each work place the details or semi products remain during their processing, after which the worker puts the box on the lower band with continuous movement and it returns to the dispatcher. The transporting band is defined as one with "free rhythm" because each worker works in accordance with his/her capacity. Placement of operations and work places doesn't impose strict order of succession within the technological process due to the fact that the jobs are not inter-dependent but are related only with the command board. The disadvantage is that the order of placement in processing can't be preserved and it requires discipline in production, as well as reorganization of manufacturing programs in the warehouse at the end of the work shift.

### 3.3. Stock bridge

The stock bridge is an installation for lifting, assembled on four wheels that is moving on a certain route at a certain height over the floor. They are used for unloading the transportation means, for depositing and stacking the raw material, transportation of stack to the cutting equipment. The stock bridges are built for tasks of 0,25-3 tf put in action manually and for tasks of 0,25-10 tf with electric action and openings up to 25 m [3]. Stock bridges also have some disadvantages requiring huge surfaces and significant constructions.

## 4. ORGANIZATION OF PRODUCTION IN CONTINUOUS FLOW, WITH INTER-OPERATIONAL MECHANIZED TRANSPORT

### 4.1. Horizontal closed transporting band with imposed rhythm

Horizontal closed transporting band permits execution of work in imposed rhythm both in each operation and on each work place. In the process of using such type of bands, the operations are set along the band in strict conformity with the technological process, semi products and details being moved from one work place to the other by the band.

The advantages of this transporting band are the following:

- reducing the time of servicing, this fact having a favorable consequence on the labor productivity;
- rhythmic production performed during a shift, at the end of which the program of manufacturing is completed ant the products can be sent directly to the beneficiary;
- ensuring continuity of processing, without lack or mass of semi products in different points if the organizational parameters of the band are respected.

## 5. AUTOMATED AND SEMIAUTOMATED LINES

The first semi automated line was designed and implemented in Sankt -Petersburg (Russia). A semi automated line means an ensemble of equipment and mechanisms ensuring the automated process of assembling footwear under a well established technology. The principle of automated supply of semi products between the equipment and their working bodies lies on the basis of semi automated lines.

Several operations are performed on the semi automated lines, among which fixing the insole on the block and putting the faces on the block; fixing or centering the heel and fixing the sole by workers and the rest of operations being automated [5].

Advantages of semi automated lines:

- technological operations are performed without removing the blocks from the band a fact that is reducing the physical effort of people;
- labor organization is improved, a definite rhythm of starting semi products is established in conformity with the blocks from the band thus permitting the exit of footwear in strict order;
- improved quality of footwear processing; the role of workers is reduced only to putting elements and base on the block. The rest of operations are made automatically and they don't depend on workers.
- improved sanitary and hygiene labor conditions because the semi automated line is ensured with a strong and constant ventilation;
- improved culture of work due to elimination of powerful and voluminous equipment from the work shop.

Disadvantages of this line:

- footwear bigger than 270 mm can't be produced using this semi automated line;
- technical servicing of the line is difficult, it requires highly qualified plumbers, electricians, electro mechanics.

Possible defects of footwear manufactured on semi automated lines.

- first quality footwear is 80-82%;
- pulling of tops is not uniform;
- shredding of base and reserve of pulling is either too strong or too weak;
- oiling with adhesive of sole and reserve of pulling is not uniform or is trickling to the upper ensemble;
- partial unstitching of base;
- over vulcanization of adhesive film.

## 6. PREZENTATION OF ORGANIZATIONAL FORMS OF TECHNOLOGICAL FLOWS IN FOOTWEAR/LEATHER ENTERPRISES

Table 1 shows the forms of organization of production in footwear/leather enterprises of the Republic of Moldova.

## 7. CONCLUSIONS

1. Analyzing the activity of footwear/leather enterprises of the Republic of Moldova it is stated that the most often used form of organization is the one using cards, followed by horizontally closed transporting bands with imposed rhythm, while the organizational form using automated lines is rarely used and the sliding band, RINK system and train of carts forms are completely missing.
2. Three of the analyzed enterprises use a single form of organization, namely: organization of production in continuous flow, without mechanical transport.
3. From Table 1 it is clearly noticed that the management of analyzed enterprises renounced to some forms of organization, for example: vertically closed transporting band, with free rhythm and order from the dispatcher, stock bridge, carts, horizontally closed transporting bands with imposed rhythm. Anyhow, after a certain time, they recurred to vertically closed transporting band with free rhythm and order from the dispatcher, as for example at "Zorile" S.C.
4. Correct selection of the organizational form will permit the enterprises: to reduce the time necessary for manufacturing the products; to increase the labor productivity; to preserve the order of products launching; to reduce the volume of unfinished products; to improve the quality of footwear manufacturing; to raise the culture of work.

## 8. REFERENCES


1. Volocariu R.S. (1999). *Processes of manufacturing in leather and leather replacers industry* . Ed. Gh. Asachi, Iaşi.
2. Chiriac V. (1996).*Technology of finalizing textile garments.* Ed. Tehnica, Bucureşti.
3. Blănaru M., Steinberg I., Gherghel D. (1967). *Mechanizing transport in light industry enterprises*. Ed. Tehnică, Bucureşti.
4. Pantazi M. (2009). *Footwear industry of Romania, where to go*? Round table of specialists in footwear industry. Collection of papers. Ed. Performantica, Iaşi.
5. Nabalov T. (1990). *Footwear production equipment*. Publishing House Light Industry Publishing House, Moscow.

**Table 1.** Existing organizational forms of footwear/leather enterprises of the Republic of Moldova

| **Name of footwear/ leather enterprise** | **Names of organizational forms** | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Organization of production in discontinuous flow, without mechanical transport** | | | | | | **Organization of production in discontinuous flow with mechanical transport** | | | **Organization of production in continuous flow with mechanical transport** | **Automa-ted lines** |
| | **Prod sincron** | **Carts** | **Train of carts** | **Sliding bands** | **Boxes** | **RINK system** | **Vertically closed transporting band, with free rhythm** | **Vertically closed transporting band, with free rhythm and order from the dispatcher** | **Stock bridge** | **Horizontally closed transporting band, with imposed rhythm** | |
| Rotan S.A | - | + | - | - | + | - | - | +* | - | + | - |
| Gabiny S.A | - | + | - | - | - | - | - | + | - | + | - |
| Zorile S.A | - | + | - | - | - | - | - | +** | - | + | - |
| Cristina S.A | - | + | - | - | - | - | - | + | - | + | - |
| CREPOR | - | + | - | - | + | - | - | - | - | - | - |
| Artima S.A | + | + | - | - | + | - | - | +* | +* | - | - |
| Tocuşor S.A | - | +* | - | - | + | - | - | - | - | +* | - |
| TiTiTi şi C. SRL | - | + | - | - | - | - | - | - | - | - | - |
| Tighina S.A | - | - | - | - | - | - | + | + | - | + | + |
| Floare S.A | - | + | - | - | - | - | + | + | - | + | - |

**Note:** * indicates the form of organization that was abolished; ** **-** organizational form to which was recurred after a period of time.

ANNALS OF THE UNIVERSITY OF ORADEA
FASCICLE OF TEXTILES- LEATHERWORK
Volume I, 2010, No. 2

# RESEARCHES ON THE COMPRESSION BEHAVIOUR OF RIGID LEATHER SUBSTITUTES

**Cristina Secan[1], Florentina Harnagea[2]**

[1]*University of Oradea, Faculty of Textile and Leather*
[2] *"Gh.Asachi" Technical University of Iaşi, Faculty of Textile and Leather*

Corresponding author: Secan Cristina, cris_secan@yahoo.com

***Abstract:*** This paper presents findings regarding behavioral patterns of rigid leather substitutes, made of leather fiber and cellulose fiber, for the manufacturing of counters and insoles.
Total deformation is the index for evaluation and calculation of behavior under compression for leather substitutes, but also remnant deformation after 24hours after the compression is stopped, and the percentage of the remnant deformation in the total deformation.
***Key words*:** counter, insole, deformation, rigid leather substitute, compression, relaxation

## 1. INTRODUCTION

Compression is applied for manufacturing of rigid patterns (like insoles, counters, soles, heels) and for the final processes when the upper part of footwear is made, in the areas where resistant patterns are placed in (counter and toe cap). This final process also comprises the manufacturing for the upper part of the footwear in the so called lasting allowance for a precisely determined separation line between the two surfaces of the footwear.

Materials used for rigid patterns have a reduced elasticity, high plasticity.

Under compression, spatial forms are obtained due to plastic deformation, when made in limited volumes.

The formation of patterns under different intensity compression procedures could lead to:

- ✓ Simultaneous compression over the entire surface of the pattern manufactured with the help of moulds, fig.1;
- ✓ Successive compression (closer and closer) of the pattern (without moulds);
- ✓ Vibration type compression (without moulds).

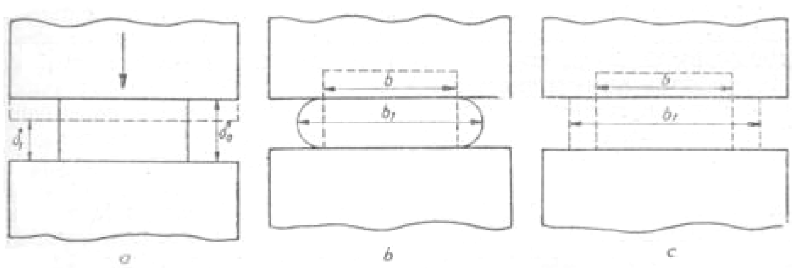


**Figure 1** Simultaneous compression over the entire surface

Under compression the pattern reduces its sizes over the entire surface, over the direction of action (all along the direction line of compression).

Total relative deformation under compression (%) is described by the following relation:

$$\varepsilon_{c_t} = \frac{\delta_0 - \delta_1}{\delta_0} \cdot 100\,(\%)$$

Where: $\delta_0$- Initial width of the pattern, in mm

$\delta_1$- Width after compression, in mm.

Besides size reduction, a transversal deformation appears. The last one can be measured taking into consideration the material's plasticity and the friction between pattern and the action element (fig 1b).

Widths' modifications of fiber structure materials are influence d by a series of technical factors: intensity and duration of action, humidity content at the starting moment of the action, relaxation when constant distortion is maintained during time frames. These factors are responsible for the total deformation index, which has an elastic and plastic (remnant) constitution.

Spatial forming under compression is associated with bending, but the remnant constitution of the total deformation is importa nt for maintaining spatial form[1]. The percentage of plastic deformation in the total deformation shows the forming capacity of the materials used. When this percentage is high, the viability of spatial form resulted after the compression is high. It is important during the footwear manufacturing that remnant deformation val ues to rise up, without varying the humidity content of the material and without the necessity of intense and time consuming drying, taking into consideration that drying can cause considerably size modifications.

This paper shows findings regarding behavi or under compression for rigid leather su bstitutes made up of cellulose and leather fibers. For this purpose total deformation value is determined, but also the remnant deformation which is evaluated 24 hours after the process ends, and the percentage of remnant deformation in the total deformation.

## 2. EXPERIMENTAL

A dynamometer with a pendulum equipped with a compression set is used to follow up the behavior of rigid leather substitutes.

Two test pieces with rigid leather substitute s are used:

IP1 – leather substitutes made up by cellulose fibers

IP2 – leather substitutes made up by leather fibers

The test pieces are each square shapes with a surface area of 1cm$^2$. These pieces are undergoing a compression over the entire surface of the material.

At the moment of compression test pieces have different humidity content (standard humidity level or additional humidity content obtained through keeping test pieces in a vapor saturated environment for 24 hours).

Test pieces are solicited under 300-500daN forces. The primary force is a simple one, but followed by relaxation for different time frames, respectively 30 seconds or 60 seconds.

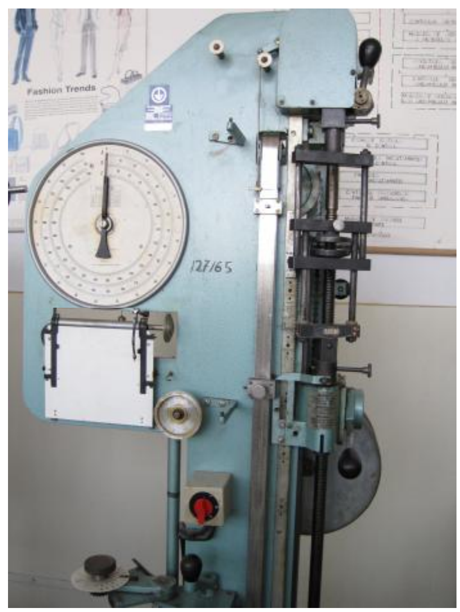


**Figure 2**. Dynamometer with pendulum

This solicitation is realized using dynamometer with pendulum equipped with a compression set.

### 3. OUTCOMES AND INTERPRETATION

The mean values are calculated as outcomes for the described experiment, for test piece 1, tables 1 and 3, and tables 2 and 4 for test piece number 2.

**Table 1:** IP1

| No. | Test environment | Width, mm | Compression force, daN | Total Deformation, % | Remnant Deformation, % | Percentage of Remnant Deformation, % |
|---|---|---|---|---|---|---|
| 1. | Standard humidity | 2.0 | 300 | 38.2 | 15.8 | 41.36 |
| | | 1.95 | 400 | 49.3 | 24.1 | 48.88 |
| | | 2.0 | 500 | 56.5 | 29.8 | 52.74 |
| 2. | Standard humidity +relaxation 30s | 1.95 | 300 | 41.4 | 21.92 | 52.94 |
| | | 1.95 | 400 | 49.3 | 27.5 | 55.78 |
| | | 2.0 | 500 | 58.8 | 34.25 | 58.24 |
| 3. | Standard humidity+ relaxation 60s | 1.95 | 300 | 51.4 | 29.5 | 57.39 |
| | | 1.95 | 400 | 58.9 | 36.5 | 61.96 |
| | | 2.0 | 500 | 61.5 | 39 | 63.93 |

**Table 2:** IP2

| No. | Test environment | Widths, mm | Compression force, [daN] | Total Deformation, % | Remnant Deformation, % | Percentage of Remnant Deformation, % |
|---|---|---|---|---|---|---|
| 1. | Standard humidity | 2.6 | 300 | 47.50 | 24.30 | 52.65 |
| | | 2.6 | 400 | 54.20 | 30.00 | 55.35 |
| | | 2.6 | 500 | 57.50 | 37.00 | 64.35 |
| 2. | Standard humidity+ Relaxation 30s | 2.6 | 300 | 51.00 | 27.00 | 52.94 |
| | | 2.6 | 400 | 55.40 | 33.20 | 59.92 |
| | | 2.6 | 500 | 58.50 | 38.50 | 65.81 |
| 3. | Standard humidity +relaxation 60s | 2.6 | 300 | 55.50 | 30.50 | 54.95 |
| | | 2.7 | 400 | 58.00 | 35.50 | 60.34 |
| | | 2.6 | 500 | 60.50 | 39.80 | 65.78 |

**Table 3**: IP1

| No. | Test environment | Widths, mm | Compression force [daN] | Total Deformation % | Remnant Deformation % | Percentage of Remnant Deformation, % |
|---|---|---|---|---|---|---|
| 1. | Standard humidity | 2.0 | 300 | 46.0 | 28.50 | 61.95 |
| | | 2.05 | 400 | 48.5 | 31.70 | 65.36 |
| | | 2.05 | 500 | 51.0 | 34.50 | 67.64 |
| 2. | Standard humidity+ relaxation 30s | 2.05 | 300 | 47.0 | 30.25 | 64.36 |
| | | 2.05 | 400 | 47.5 | 32.00 | 67.36 |
| | | 2.05 | 500 | 48.4 | 33.50 | 69.21 |
| 3. | Additional humidity+ relaxation 60s | 2.1 | 300 | 51.5 | 37.00 | 71.84 |
| | | 2.1 | 400 | 53.5 | 39.50 | 73.83 |
| | | 2.05 | 500 | 55.5 | 41.50 | 74.77 |

**Table 4**: IP2

| No. | Test environment | Widths, mm | Compression force [daN] | Total Deformation, % | Remnant Deformation, % | Percentage of Remnant Deformation, % |
|---|---|---|---|---|---|---|
| 1. | Additional humidity | 2.7 | 300 | 52.00 | 31.70 | 60.96 |
| | | 2.75 | 400 | 54.70 | 36.00 | 65.81 |
| | | 2.75 | 500 | 58.50 | 39.25 | 67.09 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 2. | Additional humidity+ Relaxation 30s | 2.75 | 300 | 56.30 | 35.25 | 62.61 |
| | | 2.75 | 400 | 57.50 | 36.50 | 63.47 |
| | | 2.80 | 500 | 60.00 | 41.20 | 68.66 |
| 3. | Additional humidity+ relaxation 60s | 2.75 | 300 | 58.50 | 40.50 | 69.23 |
| | | 2.80 | 400 | 59.75 | 42.25 | 70.71 |
| | | 2.80 | 500 | 61.50 | 44.50 | 72.35 |

The behaviors of the leather substitutes are different as shown by the values of the total deformation, remnant constitution values, and percentage of the remnant deformation in the total deformation. It is observed that total deformation and the percentage of remnant deformation within total deformation, grow together with the growth of forces applied, fig.3.

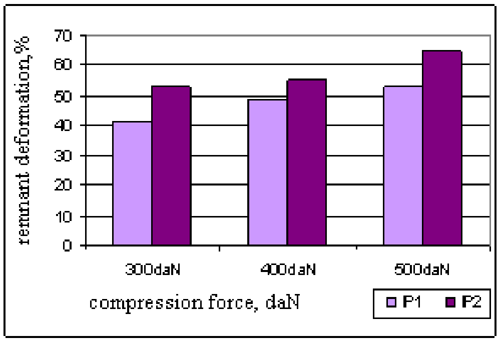



**Figure 3:** Variation of percentage for remnant deformation in a standard humidity environment

Maintaining desired form (evaluated through percentage of remnant deformation in the total deformation) is assured in a range from 41,36% to 52,74% at the cellulose fiber type test piece IP1. For the IP2 leather fiber type test piece this range is between 52,65% to 64,35%. It is specified that compression is made in a standard humidity atmosphere.

Keeping under stress the two test pieces the percentage of remnant deformation in the total deformation increases, fig.4.

Maintaining the desired shape of the material in a 60seconds time frame, in a standard humidity environment is obtained in a range of 57,39% to 63,93% (a growth of 16,03%-17,19%) for IP1 and in a range of 54,95% to 65,78% for IP2.

Additional humidity content of any test piece leads to the growth of total deformation and the growth of remnant deformation in the total deformation indicator, fig.5.

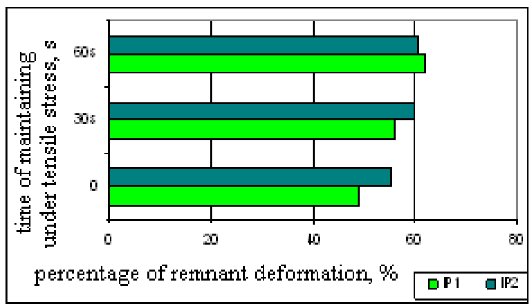



**Figure 4:** Variation of percentage of remnant deformation, when maintained under compression 400daN, in a standard humidity environment

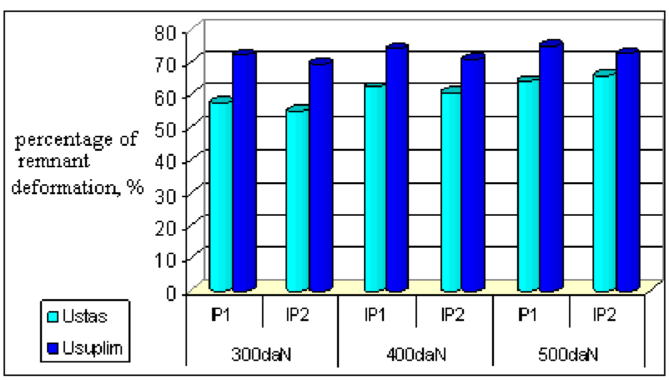



**Figure 5:** Variation of the percentage of remnant deformation as a function of the force applied: compression in a standard humidity environment and in an additional humidity content environment, relaxation time of 60seconds

As indicated by fig. 5, maintaining the desired shape of the material under additional humidity content environment, is assured in a range going from 71,84% to 74,77% for IP1 and 69,23% to 72,35% for test piece IP2.

## 4. CONCLUSIONS

After the undertaken experiments the following conclusions are drawn:

- The behavior of the two type of leather substitutes is evaluated as being good, mentioning that the conditions of the experiments are particular for these tests .
- Deformation of the two leather substitutes under compression depend on the type of material used, the value of the force applied, humidity content of the material and the time frame during test pieces are under solicitation.
- Maintaining the desired shape, translated as the percentage of remnant deformation in total deformation is assured for a higher percentage for the cellulose type substitute, IP1, at an additional humidity content environment and relaxation of 60 seconds.

## 5. REFERENCES:


1. Malureanu G., Cociu V., *Bazele tehnologiei produselor din piele şi înlocuitori*, Rotaprint, Iasi, 1991
2. Volocariu Rodica, *Cercetãri privind comportarea la solicitarea de comprimare a tãlpii artificiale şi a fibrotexului*, A X-a Conferinţa de Textile-Pielãrie, Iasi,1992
3. Cociu Voinea s.a.- *Matrite si dispozitive de formare*, Rotaprint, Iasi, 1994

**ANNALS OF THE UNIVERSITY OF ORADEA**
**FASCICLE OF TEXTILES- LEATHERWORK**
**Volume I, 2010, No. 2**

# THE IMPORTANCE OF KNOWLEDGE IN PHISICS IN FOOTWEAR MANUFACTURE

**N. Talmazan[1], M. Malcoci[1]**

[1] *Tehnical University of Moldova, Chisinau*

Corresponding author: M. Malcoci, E-mail: mmalcoci2005@yahoo.com

***Abstract:*** The knowledge in physics have always been the development base in many branches as: mechanics, chemistry, medicine, building, light industry and others. In our usual daily activities in footwear manufacture w e meet: thermodynamic processes, the quantity of heat, specific heat, optical radiations, rubbing laws, Coulomb's law. This knowledge helps us to manufacture such kinds of footwear that assures the customers' comfort in his valuable physical or intellectual activity. The human body and the ambient are the main elements in the comfort study, it includes the following components: the thermophisiological comfort; the sensational comfort; the physiological comfort; the dimensional comfort. If we study physics a nd the leatherwork domain, we can realize the footwear that will be able to protect the man of many factors and allow their work in such conditions as: low temperature, high temperature, water, radiations, vacuum.
***Key words:*** footwear, physics, comfort, factors, characteristics.

## 1. INTRODUCTION

The first men were afraid of the natural phenomena because they did' n understand them, they used to pray to many gods for rain, good crops, protection. As the mankind developed, people could find answers for many natural phenomena, this answers created physics as a science. So, physics is able to answer to our questions, it gives us power to explain and design, to understand and try to know the unknown. Physical knowledge have always been the development base in man y branches as: mechanics, chemistry, medicine, building, light industry and others. This knowledge helps us to manufacture such kinds of footwear that assures the customers' comfort in his valuable physical or intellectual activity.

We all know that the footwear can be obtained from plane materials with different sizes, and materials without a precise form or uniform materials. The movement from a plane form of the guide - marks from the spatial form of the semi-manufactured or of the final product is solved partially, through design and through creating of a remanent deformation, based on the changes in the interior design of the structure of the materials from the system, in some asked conditions.

## 2. THE IMPORTANCE OF PHISICS IN FOOTWEAR MANUFACTURE

The human body can adapt a few limits at the unfavorable natural conditions, but the adequate footwear with some characteristics, can enlarge this domain. The basically elements that assure and mentain the man' s health are: the right choose of the materials, the technology of the achievement, the dimensional corresponding of the mould that are used by the producer in wear foot manufacture with the feet of the authentic people. All these get to the idea that the footwear, the human body and the ambient are the main elements in the comfort study. The comfort in foot wearing is defined by a large domain which includes the following components: the thermophisiological comfort, the sensational comfort, the psychological comfort, the dimensional comfort.

***The thermophisiological comfort*** is determined by the body-footwear-microclimate interaction and it is touched when it is allowed to, in optimal conditions, the change of heat and humidity between the body and the ambient through the structure of the footwear, this way it assures the powered equilibrium of the body, but the temperature, humidity and speed of the traffic of the air must have some limits (that are considered comfortable).

We all know that the human body is a thermodynamic system that has contact of chang e between it and the ambient; this change may be of substance or of energy. So, it is necessary to have knowledge about the thermodynamic in order to be able to understand the thermophisiological comfort, the equation of the thermic balance, the quantity o f the heat, the temperature, etc. We call a „thermodynamical system” a part of the universe, marked out by the material surface (or fancied) on which are applied the laws of the thermodynamic. The rest of the universe, specially the space around the system, is called „environment”.

***The sensational comfort*** defines the sensations that are filled while a pearson is wearing the footwear. A special group is the touching sensations group that may appear at the contact between the human skin and the shoes; this w ay pleasant, silky, soft, etc. sensations may appear; or unpleasant sensations as: roughness, scratch, prick, etc.

***The psychological comfort*** is very important and it cannot be ignored specially in the appreciation of the universal comfort. Through the psy chological comfort we can understand the psychological state of the customer who is dressed in his own way.

***The dimensional comfort*** studies the sizes and the inside form of the footwear. The sizes and the inside form of the footwear should be realized in such a way that it must avoid the lesion of the tissue of the customers' feet, of the veins, the nerves of the feet. A comfortable footwear must assure a biological development of the feet.

Every of this kinds of comfort can be influenced by many factors , they may be classified into 3 groups:

- ✓ the components of the ambient (humidity, the atmospherically pressure, the temperature of the air, of other things from surroundings);
- ✓ the characteristics of the products (color, surface properties, thickness, etc. );
- ✓ the pshicho-phisiological features of the customer who can get warm or sweat (the quantity of the consumed oxygen, metabolism, etc.).

## 3. CONCLUSIONS

If we study physics in the domain of the leatherwork, we shall be able to realise footwear that can protect the man from the many factors, and allow their access to: the low temperature, high temperature, vacuum, water, radiations, etc. The spatial shape of the footwear is assured if we know the possible changes that may appear during the wearing of th e foot wear. Any man can create to himself his own state of comfort if he knows to use the optical radiation for his own benefit. During the sunny days the customers should wear light shoes.

## 4. REFERENCES

1. Cociu, V., Mălureanu, G. (1993) *Bazele tehnologiei produselor din piele şi înlocuitori* . Partea II. Ed. Gh. Asachi, Iaşi.
2. Curteza, A. (1998) *Confortul la purtarea încălţămintei.* Ed. Junimea, Iaşi.
3.Detlaf, A., Iavorski, B. (1991) *Curs de fizică*. Ed. Lumina, Chişinău.
4. Mălureanu, G., Cociu, V. (1991) *Bazele tehnologiei produselor din piele şi înlocuitori* . Partea I. Ed. Gh. Asachi, Iaşi.
5. Mitu, S. (2000) *Confortul şi funcţiile produselor vestimentare* . Ed. Gh. Asachi, Iaşi.

ANNALS OF THE UNIVERSITY OF ORADEA
FASCICLE OF TEXTILES- LEATHERWORK
Volume I, 2010, No. 2

# STRUCTURES AND MANUFACTURING FABRICS OF SEVERAL SAFETY FOOTWEAR DESIGNS

**Rodica Zaharie Butucel [1], Cornelia Ionescu Luca [2]**

[1] *Concern "General Contractor" Oradea , ROMANIA*
[2] *Technical University "Gheorghe Asachi" of Iassy, ROMANIA*

Corresponding author: Ionescu Luca Cornelia, E-mail: cionescu@tex.tuiasi.ro

***Abstract:*** Safety, protective and occupational footwear is a professional footwear produced and commercialised according to the specific European and international standards. Due to the diverse working conditions in which this footwear is used, there is a wide range of structures. To manufacture the footwear leather is used but textile fabrics, steel components, composite fabrics components, rubber and ethylene vinyl acetate markers as well. There are used many manufacturing systems such as: glued sol e, injected sole or stitched and injected sole. This paper presents several particularities of safety, protective and occupational footwear. It will depict the f ootwear's structure, the manufacturing fabrics, their purpose and their properties as well. At the same time the types of structural textile fabrics use d for these designs are emphasiz ed.
***Key words:*** safety equipment, safety shoes, protective shoes, work shoes

## 1. INTRODUCTION

Safety footwear includes components which allow the protection of the u ser against the injuries caused by accidents, fitted with safety toe -cap intended to deliver a protection against impacts with an energy level equivalent to minimum 200 J and against crushing when submitted to a compression force equal to at least 15 kN.

Basic and additional requirements for safety footwear are mentioned [1] in EN ISO 20345:2004 standard Protective footwear comprehends components which allow the protection of the user against the injuries caused by accidents, fitted with safety toe -cap intended to deliver a protection against impacts with an energy level equivalent to minimum 100 J and against crushing when submitted to a compression force equal to at least 10 kN.

Basic and fundamental requirements for protective footwear are stated in EN ISO 20346:2004 standard [2].

Occupational footwear encompasses components which allow the protection of the user against injuries that might result from accidents.

Basic and fundamental requirements for occupational footwear are presented in EN ISO 20347: 2004 standard [3].

EN ISO 20344:2004 [4] standard defines the general requirements and testing methods of safety, protective and occupational footwear products with special designation.

Safety, protective and occupational footwear includes the following de signs [1, 2, 3, 4]: shoes (A), ankle boots (B), half-knee boots (C), knee-height boots (D), thigh boots (E). Type (E) is a boot with the height of the shaft to the knee having as reference the design (D), to which is attached a piece of thin, waterproof fabric that adjusts to the user's size. Depending on the manufacturing fabrics these footwear designs are classified [1, 2, 3, 4] in two categories class I footwear and class II footwear.

Class I footwear is manufactured with leather or other fabrics uppers with the exception of all-rubber or all-polymeric footwear. Class II footwear is all-rubber footwear produced by vulcanization or all-polymeric footwear obtained through injection.

Basic and additional characteristics of these designs of footwear are emphasized in the structuring method of the footwear designs and in the specific properties of components' fabrics.

This paper presents several structural particularities of safety, protective and occupational footwear specific to different working environments.

The structure of the upper and bottom assembly, the bonding method of the two assemblies and the manufacturing fabrics are depicted as well.

## 2. STRUCTURES AND MANUFACTURING FABRICS

This class includes footwear with the uppers made from any kind of fabric except natural or synthetic Regardless of category the safety, protective and occupational footwear must fully meet the basic requirements with regards to: the height and the shape of the upper assembly, the sole's performance, metatarsal protection with metallic or composite fabrics toe-cap, the tightness, the specific ergonomic characteristics, the characteristics of the upper assembly - uppers and linings, the characteristics of the bottom assembly-insole, foot bed, outsole [1, 2, 3, 4, 6, 7]. It is taken into consideration the footwear design as well: shoe, boot, ankle boot etc. These categories can be differentiated by the additional requirements they must fulfils. [2, 3, 4, 6, 7].

The most complex structures is represented by S3 safety footwear category. This footwear must comply with all the basic properties stated in EN ISO 20344:2004 standard and EN ISO 20345:2004 standard to which are added the following additional: antistatic properties, energy absorbing heel, waterproof ness, puncture resistant sole and studded sole with specific spikes[1,2].

The uppers of the S3 safety footwear are made from full grain leather with pressed top surface, pigmented leathers or oil resistant leather. Pigmented leathers are split leathers covered with a pigmented layer; this is an economical quality and resistive leather frequently used for these footwear designs. The leathers are processed so that they may meet the additional working environment requirements: water impermeability, antistatic properties, electrically insulating properties, hydrocarbon resistance, insulation against heat insulation against cold etc., within the limits stated in standards [1, 4, 6, 7]. In order to obtain these properties the leathers are submitted to specific finishing treatments.

Outside linings are made from leather, from technical textiles or from absorbing polyamides. The fabric composing the textile linings utilized for this footwear designs enable the perspiration absorption and the evacuation of humidity to outside. Polyamide linings show friction, traction and chemical resistance as well as excellent flexibility and easy maintenance. In comparison to the leather the polyamides offer intricate mechanical advantages and are far more economical. They have the advantage of bottom perspiration absorption than leather or textiles and they heat sensitive. Concerning the mechanical properties leather linings must withstand a minimum strength equal to 30N and the textile linings or the textile covered with polymers linings and chemical fibers linings strength equal to 15N. For leather linings the pH value must not be less than 3.2.

In the reference leather components of the upper assembly chrome VI must not be detected.

The metallic toe-cap must be embedded in the footwear so that its removal may not be possible without damaging the footwear and must show shock resistance at an energy level equal to 200 J and compression resistance at 15 kN. In the setting area the footwear is equipped with a fabric supplement made from leather or textile which contributes to the maintenance of the three-dimensional shape and to the foot comfort through its role as a secondary skin.

The footwear is equipped with a steel puncture resistant insole/ to a greater strength than 1100 N and shows antistatic properties. The bottom assembly presents a mid sole with puncture resistant inserts fitted so that their removal may not be possible without damaging the footwear. The puncture resistant inserts must no be placed above the spare of the safety toe-cap nor attached to it. In the metatarsal-phalange joint area the sole presents flexion zones integrated into the sole to enhance flexibility.

The mid sole is fitted with a rubber piece with the purpose of absorbing the shock waves to the spinal column in heel region at an energy level greater than 20 J. In another construction the entire mid sole is designed so that by the manufacturing fabric it may, as a whole ensure the same function
The outsole is designed with double grip. Apart from the basic properties [1,2] the outsole must show resistance to hot contact, low temperatures resistance or hydrocarbon resistance depending on the working environment.

P3 safety footwear category must meet the same criteria as general safety footwear. However, there are differences regarding the metallic toe-cap shock resistance which must withstand an energy level equal to 100J and a compression strength equal to 10 kN in this case.
Basic requirements for O3 occupational footwear category are, on the whole the same as those for safety footwear with the following differences: not equipped with metallic toe-cap for metatarsal protection. The outsole must be hydrocarbon resistant.

Generally, S2, P2 and O2 footwear categories present characteristics similar to S3, P3 and O3 with some minor exceptions stated in EN 20345:2004, ISO EN 20346:2004 and ISO EN 20347:2004 standards [1, 2, 3].

S1, P1 and O1 footwear categories may not show water impermeability. The uppers can be made from meat finished leathers known as turned skin leathers, split bovine leather for the uppers, polyamide, polyamide covered with polyurethane or polyester layers and most commonly combinations of these fabrics. The linings can be made from leather, textiles or absorbing polyamide. The foot bed can be made from leather or EVA polyamide and can be detachable. The inside sole is made from steel which can withstand a puncture strength equal to 1100N. The mid sole must present energy absorbing heel. The outsole is designed with double grip.

SB and PB footwear categories present only the basic characteristics.

This paper depicts several safety footwear designs structures, Panoply and Michelin ranges manufactured by Delta Plus Company.

Delta Plus Company has developed [5] a system to ventilate the shoe at the instep and ankle by means of an air vent Aero Fresh Control, fitted on the footwear as in Figure. 1. The insole is embedded in the footwear so that its removal may not be possible without damaging the footwear.

The mid sole is fitted with damping shock piece, Panashock, a piece of expanded rubber Delta Plus [5] innovation which absorbs and reduces the shock waves and Arch Support System, which is an anatomical piece that provides rigidity to the instep, gives greater stability to the foot and enables the torsions to be avoided.

Drilex linings used in the manufacture of these designs are technical linings found in top of the range sports shoes. This lining is comprised of two fibers and maintains the foot dry by enabling the absorption of perspiration and evacuation of humidity to the outside. It has good antibacterial and anti-odor properties.

Dual Grip is the name of an outsole offering a grip system suited to smooth or friable surfaces, with a large contact tread pattern, and central channels to evacuate liquids.

This type of footwear is designed to be used in domains such as industry, construction, transport and logistics.

*"Multiwalk"* footwear is manufactured for the entire range of designs and professional categories. Fig. 1 presents a S3 safety boot design, *"Multiwalk"* collection.

**Figure 1:** Panoply protective boot, *"Multiwalk"* design, S3 category: steel 200 J toecap; steel >1100 N sole; damping shock piece, (Panashock); sole's flexion zones (Panaflex); piece that provides rigidity to the instep (Arch Support System); dual grip and studded outsole; Foot ventilation system

Figure 2 depicts a Panoply brand *"X- Large Industry"* range. These designs have extra width which leads to extra comfort and are manufactured for all safety and protective footwear categories. The uppers in this range are made from fabrics specific to the designated safety [6, 7] or protective categories.

For S3, S2 and P3, P2 there are used bovine leathers with pigmented or pressed and for S1, SB and P1, PB turned leather, nylon and polyamide or combinations of these fabrics. The linings are made from polyamide. The characteristics of these designs are as it follows. The lasts have a wider fitting, a size 11 reinforced toe. The outside sole is made from dual den sity polyurethane, is shock absorbent, has integrated flexing zones and has excellent slip resistance ensured by the toe and heel grip. The uppers are equipped with reflective stripes.

**Figure 2:** Panoply. Design *" X-Large Industry"* shoes

The *"X-Large Industry"* range designs are used in domains such as: industry, construction and transport.

Another footwear manufactured by Delta Plus**,** Panoply brand *"Outdoor"* range**.** This sis manufactured for all safety, protective and occupational footwear categories. Th e structure of the footwear, the fabrics for the uppers and the linings specific to the designated categories. The Phylon mid sole is the most important characteristic of this design. Phylon is an ethylene vinyl acetate (EVA) sole supple, ultra light and up to 40% shock absorbent. It is used as well in running shoes by all the major sports brands. The outsole, made from an hydrocarbon resistant rubber is abrasion resistant, hot contact resistant and shows high adhesion on slippery surfaces. The structure of the Outdoor footwear is presented in Figure 3.

**Figure 3:** Panoply. Design *"Outdoor"* range shoes:
Toe cap 200 J, protection; Steel outsole 1100N, protection; Mid sole an ethylene vinyl acetate ( Phylon), damping shock piece, HRO rubber outsole, abrasion, adhesion on slippery surfaces, heat resistant

Another range of footwear produced by Panoply [5] is "*Composite Tech Range* ". This range is based on a new technology which uses composite fabrics to manufacture the toe -cap and the insole/. This type of footwear is ultra light, extra flexible and non-metallic.

Figure 4 depicts a S1 category safety footwear [5]. The uppers are made from specific fabrics designated to S1, P1 or O1 categories. For this range the following fabrics are frequently utilized: split leather, polyamide covered with polyurethane or polyester layers. The linings are made from mesh. Mesh is an alveolar fiber used to enable air circulation and evacuate perspiration. The uppers are equipped with Control Aerofresh air vents as well.

The toe-cap and the inside sole are made from non-metallic composite fabrics. The composite fabric ensures physical-chemical protection to which is submitted during the manufacturing process and the wearing. Its resistance is at least comparable to the similar steel pieces. The composite toe-cap is lighter than steel and non-conductive. The toe-cap can withstand shock at energy level equal to 200J for safety and to 100J for protective footwear. In addition to that, it can withstand a compression force equal to 15 kN for safety footwear and to 10 kN for protective footwear.

The inside sole is made from composite fabrics, is anti-static and puncture resistant to a strength equal to 1100N. It is a multi-layered sole with ultra flexible ceramic fibers which ensure 100% foot protection.

The outsole is made from dual density injected polyurethane. It is composed from two soles with different densities and properties. The interior sole is more flexible and shows shock absorbing properties. The outside sole, which touches the ground is much more solid, is abrasion resistant and shows adhesion on slippery surfaces. The foot bed is made from an ethylene vinyl acetate sponge covered with a polyamide.

The process of obtaining or integrating the composite devices in the final product does not irreversibly influence the nature of the classic manufacturing process. It could easily rollback to the classic manufacturing process with steel toe-cap and anti-puncture sole. The costs of this type of raw or intermediate composite fabrics do not constitute an impediment in their large scale usage.

**Figure 4:** Panoply. Design "*Composite Tech Range* "shoes

The designs in this range are used in domains such as industry, transport, logistics, and construction.

*"Light Walkers"* range [5] is another Panoply design. This type of footwear is a low weight design. Through its construction and fabrics it is ensured a high level of ventilation and flexibility. It is suitable for extremely hot working environments or for the summer seasons. It is used in industry, transport, distribution, dry areas and spring-summer periods.

Figure 5 describes this type of footwear. The uppers are made from suede split leathers and nylon. The footwear's components made from nylon "mesh" enable an effective inside-outside ventilation by evaporating the inside water to the outside and the infiltration of outside air on the inside. The eyelets contribute to the ventilation as well. The linings are made from an absorbing polyamide. The outsole is made from dual density injected polyurethane. The inside sole has a density two times smaller than the outside sole. This characteristic enables a high level of flexibility. The outside sole, which touches the ground is much more solid, is abrasion resistant and shows adhesion on slippery surfaces.


**Figure 5:** Panoply. Design "Light Walkers" shoes

This type of footwear is produced for all safety, protective and occupational footwear categories. Figure 6 presents a S3 category design. The footwear is equipped with steel toe -cap shock resistant to an energy level equal to 200 J and steel sole puncture resistant to a strength equal to 1100 N. A reinforcing rubber is embedded in the upper assembly to protect the ankle. The linings are Drilex linings made from technical fibers with hig h humidity absorbing capacity. The insoles are detachable, preformed for the last's curve and are fitted with shock absorbing heel made from ethylene vinyl acetate. In the foot's arch area the insole presents a hole made to assemble a piece designed to sup port the arch and the ankle's hole which ensures a better foot stability to torsion. This piece is named 4x4 borders tension controlling piece. The mid sole is a Phylon sole made from ethylene vinyl acetate welded to the outsole through injection. The out sole is made from a specialized rubber. This rubber is made from a mixture based on the technology of 4x4 automobiles. It has high ascension which protects the uppers of the footwear both in the front and rear areas.

Delta Plus also manufactures Michelin footwear**.** An interesting range is the *"4x4***"** range. Figure 6 presents [5] the structure of a 4x4 footwear product.

**Figure 6:** Michelin. *"Design 4x4"*

This footwear may be used in dangerous surfaces conditions in domains such as: constructions, industry and green areas.

## 3. CONCLUSION

The uppers' fabrics protect the foot against physical or chemical harmful agents; the linings which maintain a dry environment in the inside of the footwear, the leather and textile fabrics combinations which ensure the footwear's resistance and at the same time its ventilation during wearing, the toes' protection with metallic to composite fabric toe -cap, the protection of the foot's sole with steel or composite soles, the reduction of shock by components em bedded in the heel region, soles made from high capacity shock absorbing fabrics, ankle protective pieces, arch support pieces, outsoles made from fabrics resistant to various exploiting conditions are only a few of the innovations used to obtain these footwear designs. Taking into consideration the diversity and complexity of these footwear designs it is only natural to have presented only some examples.

*Acknowledgements.*

*This paper presents the results obtaining within SIMSANO project (no.41064/20 07) which has been funded by Romanian Ministry of Education and Research within the framework of the 2nd National Research and Development Plan.*

## 4. REFERENCES

1. EN ISO 20345:2004
2. EN ISO 20 346:2004
3.EN ISO 20 347:2004
4.EN ISO 20344:2004
5.www.deltaplus.eu
6.Ionescu Luca, C., Secan C., (2005). Safety protective and occupation footwear characteristics used in metallurgical industry, Annals of the University of Oradea, R omania, ISSN 1582-5590, p. 72-78
7.Ionescu Luca, C., Dragomir A., (2005).The study of the noxious factors influence on the metalworker, Bul. Inst. Polit. Iasi, Romania, ISSN 1453 -1690, , pp.109-113.

ANNALS OF THE UNIVERSITY OF ORADEA
FASCICLE OF TEXTILES- LEATHERWORK
Volume I, 2010, No. 2

# PROMOTING STRATEGIES FOR SHOE FORMS THROUGH INTERNET

**Nicoleta Alina Andreescu, Marcela Olimpia Iuhas**

*University of Oradea, Romania*

***Abstract:*** Any company that wants to maximize sales results can create a Customer Relationship Management system, to work towards increasing the brand consumer. E -marketing helps to establish a genuine dialogue with all audiences target.
***Key words:*** Strategies, shoe forms, Internet

## 1. ORGANIZATION OF MARKETING DEPARTMENT

In the marketing department of a company which is active in the marketing of shoe products, there R & D departments, public relations, promotion and production department.

*Tasks marketing department* focuses on :

- ✓ Promoting the company image is: marketers will inform customers and potential customers about the company's activity, will prepare the business plan advertising (broadcast media, timing, targets), will consider offers advertising and identify the best forms of promotion (both in terms of market impact and in terms of prices), will design advertising materials (banners, special offers, both offline and online) and will coordinate marketing campaigns;
- ✓ Conducting market research: marketing people will identify the structure mode of the market: current customers, potential customers will look at market prices for field work and will make proposals for fundamental change in the prices of organization, will design questionnaires online and offline for market research, will perform data collection and will write a market survey report;
- ✓ Reporting on macroeconomic developments, forecasts and their implications for organizational policy and human resources material;
- ✓ Competition Study: marketers will take references about products offered by competition and how that can be expanded and optimized the products and services organization, will analyze competitors in the market online, respectively offline.
- ✓ They will track and manage sales and marketing budget, participate in setting marketing and sales of targets;
- ✓ They manage the form and (marketing) database use of the company ;
- ✓ Coordinate the form and site promotion of the company ;
- ✓ Maintain business relations with customers: their satisfaction analysis .

## 2. SETTING MARKETING OBJECTIVES

In setting goals, the firm's marketing department is focused on understanding the company by potential customers, retain existing customers and attract them and the online market, increase market share and sales in default during the current year to fund development of company in new geographical areas and even abroad.

Further, it will present the company's objectives and how they can be achieved through marketing.

***Increase awareness on the Romanian market***

Promotions online market can "help" the company and market, namely off -line by site name printed on any promotional item. In this way, potential customers and loyal customers will access the site. Another way to attract visitors on the site is done through advertisements in magazines and advertising on partner sites.

Simplicity is creating greater awareness online market because costs are much lower than off - line.

Creating a site can be very cheap and even free, and the range of information is much larger online market, Web site operating 24 hours a day, seven days a week, 365 days a year and it can be accessed from anywhere in the region, country or continent. While, in advertising offline range is very small compared to market online, promotional offers or shops are geographically dispersed and only persons in these regions may be "attracted."

The company filed permanent effort to inform potential clients on site and offer to provide strong reasons to visit and revisit the site.

***Attracting and retain existing customers of the company's online market***

Firm's current clients are people who have bought at least once or had contact with the company. These customers are already in the company database. The advantages of this target refers to the fact that these people are, more or less familiar with company products, and have made an impression and an image of firm, trusting in the services with its offers. Also includes online purchasing services. Most seafarers Internet, question the quality, validity information on the site, seriousness and honesty company offers, existing firms "ghost" that sell online and want to avoid the risk of fraud. These disadvantages are largely eliminated due to company know ledge by clients.

*Online shopping has advantages for both the company and the client. If the firm is related to Internet sales, lower costs (fixed costs, transport costs, staff costs), but also the company image and reputation. This objective can be ach ieved through online for customers, namely: the possibility to create their own footwear, this is only available online, quick delivery of products, convenience - the ability to order from home or office, and so the buyer saves time and avoid congestion in shopping centers.*

*Customer* loyalty will be based mainly on the loyalty card launched by the company. Thus, a customer who has bought at least twice on-line loyalty card benefits from the facilities. And the company has thought of a strategy to attract customers using the card. So those who will own the card will have a 10% price reduction every online purchase made during three months of receipt card.

***Increased market share***

*Creating and selling through a website can be compared with the simultaneou s opening of several stores at the same time, regions, countries and continents can be different, that's why the company turned to a growing market share and sales. That understanding is valid only for a site that is known, comparing specialist to launch a commercial site with opening a store in a very isolated place, for example in the middle of a forest or on a mountaintop. Thus, site promotion is an essential element in successful online. Attracting traffic is perhaps the most important activity what con dition the success in business activity on the Internet, and in any case is the most difficult to realize .*

.

A company website can provide all details, what a potential customer might ask about the footwear (color, size, stocks for each item separately, skin quality and materials that made shoes, etc.). If the orders, they will be processed quickly, so consumers will be satisfied and repeat business benefits in the future, another purchase. In this way, multiple users can simultaneously control, saving time, which is not possible in the off-line store.

**Other firm services**

Ordering, the delivery and return of products on the site.

Company website can be done so that any user can not experience problems. The content of the site, potential clients can review the offer and if you decided to order from the web, the main condition is that the person be certified, meaning you have account on the site. This is done very easy, you just need to enter your email and password and receive the confirmation message . Only after he was last recorded in the database company that click "Click here to buy now" and they can add to your shopping cart and can buy any desired product.

Product delivery is via courier as soon as possible after ordering ,

***Product Warranty***

Footwear have guaranteed one month of the order receipt, but if the client wants to change the product at this time, it must have a factory defect, which the buyer fails to detect the purchase if the product was deteriorated during a month by wearing o r negligence, the Company has no responsibility in this regard.

***Clients can advertise their company website.***

- Company website can advertise their customers that sell complementary products such as clothing, underwear, accessories and jewelry.
- The target market of customers who advertise on the company website is similar to the company for products and companies listed on the site, who have to address to the specific targets market.

## 3. CONCLUSIONS

It is a very simple way you would disclose details, hence sales. Customers are in permanent contact with the company, they feel like they are part from it, the company he works for them.
Company can better track sales and any behavioral changes target audience.
Last year the number of domain ro. it has be en increased by about 100%, still left less serious Romanian companies which don't benefit from a presentation on Internet.

## 4. REFERENCES

Anton,V.(2001). *Marketing, Note de curs*. Editura Universitatii din Oradea.
Munteanu, N.(2007). *Marketing.* Editura Gh. Asachi Iasi.

ANNALS OF THE UNIVERSITY OF ORADEA
FASCICLE OF TEXTILES- LEATHERWORK
Volume I, 2010, No. 2

# THE INCREASING PARTICIPATION RATE IN EDUCATION, EMPLOYMENT PREREQUISITE TO ENSURE QUALITY. A QUANTITATIVE STUDY IN THE BIHOR COUNTY , IN THE NATIONAL AND EUROPEAN UNION CONTEXT

**Floare CHIPEA**

*University of Oradea, Romania*

fchipea@yahoo.com

***Abstract:*** The article aims to achieve a quantitative analysis based on statistical sources, indicators of quality of education in the Bihor county, compared to the national and European Union countries, sta rting from the theses formulated by the human capital theory which indicates a strong relationship between investment in education and future earnings of individuals, on the one hand, and between education and economical growth, on the other hand. We also do not neglect other guidelines which presume the validity of other factors involved in economic development and labor productivity, economic and governmental policy, social capital, all having in my view, a clear educational determination.
***Key words:*** school participation, educational equity, school participation rates, human resources, school abandon

## 1. INTRODUCTION

Studies aiming the relationship between education and economy have highlighted, on the one hand, the existence of a positive correlatio n between education and income level of individuals, and secondly, that education could be a factor that resulted beginning with the twentieth century, a faster growth of gross national product than the gross ca pital gain. (3). The best known research dire ction of the relationship between school education and the economy is the human capital.

The concept of human capital skills, regards all the abilities that individuals acquire by investing in education, training or other activities that contribute to enha ncing future income along lifetime earnings (11).

The concept of human capital was first used by the American economist Theodore Schultz in 1961 (3) which dealt with education expenses as a form of investment. The school of human capital tried to formulate a complete answer on the formation way of demand for education, based on the argument that parents and children regard education as an investment and not as a commodity.

World Bank studies (12) showed that only 16 respectively 20% of global wealth can be attributed to natural resource values and products, while the remaining 64% is composed of the human resources of the planet. Other calculations devoted to determining the social profitability of educational investment made by experts from World Bank (8) suggests a social rate of social return of 18.9% for primary education, 13.1% for secondary education and 10 . 8% for higher education.

There have occurred, however, studies that questioned the effectiveness of investment in education, referring specifically to the social rates of social return to education costs or the impact of investing material resources on school results. International data shows that in many countries, the increasing access to education was followed by stagnation or economic decline. T his apparent paradox can be attributed to the inefficiency of education or to the lack of correlation between education and labor market. Since the 80s, studies have shown that the accumulation of fixed capital, human capital, money growth does not occur directly. Among the drivers behind the growth of labor productivity have been identified, or economic policies (2), government efficiency (7) or social capital (1).

Therefore, the influence of educational investment on economic growth is clearly determined by the effect of investments in education depending on many factors and on the absence of appropriate policies in other sectors may cancel the investment in education.

Also the problem of investing in education policy is put in different terms for developed countries compared with developing countries. The first (developed countries) invest in education to enhance their competitiveness while the poor countries focus on literacy and to access to education as a means for raising public awareness, in order to access their fundamental rights as citizens. OECD countries aim, for example, to develop lifelong learning as a means of reducing unemployment and raising quality of labor abilities, by promoting reforms to bring the school in the area of work experience, focusing on mathematics education, science and technology. In poor countries, education has been underfunded in its upper stages in favor of primary and secondary levels, which were considered most important for the labor market situation in those countries. Therefore education policies have a key role in efficient investment in education.

## 2. FEATURES OF EDUCATION POLICIES IN ROMANIA DURING THE TRANSITION

### 2.1 International comparisons

Indicators used for international comparisons in terms of education today are those relating to education expenditure share in GDP and gross rate of students enrolled, which represents the total number of students, regardless of age, as compared to total population official age (19-23 years) corresponding to this level of education.

In 2007 **the proportion of expenses on education in Romania GDP** was 4.1%, which is located on the last but two place among European countries, placing Slovakia on the second last place with 3.9% and, on the last place, Greece with a share of 3.5%. It should be noted that while developed countries affect the higher education share of GDP, as Denmark (8.3%), Sweden (7.1%), Finland (6.3%), and Belgium (6%), most other European countries are preoccupied with education allocation of shares exceeding 5% of GDP. (INS, Global economy in figures, p.114)

**Table 1. The public expenditure on education as % of GDP in Romania in 2000 -2008**

| 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|---|---|---|---|
| 3,4 | 3,6 | 3,6 | 3,5 | 3,3 | 3,5 | 4,3 | 5,5 | 6 |

Source: Ministry of Education and Research, Directorate General for Budget, Finance and Investment Heritage.

Compared with 1985, when the share of GDP devoted to education expenditure was 2.20% (which indicates that education was not before 1989 either, a national priority), the post -revolution years this figure is growing, but a modest increase, with interruptions (the same indicator recorded before 2000, the following values: 1985 = 2.20, 1990 = 2.83%, 1993 = 3.18%, 1994 = 2.07, 1998 = 3.30%, 1999 = 3.20%). The resources allocated to education by the Romanian governments are insufficient for achieving educational performance in the European countries that make efforts in this regard.

Regarding the gross rate of students enrolled in academic year 2007/2008, Romania with a rate of 54%, occupies a place among the 27 European countries, surpassing countries such as Slovakia (51) Germany (51) Austria (51) Bulgaria (50) Cyprus (36) Luxembourg (10). At the same time, developing countries recorded much higher rates, such as Finland (94%), Greece (91%), Slovenia (86), Denmark (80%), Sweden (75).

### 2.2. Evolution of school participation rate

Indicator gross coverage rate in all levels of education expresses the total number of learners enrolled in all levels of education, regardless of age, the percentage ratio of the total population of official age group corresponding to all levels of education (6-23 years). The indicator is used to highlight the overall level of public participation in education and education system capacity to allow access to all levels of education.

**Table 2, on the gross average of school enrollment at all the levels of education in Romania**

| | 2000/ 2001 | | 2002/ 2003 | 2003/ 2004 | 2004/ 2005 | 2005/ 2006 | 2006/ 2007 | 2007/ 2008 |
|---|---|---|---|---|---|---|---|---|
| Total | 66,5 | 68,3 | 70,2 | 71,6 | 71,7 | 72,6 | 74,1 | 76,6 |
| Feminin | 67,8 | 69,8 | 72,0 | 73,4 | 73,6 | 74,7 | 76,5 | 79,4 |
| Masculin | 65,3 | 66,8 | 68,5 | 69,8 | 69,9 | 70,6 | 71,2 | 73,9 |

Source: 2003-2004 National Report of Human Development, UNDP and INS data based on information, 2005 - 2008.

Note: In calculating the indicators pre-school education was not included

### 2.3. Evolution of the school population in Romania and the level of Bihor County

According to the report on the status of the national education system, conducted by the Ministry of Education and Research, between 2000 and 2006 there was a decrease in school population, followed by an increase of nearly 48,000 students in the coming years. During 2000 -2007, the school's population fell by 158,900 people, the most dramatic reduction occurring at secondary school level, with 396,800 students. 2007/2008 school year marks, but a growing in school population of almost 48,000 students, compared to 2006/2007.

**Table 3, On the developments in education in Romania, Bihor county, in the period 1990 -2008**

| **Indicators** | | **1990/ 1991** | **2000/ 2001** | **% compared to 90/91** | **2005/ 2006** | **% compared to 90/91** | **2007/ 2008** | **% compared to 90/91** |
|---|---|---|---|---|---|---|---|---|
| School Population | Romania | 5066031 | 4565279 | 90,1 | 4360831 | 86,1 | 4404581 | 86,9 |
| | Bihor | 139079 | 131582 | 94,6 | 130898 | 94,1 | 126798 | 91,2 |
| Preschool Education | Romania | 752141 | 611036 | 81,2 | 648338 | 86,2 | 650324 | 86,5 |
| | Bihor | 23729 | 18558 | 78,2 | 19481 | 82,1 | 19752 | 83,2 |
| Primary and Secondary School Education | Romania | 2730306 | 2411505 | 88,3 | 1900561 | 69,6 | 1789693 | 65,5 |
| | Bihor | 73217 | 65085 | 88,9 | 54757 | 74,8 | 51892 | 70,9 |
| Highschool Education | Romania | 995689 | 687919 | 69,1 | 767439 | 77,1 | 791348 | 79,5 |
| | Bihor | 30005 | 21471 | 71,5 | 25849 | 86,1 | 26296 | 87,6 |
| Arts and Krafts and Apprenticeship Education | Romania | 365860 | 239550 | 65,4 | 284412 | 77,7 | 220335 | 60,2 |
| | Bihor | 9360 | 5234 | 55,9 | 5897 | 63,0 | 5200 | 55,5 |
| Post High school and Foreman Education | Romania | 29225 | 82117 | 280,9 | 43617 | 149,2 | 45528 | 155,8 |
| | Bihor | 1762 | 3677 | 208,7 | 1653 | 93,8 | 1583 | 89,8 |
| Higher Education | Romania | 192810 | 533152 | 276,5 | 716464 | 371,6 | 907353 | 470,6 |
| | Bihor | 1006 | 17557 | 1745,2 | 23261 | 2312,2 | 22075 | 2197,3 |

Source: Romanian Statistical Yearbook 2009 Statistical Yearbook of Bihor County printed in 2008.

The analysis of gross rate of school enrollment at all educational levels show a continuous upward trend over the reference period of the Report, the difference between its first and last year , is 10 percentage points. During the school year 2007/2008 the indicator reaches the maximum, 76.6%. The upward trend is evident both in the case of the male population and female, with a higher female population growth.

The increase rate of participation at all levels of education is primarily a consequence of increasing the participation in higher education, which increases during the period 2000 -2007, with almost 26 percentage points (from 27.7% at 53 6%). In addition, the gross enrollment rate in primary education increased: from 100.3% in the 2000/2001 school year, to 109.1% in 2003/2004, 107.9% in 2004/2005 to 106.1% 103.8% in 2005/2006 and 2006/2007 school year. This increase recorded since

2003 is but an artificial one effect being the effect at th at time, forecast the onset of school age lowered to six years.

Although the trend regarding the participation in education is upward, Romania is situated on a rather lower place compared with both the EU-15 countries and the countries that recently joined the EU in terms of participation at all levels of education population aged 5 -29 years. Thus, the indicator for Romania in 2006 was 50.5% (compared to 59.2% - EU-27 average), up from 2000 (when it made only 48.4%) as a fall to last place among other Europ ean countries, except only for Bulgaria, with a participation rate of only 49.8%.

Comparing the evolution of the school population at the national level and Bihar County in the period 1990-2008, we find relatively similar trends. The school population is d eclining at both national and Bihar county level, with the observation that the decrease is more pronounced at national level compared to that of Bihor county, probably correlated with the demographic phenomena but also those related to economic developme nt. Exceptions to this trend are evident for preschool, vocational, foreman and apprenticeship, where the decreases are more pronounced in Bihor county compared to national average.

Another discrepancy is highlighted in relation to higher education, which recorded an increase in the reported period of almost five times higher than national average growth in the case. Explanation is that the four universities established in the period analyzed in Oradea (University of Oradea, private universities - "Agora", "Emmanuel", "Partium"), together with other subsidiaries of universities in Romania contribute beneficial to the increasing of the educational capital in the area, observation that, certainly, will be quantified and confirmed at the next census.

**Table 4, Regarding the gross enrollment rate in higher education in 1990 -2008**

| | 1990/1991 | 2000/2001 | 2005/2006 | 2007/2008 |
|---|---|---|---|---|
| Romania | 9,91 | 32,26 | 60,82 | 53,59 |
| Bihor | - | 39,49 | 52,68 | 48,67 |

Source: Romanian Statistical Yearbook 2009 Statistical Yearbook of Bihor County

The effect of expansion of higher education in post-revolutionary Romania is also quantified in the indicator regarding **the measure on gross participation rate in higher education,** which increased at the national level from 9.91 students per 100,000 inhabit ants in 1990-1991 academic year, at nearly 54 in academic year from 2007 to 2008. At the level of Bihor County in the academic year 2000-2001, the enrollment rate in higher education, of 39.49 ‰, exceeded the national rate due to strong growth of higher ed ucation in Oradea, in that year. During the academic year 2007/2008, the rate of enrollment decreases compared to the 2005/2006 due to the reduction of school population of in pre-university school education, being higher than in 2000, indicating that the rate of enrollment of students at the national level is higher than the one recorded at the county level.

The analysis of the situation in the Bihor county education results in a decrease in high schools from 1064 in 1990 to 225 units in 2008, especially b y merging of rural schools.
During the same period, teachers have grown by 115%, largely on account of the increase of higher education teachers at the national level although the number of teachers is decreasing in the analyzed. period

Another indicator that reflects the false concern of policy makers in the Romanian education is **regarding teachers' salaries**. Thus, in 2005, according to the European Commission, Romania, alongside Bulgaria and Slovakia, were part of a group of countries that pay their te achers the worst, which affects the motivation and the teaching practice in occupying the statuses in question. The minimum wage granted to the primary school teachers as a percentage of GDP in Romania in 2005 represented 57.3 and the maximum 85.1 at, whil e the same indicators represented, for example, in Portugal, 139.5, respectively 320.3 and in Cyprus, 139.4 and 295.4 respectively.

**Table no.5 Regarding the coverage rate of students the national level and at the level of Bihor county**

| | | 2000/ 2001 | 2005/ 2006 | 2007/ 2008 |
|---|---|---|---|---|
| Bihor | Bihor gross enrollment rate of preschool population=the preschool population/population aged 3-7 | 69,62 | 78,28 | 82,25 |
| Romania | | 58,50 | 70,09 | 77,63 |
| Bihor | Bihor gross enrollment rate of primary and secondary population = population of primary and secondary students/ population aged 7-14 | 96,12 | 101,43 | 100,22 |
| Romania | | 80,50 | 76,59 | 99,16 |
| Bihor | Bihor gross rate of the population of high school = high school population, population aged 15-18 | 62,01 | 70,25 | 78,64 |
| Romania | | 45,82 | 59,33 | 66,41 |
| Bihor | Bihor gross coverage rate of public higher education = higher education/ population aged 19-23 | 34,19 | 52,68 | 48,67 |
| Romania | | 25,44 | 37,20 | 53,59 |

Source: Statistical Yearbook

And regarding the statement on participation rates in education, as in the case of the development of the school population at the two levels of analysis shows that Bihor county records higher rates than the national average, although the educational policies are similar. The only exception in this case, too, is the higher education, which records a rate below the national average, only in 2007-2008. One explanation could be provided by the stronger guidance for students in recent years to other universities, with the decline in specific age groups.

Rates of early school abandon, especially in pre-university education, is another relevant indicator for the state of education, and implicitly for the quality of labor.

In total, during the analyzed period, the abandon rate is more than double in the school year 2007/2008 as compared to 2003/2004. Following the distribution of the school abandonment on types of education, we find that post-secondary education and vocational education as master and apprentice are facing the highest rate of abandonment, in conjunction with policies to discourage this type of education in the years after the revolution in Romania. Abandon rate is increasing within the other types of education, too: more than doubled in secondary education (from 0.6% to 1.5%), followed by primary education (from 0.7 to 1.3% ), secondary education while maintaining the same high rate is 1.7%.

Evolution of school abandon on a national level.

The research conducted in the field have highlighted several cases of early school abandonment, including: lower social position in the social structure of families of origin of the subjects, reflected in low education level of the parents, low income recorded by family members, low intra-family and extra-family social capital, specific axiological orientations which are reflected in the lack of interest of parents for their children's school situation, emigration, poor cooperation with school, friends or group of institutions that could support the school participation, poor living conditions, the lack of opportunities to ensure children's clothing and school supplies to the current requirements, other sources derive from the subjects' behavior in relation to their own educational and vocational training, indicators such as non promotion, absenteeism and poor school performance are good predictors of early school leaving; relatively young age at marriage, especially Romm (gipsy) girls, and teenage pregnancy or early engagement in various types of maintenance activities for the home are other sources of abandonment; School as it functions at this point in social space of Romania, Bihor County default, it hides mechanisms that perpetuate inequalities by disinterest of school teachers for the situation of the marginalized, the attitudes of stigmatization, by disregard for absenteeism and non-promotion or at least with insufficient involvement for the adequacy of the curriculum to the local aspect, or Low qualification of teachers, especially those in rural areas. Local authorities, in an inadequate collaboration with schools and the families of those who abandon school and by not initiating appropriate policies to local and family specific, are an enhancer for school abandonment, including social exclusion (1).

## 3.CONCLUSION

Quantitative analysis based on statistical sources in the Bihor County school participation in the national context and the European Union highlighted several features:

• Starting from the premises, set the human capital theory, that between level of education and future personal income of individuals, on the one hand and economic growth, on the other hand, would be expected that the governments of Romania, who have followed after the 1989 revolution, consider education a national priority aimed at increasing education quality indicators in the developed countries that have achieved results in the field.

• development of quality indicators (share of education expenditure in GDP, the overall rate of school participation and educational levels, changes in school population, enrollment rate of students), sh ow an increase in light gaps in the reported period, the value these indicators, noting that quality growth is higher in Bihor county, compared with the national level, which shows a higher potential of this area.

• Along with increased rates of participa tion in education is established and an increase in early school pupils during school route with the highest rates in vocational and secondary education, followed by the Secondary and Primary.

• The reasons for teachers, European Commission data shows the location of Romania, alongside Bulgaria, the last places among European Union countries in terms of minimum and maximum salary of teachers in primary education has, for example.

• Comparison of value indicators to analyze the situation of countries in th e European area find discrepancies against Romania, on all indicators, suggesting that education is not and has not been a priority for Romanian policy. On this basis one can predict poor quality of future human resources, which will not be competitive in the global economy.

## 4. REFERENCES


1. Chipea F., (2009) "*Early school - Size, Power, Implications*" in Hatos, A., and Săveanu, S. (coord.), Education and social exclusion of teenagers from Romania, University of Oradea, pp. 93-119;
2. Easterly, W., Levine R., (2001), *It Is Not Factor of Accumulation: Stylized Facts and Growth Models "*, The World Economic Bank Review, vol 15, No. 2, pp 177-220
3. Hatos, A., (2006), *Sociology of Education*, Polirom, Iasi, p.80;
4. NIS, *Statistical Yearbook*, 2009;
5. NIS., *Bihor County Statistical Yearbook*, 2009;
6. NSI, *The world economy in figures*, 2009;
7. Olson M., (1999) *Growth and Decline of Nations (Rom version.*), Humanitas, Bucharest;
8. Psacharopoulos G., Patrinos, H., (2002) *Returns to Investments in Education. A Further Update the World Bank Research Paper*, 2881, September
9. *Report on the status of the national education system*, Ministry of Education and Research, between 2000 – 2007.
10. Vlăsceanu L, (2007), *Sociology and Modernity. Transition to Reflexive Modernity* (Sociology and Modernity. Transitions Towards Reflexive Modernity) Polirom, Iasi;
11. Woodhall, M., (1997), *"Human Capital Concepts",* in AHHalsey and co. (Coord.), Education, Culture, Economy, Society, Oxford University Press, pp 219 -223;
12. World Bank, (1995) *Monitoring Environmental Progress: A Report on Work in Progress, Environmental Compatibility Department,* March, Washington, pp 52-53;

ANNALS OF THE UNIVERSITY OF ORADEA
FASCICLE OF TEXTILES- LEATHERWORK
Volume I, 2010, No. 2

# ESTABLISHING EDUCATIONAL PRINCIPLES USED FOR TRAINING ENGINEERS DESIGNERS IN THE FIELD OF CLOTHING INDUSTRY

**Victoria Danila[1], Stela Balan [2]**

[1] *Technical University of Moldova,, Chişinău, Republic of Moldova, e-mail: victoriavasilecojocari@yahoo.com*
[2] *Technical University of Moldova,, Chişinău, Republic of Moldova, e-mail: stela.balan@yahoo.com*

***Abstract:*** The development of education and training of engineers of clothing industry today is considered effective in view of current and future economic challenges. The function of education is to supply efficient workforce capable, adaptable and mobile, open and able to use skills acquired during studies, able to anticipate a certain measure technological. In preparing engineers designers in the field of clothing industry is necessary to apply educational principles different from those traditional to develop adaptive skills that will allow them to respond to ongoing change process and develop specialist knowledge. This has led to searching, finding and formulating a set of modern principles that underlie the training of engineers in the clothing industry. The educational principles are rules teaching strategic and operational value to be observed continuously in the design and construction of all forms of teaching activity.
***Key words:*** Educational principles, training, clothing industry, active learning.

## 1. INTRODUCTION

The sense of changes in current teaching is skills-oriented on forming the competences, of those structured sets of knowledge and skills acquired through learning, identifying and solving specific problems in different contexts. Learning can no longer be the sole purpose of storing and reproducing knowledge: an effective learning in contemporary society requires explanation and supporting their views and exchanging ideas with others.

Educational institution has a noble purpose - to ensure performance and creativity in preparing highly qualified engineers, designers, to be valued and the labor market.

The main role of the student award is humanizing their learning in higher education. Humanization involves setting educational process from two perspectives: the characteristics of graduates to ensure compliance of standards for training (control) and ensuring the adaptation of training facilities student characteristics (learning facilitation) [3].

## 2. GENERAL INFORMATION FOR AN EFFICIENT TRAINING

Assimilation complex functions of higher education institutions for providing training to engineers, researchers and ensure thorough preparation of knowledge and technology innovation can be achieved only through a new way to organize the training process. The training of higher education focuses on ways in which training can be done in different areas and the various principles.

The development of the society determines the imposition of progressive of new educational principles (Table 1) [1].

**Table 1:** Comparative presentation of the principles of classical and modern educational paradigm

| Classical educational paradigm principles | **Modern educational paradigm principles** |
|---|---|
| Content focus is on acquiring specific informati on definitively. | Emphasis is placed on the connections between information, the receptivity to new concepts, highlighting the need for lifelong learning. |
| Learning is a result. | Learning is a process. |
| There is a hierarchical and authoritarian structure where conformity is rewarded and rebellion different thinking is discouraged. | There anti-hierarchical principles, teachers and students looking at each other especially as people and not roles. |
| Rigid structure of education, compulsory syllabus. | Flexible structure to conduct the educational process, optional subjects and alternative work. |
| To acquire knowledge at a pace required for all. | Accepting that in terms of potentialities students are different, which complains about the admission of different rates of advance in. |
| The emphasis is on efficiency, the successful. | Emphasis is placed on developing the learners' personality. |
| Importance is given mainly to the outside world. | It promotes activation potentiating and imagination, inner potentialities of the stud ent experience. |
| Emphasis is placed on developing thinking linear analytical. | Is concerned strictly rational combination strategies with the nonlinear, based on intuition. |
| Student's assessment is based on stricter labeling, which can sometimes lead to sti gmatization in their cap to limit the label that was applied to. | Labelling is restricted to a role auxiliary descriptive, not necessarily that it becomes valorisation flat final resolution to the stigma that educates biography. |
| Concern about the rules and standards that often are outside the student. | Student's performance reporting and the possibilities of its aspiration. |
| Emphasis is placed on theoretical knowledge of nature. | Is promoted expanding theoretical knowledge with practical experience completed outside their classrooms and. |
| Bureaucracy and community resistance to proposals. | Community proposals are taken into account and even supported. |
| Classrooms are designed and constructed strictly functional criteria. | Classrooms ergonomically meet the criter ia order (conditions for lighting, color, natural ventilation and comfort, etc.. ). |
| Learning is achieved for the present moment, as subsequent scientific progress Recycling Information. | Education has a prospective character, it being carried out for future recycling anticipating scientific information. |
| Information's flow is conceived as having a one - way from teacher to student. | It is promoted reciprocal learning relationship is "teacher-student". |

Modern educational principles focus on the main orient ation manifested today in the study of higher education. They rely on active participation and on their training and the student's cognitive development.

Active cooperation of the two pillars of the educational process "student -teacher" is the key to development and intellectual development - application of the new millennium.

Gibbs (1992) states that student-centered learning "gives students more autonomy and more control on the subjects of study, learning methods and pace of study" [2]. This perspective emphasizes the fundamental characteristics of student-centered learning, promoting the idea that students should be given more control over their learning by taking responsibility on:

- what is learned;
- how to teach and why;
- when it learns.

Passing responsibility from teacher to student is widespread in contemporary pedagogy. In a summary of the characteristics of effective learners, de la Harpe, Kulski and Radloff (1999) states that an effective learner:

- have clear goals ab out what the learner;
- has a wide range of learning strategies and know when to use them;
- use available resources effectively;
- know which are the strengths and weaknesses;
- understand learning;
- adequately control their f eelings;

• assume responsibility for their learning process,
• its planning, its monitor, assess their learning and responding [5].

Preparation of designers engineers in the field of clothing industry by applying the methodology and technology innovation based on the following principles outlined in Figure 1, the principles of active learning:

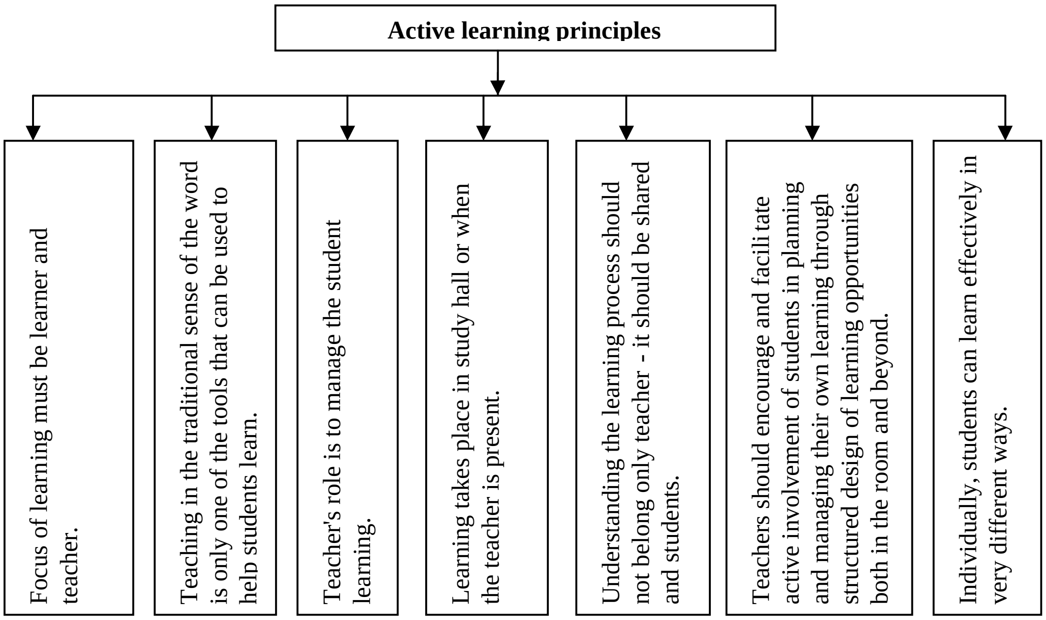



**Figure 1:** Presentation of the principles of active learning to help engineers prepare the clothing industry

A major role in developing education and training assigned by the computerization process by applying modern technology and create an open education [3]. This raises interest in training students and training of specialists with high professional skills.

Given the principles mentioned in Figure 2 shows the general scheme of the training process engineers are defined stages through which an effective training:

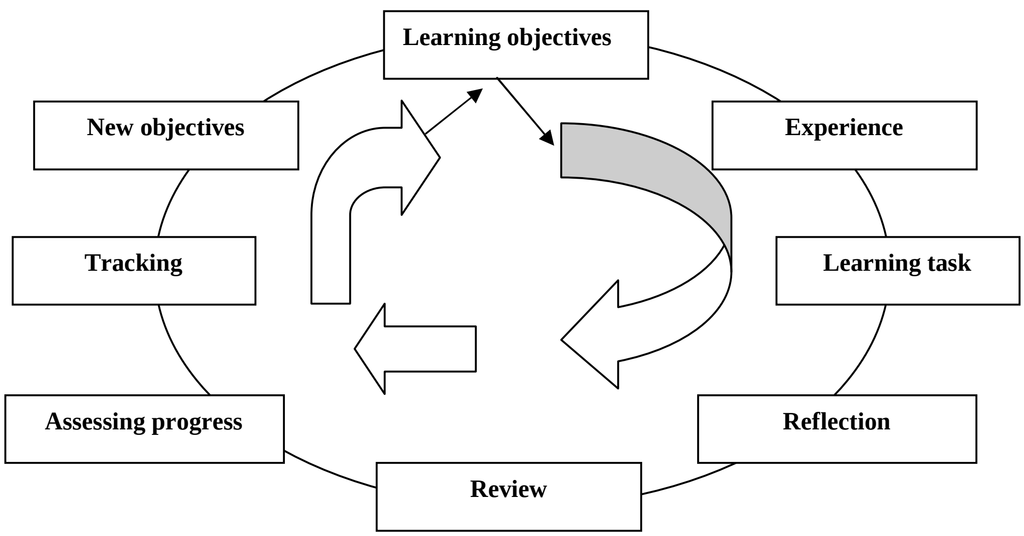



**Figure 2:** The general scheme of the preparation / training of engineers of clothin g industry

The study conducted by R. R. Bibrih and I. A. Vasilyev [5] showed that during the process of study at university students support a change, learning goals interact with reasons, in fact the result of which forms the internal reasons for learning activities, particularly on educational professional. A key factor participating in intensifying this process is the ability to establish personal learning goals to students.

G. P. Shchedrovitsky called active methods of training and educating those that allow "students in a shorter time and with less effort to obtain necessary knowledge and skills" aware "of student skills training" and awareness "training they need for activities future "[6].

We can distinguish the following basic steps to increase student activity and efficiency of study:

1) increasing student motivation for learning by: a) internal reasons and b) external reasons (reasons, incentives);

2) creating the conditions for the formation of new and more May the higher forms of reasoning (for example, desire or reason autoupdate his personality growth (after. Maslow, desire for self-expression and self-knowledge in learning (after B. A. Sukhomlinsky);

3) giving to those who learn new and more effective means for developing their activities would enable them to implement new activities, knowledge and skills;

4) ensuring better coherence of organizational forms and means learning content [7];

5) enhancing the student's mental activity based on more rational use of time study process, enhancing the dialogue between teacher and student colleagues peer through open dialogue;

6) taking full account of the particularities age and individual characteristics of students.

Modern operating methodology changes which are the weight, especially for value, by increasing the formative potential of conventional methods by emphasizing their heuristic nature and active, participatory. Modern teaching methods promoting active learning, learning based on experience conceptualized assimilation of humanity, but also its own investigation of reality and the formation of knowledge and experience through their own effort. Teaching no longer means to induce the student to remember stored in a volume of knowledge, but to learn to take part in the production of new knowledge.

Thus, preferred modern heuristic methods of teaching and learning as they focus on the following capabilities [8]:

- the ability to ask questions and to construct responses;
- cultivation of habits, skills and intellectual qualities;
- develop critical thinking and Creativity;
- application of concepts and algorithms in projects or works in different contexts;
- formation of opinions, outlooks or desirable behavior.

## 3. CONCLUSIONS

For effective training, a stock of knowledge and successful performance while changing attitudes and fostering motivation in this context is necessary to achieve the following:

1. inform students on educational aims in accordance with the principles of the Bologna Process;
2. application and use of active-participatory methods of teaching and conducting laboratory work, which contribute to the professional skills of students, they facilitate their entry into employment;
3. university programs of study focusing on current issues, taking into account the requirements of employers;
4. student orientation to both professional and personal training;
5. increase transparency and student participation in decision-making activities;
6. democratization of higher technical education.

## 4. REFERENCES


1. Cucoş, C., Pedagogie, Iaşi, Polirom, 2002, pag. 52-53.
2. Gibbs, G. *Evaluarea mai multor elevi.* Oxford: Universitatea Oxford Brookes, 1992, pag. 23.
3. Андреев А.А. *Педагогика высшей школы.* Новый курс – М., 2002.
4. De la Harpe, B., Kulski, M. şi Radloff, A. (1999). Cum se documentează cel mai bine calitatea actului predării şi modul cum învaţă elevii noştri? În K. Martin, N. Stanley şi N. Davison (Eds),

*Predarea disciplinelor / Învăţarea în context*, 108-113. Lucrările celui de al 8-lea Forum anual de predare învăţare, Universitatea Western, Australia, februarie 1999. Perth: UWA., p.110.
*5.* Бибрих Р. Р., Васильев И. А. *Особенности мотивации и целеобразования в учебной деятельности студентов младших курсов* // *Вестник Моск. ун-та.* – Сер. 14. Психология. – 1987. – № 2. – С. 20-30.
*6.* Щедровицкий Г., Розин В., Алексеев Н., Непомнящая Н. *Педагогика и логика.* – М., 1993.
*7.* *Основы педагогики и психологии высшей школы.* / Под ред. А. В. Петровского. — М., 1986.
*8.* Albulescu I., Albulescu M., *Predarea şi învăţarea disciplinelor socio-umane*, Iaşi, Polirom, 2000, pag. 99.

ANNALS OF THE UNIVERSITY OF ORADEA
FASCICLE OF TEXTILES- LEATHERWORK
Volume I, 2010, No. 2

# A MODEL OF MANAGEMENT SYSTEM REGARDING THE COMMERCIAL HUMAN RESOURCES INSIDE THE ROMANIAN TEXTILE COMPANIES

**Raluca Petronela Lăzărescu**

*„Gh. Asachi" Technical University of Iasi , ROMANIA*

Corresponding author: Lăzărescu Raluca Petronela, rdragoi@tex.tuiasi.ro

***Abstract:*** *The paper presents a model for a management system regarding the commercial human resources inside the Romanian textile companies, outlining the factors that can influence the conception, implementation and the results of the system.*
***Key words:*** *management system for commercial huma n resources.*

## 1. INTRODUCTION

The management of the commercial human resources aim to consider the employee` s necessities and needs in correlation with production necessities and technical and technological possibilities. The personnel function contents all the activities centered to the human factor having as main objectives to realize, orientate, utilize efficiently and maintain the development of human resources system. Therefore, in the designing process of the commercial human resources management system, the managers must follow the correlation between textile company` s objectives and employees` s objectives in order to create an efficient strategy. The essential information in this stage are: to analize the commercial tasks; to identify the require ments oriented to the individual performance; to identify the optimum operation process of the system; to foresee the design costs of the system.

The design stage of the management system regarding the commercial human resources is based on activities as:

- To identify, describe and analize the commercial jobs inside the company;
- To plan the commercial human resources necessary to achieve the commercial objectives of the company;
- To design the human communication network corelated with the informational sys tem;
- To set up the rights and the obligations of the commercial human resources.

The "building" stage of the management system regarding the commercial human resources involves recruitment, selection, integration activities.

The maintenance of the managem ent system regarding the commercial human resources refers to aspects concerning the migration of the personnel and the identification of solutions to solve conflicts in order to aply the work ethical principles.

The development of the management system regarding the commercial human resources represent the stage when the management of the company must adapt the system to the internal/external factors that are in continuouse changing.

The textile company as system must outline the personnel function an d its importance to accomplish the main objectives. The management system regarding the commercial human resources claims an open systemic approach, refering to the internal and external environment of the company. The connection between commercial personnel system and the global strategy of the company, togheter with the nature of the organizational climate is essential.

## 2. THE MANAGEMENT SYSTEM` S COMPONENTS REGARDING THE COMMERCIAL HUMAN RESOURCES

The main components of the commercial personnel management system are:

*a). The expected results:* the management system of the commercial personnel must reach to results that can be used by other system inside the company. The expected results, specific for the commercial human resources, can alow a demarcation of the management system inside the company, and their materialization can distinguish the eficiency and the performance of the system in the company`s general vision.

The results of an efficient system regarding the management of commercial human resources can be:

- To recruit and select the suitable commercial personnel according to the quantitative and qualitative requirements of the company` policies;
- To assure the stability of the commercial personnel through continuous concerning regarding the carrier development, professional improvement, proper remunaretion;
- To create and mentain an adequate work environment according to the commercial employees` expectations.

*b). The activities:* during the planning process of the management system regarding the commercial human resources it is important to take account of specific activities of this cathegory. The ensemble of the actions that are taken inside the company in order to reach the desired results it is indicated to be centered on the commercial activities.

Beginning from the necesity of a vision regarding the management of the company to commercial human resources, it can be identify general and specific activities. The general activities can be:

- To adjust the management system in such a way to envolve the employees in the construction of the entrapment and organisation objectives;
- To establish the new work organization forms: changes in the work schedules in such a manner to become flexible and encouraging for the commercial employees, enrichment of the tasks and responsibilities in a creative direction;
- To adopt a modern vision regarding the management of the commercial human resources according with employees` requirements.

Some of the specific activities reflected in the management of commercial human resources can be:

- To establish the objectives and the policies regarding the commercial human resources in order to use in an efficient way their work in the company;
- To use efficient planning of the commercial human resources;
- To ensure the company with commercial employees using the efficient methods, techniques and instruments during the recruitment, selection and integration processes;
- To elaborate well structured plans looking for the development of the commercial employees, based on the identification of the training needs;
- To develop measures to maintain the commercial personnel inside the company establishing an equitable system of remuneration, promotion, social advantages and so on.

*c). The resources:* in order to reach the required objectives, the commercial employees need to use resources, such as: technological resources (IT resources) and finnancial resources. The tehnological support means specially the equipments (computers, sales and statistical softs), and the finnancial aid gives the opportunity to the employees to participate to trainning sessions with the main goal to enrich the professional knowledge.

*d). The feedback:* shows the measure of the commercial employees` work to obtain the rusults expacted by the company` s manageme nt. Many times, the feedback helps to regulate the perturbations inside the management system regarding the commercial human resources, alowing the continuously improvement of it. The efficient results of commercial activities are based on a constant communication between employees and company`s management, and in this way, the feedback has an essential role.

*e). The disemination of the results*: this component reffers to the integration of the work results obtained by the commercial employees into the gen eral results of the company, considering that they are used as resources for other systems inside the company.

Therefore, the commercial of human resources management system can be represented as bellow *( figure 1):*

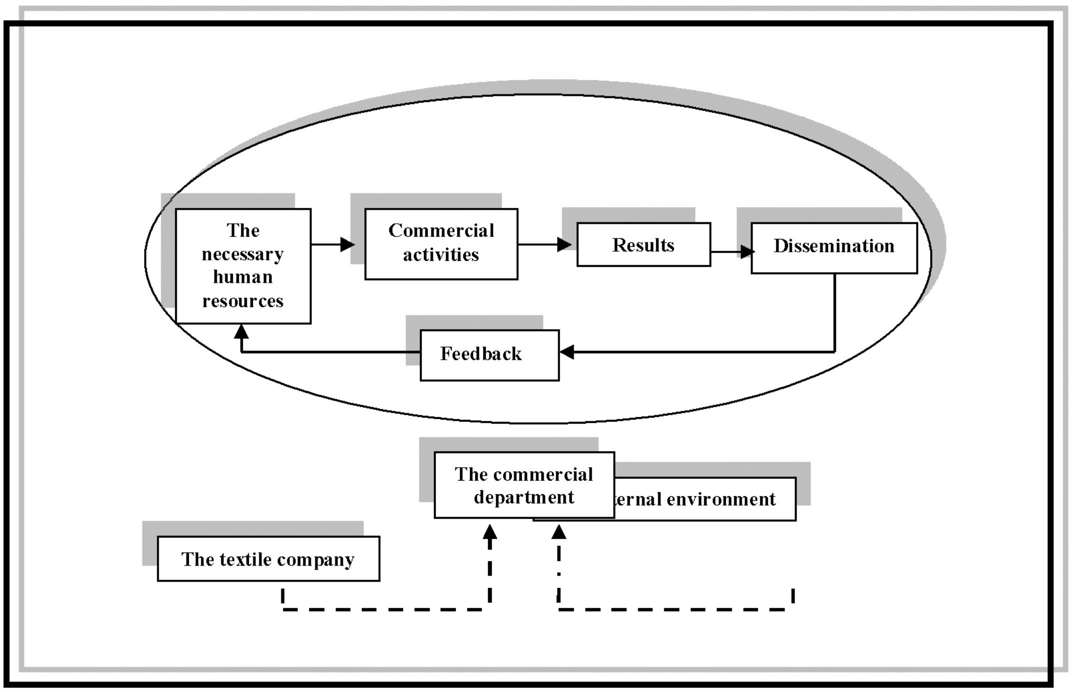



**Figure 1**: The commercial human resources management system

The nature and intensity of commercial human resources management system, as part of the company` s environment is based on the open system model, because between them it is a continouse communication. These happen because it is necessary to obtain and use information that can offer the possibility to the commercial human resources management system to be adapted to the requirements of a high performance.

## 3. THE FACTORS OF THE MANAGEMENT SYSTEM REGARDING COMMERCIAL HUMAN RESOURCES INSIDE THE ROMANIAN TEXTILE COMPANIES

The management system of the commercial human resources depends on internal and external factors.

*a). internal factors:*

- *the management vision:* includes the value system of the management, the view regarding the commercial human resources in general, but also individually, as employee of the company; managers of the Romanian textile companies tend to follow the main objective – the profit, showing less interest in work satisfaction of the em ployee;
- *the size of the company:* inside the small size Romanian textile companies, the activities and responsibilities regarding the commercial human resources are accomplished by the owners or managers, this aspects going to:

- ✓ *Advantages* (a better understanding of the employees` necessities, direct communication with the employees and so on);
- ✓ *Disadvantages* (the lack of knowledge or ignorance regarding functions of human resources management: professional development, continuous training and so on).

Inside the big textile companies, there is the possibility to develop commercial departments with motivated employees, altghout the managers do not invest time and financial resources to make the human resource more performant.

- *human relations inside the commercial team*: the conflicts and the lack of cooperation can affect in the negative way the work environment. In order to avoid these aspects, the commercial manager can organize special meetings with the employees outside the company, with the main objective to make them to interact, to know each other better and to understand the own needs and necessities;
- *the equipments:* working in a dynamic area, the human resources involved in the commercial activity of the company need IT performant equipments: special soft to register and supervise the sales, clients and stocks and so on. Missing the equipments, the work becomes inefficient and the employees tend to waste time and resources for less important responsibilities, instead to invest their knowledge in essential objectives;
- *the organizational culture:* inside most of the Romanian textile companies, the managers take centralized decisions based on the certain rules and procedures that must be following by the employees. Inside the non-traditional textile companies, the decisions involve the human resources and encourage the open and flexible communication with benefits for employees and managers.

*b). external factors:*

- *the development and dissemination of the knowledge:* in order to value efficiently the commercial personnel it is important to know the real performances of the company as a whole, and also to understand the factors that can affect the employee` s behavior, as individual inside to a team.

The study of the commercial employee` s behavior can be based on some aspects, such as:

- ✓ finding methods to motivate the individual with the aim to make him work more performant for the company;
- ✓ organizing training in the human relation communication field;
- ✓ measuring the psychological impact of remuneration system to the employee` s behavior;
- ✓ trying to reorganize the tasks and responsibilities in a manner to become challenging and motivated for the employee.

- *the technological progress*: because of the present context of the economical environment, the employees have developed an unsecured feeling that they do not have the high technological skills required by the most of the textile companies. The intellectual effort becomes an essential component of the commercial employee, forced to accumulate and actualize information in the work field;
- *the economical context*: the penetration on the Romanian textile market of Chinese products, the lohn system and the destruction of the old textile companies before 1989 have as result a decreasing of local demand. As a direct consequence, the commercial component diminished inside the textile companies and the managers are more interested on the production aspects ;
- *the changes of the work force*: lately, the work force is oriented to the companies that can offer a certaine seccurity in keeping the work place and the possibility to carrier development. Althought, the commercial field is searched by many individuals, the work force is less interested by the textile companies, because these do not offer entirely the hereinbefore conditions.

## 4. CONCLUSIONS

The managers of Romanian textile companies must become more involved in developing a management system for commercial employees according with the particularities regarding their necessities and needs, in order to become more efficient. The commercial human resources are a key element in the relationship with the textile company` s clients, so the managers must analyse the factors that can affect this category, and improve the management system according to the continues changes of the environment.

## 5. REFERENCES

1. Macarie, F. C., (2006), *Bazele managementului*, Editura Aletheia, ISBN 973-8182-78-6, Bistrita.
2. Russu, C., Dumitrescu, M., Plesoianu, G., (2008), *Calitatea managementului firmei. Evaluare si interpretare*, Editura Economica, ISBN 978-973-709-349-3, Bucuresti.
3. Armstrong, M., (2003), *Managementul resurselor umane : Manual de practică*, Editura Codecs, ISBN 973-8060-60-5, Bucureşti.
4. Armstrong, M., (2001), *Manual al tehnicilor de management*, Casa Cărţii de Ştiinţă, ISBN 973-686-214-3, Cluj-Napoca.
5. Cole, G. A., (2000), *Managementul personalului*, Editura Codecs, ISBN 973-8060-23-0, Bucureşti.
6. Gazier, B., (2003), *Strategiile resurselor umane*, Institutul European, ISBN 973-611-233-0, Iasi.

ANNALS OF THE UNIVERSITY OF ORADEA
FASCICLE OF TEXTILES- LEATHERWORK
Volume I, 2010, No. 2

# PROSPECTS OF IMPLEMENTATION OF INTEGRATED MANAGEMENT SYSTEMS IN THE FIELD OF ECONOM IC UNITS TEXTILE GARMENTS FROM R MOLDOVA

**Viorica SCOBIOALĂ**

[1] ***Technical University of Moldova***

vioricascobioala@gmail.com

***Abstract:*** The paper aims to highlight the opportunities and prospects arising from the implementation of integrated management systems and complex integrated system of textile and leather clothing industry. The trend of economic integration units in line with socio -economic environment rigors of the competitive market stands need to implement integrated management systems for the most part even if they operate in the production strategy in the system “lohn”. Production in the system “lohn” accepted by producers, initially as survival chance, then the light of existing conveniences and without too much risk remains in continuous search of customers is likely. This is particularly so proliferated as the external customers aware of the possibilities offered by companies engaged in the game, increasing demands from day to day. Implementation of integrated management systems: ***quality (ISO 9000)*** - will allow a gradual transition from economic units in production system tallies to promote its clothing brand, customer training, improvement of relations with external partners, providing opportunity for marketing and communication market recogniti on, the possibility of negotiating payment for work, launching competitive products that exceed customer expectations, increase accountability of employees to quality, staff training, continuous improvement; ***environment (ISO 14001)*** - increasing concern for environmental credibility and public show of it, reducing environmental risks, improving relations with external customers, providing opportunities for marketing and communication Improvement community relations, recognition; ***occupational health and safety (OHSAS 18001)*** - improve relations with employees, improving relations with partners, Improvement of relations with community, recognition.
***Keywords:*** integrated systems management, quality, environment, health

## 1. INTRODUCTION

The trend of economic integration units in line with socio-economic environment rigorilie competitive market stands need to implement integrated management systems. This need is becoming increasingly proliferated, although much of the clothing companies operating under production strategy in the system “lohn”. Production in the system “lohn” accepted by producers, initially as survival chance, then the light of existing conveniences and without too much risk remains in continuous search of customers is likely. This more strongly wi th both external customers aware of the opportunities it offers businesses engaged in the game, increasing demands from day to day for the same deals. In these circumstances, applying the approach in respect of quality is inevitable, and his extinterea provide new development opportunities for sure.

### 1. Need to extend the implementation of integrated management systems

Clothing is an economic area of R Moldova predominantly agricultural country which has little economic development opportunities such as oil e xtraction and other fields, machine-building industry, etc.. which has made an important contribution to the state budget and the more tenaciously resisted many imperatives of time and developments from an economic model to another. Tenacity evolution of this area was subject to the need and desire at any cost to managers of firms are not stationed, since it would be conditioned and conditioned in part to staff layoffs. This has led many of them to advocate the production of clothing in the system “lohn” gav e up their own brands. The most important causes which led the managers to ensure the existence at that time held by:

- need to ensure continued operation by the possibility of construction;
- need to implement new technologies and modernization of manufactu ring facilities;
- the possibility of launching co-branded products under its own national brand is recognized and the CSI, such as SA "Ionel", JSC "Odema", etc..

Currently the clothing industry of R Moldova in terms of economic globalization must deal with conditioning, such as:

- lack of financial resources for investment in machinery and technologies;
- lack of financial resources for investment in continuous improvement of staff training, tradition and left forgotten after very practiced at this time;
- lack of financial resources for investment in improving working conditions of staff employed in manufacturing such as canteen operation, providing meal vouchers, medical offices functioning in the economic units, operating nursing homes, rest including offering v ouchers for children functioning kindergartens for children attached to them, etc.;
- general economic and financial blockade on the macro -economic level;
- tough competition in international markets, given that there are many multinationals that have comparative advantage in terms of relatively easy access to sources and markets, access to technology and low operating costs and processing;
- tough competition on the international market to obtain bids to manufacture the “lohn”, given that there are many asian companies offering services at heavily reduced prices;
- obtaining bids from the manufacturing n intermediate and very frequently directly from the client;
- in case of production under own brand clothing, fashion trends change fashion trends accelerate change-a key factor to promote clothing and fewer opportunities to materialize them;
- stopping activities textile producers in the country and importing them from abroad, entailing considerable costs of products;
- absence companies producing accessories in the count ry;
- increasing demands of society to obtain the most modern and environmentally friendly products;
- economic instability, regulatory and cost inputs;
- increasing complexity of processes.

## 2. Implementing an integrated management system in a society of increasin g complexity of processes of textiles

Implementing a quality management system-environment-health and safety at work [1, 2] in the economic units of textiles involves the following steps:

- preliminary analysis of the company to implement the integrated system;
- training management team;
- setting policy and implementation of integrated management objectives;
- implementation of integrated planning throug h: environmental issues, hazard identification, legal requirements, objectives, programs by documents;
- involvement by resource: human resources training and infrastructure and working environment, management information - control of documents, records control, communication;
- operational implementation of the system: achieving product -user requirements/ customer relationship, design, procurement, project, product manufacturing, design and development, product supply, control monitoring and measuring equipment [3], operational control, control waste emergency (figure 1);
- verification, monitoring and measuring, assessing compliance, customer satisfaction;
- internal audit;
- analysis of nonconformities, developing corrective and preventive measures;
- improvement;

- selection of certification body;
- providing assistance during the certification process;
- certification;
- providing post-certification assistance.

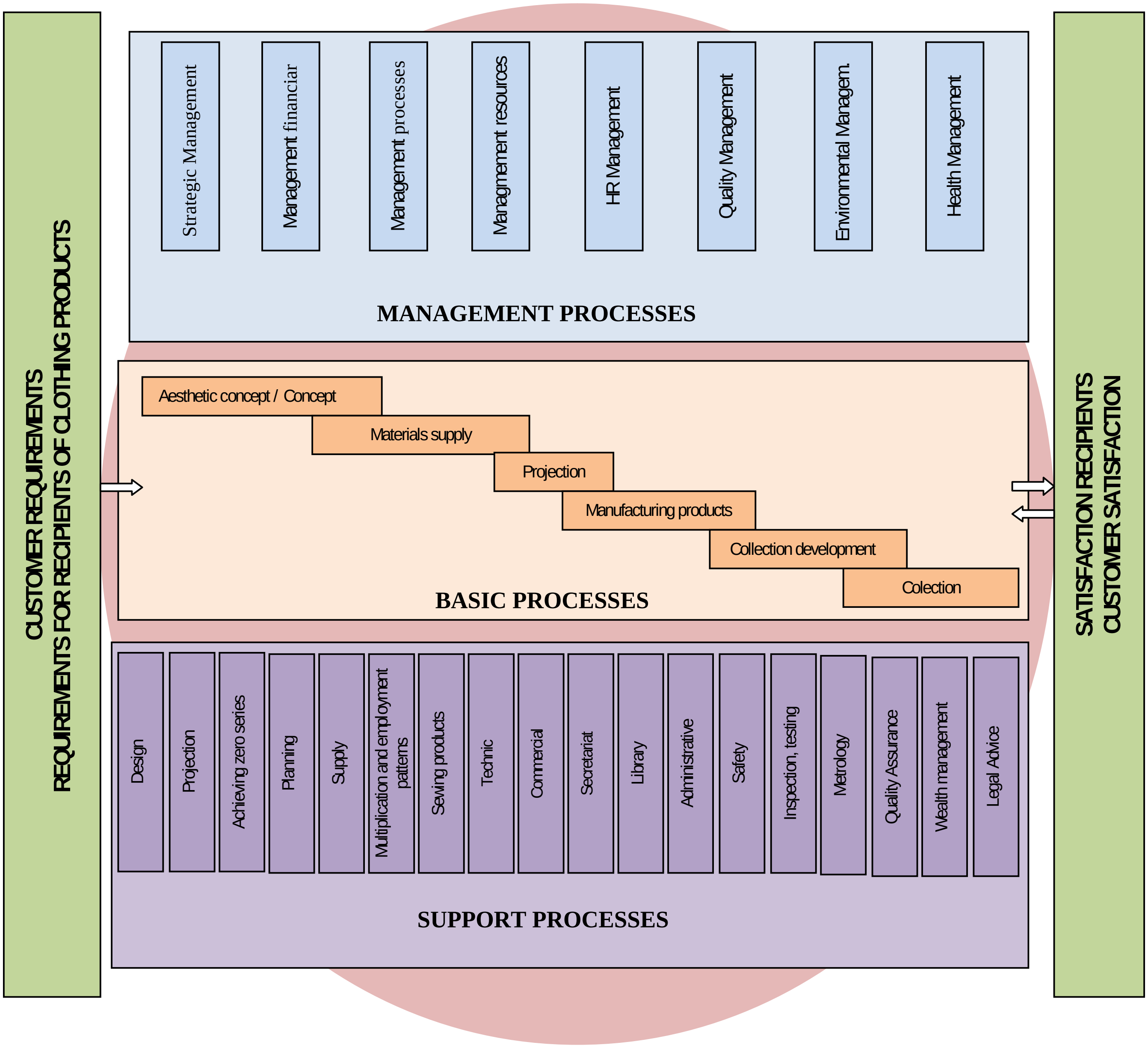



**Figure 1.** Charter process in the clothing company clothing products

## 3. CONCLUSIONS

Implementing an integrated management system will provi de clothing companies the following advantages:

- implementation of ***quality*** management system (*ISO 9001*) - will allow a gradual transition to manufacture the system tallies to promote its clothing brand, improving company image, customer training, improvemen t of relations with external partners, providing marketing opportunity and communication, market recognition, the possibility of negotiating labor, launching competitive products that exceed customer expectations, increase accountability of employees to quality, staff training, continuous improvement;
- implementation of ***environmental*** management system (*ISO 14001*) - increasing concern for environmental credibility and public show of it, reducing environmental risks, improving relations with external customers, providing opportunities for marketing and communication

improvement community relations, recognition;

- implement management system for ***occupational health and safety*** (*OHSAS 18001*) - improve relations with employees, improving relations with partners, Improvement community relations, recognition.

## 4. REFERENCES


1. Popescu S. (2009). Suport de curs *Ingineria şi Managementul Calităţii.*
2. Avram, E. (2009). *Implicaţiile implementării unui system integrat de management într-o organizaţie*. Simpozion. Agigea 28-29 august.
3. Scobioală, V. (2005). *Contribuţii privind îmbunătăţirea calităţii produselor de îmbrăcăminte pentru femei*. Teză de doctorat. Iaşi.

ANNALS OF THE UNIVERSITY OF ORADEA
FASCICLE OF TEXTILES- LEATHERWORK
Volume I, 2010, No. 2

# ASPECTS OF THE CLOTHING PRODUCTS CONSUMER'S SATISFACTION

**Simona TRIPA, Cristiana MARC, Viorica BANCIU**

*University of Oradea, Romania*

tripasimona@yahoo.com

***Abstract:*** Starting from the basic condition to be met by a company to succeed on long -term, namely to achieve and provide quality products, which to provide customers satisfaction, this paper aims to present aspects of the definition of consumer's satisfaction, generally, and its influence factors when the products purchased are from the category of clothing.
***Key words:*** needs, consumer satisfaction, clothing, quality

## 1. INTRODUCTION

People have different value systems that guide the different propensity for certain goods. As such, preferences will be different both from individual to individual and for the sam e individual under different spatio-temporal conditions. Basically, it shows different preferences in relation to the total utility level.

The diversity of consumer needs puts in evidence the great diversity of human preferences and implicitly the variety of consumption patterns These consumer needs are influenced by "the evolution of the level of culture and civilization" [8].

The choice of the product of all existing products (which are available) by the consumer depends on his tastes and habits. Each property is designed to meet a particular need. The capacity of a good to satisfy a need is called the good utility. The usefulness of a product also has a strong subjective load, which affects consumers differently and relatively, and it is in direct connex ion with the consumer's satisfaction [12].

## 2. DEFINITIONS OF THE CONSUMER SATISFACTION

The consumer's satisfaction has been typically conceptualized both as an emotional response and a cognitive response, and the latest definitions of satisfaction is con sidered a response of an emotional nature whose intensity varies depending on the situation [5].

Despite numerous surveys conducted over the years, starting with the first attempt to define customer's satisfaction in 1965 belonging to **Cardozo's** it has not yet reached a consensus on the definition of this concept [5]. In 1997**, Oliver**, a renowned researcher in the field, stated that *"everyone knows what satisfaction is until he is required to define it. And then, nobody knows "*[9]. Among the definitions of satisfaction found in the literature, we mention some of them with a view to strengthening the above. So satisfaction is seen as *"a phenomenon that expresses the fact that the performance and the benefits produced exceed customer expectations* [10] as a "*feeling developed as a result of the assessment of consumer's experience "* [2] or as a "*global evaluative assessment referring to the use or consumption of a product* [14]. **Fornell** [4] sees satisfaction as an "*overall evaluation postbuying*" and **Mano and Oliver** believes that it "*represents an attitude, an evaluative assessment postconsume ranging along a hedonic continuum"* [7].

One of the reasons behind the inconsistencies of the definition of the concept refers to the disagreement of opinions regarding to considering satisfaction as a process or as a benefit [15]. Another disagreement concerns the term used to describe the concept. Thus, terms such as consumer's satisfaction were used (Cronin and Taylor in 1992, Oliver 1993, Tse and Wilton in 1988, Westbrook 1980), customer's satisfaction (Churchill and Surprenant 1982, Fornell 1992) or simply satisfaction (Oliver in 1992, Oliver and Swan 1989) [3].

However, a comprehensive examination of these definitions highlights the fact that all have three components namely:

• the consumer's satisfaction is a response (emotional or cognitive);
• the response has a specific target (expectations, product, consumer's experience);
• the response occurs after a certain time (after consumption, after choice).

Whatever the definition of consumer's satisfaction, it has become today the key to the survival of any business, an imperative of its marketing strategy [6]. A prerequisite for a dominant company, in other words a successful long-term company is to achieve and provide quality products to provide customers satisfaction, which is the premise of developing a relationship of loyalty towards the brand, and customers being loyal to the brand [1].

## 3. INFLUENCE FACTORS OF THE CONSUMER OF TEXTILES' SATISFACTION

Regarding the satisfaction of textile buyers, it is considered to be influenced by the following factors: quality of service, quality of products and branding [16].

The studies developed in this regard show that today there is little advantage that each client is different and optimal satisfaction, without compromise of individual preferences represents a high economic value [13]. Textile goods oriented to customers and, in particular, fashion clothing sector are not only serving functional purposes but often plays a major role in identifying and personal expression, that's why being one way that people communicate nonverbally [3]. They therefore represent ideal products for their orientation towards the customer and their customization according to customer specifications, can provide significant added value.

A survey [17] on customers' satisfaction towards the purchase of clothing and footwear shows that most consumers in the EU-27 are relatively satisfied. On a scale of 1-10 (10 meaning maximum satisfaction, 1 a minimum satisfaction) to obtain an EU average of 8.3. Among the member states, the biggest consumer's satisfaction was recorded in Germany, Luxembourg, Austria and Britain, while in Italy and Latvia there were the most dissatisfied consumers. The same study shows that 10.9 % of consumers in the EU-27 have various complaints related to the purchase of clothing and footwear products.

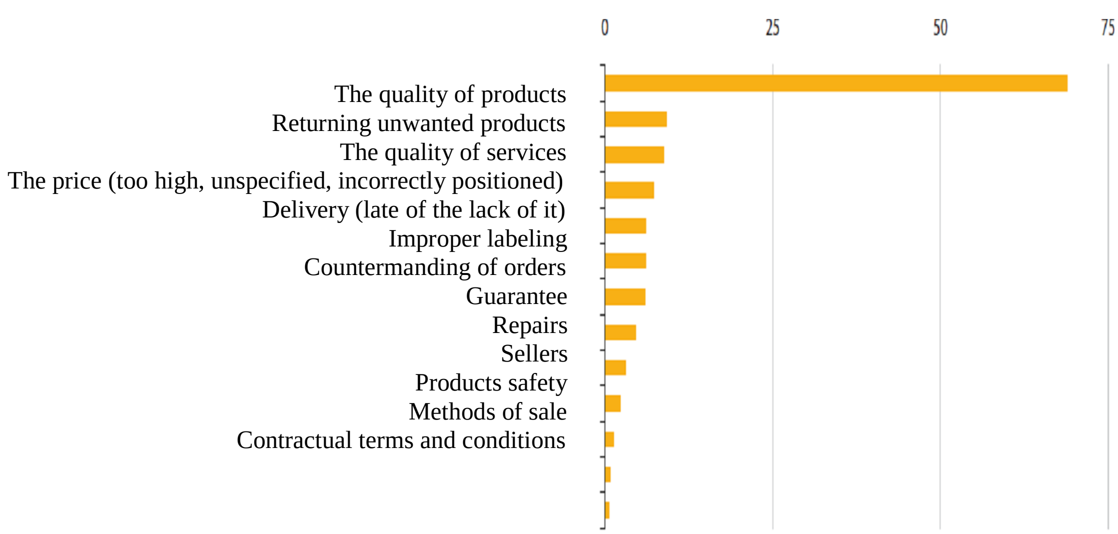



**Figure 1.Problems faced by consumers when purchasing clothing or shoes in the last 12 months, EU-27, 2008**

Source: *** Consumers in Europe, Office for Official Publications of the European Communities, 2009, p. 186

More than two thirds (68.9%) of dissatisfied consumers complain about the quality. Other complaints registered relate to return unwanted goods (9.2%), quality of service (8.8%), product prices (too high, unspecified, incorrectly positioned), delivery information on the labels, possibility of cancellation (of orders) guarantee, repair etc.. The same surve y regarding the consumer's satisfaction has tried to find their opinions vis-à-vis the trust that products present. In this respect, the measure whether consumers felt that the goods were reliable (ie, that they do not decompose, do not break or stretch the seams when worn, etc.) was analyzed and also if retailers will take into account that the goods they sell have been manufactured respecting ethical standards (eg, without using child labor in their achievement).

Results show that on the same scale of 1-10, EU consumers generally agree that items of clothing and footwear purchased are reliable, with an average of 7.9. Highest scores were recorded in Ireland, Austria, Great Britain, Luxembourg and Germany, countries where consumers have shown in the same way when they were questioned about the risks of replacement, repair, or refund the price reductions money if they bought defective products.

Regarding the clothing and footwear made to high ethical standards, the overall situation was quite different. EU average was 7.5. Among member states, consumers from the Northern countries and also those from Luxembourg, Latvia, France and Bulgaria were less satisfied with the choice of goods produced ethically. At the opposite end are consumers from Romania, Malta, C yprus and Czech Republic.

Another study [11] regarding the perception of clothing products' quality orders the characteristics which must be fulfilled by them according to their importance, in terms of male and female consumers. And as can be seen from the data presented in Table 1, women compared with men, attaches great importance to aesthetics, toxicity of products (over 30 years consumers) and the quality of their finishings. According to that study, most consumers believe that fashion, branded products, price and quality or the presence of environmental impact certificates are particular parameters influencing the quality of household textiles, and less on the clothing products.

**Table. 1. -** Structure parameters related to the quality of clothing produ cts, according to their importance given by respondents of different gender

| Significance level | Parameters related to the quality of clothing products | |
|---|---|---|
| | **Men** | **Women** |
| The most important features | physiological comfort<br>product toxicity | physiological comfort, , product toxicity, product aesthetic, convenience of use, quality finishing |
| Very important features | aesthetic, convenience of use, quality finishing, properties of use(safety, health) | utility, durability, hygienic properties, sensory sensations, fiber content and the way maintenance |
| Important features | durability, hygienic properties, sensory sensations, fiber content and type, maintenance mode, fashion, price, brand | nature and structure of the fabric brand, fashion brand, price, environmental impact, possessing quality certificates or other types |
| Very minor features | the nature and the structure of the fabric, environmental impact, possessing different certificates | - |

Source: Salerno-Kochan, R., *Consumer Approach to the Quality and Safety of Tex tile Products. Part I. Quality of Textile Products from the Point of View of Consumers* , FIBRES & TEXTILES in Eastern Europe, 2008, Vol. 16, No. 4 (69), pp. 8-12

## 4. CONCLUSIONS

The fact that the EU market for apparel products, consumers have not complaine d much dissatisfaction on the purchase of clothing products shows the importance attached by both producers and the traders for their quality.

## 5. REFERENCES:


1. Balaşco Anca, Cuc Sunhilde. (2009). *The Perception of Customer Satisfaction in Textile Industry,* International Scientific Conference - Innovative Solution for Sustainable Development of textiles industry, Ed. University of Oradea, pp. 447-450

2. Cadotte, E.R. et al., (1987). *Expectations and Norms in Models of Consumer Expectations*, Journal of Marketing Research, 24, pp. 305 - 314

3. Condra, Jill. (2008). The *Greenwood Encyclopedia of Clothing Through World History*, Greenwood press, Westport, p. 2

4. Fornell, Claes. (1992). *The National Customer Satisfaction Barometer: The Swedish Experience,* Journal of Marketing, 56 (January), pp. 6-21

5. Giese, JL, Cote, JA, *Defining Consumer Satisfaction*, Academy of Marketing Science Review, p.1,6 http://findarticles.com/p/articles/mi_qa3896/is_200001/ai_n8881546/ , accessed 12/12/2009

6. Grace, Debra, O'Cass, Aron, (2005). *Examining the Effects of Service Brand Communications on Brand Evaluation,* Journal of Product & Brand Management, 14/2, pp. 106–116

7. Mano, H., Oliver, RL, (1993). *Assessing the Dimensionality and Structure of the Consumption Experience: Evaluation, Feeling, and Satisfaction*, Journal of Consumer Research 20 (December), pp. 451-466

8. Olah, G., (1998). *Macroeconomics*, Ed TREIRA, Oradea, p. 240

9. Oliver, RL, (1980). *A Cognitive Model of the Antecedents and Consequences of Satisfaction Decisions,* Journal of Marketing, Research 17 (August), pp. 460-469

10. Peter, JP, Olsan, JC, (2005). *Consumer Behaviour and Marketing Strategy*, McGraw-Hill Companies Inc.., New York,

11. Salerno-Kochan, R., (2008). *Consumer Approach to the Quality and Safety of Textile Products.* Part I. Quality of Textile Products from the Point of View of Consumers, Fibres & Textiles in Eastern Europe, Vol 16, No. 4 (69), pp. 8-12

12. Trevisani, Daniel, (2007). *The Psychology of Marketing and Communications* IRECSON Ed. Bucharest

13. Visileanu, Emilia, *European Technology Platform for the future of textiles and clothing,* Universe Engineering, http://www.agir.ro/univers-ingineresc/platforma_tehnologica_europeanapentru_viit orul__textilelor_si_confectiilor_1063.html, accessed 11/12/2009

14. Westbrook, AR, (1987). *Product / Consumption-Based Affective Responses and Postpurchase Processes,* Journal of Marketing Research, 24 (August), pp. 258-270

15. Yi, Y., (1990). *A Critical Review of Consumer Satisfaction, Review of Marketing*, American Marketing Assosiation, Chicago, p. 74

16. Zeithaml, VA, (1988). *Consumer Perceptions of Price, Quality and Value: A means-end model and synthesis of evidence*, Journal of Marketing., Vol.52, No.3, pp. 2-22

17. *** Consumers in Europe, (2009). Office for Official Publications of the European Communities, p.186

ANNALS OF THE UNIVERSITY OF ORADEA
FASCICLE OF TEXTILES- LEATHERWORK
Volume I, 2010, No. 2

# POLYURETHANE-UREEA NANOFIBERS FOR WASTEWATER PURIFICATION

**I. Bălău Mîndru[1], T. Bălău Mindru[1], V. Tura[2]**

[1]*Technical University "Gh. Asachi", Jassy, ROUMANIA*

[2] *"Al. I. Cuza"University, Jassy, ROUMANIA*

Corresponding author: Tudorel Bălău Mîndru, tbalau@yahoo.co.uk

***Abstract:*** In this paper, nanofibers were electrospun from a solution of polyurethane ureea in dimethylformamide (DMF) – tetrahidrofurane (THF) (1:1w/v ) in the form of a nonwoven mat. In this study we were interested primarily on the reduction of sulfides in nanofiltration process, in order to refine post -processing such as precipitation. The effluent (the lime bath) was characterized and treated by nanofiltration, studying the operating parameters: pH and pressure. The membrane structure and morphology was characterized for by Fourier transform infrared spectroscopy (FTIR), scanning electron micro scopy (SEM), atomic force microscopy (AFM) techniques. Tensional properties, permeability, water vapor permeability, turbidity DBO and DBO $_5$ and [$S^{2-}$] retention were also determined.
***Key words:*** polyurethane-urea, nanofibers, nanofibers based-membranes.

## 1. INTRODUCTION

Nowadays there is an increasing concern about industrial water use. In a very near future the collected water will be taxed in UE environmental legislation by imposing more severe discharge limits to liquid effluents.

In this context the reuse of process water became very important especially for the companies with high water consumption such as tannery industries. The main ingredients are: sodium chloride, sodium sulphide, lime, chromium, organic matters like, proteins, fats, etc. These effluents contain high biological oxygen demand (BOD) and chemical oxygen demand (COD).

Membrane separation systems are widely used to purify water of different qualities according to the process needs. Studies involving tannery wastewater with membrane pr ocess have been developed in order to recover chromium, but other parameters have been also evaluated [1, 2]. The aim of this work is:

- the obtaining of the polyurethane-urea nanofibers by electrospinning;
- analysis and characterization of the nanofibrilar material;
- the implementation of membrane separation process combined with conventional tannery wastewater treatment, with the aim of recycling the spent lime bath in the leather production process.

In the search of "cleaner technologies", the membrane -based processes are successfully tested in various industrial processes [2–5]. Membrane is defined as a thin film separating two or more components from a fluid flow. The advantage of membrane techniques include continuous separation, low energy consumption, easy combination with other existing technique, easy up -scaling, and no additives used.

Nanofiltration membrane retains solute molecules ranging from 100 to 1,000 daltons in molecular weight [3, 4, 5]. It can also reject contaminants as small as 0.001 µm. Nanofiltration removes suspended particles, bacteria, viruses, pesticides and organic material.

The membrane based processes are attractive, but limitation of these processes is the decline of flux. The throughput of these processes decrease with the time of the operation because of membrane fouling and concentration polarization (i.e., deposition/increase of concentration of solutes over the membrane surface).

In this study we used polyurethane nanofibrous membranes prepared by electrospinning. Produced via electrospinning, polyurethane membranes have been of interest in medical fields and filtration processes. Electrospinning is a process by which nanofibers can be produced by an electrostatically driven jet of polymer solution. Electrospun fibers are collected in the form of membranes. The porous structured electrospun membrane is particularly important for its favorable properties: it exudates fluid from the wound, does not build up under the covering, and does not cause wound desiccation. The electrospun nanofibrous membrane shows controlled evaporative water loss, excellent oxygen permeability, and promotes fluid drainage ability, but still it can inhibit exogenous microorganism invasion because its pores are ultra-fine.

## 2. EXPERIMENTAL

### 2.1 Materials

In this work was used PELLETHANE* 2363-80A (Dow Chemical Europe) thermoplastic polyurethane. DMF and THF (Fluka Chemicals) were also used for polyurethane solvation. All the chemicals required for the determination of DCO and $DBO_5$ were procured from Fluka Chemical, were of the analytical grade and were used without further treatment.

The hydraulic resistance of the membranes was determined using distilled water and was estimated at 47×1013 m−1 for 200 MWCO membrane.

The solutions containing 30% solid in DMF-THF (1:1 with intrinsec viscosity about 102.3) were electrospun from spinning pipette held horizontally and fitted over a positive electrode lead charged to 11 kV from DC power supply. The droplet of polymer solution at the tip of the pipette formed a spray of fine, positively charged fiber that quickly dried and collected in a continuous network onto a grounded metal target. The resulting fibers were collected on a rotating drum to produce a sheet of membrane. PU nanofibrous membranes were prepared with approximately 10 µm thick. PU nanofibrous membrane consisted of fibers with diameters from 50nm to 500 nm, with an average diameter of 220 nm.

### 2.2 Membrane filtration cell

The unstirred batch experiments are conducted in a 100mL filtration cell made of stainless steel. Inside the cell, a flat circular membrane is placed over a metallic support. The membrane diameter is 5×10−2 m and the effective area of the membrane is $15.9 \times 10^{-4}$ $m^2$. The operating pressures are 0,5, 1 and 1,5 1,75 bars for NF experiments.

### 2.3 Analysis

The specimens were characterized by Fourier transform infrared spectroscopy (FTIR), scanning electron microscopy (SEM), atomic force microscopy (AFM) techniques. Tensile properties, permeability, water vapor permeability, were also determined. Turbidity, COD, BOD and pH of all samples (feed and permeate streams at all the operating conditions) were measured at room temperature using standard techniques.

## 3. RESULTS AND DISCUSSIONS

***SEM images*** of electrospun polyurethane nanofibrous membrane and frequency of diameter distribution can be observed in fig. 1.

***FTIR investigation.*** As shown in fig. 2, dopping the polyurethane with Silver nanoparticles did not bring important changes on the FTIR spectra. One can notice that in the case of doped polyurethane, the absorbance peak at 3450 $cm^{-1}$ has a lower intensity and the total surface of the 3450 $cm^{-1}$ and 3330 $cm^{-1}$ peaks decreased. Because no important shifting of the main absorbance peaks appeared between the two spectra, it can be concluded that Silver is not chemically bond to the polyurethane matrix.

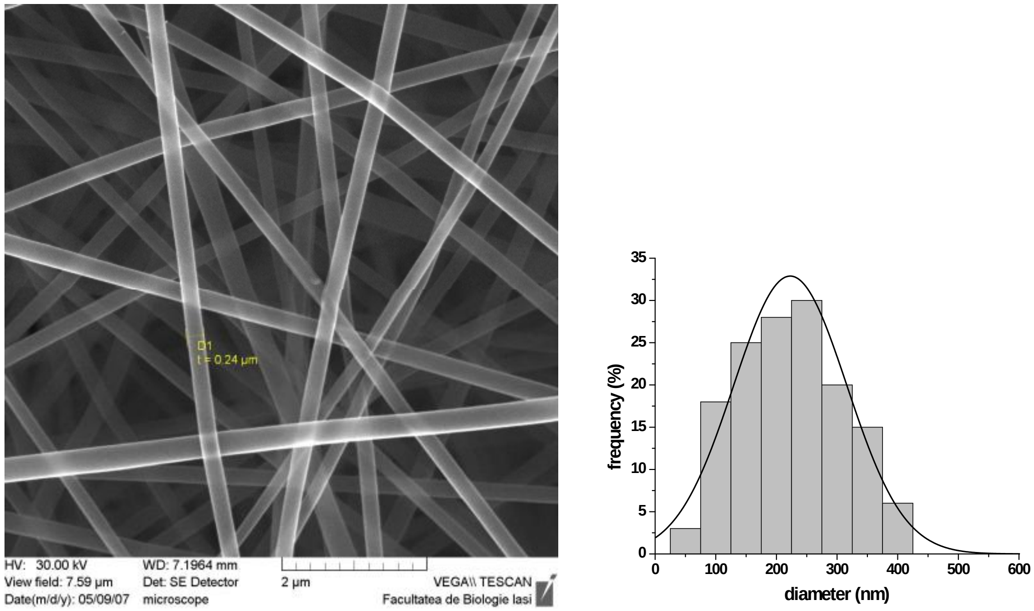



**Figure 1.** SEM image of electrospun polyuretane nanofibers (left). Fibers diameter distribution and a Gaussian peak fit centered at 220 nm.

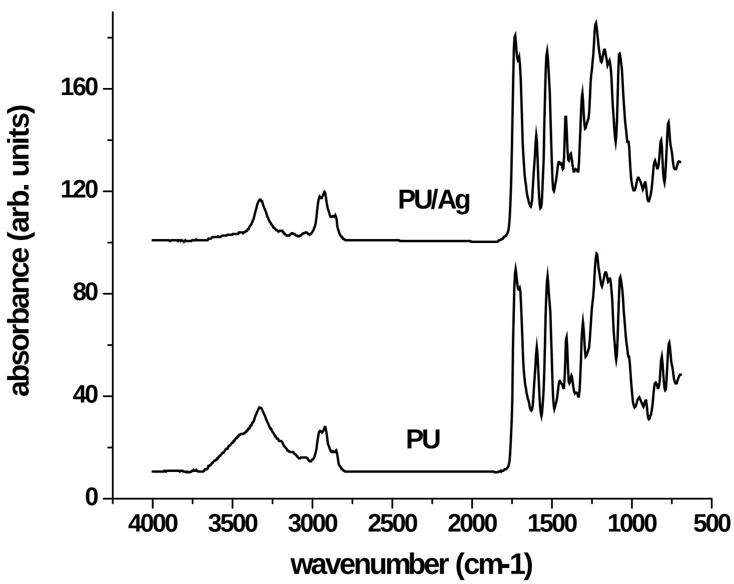



**Figure 2.** FTIR spectra of electrospun nanofibers prepared from polyu rethyane simple and doped with silver nanoparticles.

However, the presence of Silver nanoparticles promoted a different crystalline structure, as proved by the ***AFM images*** (fig. 3 and 4). In fig. 3, the phase image (right) recorded in tapping mode show a perfect homogenity of the nanofibers prepared from simple polyurethane. In fig. 4, the phase image for Silver nanoparticles doped polyurethane show a very clear spherullite structure of the nanofibers. We can see that silver nanoparticles act as crystalliz ation centers and the resulting nanofibers have a structure consisting of a linear arrangement of spherulittes. This completely different crystalline structure of the nanofibers is probably responsable for the differences observ ed on the FTIR spectra in fig. 2.

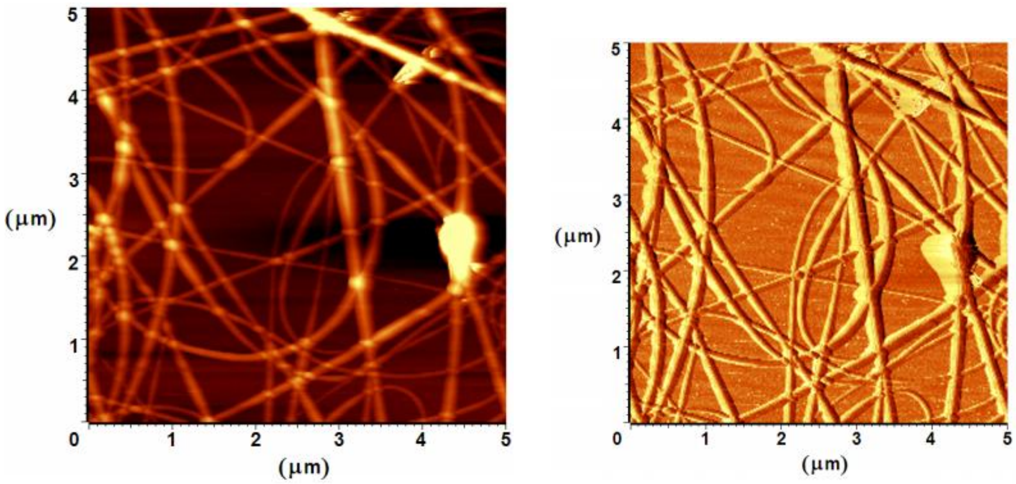



**Figure 3.** Atomic Force Microscopy image of polyurethane nanofibers, recorded in tapping mode: topography (left) and phase (right).

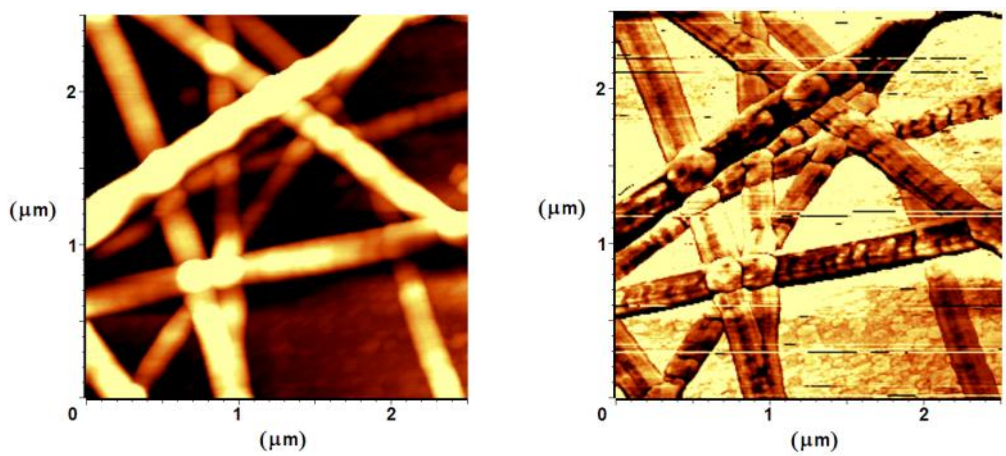



**Figure 4.** Atomic Force Microscopy image of electrospun nanofibers of polyurethane/Ag nanoparticles composite, recorded in tapping mode: topography (left) and phase (right).

***Water vapor permeability.*** Fig.5 shows the variation of WVP of polyurethane specimen with temperature. The water vapor permeability in membrane is the measure of the ef fective mobility of the penetrant in the polymer matrix. When the size of free volume is comparable with water vapor molecule, it's diffusion is restricted. On the other hand, if the free volume of the holes is large enough as compared to the water vapor m olecules, it will diffuse through the membrane with a large diffusion constant.

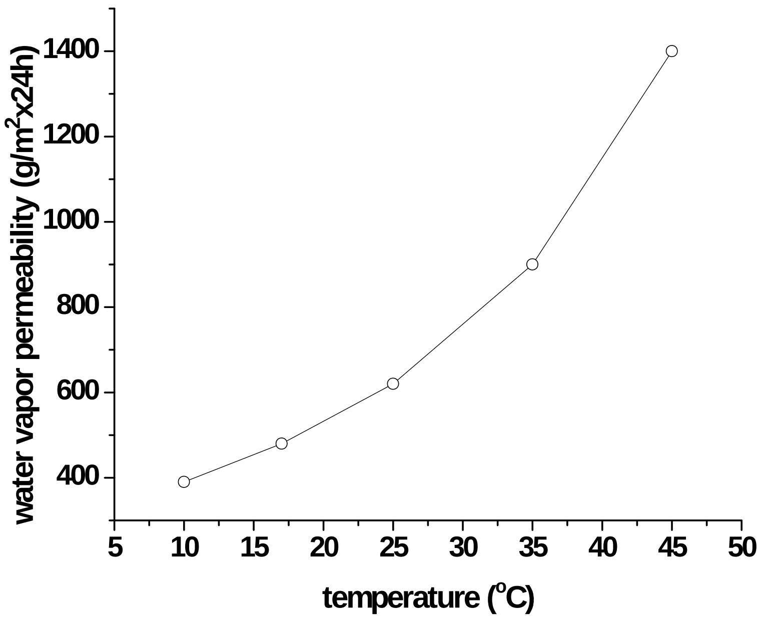



**Figure 5**. Water vapor permeability of PU nanofiber membrane .

As expected, the free volume has direct correlation with the water vapor permeability: a large hole of free volume is required for greater gas permeability. The structural compositions that cause the change in the free volume also affect the polymer–water interaction. Experimental results revealed that the water vapor permeability can be controlled by free volume which would depend on the chemical composition, and hydrophilicity of membranes[6]. The nonwoven fiber mats were not continuous and contained a high degree of sub-micron porosity.

***Tensional properties.*** Fig. 6 shows that electrospun fiber mats exhibited high elongation before break. The linear film failed at 296,6% elongation, with a break force by 0,403 N. Specific mass of the membrane specimen was 40 $g/m^2$.

The significantly large elongation at break may be attributed to a higher concentration of point-bonded contacts between individual fibers [7].

***Flowmeter test.*** Samples permeability was measured using a device presented in fig.7 [8]. The flowmeter measures the amount of fluid passed through a fixed electrospun specimen area over time. Electrospun samples have high porosities, allowing water to migrate outside of the intended area of fluid flow and into surrounding areas of the material. To create a larger pressure head and push fluid through the tightly packed electrospun faster, the height h was increased from 20 cm to 150 cm.

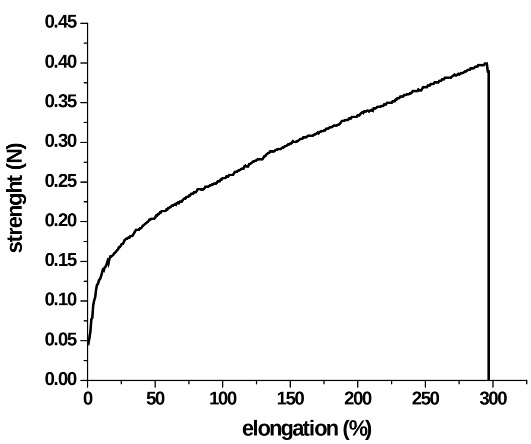



**Figure 6**. Strain-elongation diagram for polyurethane-ureea membrane.

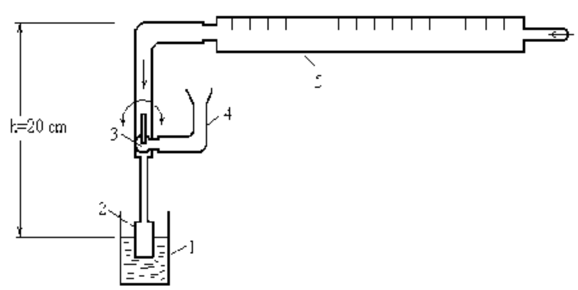



**Figure 7.** Scheme of the flowmeter (1- solution; 2 - nanofilter micromodule; 3 - three- way valve; 4 - filling port; 5 - scale glass tubing).

To ensure that all fluid traveled through a set area of the electrospun specimen and produced accurate permeability values, the mounting apparatus was designed to work by compressing the outer edge of the membrane between two silicone gaskets. The compression was int ended to form a tight seal and force all fluid to flow through the open center of the specimen mounting apparatus. A large pore metal screen was placed on the underside of the specimen to prevent excessive distension of the sample, which would again alter the cross sectional area of fluid flow and effect permeability measurement. The results were presented in fig. 8.

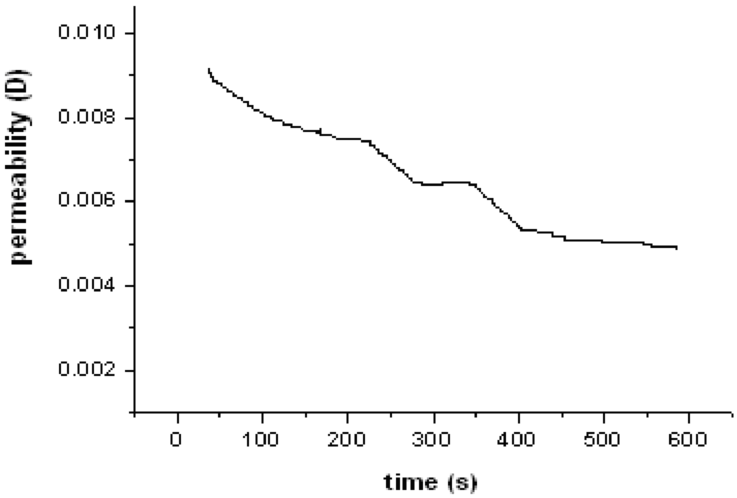



**Figure 8.** Variation in time of membrane permeability (D) .

***Lime bath analyse.*** The toxic action of sulfides in water is related to their str ongly reducing properties. Once oxidized in the form of sulfate, thiosulfate or sulfite, sulfides have an indirect toxic action which consist in oxygen impoverishment of the medium. It can generate disturbances in the microbial activity of water. Chromium, acids, bases, lime and suspended matters are also causes of pollution.

In this study we analysed the nanofiltration process based primarily on sulfides, to reduce the pollution in the effluent in order to refine post- processing such as precipitation.

The effluents rejected by the process unit were characterized and treated by nanofiltration. In experiments we used an apparatus wich contain a nanofilter polyurethane - membrane modulus. It permeate and retentate the effluents back to the feed tank. The surf ace area of membrane was 0.28 $m^2$ and the molecular weight 200 Dalton. It work up 35-40$^0$C, a pH range of 2-10 and up 5 bars pressure.

Samples were carried after draining the liming bath and filtered to reduce the quantity of the fat and solid particles. The analyse of the physic-chemical parameters of the liming bath (table 1) show a high pollution rate. The characteristics of the specimens before and after treatment (permeate and retentate) are presented in table 2.

**Table 1:** Physic-chemical characterisation parameters of lime bath

| Parameter | Value |
|---|---|
| Temperature ($^0$C) | 25 |
| pH | 11,5 |
| Turbidity (NTU) | 325 |
| $BOD_5$ (mg/l) | 4122 |
| COD (mg/l) | 32300 |
| COD/ $BOD_5$ | 7,83 |
| Sulfides (mg/l) | 5230 |

**Table 2:** Physico-chemical characteristic of the sample before and after treat ment by nanofiltration

| Parameter | Feed water | Permeate | | | | Retentate | | | |
|---|---|---|---|---|---|---|---|---|---|
| Δp (bars) | 0 | 0,5 | 1 | 1,5 | 1,75 | 0,5 | 1 | 1,5 | 1,75 |
| Turbidity (NTU) | 41,3 | 0,29 | 0 | 0 | 0 | 38,9 | 39,1 | 40,23 | 42,4 |
| pH | 7,3 | 7,9 | 7,8 | 7,3 | 7,3 | 7,3 | 7,5 | 7,6 | 7,7 |
| $[S^{2-}]$ (mg/l) | 152 | - | - | - | - | 125 | 150 | 180 | 210 |

We can observe:

- a high decrease of turbidity and 93,6 % value of COD (302,32 );
- an increase of permeate flow and turbidity with pressure increasing;
- an increase of $[S^{2-}]$ retention with pressure increasing, indicating a high efficiency of the polyurethane membrane nanofilter.

For basic medium, the variation in permeate flow is more significant. The decrease of the pH determine a $[S^{2-}]$ and turbidity decrease, because pH directly affects direct selectivity of the membrane.

## 4. CONCLUSIONS

- Polyurethane nonwoven membranes were successfully prepared by electrospinning.
- The water vapor permeability of PU nonwoven membranes depend on temperature and the turbidity decrease with pressure increasing.
- Increasing of permeate flow and COD (93,6%) with pressure increasing.
- Increase of $[S^{2-}]$ retention with the pressure increasing, which indicates a high efficiency of the polyurethane membrane nanofilter.

Nanofiltration using polyurethane electrospun membranes improve s the quality of the effluent characteristics.

## 5. REFERENCES


1. Cassano A., Drioli E., Molinari R. and Bertolutti C., (1996). Quality improvement of recycled chromium in the tanning operation by membrane processes , *Desalination*, 108, 1996, 193–203.

2, Fabiani C., Ruscio F., Spadoni M. and Pizzichini M., (1996). Chromium (III) salts recovery process from tannery wastewaters, *Desalination*, 108, 1996, 183–191.

3. Chellam, S. et al. (1997). Effect Operating Conditions and Pretreatment for Nanofiltration of Surface Water, *AWWA Membrane Technology Conference*, New Orleans, Louisiana, 1997.

3. McClellan, S., (19930. Membrane Process Technology Basics – Nanofiltration, *AWWA Membrane Technology Conference.*, Baltimore, Maryland, 1993.

4. United States Patent, Chung et al., (2005). Patent. Nr. US6,924,028 B2, Aug 2, 2005.

5. Mondal S. et al. (2006). *Journal of Membrane Science,* 280, 2006, 427–432.

6. McKee M.G., et al. (2005). *Polymer*, 46, 2005, 2011–2015.

7. Carr Jr. M.E., Linus L. Shen, and Hermans J., (1997). Mass-Length Ratio of Fibrin Fibers from Gel Permeation and Light Scattering, *Biopolymers,* 16, 1977, 1-15.

**ANNALS OF THE UNIVERSITY OF ORADEA**
**FASCICLE OF TEXTILES- LEATHERWORK**
**Volume I, 2010, No. 2**

# TOXICOLOGY OF TEXTILE DYES

**Sanda Bota[1], Liliana Indrie[1], Mariana Rațiu[1]**
¶
[1] *University of Oradea,ROAMNIA)*
¶
Corresponding author: Sanda Bota, sbota@yahoo.com
¶
***Abstract:*** In textile industry are used large volume of water and a variety of chemicals in differ ent processes. More problems can arise in relationship to the potentially dangerous degradation products of textile dyes. Much of this are carcinogenic and mutagenic. In this paper are presented characteristics of dyes structure, adverse effects and mechanism of toxicity.
***Key words:*** textile dyes, toxic, dermatitis, carcinogenic, mutagenic

## 1.INTRODUCTION

Textile processing industry is characterized not only by the large volume of water required for various unit operations but also by the variety of c hemicals used for various processes. There is a long sequence of wet processing stages requiring inputs of water, chemical & energy and generating wastes at each stage. The other feature of this industry, which is a backbone of fashion garments, is large variation in demand of type, pattern and color combination of fabric resulting into significant fluctuation in waste generation volume and load. Textile processing generates many waste streams, including liquid, gaseous and solid wastes, some of which may b e hazardous. The nature of the waste generated depends on the type of textile facility, the processes and technologies being operated, and the types of fibers and chemicals used.

Textile effluent is notoriously known to have a strong color, large amount o f suspended solids, broadly fluctuating pH, high temperature and high chemical oxygen demand (COD) [1]. Synthetic textile dyes can be structurally different and a very low concentration of dyes in effluent is highly visible and undesirable. Discharge of these dyes is undesirable not only for aesthetic reasons, but also because they may decrease the absorption of light by the water, plants and phytoplankton reducing photosynthesis and the oxygenation of water [11]. Many azo dyes and their intermediate produc ts are toxic and mutagenic or carcinogenic to aquatic life and humans [9] and they may also contain levels of heavy metals that breach environmental standards [10]. Due to large scale production and extensive application they can cause considerable environ mental pollution and are health risk factors [18].

## 2.DYE MOLECULE

Organic molecules become cooled, and are thus useful dye molecules, if they contain at least one of the following radicals called chromophores (which provide colour) and auxochromes (wh ich intensify and deepen the colour) which can selectively absorb and reflect incident light [26,13]. Chromophores are unsaturated organic radicals. Their specific state of unsaturation enables them to absorb and reflect incident electromagnetic radiation within a very narrow band of visible light.

Loosely held electrons in the conjugated system of the chromophores are able to absorb certain incident light waves [26]. The auxochromes influence the orbitals of the loosely held electrons of the chromophores, which causes these electrons to absorb and reflect incident light energy only of specific wavelengths. This also intensifies and deepens the hue of the dye molecule. Auxochromes also increase the overall polarity of the dye molecule and make it more readil y soluble in water and more readily attracted to the fibre polymer (Figure 1) which improves the colour - fastness properties of the dyed fibre.

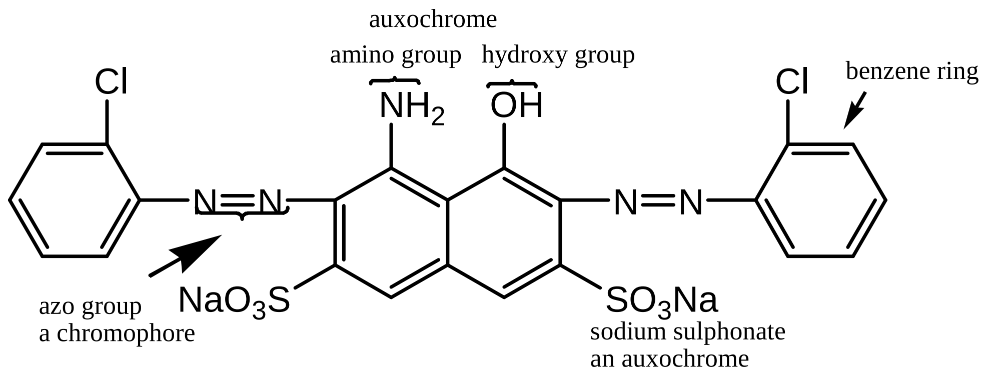



**Figure 1:** Structural formula of a textile dye molecule. C.I. Acidic Blue 86, 44075 – an acid dye

The majority of dyes can be regarded as resonance hybrids with the colours obtained depending on the energy states of the orbitals. Lengthening the conjugated chains increases the number of double bonds and decreases the energ y gaps between the $\pi$-orbitals. Therefore, the longer the conjugated chain, the less energy will be required to excite the electrons and the greater will be the wavelength of the absorbed light. This can be seen in the properties of carbocyanine dye [30](Figure2). As the number (n) of double bonds increases, there is a clearly defined shift of the light absorbed towards red, with a corresponding relative increase in the proportion of blue reflected.

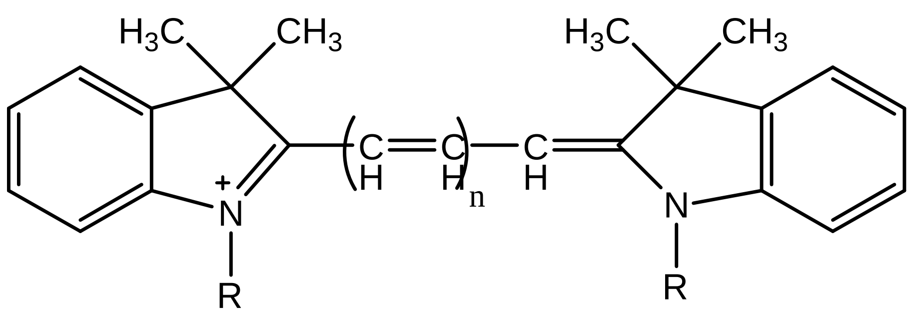



**Figure 2:** Carbocyanine dye. When n = 0 (yellow), n=1 (red), n=2 (greenish blue), n=3 (blue)

There are over 13,000 different compounds classified as dyes in the Colour Index (CI) 2001. About 8000 compounds of them are textile dyes and they give rise to about 40000 commer cial names which are used as textile dyes. The CI classifies the dyes according to their application class and to their chemical structure. For the textile dyer, the classification according to application class is more significant. The classes are: acidic dyes, azoic (naphthol) dyes, metal-complex dyes, developed dyes, disperse dyes, mordant dyes, reactive dyes, direct dyes, cationic (basic) dyes, sulphur dyes and vat dyes as well as pigments and fluorescent brighteners. Each dye has a five -digit CI-number. Synthetic textile dyestuffs contain many different chemicals with different applications, for instance to increase shelf life, to improve water solubility and to reduce dusting.

## 3.ADVERSE EFFECTS OF TEXTILE DYES

Textile manufacture is a global activity and it is difficult for consumers to obtain information about the production and chemicals of textile products. It is known that harmful chemicals may have been used, but potential adverse effects of textile products are not widely appreciated. However, information about the chemicals of textile products can be important, especially for sensitized consumers. The Austrian Textile Research Institute and the German Hohenstein Research Institute jointly developed the Öko-tex-100 standard and eco-label (www.oeko-Tex.com) which is now used globally to indicate that the textile product has been tested for the presence of harmful substances. However, the overall toxic effects of end products are not included and information about overall toxicity is not available.

Symptoms of asthma, rhinitis and dermatitis have been frequently detected in workers exposed to reactive dyes[28,20,3,2]. Dyes containing anthraquinone or azo structures are known to cause contact dermatitis [24,21]. The result of a clinical and immunological investigation of respiratory disease indicated that about 15% of 400 workers handling reactive dyes experienced work-related respiratory and nasal symptoms [25]. Many studies have also found statistically significant relationships between reactive dyes and increasing immunoglobulin blood values in workers who have been contact with these dyes [29]. Was stated that reactive dyes should be classified as potential allergens, even their presence in clothes[4]. The cause of skin reactions is difficult to trace because the dye usually acts as a delayed sensitizer and as such does not cause an immediate response. It has been assumed that since the properties that enable the dyes to react with textile fibres also allow them to bind to body protein, the health hazard resulting from exposure to such substances is significant [27]. The international register of cancer-causing chemicals includes many textile dyes (including those based on benzidine and o-toluidine) and their raw chemicals for synthesis[19]. The UK Health and Safety Executive warns industrial workers who have contact with reactive dyes that they may become sensitized, stressing the potential for respiratory sensitization. In many European countries, the use of textile dyes releasing certain aromatic amines at concentrations above 30 ppm is forbidden. If one wishes to detect any adverse effects of textile dyes, then it is important to conduct tests for mutagenicity and genotoxicity [22,11,5,6], carcinogenicity[7] and teratogenicity [8]. All these studies have revealed adverse effects of dyes, although not all the dyes tested were reactive dyes. Due to the problems associated with textile dyes, the dyeing process is under constant development, with increasing attention being paid to the ecological effects of these chemicals.

## 4.MECHANISMS OF TOXICITY

The toxicity is of a compound becomes apparent when a toxicant is delivered to its target and reacts with it and the resultant cellular dysfunction manifests itself in toxicity. Sometimes a xenobiotic does not react with a specific target molecule but rather adversely influences the biological (micro) environment causing molecular, organellar, cellular or organ dysfunction and leads to deleterious effects. [14]

The most complex path to toxicity involves four steps. First, the toxicant is delivered to its target or targets, after which the ultimate toxicant interacts with endogenous target molecules, triggering perturbations in cell function and/or structure, which initiate repair mechanisms at the molecular, cellular and/or tissue level. When the perturbations induced by the toxicant exceed the repair capacity or when repair becomes malfunctional, then toxicity occurs. The examples of chemically induced toxicities followed by this four-step course are tissue necroses, cancer and fibroses.

Non-polar xenobiotics accumulate into lipid-containing tissues or are metabolised to a more water soluble compounds. The first step is xenobiotic metabolism, the so-called phase I reactions that consisting of non-synthetic reactions like oxidation, reduction and hydrolysis. Phase II reactions in the second phase are conjugation reactions with compounds having hydroxyl -OH, amine –$NH_2$ or carboxylic –COOH groups. The functional groups may be present in the parent compound or may have been formed during phase I reactions that lead to toxicity.[15,23]

Benzene, similar to other aromatic compounds, is oxidised into a variety of reactive metabolites which are normally more toxic than the original compounds. For instance, benzene can be oxidized to a variety of quinines and semiquinones that can cause hematopoietic toxicities and leukaemia. Benzene and many other volatile organic compounds (VOCs) are converted via multiple metabolic pathways to products with varying toxicities. Some of these competing pathways are considered as bio activation, others as detoxification pathways. A variety of factors (for example differences between species, functions of enzymes) can influence the prominence of the different pathways and hence alter toxicity outcomes. When different cell signalling pathways become disrupted, the cell has typically become exposed to some toxic substance [12,16].

## 5. CONCLUSIONS

Reactive textile dyes are extensively used for dyeing process in textile, and about 20 -40% of these dyes are lost in the effluents. They exhibit a wide variability in chemical structure, primarily based on substituted aromatic and hetero cyclic groups. Was demonstrate the toxic effect of this substances. Allergic reactions are commonly known to cause allergic diseases for workers in industry. In response to an EEC Council Directive of 1979 regarding the labelling of dangerous substances, ETAD in 1986 decided to publish a list of twelve colorants that have been classified as toxic on the basis of their acute peroral LD50 values. These varied within the range 25 mg/kg (CI Basic Red 12) to 205 mg/kg (CI Basic Blue 81) and the list included six basic dyes, three azoic diazo components, two acid dyes and one direct dye. Although such data provide an essenti al basis for advice on safe handling procedures, long-established experience indicates that dyes, and even more so organic pigments, present few acute toxicological risks providing good practices are followed.

¶

## 6. REFERENCES

¶


1. Kim T.H., Lee J.K., Lee M.J., 2007, *Biodegradability enhancement of textile wastewater by electron beam irradiation,* Radiation Physics and Chemistry, 76, p 1037-1041;
2. Park H. W. et colab., 2007, *outcomes in occupational asthma caused by reactive dye after long term avoidance*, Clin Exp.Allergy, 37(2), p 225 – 230;
3. Park H. W. et colab., 2006, *Avoice therapy in reactive dye induced occupational asthma; long term follow-up,* Ann. Allergy Astma Immunol, 97(4), p 551-556Ș
4. Marean N, Goossens A., 2005, *Allergic contact dermatitis associated with reactive dyes in dark garment: a case raport,* Contact Dermatitis, 53(3), p 150-154;
5. Mathur K et colab, 2005, *Mutogenicity assessment of effluents from textile dye industry*, Ecotoxical Envirom. Saf., 61(1), p 105-113;
6. Dason M et colab, 2005, *Genotoxicity testing of four textile dues using wing somatic mutation and recombination test*, Drug Chem Toxicol, 28(30, p 289-301;
7. De Ross et colab., 2005, *Colorectal Cancer Incidence Among Female Texile Workers*, Cancer Cause Control, 16(10), p 1177-1188;
8. Birhanli G., Ozmense W., 2005, *Evaluation of toxicity and teratogenicity of six commercial textile dyes using the frag embryoterologemesis assay,* Derug Chem. Toxicol, 28(1), p51-65;
9. Forgacs, E., Cserhati T., Oros G., 2004, *removal of sunthetic dyes from wastewater, a review*, Environmental International, 30, p 953-971;
10. Ozdemir, O.; Armagan, B.; Turan, M. and Çelik, M.S., 2004, *Comparison of the adsorption characteristics of azo reactive dyes on mezoporous minerals,* Dyes and Pigments, 62,p 49-60;
11. Schneider D. et colab; 2004, *Mutogenicity of textile dye products*. Appl. Toxicol.,24(2), p 83-91;
12. Alberts A. et colab, 2002, *Molecular Biology of the Cell,* Gerland Publishing;
13. Broadbent W.G., 2001, *Basic principles of textile coloration*, Woodhead Publishing Cambridge;
14. Grogud S, Kloosem D., 2001, *Mechanism of toxicity,* The McGrow – Hill Comp.;
15. Parkimso. W. et colab.,2001, *Biotransformation of Xenobiotics,* The McGrow-Hill Comp.;
16. Gregus A.W. et colab., 2001, *Toxicology: the basic science of poisons. Mechanisms of toxicity,* The McGrow-Hill Comp.;
17. Meric P., 2000, *Physical removal of textile dues from effluents,* Bioresurse Technology, 72,3,p219-226;
18. Fang, X. and Wu, J.,1999, *Some remarks on applying radiation technology combined with other methods to the treatment of industrial wastes,* Radiation Physics and Chemistry, 55,(4), p 465-468;
19. IARC, 1998, *Re-evaluation of some chemicals*,IARC *vol. 71, Lyon,* http://monographs.iarc.fr/htdocs/monographs/vol.148/48-05.htm*;*
20. Manzini G. et colab., 1996, *Sensitization to reactive textiles dyesin pastients with contact dermatitis,* Contact Dermatitie, 34(3), p 172-175;

21. Wilkinson S.M., 1996, *O*ccupational Allergic Contact Dermatitis from reactive Dyes, Contact Dermatitis, 35(6), p 376-378;
22. Przybojewska D., et colab.,1989, *Mutagenic and Genogenic Activity of Chosen Dyes and Surface Active Compounds Used in the Textile Industry*, Pol. J. Occup. Med. 2(2), p 175 – 185;
23. Sijm. M. et colab.,1989, *Handbook of environmental chemistry*, Spinger Verlay, Berlin;
24. Estlander H. et colab., 1988, *Allergic dermatoses and respiratoyz diseases from reactive dyes contact*, Contact Dermatitis, 18(5), p 290-297;
25. Docker A. et colab., 1987, *Clinica land immunological invertigations of respiratory diseases in workers using reactive dyes,* Br. J. Ind. Med. 44(8), p 534-541;
26. Gohl F., Vilensky S., 1983, *Textile Science,* Langmen Gheshire Ltd, Melbourne;
27. Keneklis W. H. 1981, *Fiber reactive dyes, toxicological Profiles;*
28. Hatch S. , 1980, *Chemicals and Textiles,*Textile Res. J., 54(10), p 664-682;
29. Alanka A. et colab., 1979, *Immediate type hypersensitivity to reactive dyes,* Clin. Allergy, 8(1), p 25-32;
30. Thotman W. , 1954, *Dyeing and chemical technology of textile fiber*, Charles Griffi &Co LTD. Worcester.

ANNALS OF THE UNIVERSITY OF ORADEA
FASCICLE OF TEXTILES- LEATHERWORK
Volume I, 2010, No. 2

# MONITORING THE PROCESS PARAMETERS USED IN THE PUMPING STATION HYDROPHORE WATER WATER FOR TALL BUILDINGS

**Botiş Aurel Cristian[1], Şuteu Marius[2], Mihăilă Ioan[3]**

[1] *SC Compania de apă Oradea S.A, ROMANIA*
[2] *University of Oradea, Faculty of Textiles and Leather,*
[3] *University of Oradea, Faculty of Management and Technological Engeneering*

Corresponding author: Botiş Aurel Cristian, botisrodica@yahoo.com

***Abstract:*** The purpose of such monitoring is to provide safety and continuity in the process of distribution of drinking water in a city where buildings are supplied with very high water, such as residential neighborho ods of blocks. Hydrophore type pumping stations equipped with measuring systems, storage and transmission parameters, a M-BUS network to the central dispatcher. All these data are interpreted quickly by a dispatcher software that can detect anomalies in ne twork and alerts the human operator so that it can respond promptly to remedy the malfunctions occurred in the water distribution system.

***Key words:*** water, water supply plant, network monitoring, readers M -Bus Dispatcher.

## 1. GENERAL INFORMATION

System monitoring stations hydropore provide centralized management of all stations from hydropore dispatching center. It provides the following function:

-Transmission by dispatching the parameters (technological and electrical) of groups of water pumps;
-Work-scheduling system to pump
-Central-control groups hydrophores;
The aim hydrophore monitoring stations is to get these advantages:
-Very easy and accurate records of water consumption;
-Substantial reduction in the number of staff involved in the AA reading water meters;
-Auto-editing water bills to subscribers;
-Quick and accurate detection, on balance the consumption of the system malfunctions occurred in the distribution of cold water;
-Shortening of the intervention by determining the exact fault zone;

It thus creates, the conditions necessary to optimize time and costs affected the water supply system operation.

To achieve it requires installation of more monitoring equipment to measure, save and transmit data.

In hydrophore station is installed w ater meters and differential pressure transducer. It connects to a Data-Logger Transmission of information from his memory by dispatching is done using a modem via the TV cable bus in town.

At this level is achieve by transmitting information supplied SUPE RCAL type units water pumps installed in stations for taking over the flow of cold water flow starting from the station to the consumer. Retrieving information is achieved by connecting the unit SUPERCAl M -BUS bus. Also on this level is achieved and mo nitoring groups hydrophore pumping station. This function is performed using a G100 Gateway Interface module and a module is modem. Acest gate made communication between units connected to bus GENIE -BUS feature GRUNDFOS and other network equipment.

Transmission of information to central dispatcher, is through a cable television network.

Monitoring groups consists in the pumping function of transmitting status signals to the central dispatching and receiving commands from the latter.

## 2. FIGURES ACHIEVEMENT

In Figure 1, is presented a model hydrophore stations, layout and how to view process parameters such as water pressure and flow recorded at a particular date and time.

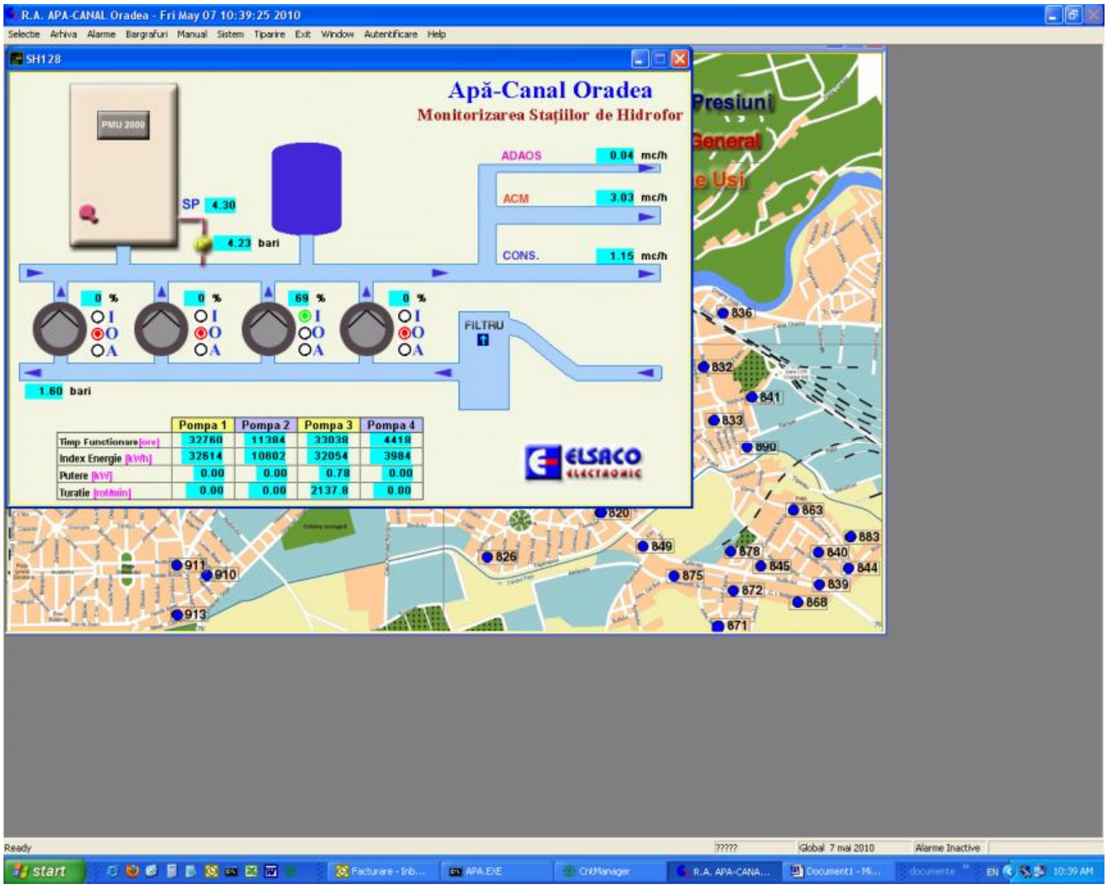
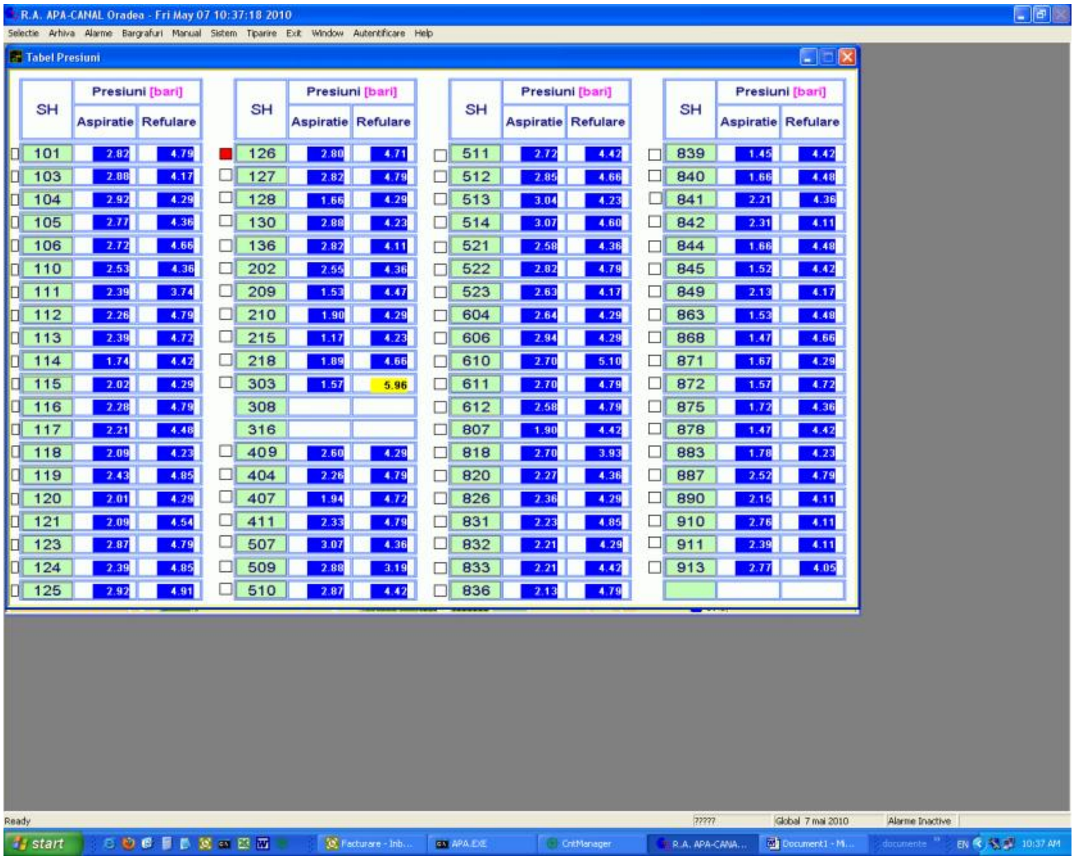



**Figure 1:** SH layout, technological parameters

In Figure 2, the manner in view of the plant discharge water pressure and the installation of aspiration for all stations monitored hydrophore.





| SH | Presiuni [bari] | | SH | Presiuni [bari] | | SH | Presiuni [bari] | | SH | Presiuni [bari] | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Aspiratie | Refulare | | Aspiratie | Refulare | | Aspiratie | Refulare | | Aspiratie | Refulare |
| 101 | 2.82 | 4.79 | 126 | 2.80 | 4.71 | 511 | 2.72 | 4.42 | 839 | 1.45 | 4.42 |
| 103 | 2.88 | 4.17 | 127 | 2.82 | 4.79 | 512 | 2.85 | 4.66 | 840 | 1.66 | 4.48 |
| 104 | 2.92 | 4.29 | 128 | 1.66 | 4.29 | 513 | 3.04 | 4.23 | 841 | 2.21 | 4.36 |
| 105 | 2.77 | 4.36 | 130 | 2.88 | 4.23 | 514 | 3.07 | 4.60 | 842 | 2.31 | 4.11 |
| 106 | 2.72 | 4.66 | 136 | 2.82 | 4.11 | 521 | 2.58 | 4.36 | 844 | 1.66 | 4.48 |
| 110 | 2.53 | 4.36 | 202 | 2.55 | 4.36 | 522 | 2.82 | 4.79 | 845 | 1.52 | 4.42 |
| 111 | 2.39 | 3.74 | 209 | 1.53 | 4.47 | 523 | 2.63 | 4.17 | 849 | 2.13 | 4.17 |
| 112 | 2.26 | 4.79 | 210 | 1.90 | 4.29 | 604 | 2.64 | 4.29 | 863 | 1.53 | 4.48 |
| 113 | 2.39 | 4.72 | 215 | 1.17 | 4.23 | 606 | 2.94 | 4.29 | 868 | 1.47 | 4.66 |
| 114 | 1.74 | 4.42 | 218 | 1.89 | 4.66 | 610 | 2.70 | 5.10 | 871 | 1.67 | 4.29 |
| 115 | 2.02 | 4.29 | 303 | 1.57 | 5.96 | 611 | 2.70 | 4.79 | 872 | 1.57 | 4.72 |
| 116 | 2.28 | 4.79 | 308 | | | 612 | 2.58 | 4.79 | 875 | 1.72 | 4.36 |
| 117 | 2.21 | 4.48 | 316 | | | 807 | 1.90 | 4.42 | 878 | 1.47 | 4.42 |
| 118 | 2.09 | 4.23 | 409 | 2.60 | 4.29 | 818 | 2.70 | 3.93 | 883 | 1.78 | 4.23 |
| 119 | 2.43 | 4.85 | 404 | 2.26 | 4.79 | 820 | 2.27 | 4.36 | 887 | 2.52 | 4.79 |
| 120 | 2.01 | 4.29 | 407 | 1.94 | 4.72 | 826 | 2.36 | 4.29 | 890 | 2.15 | 4.11 |
| 121 | 2.09 | 4.54 | 411 | 2.33 | 4.79 | 831 | 2.23 | 4.85 | 910 | 2.76 | 4.11 |
| 123 | 2.87 | 4.79 | 507 | 3.07 | 4.36 | 832 | 2.21 | 4.29 | 911 | 2.39 | 4.11 |
| 124 | 2.39 | 4.85 | 509 | 2.88 | 3.19 | 833 | 2.21 | 4.42 | 913 | 2.77 | 4.05 |
| 125 | 2.92 | 4.91 | 510 | 2.87 | 4.42 | 836 | 2.13 | 4.79 | | | |

**Figure 2:** Discharge pressure and suction table S.H.

Figure 3 is presented the table with all parameters monitored:

-Pressure suction and discharge;

-Flow of water consumed;

-Pumps are in operation at a certain time;

-Water-filter status of the station;

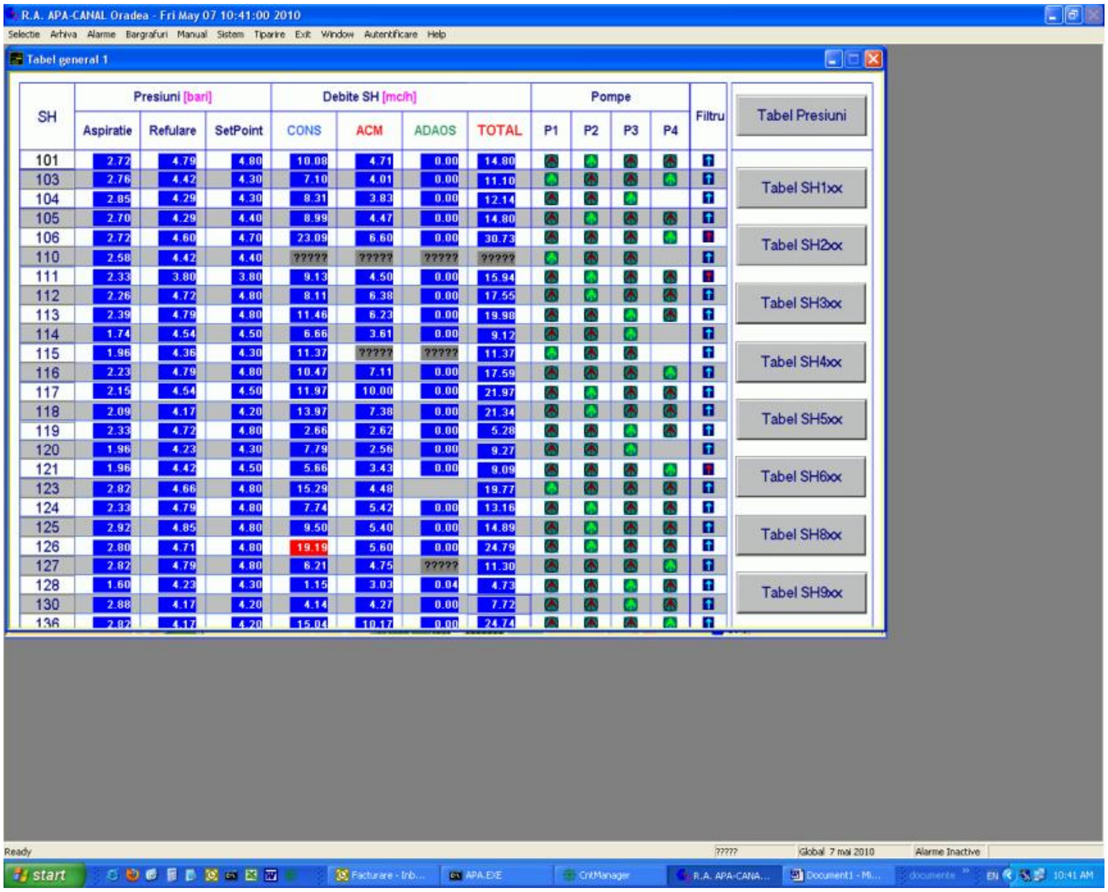



**Figure 3:** Summarizing table parameters monitored

## 3. CONCLUSIONS

Through this system of monitoring is carried ou t following functions:

- Constant surveillance network technological parameters of cold water;
-Determining the exact consumption of cold water on the plant discharge;
- Continuous-monitoring stations hydrophores technological parameters;
-Centralized management of all stations hydrophore;
- Quick and accurate detection of malfunctioning occurs, eliminating the subjective factor in reading and interpreting information;
- Time and cost-optimized for use as water supply system;
- Store purchase and registering all parameters of process, c onducting surveys, modeling the distribution network, automatic billing to subscribers, and generally operating at a higher level of PC System Technology.

## 4. REFERENCES

1. Bruce Schneider:Aplied Cryptography, Prot ocols, Algorithms, and Source Code in C, 2.Auflage, John Wiley and Sons, New York

2. A.Sikora,"Algoritmen fur die sichere Netzanbindung von Embedded Systemen", in: Tagungsband des MPC- Workshops Februar 2007. Pforzheim, Herausgeber:MultiProjectChip Gruppe Baden-Wurttemberger, Hochschule Ulm, ISSN 1862 -7102.

3. N.Baun, A.Sikora,"Secure Embedded Networking using Standard Protocols", Embadded World Conference, 13- 15.02.2007, Nuremberg.

ANNALS OF THE UNIVERSITY OF ORADEA
FASCICLE OF TEXTILES- LEATHERWORK
Volume I, 2010, No. 2

# "IN VIVO" CULTURE OF HEMP CULTURE FOR TEXTILE AND PHARMACEUTICAL INDUSTRY

**Julieta-Emilia Romocea[1], Gianpaolo Grassi[2]**

[1] *UNIVERSITY OF ORADEA, FACULTY OF SCIENCE, Department of Biology, phD student, Oradea, Romania. phonexhunter@yahoo.co.uk*
[2] *CENTRO DI RICERCA PER COLTURE INDUSTRIALI CRA – CIN, Rovigo, Italia. g.grassi@isci.it*

***Abstract:*** The hemp plant (*Cannabis sativa* L.) is cultivated in many parts of the world for his fiber, oil, and seed. The development of new hemp cultivars with improved traits could be facilitated through the application of biotechnological strategies. The purpose of this study was to investigate the germination of two varieties of hemp seeds, *Cannabis sativa* L. var. Ermo and *Cannabis sativa* L. var. Finola, and their transfer in an *in vivo* condition of small plants with half cotyledon, after germination process for obtaining plantlets. The small plantlets were sectioned by removing the half developed cotyledon after their germination and were placed on rockwool sterile cubes placed in Magenta sterile plastic recipients with basal medium (B M) – Murashige-Skoog (MS) medium supplemented with 30 g·sucrose and 2 mg / l thidiazuron (TDZ), and exposed under light for 16 h per day. These plants are selected to be used in mass cultivation for the production of biomass as a starting material for the isolation of THC as a bulk active pharmaceutical (**Lata H.** et al., 2009).
***Keywords:*** hemp, fiber, TDZ (thidiazuron), rockwool, germination.

## 1.INTRODUCTION

The fiber of *Cannabis*, the "True Hemp", is tightly woven into the tapestry of human life. Since earliest times, this great plant ally has provided people with cordage, cloth, paper, medicine, and inspiration.

It was the first fiber plant to be cultivated there at the dawn of human society. Cotton from India and Mediterranean flax were not introduced until thousands of years later.

Since 1995, several large fashion design houses have introduced new hemp products. For example, Adidas offers hempen sneakers for skateboarders, and Converse and Vans are manufacturing hemp sneakers. Calvin Klein offers hemp bed spreads. Hemp textiles are now used in all manner of apparel, from baby diapers to work clothes, socks and shoes, and high fashion creations. The industrial textile applications include rope, twine, nets, canvas, tarpaulins, and geotextiles.

For all the many benefits it bestows, *Cannabis* hemp is a friendship well worth cultivating. Hemp is many things to many people, and it is known by hundreds of names. Doctors prescribe it as a medicine, yet prohibitionists proscribe it as a poison. Cannabis has been used in medicine since about 2300 B.C., when the legendary Chinese Emperor Shen-Nung prescribed *chu-ma* (female hemp) for the treatment of constipation, gout, beri-beri, malaria, rheumatism, and menstrual problems. Hemp is a most interesting and paradoxical plant, one that defies control and begs understanding (**Chang, U., King, G.**, 1877).

The oldest known samples of cloth, found in China and in Asia Minor, were made of hemp. Throughout history, the masses of Chinese people have worn hempen clothes. The earliest archaeological discovery of hemp cloth and rope in Europe, dating to the pre-Roman period (600-400 BC), was found near Stuttgart, Germany. More recently, the original Levi Strauss "jeans" were made of hemp cloth imported from the French city of Nimes, from which is derived the word "denim" ("of Nimes") (**Bensky, D., Gamble, A.,** 1993).

## 2. MATERIAL AND METHODS

In this *experiment*, we collected hemp seeds as vegetable material for "in vivo" culture, a monocieous hemp variety called Ermo and another variety c alled Finola, varieties of Italian origin. These seeds were sterilized under aseptic conditions. They were put separately in a confectioned small cloth bags and kept few minutes in sterile distilled water under cover, then they were placed in 90° alcohol for 1 minutes, after that the seeds were flowed and washed from the alcohol with sterile water, than they were put in 10% sodium hypochlorite ( NaOCl) with sterile water in a ratio of 1:1 with 3 drops of Tween 20 for 15 minutes under continuous agitation, af ter this the hemp seeds were washed 5 times / each 5 minutes with sterile water. During the sterilization procedure, the hemp seeds were placed on sterile germination boxes with sterile filter paper inside. These germination boxes with filter paper were sterilized under UV light for 24 hours. After their sterilization were places the seeds on sterile water for 24 hour for a temperature of 25±1°C for 24 hours.

It was also sterilized under aseptic conditions some Magenta plastic recipients with rockwool cubes inside sterilized by autoclave at 121ºC for 30 minutes.

In same time it was prepared a liquid Murashige-Skoog (MS) (1962) basal medium culture supplemented with a mixing of 2 mg / l TDZ (thidiazuron) and 1 mg/l IBA ( indole-3-butyric acid). The pH of liquid basal medium culture MS was adjusted to a value of 5.8 and portioned in the sterile Magenta recipients with rockwool cubes under aseptic conditions.

After the hemp seeds did germinated, and the seeds were get quite open, one half cotyledon of the developed plant was removed with a cezar and stored in a small sterile plastic tubes. The another half of cotyledon and the root of the plant placed in the Magenta plastic recipients with the rockwool cubes with the Murashige-Skoog (MS) (1962) basal medium cultur e supplemented with 2 mg / l TDZ and the each half of hemp seed was stored in small sterile test tubes to analyze them content, comparing both variety which is more recommended to be more resistant to infection and following them development *in vivo* condition.

After sectioning and storage of hemp germinated plants, the recipients were covered with the plastic cover, and were passed on the shelves, at a temperature ranged between 22 -25ºC and with a photoperiod of 16 hours light / 8 hours darkness, with light intensity being approx. 1500-1700 lucks, emitted by white light fluorescent tubes, respectively the another stored half cotyledons from both varieties were kept in the freezer. At intervals of few days were made biomeasures, respectively regular eye observations and the most important issues were photographed.

Through the performed *in vivo* culture, biomeasures was followed the small plantlets organogenesis ability in imposed growth conditions, being observed: *the length of stems, the number of leaves, the size of leaves*. All experiments were performed by a data reporting results at different options and the obtained values. The interpretation and reporting results we used: images of hemp plants in different phases of development, graphics.

## 3. RESULTS

After 2 weeks of *in vivo* hemp culture, we observed that the small hemp plantlets regenerated new big leaves on *Cannabis sativa* L. var. Ermo, comparing to *Cannabis sativa* L. var. Finola where the plantlets regenerated smaller leaves and very weak development.

In **Figure 1** it is presented *Cannabis sativa* var. Ermo plantlets and *Cannabis sativa* L. var. Finola after *2 weeks* of culture "in vivo".

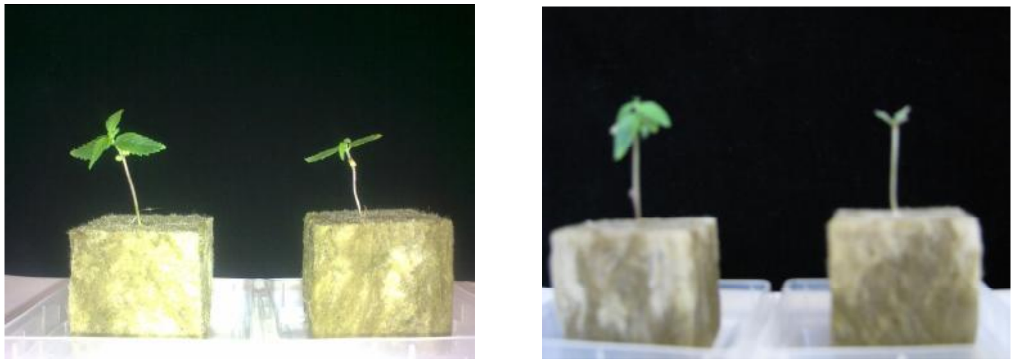
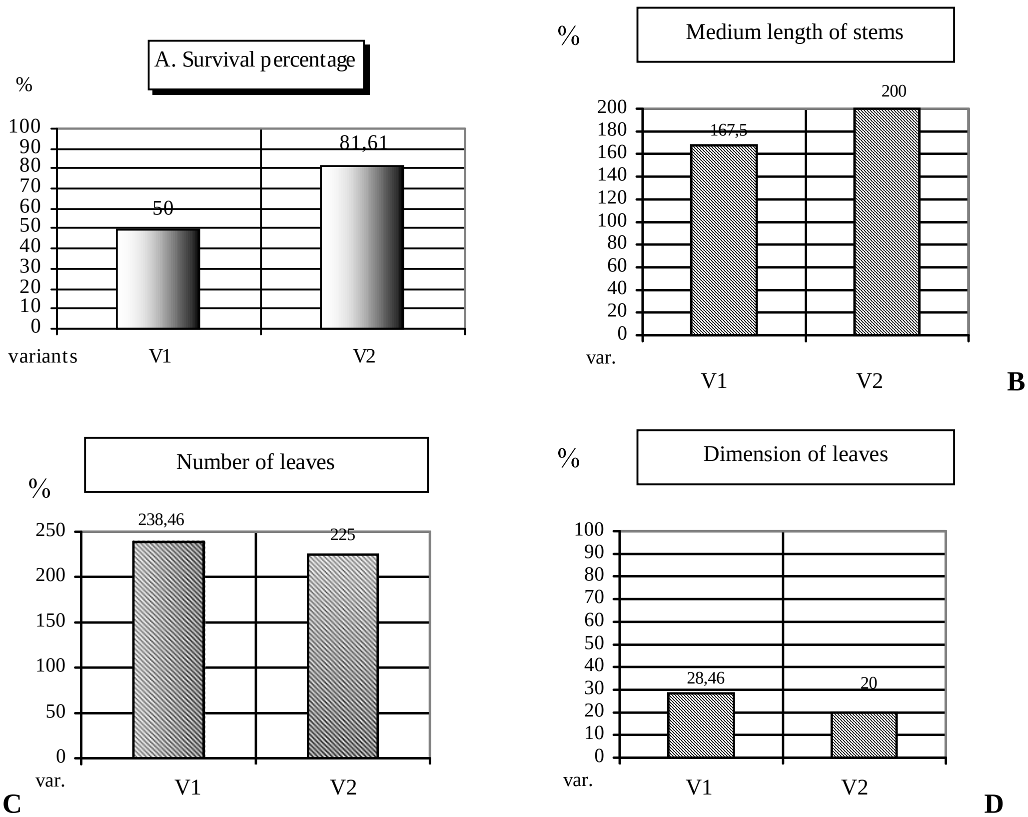



**Figure 1 –** *Cannabis sativa* L. var. Ermo plantlets (A) and *Cannabis sativa* L. var. Finola plantlets (B), at *2 weeks* after germination on rockwool sterile cubes, under sterile "in vivo" conditions

After *2 weeks* of hemp culture germination on sterile rockwool cubes under sterile conditions, the *survival percentage* of the obtained *in vivo* plantlets was 81,61% on variant $V_2$ (*Cannabis sativa* var. Finola), respectively variant $V_1$ (*Cannabis sativa* var. Ermo) where it was lower with 50% **(Figure 2A)**.



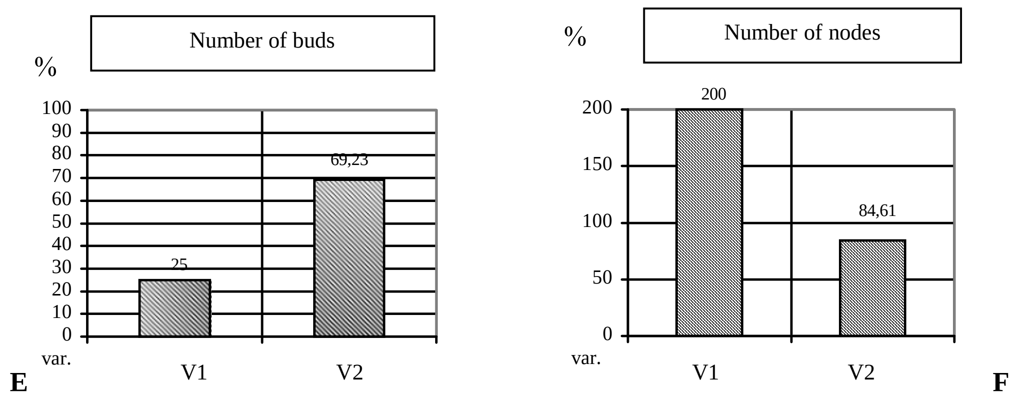



**Figure 2** – Comparative evolution of *Cannabis sativa* var. Ermo plantlets ($V_1$) and *Cannabis sativa* var. Finola plantlets ($V_2$) at <u>*2 weeks*</u> after *germination* on sterile *in vivo* condition, values being expressed in percentage values obtained in relation to the biometric measured hemp plantlets.

The *medium length of stem* **(Figure 2B)** has reached a maximum value of 200% on variant $V_2$ (*Cannabis sativa* var. Finola), causing the stems elongation of the developed hemp plantlets, compared to variant $V_1$ (*Cannabis sativa* var. Ermo) reaching a value of 167,5%.

The leaves regeneration of the hemp plantlets was very high on variant variant $V_1$ (*Cannabis sativa* var. Ermo) with a value of 238,46%, the *number of leaves* **(Figure 2C)** on variant $V_2$ (*Cannabis sativa* var. Finola) was the lower with a value of 225% generating not many leaves.

On variant $V_1$ (*Cannabis sativa* var. Ermo) was observed a generation of big leaves formation, the hemp plantlets reaching a maximum size of 0,7 mm and the *dimension size of leaves* **(Figure 1D)** showing a value of 28,46%, following variant variant $V_2$ (*Cannabis sativa* var. Finola) with a value of 20% and them size was smaller with a maximum size of 0,6 mm.

The highest value regarding to the *number of buds* **(Figure 2E)** was observed on variant $V_2$ (*Cannabis sativa* var. Finola) with a value of 60,22%, respectively variant $V_1$ (*Cannabis sativa* var. Ermo) registering a value of 25%.

The most *number of nodes* **(Figure 2F)** it has been shown on variant variant $V_1$ (*Cannabis sativa* var. Ermo) with a value of 200% generating maximum 3 nodes / plant, respectively variant $V_2$ (*Cannabis sativa* var. Finola) with a value of 84,61% generating 1-2 nodes / plant.

## 4. DISCUSSIONS

In this experiment we did study the possibility of obtaining hemp plants using 2 varieties of Italian origin, germinated seeds from *Cannabis sativa* var Ermo ($V_1$) and *Cannabis sativa* var. Finola ($V_2$), under sterile conditions. After *2 days* of germination, it was removed the half generated cotyledon of each hemp plant from both varieties and they were transferred under aseptic condition on sterile rockwool cubes and it was added a mixing of growth regulators to control the formation of stem and roots by adding a prepared liquid Murashige-Skoog (MS) (1962) basal medium culture supplemented with a mixing of 2 mg / l TDZ (thidiazuron) and 1 mg/l IBA ( indole-3-butyric acid) and grew *in vivo*.

After *2 weeks* of *in vivo* culture, we deducted that the variant $V_2$ (*Cannabis sativa* var. Finola) showed higher values regarding the number and medium length of stems, number of buds, but the most number of nodes, number and dimension of leaves were generated on variant $V_1$ (*Cannabis sativa* var. Ermo).

The recommended variety used in this experiment to harvest hemp plants of well developed leaves it was variant $V_1$ (*Cannabis sativa* var. Ermo) and also it has been proved that removing a cotyledon of a small germinated plant, they can regenerate very good an entire plant under *in vivo* condition with an adding of hormonal liquid medium culture.

Since then, the cultivation of *Cannabis* has been severely suppressed in the USA. Fortunately, hemp still is welcome at home in China, which is the world's biggest supplier of the vital fiber and seed. Cultivars have been developed that produce less than the legal limit of 0.3% THC, thus enabling the development of a fiber market without diversions for drug use. The crop also is cultivated for its fiber in France, England, Canada, Russia, Romania, Hungary, and some two dozen other countries. The French strains Fedora, Felina, Ferimon, Fibrimon, and Futura are the only registered low-THC hemp cultivars that are eligible for farm subsidies from the Britain lifted the ban on industrial hemp cultivation.

## 5. REFERENCES


1 Bensky, D., Gamble, A., 1993, *Chinese Herbal Medicine: Materia Medica*; Eastland Press, Inc., Seattle.

2 Chang, U., King, G., 1877, *The Materia Medica of the Hindus*, Thacker, Spink & Co.

3 Lata, H., Chandra, S., Khan, I.A., ElSohly A., 2009, Propagation through alginate encapsulation of axillary buds of *Cannabis sativa* L. – an important medicinal plant, Physiology and Molecular Biology of Plants, Springer India, Vol. 15, No.1, p:79-86.

4 Murashige, T., Skoog, F., 1962, *A revised medium for rapid growth and bioassays with tobacco tissue cultures*. Physiol Plant 15: .473-497, doi:10.1111/j.l399-3054.

ANNALS OF THE UNIVERSITY OF ORADEA
FASCICLE OF TEXTILES- LEATHERWORK
Volume I, 2010, No. 2

# ASPETS CONCERNANT LA LEGISLATION EUROPEENNE DANS LE DOMAIN DES DECHETS SORTANT DE L'INDUSTRIE TEXTILLE

**Claudia Simona TIMOFTE**

*Université d' Oradea*

clau_timofte@yahoo.com

***Résumé:*** Au niveau de l'Union Europeenne s'est etablit un systheme de réduction des déchets qui a pour objectif de s'adresser au public le plus large possible. Le terme générique de « réduction des déchets » est identifiable à la « prévention de la production des déchets ».
La réduction des déchets peut ainsi être définie comme l'ensemble des mesures prises pour éviter qu'une substance, une matière ou un produit ne devienne un déchet. Ces mesures visent à réduire :la quantité de déchets produits, y compris par l'intermédiaire du réemploi ou de la prolongation de la durée de vie des produits ; les effets nocifs des déchets produits puis traités sur l'environnement et la santé humaine ; la teneur en substances nocives des matériaux et produits.
***Mots- clés:*** dechets, Union Europeenne, gestion, preventions de la production des dechets

## 1. INTRODUCTION

Dans la plupart des pays développés ou en développement où la population, la prospérité et l'urbanisation s'accroissent, il est difficile de collecter, recycler et traiter une quantité grandissante de déchets solides et d'eaux usées, ou d'en disposer.

Plus de trente ans après la directive du 15 juillet 1975 qui posait les bases réglementaires de la gestion des déchets en Europe, l'Union européenne a adopté en novembre 2008 une nouvelle directive chargée de combler les vides juridiques. En effet, le texte de 1975 encourageait le recyclage et la transformation des déchets en matières premières mais ne donnait aucun statut particulier à ces matières recyclées qui restaient des déchets d'un point de vue juridique avec tout ce que cela implique : responsabilité du producteur de déchet tout le long de la chaîne de recyclage, difficulté de circulation sur le marché intérieur de l'Europe et au-delà, constitutions de garanties financières...

L'interprétation de ce vide juridique a été laissée aux bons soins de la justice qui, dans ses décisions, a choisi de s'en tenir à l'objectif d'origine de la directive, à savoir répondre à des préoccupations environnementales et sanitaires. Ainsi, pour certaines affaires, des débris d'extraction issus d'une carrière ont été assimilés à des déchets, tandis que des résidus solides issus de la distillation du pétrole (coke) ont été considérés comme des sous-produits. (5)

*Definition*

On entend par déchets textiles : les déchets neufs d'origine industrielle (chutes de fabrication des filatures et usines de tissage, chutes de tissus),les chiffons et textiles usagés provenant des ménages.

La collecte des déchets de textiles se fait selon deux circuits :
- le circuit professionnel des récupérateurs qui collectent les déchets de fabrication des entreprises du textile et de l'habillement,
- le circuit des organisations caritatives et des entreprises d'insertion qui collectent en porte-à-porte les textiles usagés chez les particuliers ou auprès des collectivités mettant à la disposition de la population des points d'apport volontaire.

*Cadre juridique*

Traité CE:

(a) Article 175: Normalement, la base juridquement correcte pour l'adoption de la législation déchets. Décisions à majorité qualifiée.

(b) Exceptionnellement applicable lorsque la libre circulation est en question: Dir.94/62 (emballages et déchets d'emballage); directive 266/2006 (batteries):

Différence: Article 175 donne davantage de pouvoir aux Etats membres. La législation CE ne cherche pas à uniformiser.

Droit dérivé communautaire: Quelques 15 directives et règlements sur des flux spécifiques;Environ 15 arrêts de la Cour, formant le droit communautaire.

Autres instruments:Programmes, stratégies thématiques: plutôt politique; Recommandations: peu d'influence pratique.

Droit international de déchets : Convention de Bâle sur le contrôle de transferts transfrontaliers de déchets et de leur élimination (1989): Établit une interdiction d'exporter des déchets dangereux des pays OCDE aux pays non-OCDE. Interdiction pas encore en vigueur.UE a ratifié la Convention, y compris l'interdiction d'exporter. Convention pas ratifiée par EU.

Le cadre juridique communautaire et les etats membres

1. Le droit communautaire fixe le cadre: définitions, exigences de base comme les permis, les obligations de planifier, les conditions de base pour les installations.

2. Droit national fixe l'infrastructure de gestion (administrations), les responsabilités des administrations locales, régionales, nationales, les priorités pour le placement et choix des installations (incinérateurs, décharges de déchets, installations de compostage), inspections, surveillance, contrôles etc.

3. Le droit communautaire n'impose pas la construction d'incinérateurs etc; elle laisse le choix aux États membres; se concentre plus sur les déchets eux-mêmes que sur les détails de la gestion. (1)

## 2. DISSCUSSIONS ET INTERPRETATIONS

Après collecte, les textiles sont orientés vers l'une des quatre filières de valorisation :

- la friperie permet la réutilisation de vêtements d'occasion en bon état, qui sont, pour l'essentiel, exportés vers les pays en voie de développement ;
- l'essuyage industriel produit des chiffons à partir de vêtements devenus importables ou de linge de maison en fin de vie (surtout en fibres naturelles) coupés aux dimensions requises ;
- l'effilochage, essentiellement de lainages, permet de fabriquer de nouvelles fibres qui seront tissées pour la plupart en Italie et en Inde. L'effiloché mêlé est également utilisé pour le rembourrage de sièges ou comme isolant ;
- enfin les textiles, inutilisables en friperie, en essuyage ou en effilochage, sont mêlés à du bois et à du carton et servent à fabriquer du carton feutre et un matériau pour l'isolation.

Globalement 88% des textiles collectés sont écoulés en friperie ou sous forme de matières premières dans le secteur du textile.

Etant donné les reglementations presentée ci-dessous, nous somme obligés à mentionner la Directive 2008/98/CE du Parlement européen et du Conseil relative aux déchets. L'objectif du cette Directive est de créer un nouveau cadre pour la gestion des déchets dans l'UE, afin d'encourager le réemploi et le recyclage des déchets et de simplifier la législation actuelle.

La directive établit des mesures visant à protéger l'environnement et la santé humaine par la prévention ou la réduction des effets nocifs de la production et de la gestion des déchets, et par une réduction des incidences globales de l'utilisation des ressources et une amélioration de l'efficacité de cette utilisation. En adoptant la directive, le Conseil a accepté tous les amendements adoptés par le Parlement européen en 2ème lecture le 17 juin 2008.

Premierement nous devons sougliner que la directive introduit une nouvelle approche de la gestion des déchets qui met l'accent sur la prévention. Les États membres devront donc élaborer et mettre en œuvre des programmes de prévention des déchets au plus tard le 12 décembre 2013 et la Commission européenne fera périodiquement rapport sur les progrès réalisés dans ce domaine.

La Directive 2008/98/CE met en evidence la hiérarchie des déchets. Elle a établit une hiérarchie en matière de traitement des déchets, applicable dans le cadre de la définition des politiques nationales de gestion des déchets, qui prévoit les cinq actions suivantes par ordre de priorité:

- prévention des déchets (solution à privilégier);
- réemploi;

- recyclage;
- valorisation (y compris la valorisation énergétique) et
- élimination des déchets, en dernier recours.

À cet égard, la nouvelle directive considère l'incinération des déchets à haut rendement énergétique comme une opération de valorisation, à condition qu'elle réponde à certains critères de rendement énergétique.

Dans ces conditions les États membres doivent veiller à ce que l'élaboration de la législation et de la politique en matière de déchets soit complète et transparente et respecte les règles nationales en vigueur quant à la consultation et à la participation des parties concernées et de la population. Ils doivent tenir compte des principes généraux de précaution et de gestion durable en matière de protection de l'environnement, de la faisabilité technique et de la viabilité économique, de la protection des ressources ainsi que des effets globaux sur l'environnement et la santé humaine, et des effets économiques et sociaux.

En ce qui concerne la responsabilité des producteurs, la Directive precise en vue de renforcer la prévention, le réemploi, le recyclage et la valorisation en matière de déchets,que les États membres peuvent prendre des mesures législatives ou non pour que la personne physique ou morale qui élabore, fabrique, manipule, traite, vend ou importe des produits (le producteur du produit) soit soumise au régime de responsabilité élargie des producteurs. De telles mesures peuvent prévoir l'obligation de fournir des informations accessibles au public concernant la recyclabilité et la réemployabilité du produit.

La collecte séparée sera instaurée d'ici 2015 au moins pour les déchets suivants: papier, métal, plastique et verre. Afin de tendre vers une société européenne du recyclage, avec niveau élevé de rendement des ressources, les États membres prendront les mesures nécessaires pour parvenir aux objectifs suivants:
-d'ici 2020, la préparation en vue du réemploi et le recyclage des déchets tels que, au moins, le papier, le métal, le plastique et le verre contenus dans les déchets ménagers et, éventuellement, dans les déchets d'autres origines pour autant que ces flux de déchets soient assimilés aux déchets ménagers, passent à un minimum de 50% en poids global;
- d'ici 2020, la préparation en vue du réemploi, le recyclage et les autres formules de valorisation matière - y compris les opérations de remblayage qui utilisent des déchets au lieu d'autres matériaux - des déchets non dangereux de construction et de démolition, à l'exclusion des matériaux géologiques naturels définis dans la catégorie 17 du catalogue européen des déchets, passent à un minimum de 70% en poids.

Pour le 31 décembre 2014 au plus tard, la Commission examinera les mesures et les objectifs visés à la directive en vue de renforcer les objectifs et d'envisager de définir des objectifs pour d'autres flux de déchets.

En outre, la directive simplifie et modernise la législation européenne existante en matière de déchets en clarifiant les notions de valorisation, d'élimination, de fin du statut de déchet et de sous-produit; définissant les conditions du mélange des déchets dangereux; prévoyant des mesures pour encourager la collecte séparée des biodéchets à des fins de compostage et de digestion ; obligeant les États membres à prendre des mesures en matière de contrôle des déchets dangereux.

Nous devons aussi mentionner que la presente directive abroge la directive -cadre en vigueur relative aux déchets (2006/12/CE), la directive relative aux déchets dangereux (91/689/CEE) et une partie de la directive concernant l'élimination des huiles usagées (75/439/CEE).

## 3. CONCLUSIONS

La réduction des déchets est une urgence pour l'ensemble de l'Union Européenne. La quantité de déchets ménagers produits a doublé en 40 ans et a augmenté de 1 à 2 % par an; en 2007, 52 2 kg de déchets municipaux ont été générés en moyenne par personne dans les Etats membres de l'Union européenne (source : Eurostat). Ces déchets sont le résultat de modes de production et de consommation non durables : par exemple, la consommation de produits (incluant leur production, leur transport et leur distribution) représente presque 50 % des émissions contribuant au changement climatique.

Cette augmentation de la quantité de déchets à gérer rend nécessaire un développement des collectes sélectives et des infrastructures de traitement, dont le coût important met en difficulté les budgets des autorités publiques locales et régionales.

Dans ce contexte, la prévention est devenue un concept simple et essentiel en matière de gestion des déchets, d'abord en tant que facteur technique de la résolution locale et globale du problème des quantités croissantes de déchets, mais aussi parce qu'il amène à prendre en compte la raréfaction des ressources naturelles.

## 4. BIBLIOGRAPHIE :


1.Charbonneau S, (2002). *Droit communautaire de l'Environnement*, Edition Harmattan, Paris
2.Duţu M.(2003)*Dreptul mediului. Tratat. Abordare integrată,* vol I şi II, Editura Economică, Bucureşti,
3.Galin –Corini V.(2000). *Legislaţia de mediu*, Universitatea din Oradea, Facultatea de Protecţia Mediului, Editura Universităţii Oradea
4.Lupan E. (2000). *Dreptul mediului*, *Tratat*, Editura Lumina Lex, Bucureşti
5. Marinescu D. (1996) *Dreptul mediului înconjurător*, Casa de Editură şi presă Şansa SRL, Bucureşti
6. Marinescu D. (2007) *Dreptul mediului înconjurător*, Editura Universul Juridic, Bucureşti
7. Zaharia C. (2003) *Legislaţia pentru protecţia mediului,* Editura Universităţii Alexandru Ioan Cuza, Iaşi,
8. www. europa.eu.int, consulté : 20.05.2007
9. www.ineris.fr, consulté : 14.04.2010
10.http://www.europarl.europa.eu/ , consulté : 16.04.2010
11. http://www.actu-environnement.com/idx_ae.php4 , consulté : 03.03.2010
12. http://cours.funoc.be/, consulté : 16.04.2010

ANNALS OF THE UNIVERSITY OF ORADEA
FASCICLE OF TEXTILES- LEATHERWORK
Volume I, 2010, No. 2

# A MULTI-LEVEL APPROACH TO SITTING TEXTILES WASTE TREATMENT RESOURCES

**Milorad Vidovic[1], Branislava Ratkovic[1]**

[1] *University of Belgrade, Faculty of Transport and Traffic Engineering,Belgrade, SERBIA*

Corresponding author: Milorad Vidovic, mvidovic@sf.bg.ac.rs

***Abstract:*** This paper presents the modeling approach to establishing reverse logistics network for textiles recycling, through defining optimal locations of nodes in three level network: collection points, sorting and treatment facilities. In order to model the influence of distance between users and collection points on the optimal locations of facilities to be located, we introduce the collection point's catchment area. Proposed modeling approach was tested on the numerical example.
***Key words:*** Reverse logistics, textiles waste, facility location

## 1. INTRODUCTION

Production of textile increases and an increasing amount of textile waste is generated each year (the term textiles waste covers all materials that are completely or mostly made from fibres or fur). According to the Council for Textile Recycling, textile waste can be classified as either pre-consumer or post-consumer waste. Pre-consumer textile waste consists of by-product materials from the textile, fibber and cotton industries. Post-consumer textile waste consists of any type of garments or household article, made of some manufactured textile that the owner no longer needs and decides to discard. These articles are discarded either because they are worn out, damaged, outgrown, or have gone out of fashion. They are sometimes given to charities but more typically are disposed of into the trash and end up in municipal landfills. For economic and environmental reasons, it is preferable to maximise the recovery of textile waste instead of disposing them in landfills. All textile waste streams are often unrealised sources of valuable raw materials that can be repurposed or regenerated into saleable and usable products by intelligent collection, sorting, reengineering and reprocessing.

Textiles present a problem in landfill, since synthetic fibres will not decompose and woollen fibres emit methane when decomposing. In addition, textiles waste can be contaminated with heavy metals (e.g. from colours), which can be set free in incineration processes, or cause toxic reactions by re-use and recycling. Heavy metals can include chrome, which is carcinogenic, mercury or nickel. Also, textile products with their wide range of applications and complex chemistry could be a significant source of dioxins and/or precursor compounds for the formation of dioxins and other POPs (persistent organic pollutants), appearing during the incineration process.

In EU countries, textiles waste make 5-10 % of a solid waste, which not seems like a large amount, but it is when one considers that nearly 100% of the post-consumer textile waste is recyclable. The amount of waste textiles generated in the EU 27 can be estimated at nearly 12.2 Mt in 2004 [1]. Today, recovering textile waste is a multi-billion dollar global industry that performs a vital social and environmental function and provides employment for millions of people all around the world. An internet search on "textile waste" will elicit more than 2,664 products or listings, including headings such as hosiery cuttings and clips, polyester tow, cotton shoddy, used clothing wiping rags, denim/jean clippings, 100% cotton yarn waste, silk fibre waste, etc.

In the last decade of the XX century, the growth on environmental concerns, legislative measures and economical benefits related to management of end of life products (EOL) such as textiles waste, has favoured the development of reverse logistics systems. Reverse logistics encompasses all the logistic activities from used products no longer required by the users or last owners to products again useable on the (secondary) market or properly disposed of. The objectives of such systems are to reduce the total distance of transportation, increase the quantities of EOL products collected, reduce the amount of EOL products carried to treatment facilities inefficiently and to connect reverse logistics to forward logistics in an efficient way [2]. Most of the literature about reverse logistics network design considers various facility location models based on the MILP, and in many cases depending on the problem, forward and reverse networks can be modelled separately. Consequently, this leads to significant problem reduction, which is the case with this paper. However, there are only few researches related to problems in textiles recycling networks, and in our best knowledge, there is no studies related to location problems in those networks. For example, in the research project [3], the authors investigate economic and environmental benefits of product integrated environmental protection strategies. An example is given by the textile supply chain for wool. Very interesting chapter about carpet recycling can be found in [4] where authors explore the issues of reverse logistics for recycling within the carpet industry, including an economic analysis of the success of carpet recycling.

The main intention of this paper was to analyze modelling approach that could be used to establish three level reverse logistics network for textile waste products, composed of a set of collection points, sorting points and recycling facilities. In order to make textiles waste products available for any recovery options, the first step is an effective collection or acquisition from the generators. Hence, achieving any recovery objective requires the active participation of consumers, which is in most cases always assumed. However, through many researches, it has been shown that proximity, and ease of access to the collection point sites plays an important role in consumer's willingness to participate in any collection program. In order to model the influence of distance between users and collection points on the optimal locations of facilities, we introduce the collection point's catchment area (catchment area denotes the area within the circle of certain predefined radius from the collection point's location). Proposed modelling approach was one tested on the case of the numerical example.

Remaining part of the paper was organized in following way. Section two describes structure of reverse logistic networks for waste textiles, and introduces some requirements which should be satisfied. Section three introduces modelling approach, while numerical results of modelling approaches proposed are shown in section four. Ending part of the paper gives some concluding remarks.

## 2. REVERSE LOGISTICS NETWORKS FOR TEXTILES WASTE

The design of reverse logistics networks is a strategic level decision, and like other network design decisions, it includes determining numbers, locations, and capacities of facilities and the quantity of the flow between them. However, the design and development of a reverse logistics network differs from forward logistics in several ways. First, one the main characteristic of RL is the presence of uncertainty in quality, quantity, and time of returned products. Secondly, composition and structure of a RL network differs from traditional logistics networks like convergent vs. divergent structure, new actors involved or new roles assumed by existing actors. One of the major issues in reverse logistics systems is collection or acquisition of used product discarded by last owners or consumers. It is the first and crucial activity of reverse logistics system that triggers the others activities such as repairing, refurbishing, remanufacturing, cannibalization and recycling [5].

In general, collection systems for textiles waste differ depending on whether the textiles are collected from the households or whether the waste is brought to special areas or premises. The first is known as kerbside collection and the second is known as drop-off collection system (e.g. containers for used textiles, made available for public use). To be recyclable, textile waste should be made of only one type of fibre, or it should be produced in such a way that the different types of fibre can easily be disentangled. All collected textiles must be sorted and graded by highly skilled, experienced workers, who are able to recognise the large variety of fibre types resulting from the introduction of synthetics and blended fibre fabrics. Used textiles are normally separated by hand at sorting facilities, depending on their quality and characteristics. For recycling, used textiles have to be free of impurities (like buttons or zippers), which are manually removed. After the removal of impurities, the waste textiles are sent for treatment facilities (e.g. recycling company). In general, the reverse logistics networks for textiles waste may be represented as shown in **Fig 1**.

As mentioned, in most collection programs the active participation of end owners of used products is always assumed, but through many researches, it has been shown that convenience and easy access to collection points are very important factors for public participation. Key elements of successful and efficient drop-off location systems are accessibility, distance to residence and proximity to other facilities that could influence multi-purpose trip making. Many studies demonstrated that the decision to participate in recycling activities is influenced by the provision of waste collection bins and easily accessible collection sites ([6], [7], [8]). In textiles waste case, survey by Goodwill Industries, one of the largest textile collectors, found that people would not go more than 10 minutes out of their way to make a drop off. Hence, this time limitation, which in turn gives approximate distance of max 300 meters. However, this distance is also questionable, parti cularly when consider different geographic regions, mentality, cultural inheritance, behavioural matrixes, level of development, and level of environmental awareness, but also many different socio demographic characteristics  Hence, in the modelling approa ch we propose, catchment area is introduced as a part of multilevel facility location model as an idea, and its impact is shown only to demonstrate potential impact. The catchment area, or the distance between the end user, and collection point is very important in case of collection textile waste, since the drop-off collection system seems to be more preferable. Namely, kerbside systems which are traditional waste collection systems, are very convenient for end owners of used products, because close to the m (catchment area radius is very small), but these systems are more costly.

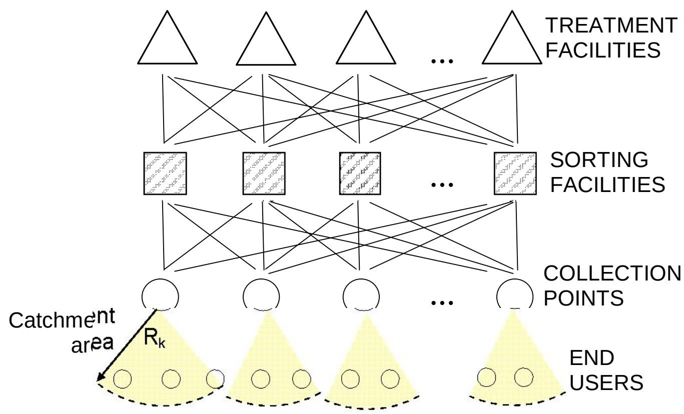



**Figure 1:** Textiles waste reverse logistics network

### 3. MODELLING APROACH

Solving problem of locating collecting, sorting and treatment facilities may be realized in different ways by using different problem formulations and modeling approaches. In this research, we introduce collection point's catchment area in order to model the influence of distance between consumers and collection points on the optimal locations of three types of facilities to be located on this network. Namely, as mentioned, end owners of textiles products will use drop -off location only when they are within a certain reasonable distance from it. Therefore, catchment area denote s the area within the circle of certain predefined radius from the drop-off location. That is, any arbitrary end user can be allocated to the collection point only if it is located within the collection point's catchment area (**Fig 2**).

$R_k$ – radius of the collection points catchment area *k*
$d_{ki'}$ – distance between collection point *k* and end user *i'*
$d_{ki''}$ – distance between collection point *k* and end user *i''*

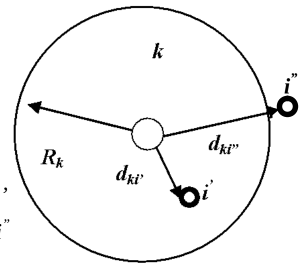



**Figure 2:** Collection point's catchment area

In its main idea, facility location model proposed here is similar to the formulation of multiple assignment hub-network design approach described in [9], but because of multilevel facility location problem nature, mentioned formulation has to be modified, and combined with the catchment area constraint accordingly to the idea introduced in [10]. There is a limit to the number of collection, sorting and recycling sites that can be opened, but the choice of which collection sites, which sorting and recycling sites to be opened must be decided by the model.

The following notation will be used to describe a model:

*i* Is an end user/owner of textile products (origination site). All products currently locat ed at end users/owners are passed to collection points.

*k* represents an collection point (drop – off location) which receives textile waste products from origination locations, only if this sites are within catchment area. The last collection site is a dummy site with infinite cost and infinite capacity, and prevents infeasibility in the solution procedure due to insuffcient capacity.

*l* represents an sorting facility which receives textile waste from collection points. The last sorting site is a dummy site with infinite cost and infinite capacity, and prevents infeasibility in the solution procedure due to insuffcient capacity.

*j* is an recycling facility which receives sorted textiles waste from sorting facilities. The last recycling site is a dummy site wi th infinite cost and infinite capacity, and prevents infeasibility in the solution procedure due to insuffcient capacity.

$C_{ijkl}$ transportation costs of transporting textiles waste from end user *i* to recycling facility *j*, through collection point *k* and sorting facility *l.*

$X_{ijkl}$ fraction of units at origination site i that is transported through collection site k and sorting facility l onto recycling facility j

$a_i$ Number of textile waste products residing at end users site *i*

$G_k$ capacity of collection point *k*

$S_l$ capacity of sorting facility *l*

$B_j$ capacity of recycling facility *j*

$R_k$ radius of the catchment area for collection point

$Y_k$ binary variable, $Y_k$=1 if collection point *k* is opened, otherwise $Y_k$ =0

$Z_l$ binary variable, $Z_l$ =1 if sorting facility *l* is opened, otherwise $Z_l$ =0

$T_j$ binary variable, $T_j$ =1 if recycling facility *j* is opened, otherwise $T_j$ =0

Mathematical formulation of described problem is shown below.

$$\text{Min} \sum_i \sum_k \sum_l \sum_j a_i C_{ijkl} X_{ijkl} \quad \textbf{(1)}$$

s.t.

$$\sum_k \sum_l X_{ijkl} = 1, \ldots \forall i \quad \textbf{(2)}$$

$$X_{ijkl} \le Y_k, \ldots \forall i, j, k, l \quad \textbf{(3)}$$

$$X_{ijkl} \le Z_l, \ldots \forall i, j, k, l \quad \textbf{(4)}$$

$$X_{ijkl} \le T_j, \ldots \forall i, j, k, l \quad \textbf{(5)}$$

$$\sum_i \sum_j \sum_l a_i X_{ijkl} \le G_k \ldots \forall k \quad \textbf{(6)}$$

$$\sum_i \sum_j \sum_k a_i X_{ijkl} \le S_l \ldots \forall l \quad \textbf{(7)}$$

$$\sum_i \sum_k \sum_l a_i X_{ijkl} \le B_j \ldots \forall j \quad \textbf{(8)}$$

$$(d_{ik} - R_k) X_{ijkl} \le 0, \ldots \forall i, j, k, l \quad \textbf{(9)}$$

$$Y_k \in (0,1) \quad \textbf{(10)}$$

$$Z_l \in (0,1) \quad \textbf{(11)}$$

$$T_j \in (0,1) \quad \textbf{(12)}$$

$$0 \le X_{ijkl} \le 1 \quad \textbf{(13)}$$

The objective function (1) minimizes the sum of costs to transfer products from origination sites through collection sites to the destination facilities. All the supply of products available at the origination site are transported to destination facilities via collection sites in the network by way of constraint set (2). Constraint set (3) prohibits units from being routed through collection site k unless the site is opened, constraint set (4) prohibits units from ending up at destination site l unless this site is opened, and constraint set (5) prohibits units from ending up at destination site j unless this si te is opened. Constraint set (6) limits the units sent through collection site k to the capacity of site k, constraint set (7) limits the unit sending up at destination site l to the capacity of site l, and constraint set (8) limits the unit sending up at destination site j to the capacity of site j. Constraint set (9) represents the catchment area of collection point k and allocation of end users to collection points. Constraint set (11) requires the decision variable X to be continuous between zero and on e, while constraint sets (10), (11) and (12) enforce the binary restriction on the $Y_k$, $Z_l$ and $T_j$ decision variables.

## 4. NUMERICAL RESULTS

Each end user, collection point, sorting and recycling site is randomly located in a 10x10 square. The last collection, sorting and recycling site , were used as a dummy nodes with very high costs and very large capacity to eliminate infeasible solutions. Transportation costs are computed as $C_{ijkl}=C_{ik} + C_{kl} + C_{lj}$, where $C_{ik}$, $C_{kl}$, $C_{lj}$ represents Euclidean distance from *i* to *k*, *k* to *l* and *l* to *j* , respectively. The last points in each level are dummy nodes with very high costs , so these costs are computed as Euclidean distance multiplied with 100.

The demand is generated as: $a_i$=[0,500], and the capacities are generat ed as follows: collection sites $G_k$ = [0,2000], sorting facilities $S_l$ = [0,6000] and recycling facilities $B_j$ = [0,30000]. (Note: Square brackets denote random number generation from a uniform distribution in the range indicated inside the brackets). Spatial representation of randomly generated location of end users, collection points, sorting and recycling facilities are shown in figure 3. For the radius of collection point's in example from the figure 3., catchment area was. Model (1) - (12) is solved through the open source solver LPSolve IDE - 5.5.0.5.

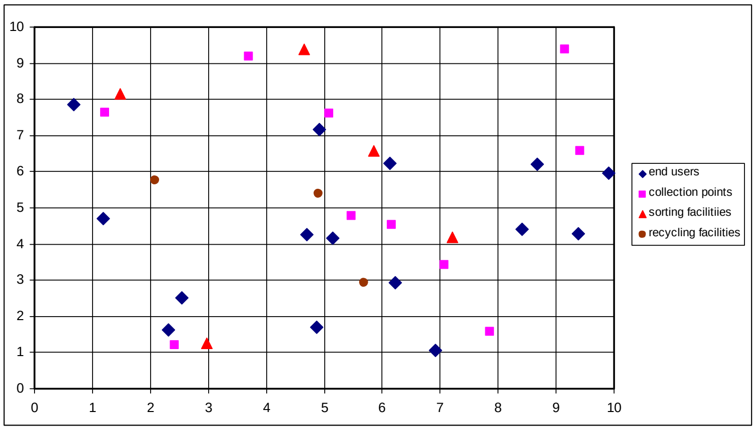



**Fig 3: Spatial distribution of generated data**

Among 10 potential collection points model determined 6 plus dummy node to be optimal locations, and all sorting and recycling sites was ch osen. Allocation of end users to collection points, and allocation of collection points and sorting facilities to recycling facilities is shown in table 1.

**Table 1 Allocation of end users to collection points**

| Users | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Collection point | 10 | 7 | 5 | 8 | 10 | 2 | 7 | 9 | 6 | 7 | 5 | 10 | 6 | 5 | 2 |
| Sorting facility | 5 | 3 | 3 | 4 | 5 | 3 | 3 | 3 | 3 | 3 | 3 | 5 | 1 | 1 | 2 |
| Recycling facility | 3 | 3 | 3 | 2 | 3 | 2 | 2 | 2 | 2 | 1 | 3 | 1 | 1 | 1 | 1 |

Previous imaginary reverse logistic network from the figure 3, can be also used to demonstrate impact of the catchment area radius to the expected number of users served (and from there quantity of waste textiles collected), as well as to the network configuration (number and structure of logistic nodes opened). Hence table 2 shows results about percentage of users served, and reverse logistic network configuration parameters when collection points' catchment area varies from 0.5 up to 5 distance units. From the table 2 importance of the catchment area radius becomes obvious, because of its huge impact on collected quantity of recyclables from the one side, and on the logistic network configuration from the another. Also, results shown in the table 2 indicate importance of transport costs accuracy, facilities' capacities and other parameters used in defining in modelling and shaping reverse logistics networks, and in collection process efficiency assessing.

**Table 2 Impact of the catchment area radius**

| Catchment area radius | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 3.5 | 4.0 | 4.5 | 5.0 |
|---|---|---|---|---|---|---|---|---|---|---|
| Collection points opened | dummy | 3 | 4 | 3 | 6 | 3 | 2 | 1 | 1 | 1 |
| Users served (%) | 0 | 26.7 | 33.3 | 53.3 | 80.0 | 66.7 | 66.7 | 66.7 | 86.7 | 86.7 |

## 5. CONCLUSIONS

The integration of reverse flow of products into existing or planned logistic systems has become a very important issue in the last decade of the twentieth century, both from theoretical and practical point of view. Although the recycling of products, is a common and known activity for many decades, recycling textiles waste becomes more important at the beginning of XXI century because increasing attention to the recyclin g of consumer textiles may be one way of further reducing the amount of solid waste that is ultimately channelled to landfills.

Problem of determining the location of collection points, sorting and recycling facilities have an important role in the proce ss of recycling textiles waste because recycling process generates high logistics costs. This paper presents a possible approach to define the optimal network for recycling textiles waste, by determining the number and location of collection points, sortin g and recycling facilities. The proposed model aims finding effective strategies for the return of discarded products from end users to recycling factories, via collection points and sorting facilities, with minimal costs.

The main contribution of this paper is introducing collection point's catchments area in order to correctly model the influence of distance between users and collection points on optimal locations of three types facilities to. Although the results obtained give some answers related to the possibility of defining optimal locations of these facilities, in sense of indicating complexity and importance of the problem, numerous aspects of the problem and application of approach proposed are still without answer, and need future research. Let introduce only some of them. Defining catchment area as a function of socio demographic and other relevant characteristics of potential users; aggregation concept to be applied for grouping users to be analysed as a textile waste sources, with objective to make model tractable in real systems; integrating textile waste flows with other recyclables, and modelling those systems, etc.

## 6. REFERENCES


1. http://www.waste-stream.eu/html/textiles.html. Accessed 10.05.2010.
2. Umeda, Y., Tsukaguchi, H., Li Y. , (2003). Reverse logistics system for recycling: efficient collection of electrical appliances. Vol., 4., *Proceedings of the Eastern Asia Society for Transportation Studies*. pp. 1319-1334
3. Prigge V., Siestrup G., Förster M., Haasis H.D., "Product Integrated Environmental Protection Strategies in the Textile Supply Chain: Source of Economic and Environmental Benefits", University of Bremen, http://www.pro.wiwi.uni-bremen.de
4. Helms M. M., Hervani A. A., (2006). Reverse Logistics for Recycling: Challenges Facing the Carpet Industry" Book chapter in *Greening the Supply Chain*, Joseph Sarkis, Springer.
5. Thierry, M., Salomon, M., van Nunen, J., van Wassenhove, L. N. (1995) Strategic issues in product recovery management. Vol., 37., *California Management Review* . pp. 114-135.
6. Ball, R., Lawson, S.M., (1990). Public attitudes towards recycling in Scotland. Vol., 8., *Waste Management and Research* . pp. 177–192.
7. Belton, V., Crowe, D.V., Matthews, R., Scott, S., (1994.) A survey of public attitudes to recycling in Glasgow (U.K.). Vol., 12., *Waste Management and Research*. pp. 351–667.
8. Domina, T., Koch, K., (2002) Convenience and frequency of recycling implications for including textiles in curbside recycling programs. Vol., 34., *Environment and Behavior*. pp. 216–238.
9. O'Kelly, D. Bryan, D. Skorin-kapov, J. Skorin-kapov (1996) Hub network design with single and multiple allocation: a computational study Vol.4, *Location Science* pp.125-138
10. M. Vidovic, S. Zečevic, M. Kilibarda, J. Vlajic, N. Bjelic, S. Tadic (2010) The p-hub model with hub-catchment areas, existing hubs, and simulation: A case study of Serbian intermodal terminals, *Networks and Spatial Economics* (Online first) DOI: 10.1007/s11067-009-9126-7

ANNALS OF THE UNIVERSITY OF ORADEA
FASCICLE OF TEXTILES- LEATHERWORK
Volume I, 2010, No. 2

# THE CHARACTERIZATION OF STOUT HUMAN BODY

**Elena Filipescu[1], Emilia Filipescu[2], Manuela Avadanei[3]**

*[1.]Technical University "Gheorghe Asachi" Iassy, ROMANIA*
*[2.]Technical University "Gheorghe Asachi" Iassy, ROMANIA*
*[3.]Technical University "Gheorghe Asachi" Iassy, ROMANIA*

Elena Filipescu: elena.filipescu@yahoo.com
Emilia Filipescu: emfi@tex.tuiasi.ro
Manuela Avadanei:mavad@tex.tuiasi.ro

***Abstract***. *In garment pattern activity the human body peculiarities are considered very important characteristic primary data because those information determine a good correspondence insurance human body- garment. Human shape is determined by genetically, social factors an also by biological modifications specified in some life intervals.*
*This paper presents the results of a study on anthropometrics dimensions' variability, important to characterize female human body, with* $P_{bIII}$ *bigger than 100 cm. The study is made on a female selection with age between 20÷56 years old and for small ones, too, made after age criterion.*
*The results of this analyze are very useful in pattern cutting activity, for female garments support on shoulders and so is possible to conduct the garment quality from the first stage of designing process.*
*Keywords.* ***Stout female, statistical parameters, conformation, age, anthropometrical dimension.***

## 1. INTRODUCTION

Garment designing process must fulfill ergonomically, aesthetical and using requests for the female bearer's and so it is necessary to characterize human body from anthropo - morphological point of view considering age criterion.

The female population consists different anthropo-morphological types, determined by hereditary, social and economics factors, and also by biological modifications specified for some life intervals.
It is very well known that biological female modifications are also determined by maternity transformations, working activities and endocrine changes usually shown by increase values for principal perimeters (bust, waist and hips) which determine the base garments' patterns.
On these terms, the characterization of female adult population from anthropo - morphological point of view and the analyze of them body shape are important data used to establish the sample volume required to improve garments' clothing process.
This research is conducted to characterize the stout female population with big values for the main perimeters, by the analyze of the statistic parameters for the main indicators (curve and liner's ones) which determine the human body shape and are also required in pattern cutting activity for female bearer's.

## 2. THE ANALYZE OF THE MAIN STATISTIC PARAMETERS TO CHARACTERIZE ANTHROPOMETRICAL DIMENSIONS

In order to solve all the objectives proposed in this research there have been obtained primary data after an anthropometrical survey on a sample of 500 female subjects of 20÷56 years old, homogeneity and representative from statistical point of view [1].

All primary sheets contain values for the main human body dimensions measur ed by classical method From the whole sample (about 500 subjects) there have been chosen only the sheets, which characterize the stout female (those female have for the third bust perimeter bigger values than 90 cm). Besides that criterion of selection, it was also choose another one, age criterion, in order to make small samples, as follow:

- the youngest female group: 20 ÷29,9 years old;
- the medium age group: 30 ÷44,9 years old;
- the eldest group: 45 ÷56 years old.

If the bust perimeter' values are considered as a criterion than, it is was necessary to select about 242 sheets for the research, approximate 48,4% from the whole sample (the t hird bust perimeter has bigger values than 90 cm).

Figure 1 shows the percentage distribution after age criterion for a sample with n = 242 subjects.

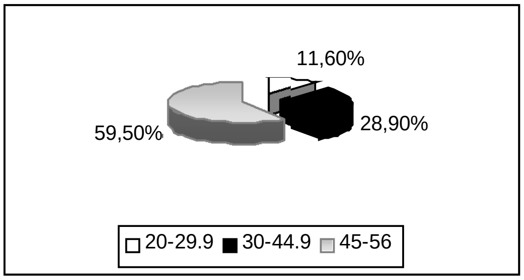



**Figure 1.**The percentage distribution after age, female bearer.

This type of percentage distribution after age criteria for female population who have bust values bigger than 90 cm underlines the idea that the third bust perimeter is an global indicator which has the same value for 18 ÷25 years interval and concurrently with age, that person registries bigger and bigger values for this anthropometrical dimension, because of the stout tissue's thickness and trunk' changes (the eldest persons are characterized by pronounced curve of vertebral column on cervical area, for the backsid e).

From all anthropometrical sheets with primary data there have been selected 40 dimensions, because:

- those dimensions characterize the female body from dimensional point of view;
- those dimensions are used to characterize female population from anth ropo- morphological point of view.

Each anthropometrical dimension was analyzed using EXCEL programmer and after that, all the values of the main statistical parameters were interpreted considering the peculiarities of the human body.

For the whole sample and the small ones (determined by age criteria) there have been determined the following parameters:

- the average value ($x_{med.}$), (cm);
- the minimal value ($x_{min}$), (cm);
- the maximal value ($x_{max.}$), (cm);
- the amplitude :A (cm);
- the square medium deviat ion of the sample ($S_x$), (cm);
- dispersion ($S^2_x$), ($cm^2$);
- variation coefficient ($C_v$), (%).

Table 1 explains the name and symbol for each anthropometrical dimension selected from the total (40), measured by directly method according to measuring standard [ 3].

**Table 1.** Anthropometrical dimension

| **Dimension type** | **No.** | **Anthropometrical dimension** | **Symbol** |
|---|---|---|---|
| **Heights** | 1. | Body height (stature) | Ic |
| | 2. | The height of cervical point | Ipcerv. |
| | 3. | The height of the neck base point | Ipbg |
| | 4. | The height of shoulder point | Ipu |
| **Dimension type** | No. | Anthropometrical dimension | Symbol |
| **Perimeters** | 5. | The III-rd bust perimeter | $P_{BIII}$ |
| | 6. | The first bust perimeter | $P_{B\ I}$ |
| | 7. | The second bust perimeter | $P_{B\ II}$ |
| | 8. | The waist perimeter | $P_t$ |
| | 9. | The hips perimeter | $P_ş$ |
| | 10. | The fourth bust perimeter | $P_{B\ IV}$ |
| | 11. | The axillaries arm perimeter | $P_{ax.\ br.}$ |
| **Lengths** | 12. | The front side length of the trunk | $L_{Tf}$ |
| | 13. | The backside length of the trunk | $L_T$ |
| | 14. | The length from the cervical point to the nipple point | $L_{c\text{-}b}$ |
| | 15. | The length from the cervical point to the neck base point | $L_{c\text{-}Bg}$ |
| **Width** | 16. | The backside width measured on axillary's level | $L_{s\ ax.}$ |
| | 17. | The vertical arc of the backside | $A_{vs}$ |

| Dimension type | No. | Anthropometrical dimension | Symbol |
|---|---|---|---|
| | 18. | The cervical arc of the trunk | $A_{vt}$ |
| **Diameters** | 19. | Distance between mammilla points | $D_{p\ mam.}$ |
| | 20. | The anther- posterior diameter of neck | $D_{a\text{-}p\ bg}$ |
| | 21. | The anther- posterior diameter of the third bust perimeter | $D_{a\text{-}p\ PbIII}$ |

Table 2 shows the main statistic parameters determined of the whole sample (n = 242 subjects) for those 21 selected dimensions.

**Table 2**. Values for the main statistic parameters used to characterize anthropometrics dimensions (whole sample)

| Dimension (cm) | $x_{med}$ (cm.) | $x_{min}$ (cm.) | $x_{max}$ (cm.) | A (cm.) | $S^2_x$ (cm.) | $S_x$ (cm.) | $C_v$ (cm.) | $t_x$ |
|---|---|---|---|---|---|---|---|---|
| $I_c$ | 158,20 | 143,4 | 171,5 | 28,1 | 31,58 | 5,62 | 3,55 | 28,16 |
| $I_{pcerv}$ | 135,50 | 123,1 | 148,5 | 35,4 | 26,10 | 5,11 | 3,77 | 26,56 |
| $I_{pbg}$ | 134,42 | 122,0 | 146,7 | 24,7 | 25,26 | 5,03 | 3,74 | 26,75 |
| $I_{pu}$ | 130,86 | 120,1 | 143,5 | 23,4 | 24,56 | 4,96 | 3,79 | 26,41 |
| $P_{bIII}$ | 105,75 | 98,0 | 131,0 | 33,0 | 48,42 | 6,96 | 6,58 | 15,20 |
| $P_{bI}$ | 96,15 | 81,0 | 124,0 | 43,0 | 35,70 | 5,98 | 6,21 | 16,09 |
| $P_{bII}$ | 109,77 | 96,0 | 134,0 | 38,0 | 47,80 | 6,91 | 6,30 | 15,88 |
| $P_t$ | 89,85 | 68,0 | 123,0 | 55,0 | 86,78 | 9,32 | 10,37 | 9,64 |
| $P_ș$ | 112,31 | 97,5 | 146,5 | 49,0 | 60,29 | 7,76 | 6,91 | 14,46 |
| $P_{bIV}$ | 90,70 | 73,0 | 124,0 | 51,0 | 52,10 | 7,22 | 7,96 | 12,57 |
| $P_{axbr}$ | 34,66 | 27,0 | 109,0 | 27,0 | 35,46 | 5,95 | 17,18 | 5,82 |
| $L_{Tf}$ | 39,10 | 34,0 | 46,0 | 12,0 | 5,37 | 2,32 | 5,93 | 16,87 |
| $L_T$ | 39,98 | 32,5 | 46,0 | 13,5 | 5,51 | 2,35 | 5,87 | 17,03 |
| $L_{c\text{-}b}$ | 52,56 | 45,0 | 65,0 | 20,0 | 10,84 | 3,29 | 6,26 | 15,96 |
| $L_{c\text{-}bg}$ | 8,95 | 7,0 | 112,0 | 5,0 | 0,81 | 0,9 | 10,09 | 9,91 |
| $l_{sax}$ | 37,47 | 30,0 | 47,0 | 17,0 | 6,67 | 2,58 | 6,86 | 14,51 |
| $A_{vs}$ | 42,20 | 34,5 | 50,5 | 16,0 | 5,77 | 2,40 | 5,69 | 17,56 |
| $A_{vt}$ | 85,56 | 75,5 | 103,0 | 27,5 | 22,87 | 4,78 | 5,59 | 17,89 |
| $D_{pmam}$ | 21,85 | 16,5 | 30,0 | 13,5 | 3,68 | 1,92 | 8,77 | 11,40 |
| $D_{a\text{-}pbg}$ | 12,64 | 9,7 | 15,7 | 6,0 | 1,20 | 1,09 | 8,65 | 11,57 |
| $D_{a\text{-}pPnbIII}$ | 29,42 | 22,7 | 39,2 | 16,5 | 8,35 | 2,89 | 9,82 | 10,18 |

All statistical values presented in table II conduct to the following conclusions:

- All the heights have the smallest variability degree ($C_v$< 10%) because the sample has adult female subjects (the growing process is finished at this time);
- Perimeters, lengths, widths and arcs (those dimensions are determined by the skeleton evolution) have a smallest variability degree ($C_v$ <10%), but the others ($P_t$, $P_ș$, $P_{ax.\ br.}$, $L_{c\text{-}bg}$) have a medium variability degree (the fat tissue has an important part);
- All studied diameters have a medium or small variability degree because those parts of human body are determined or not by the fat tissue.

The study for the main indicators that define human body type ($I_c$, $P_{bIII}$ and $P_ș$) is conducted to establish the differences for the average values for all those dimensions, in case of whole sample and the small ones made after age criterion (table 3, table 4 and table 5).

**Table 3.** Differences between the average values for $I_c$, made after age criterion

| Age group (years) | Differences between the average values , by age groups(cm) | | | |
|---|---|---|---|---|
| | **20 - 56** | **20 - 29** | **30 - 44** | **45 - 56** |
| **20 – 29** | + 3,8 | 0,0 | + 2,1 | + 5,1 |
| **30 – 44** | + 1,7 | - 2,1 | 0,0 | + 3,0 |
| **45 - 56** | - 1,3 | - 5,1 | - 3,0 | 0,0 |

Analyzing the results from this table it' s noticed that the youngest female have the body height with 3,8 cm bigger than the value determined from the whole sample, with 2,1 cm bigger than the height for the female bearer with a medium age and with 5,1 cm bigger than the old female group. From an age group to another, the average value for the body height it's changing approximate with 3 cm, a value that represent the sensibility limit for this anthropometrical dimension. All thos e result show the fact that female garments must be done considering the age criterion, as follow: for the youngest female, the garments must have first stature (I) and for the old female group the garments must be on third stature (III).

**Table 4.** Differences between the average values for $P_{bIII}$ , made after age criterion

| **Age group (years)** | **Differences between the average values , by age groups(cm)** | | | |
|---|---|---|---|---|
| | **20 - 56** | **20 - 29** | **30 - 44** | **45 - 56** |
| **20 – 29** | - 3,9 | 0,0 | - 3,8 | - 4,7 |
| **30 – 44** | - 0,5 | + 3,4 | 0,0 | - 1,3 |
| **45 - 56** | + 0,8 | + 4,7 | + 1,3 | 0,0 |

From this table it's noticed that the women with medium age have $P_{bIII}$ equal with the average value for this indicator determined for the whole sample. The $P_{bIII}$ values are bigger with 3,4 cm for the medium age female and smaller with 1,3 cm for the older bearer group and so is possible to say that garment sizes increase in the same time with the age.

**Table 5.** Differences between the average values for $P_ş$, made after age criterion

| Age group (years) | Differences between the average values , by age groups(cm) | | | |
|---|---|---|---|---|
| | 20 - 56 | 20 - 29 | 30 - 44 | 45 - 56 |
| 20 – 29 | - 2,9 | 0,0 | - 2,7 | - 3,45 |
| 30 – 44 | - 0,2 | + 2,7 | 0,0 | - 0,7 |
| 45 - 56 | + 0,5 | + 3,45 | + 0,7 | 0,0 |

Table 5 demonstrate that the youngest female group have $P_ş$ smaller with 3 cm than the medium value obtained for the whole sample. The women with a medium age have the $P_ş$ value approximate equal with the value determined for the whole sample, but for the old group the differences between them hips' values perimeter and the whole sample are not very significa ntly. All those results demonstrate that the women with a medium age and the old one belong to the same conformational group (it is very well known that the difference between the hips and bust perimeter determine the conformation value).

## 3. CONCLUSIONS

- ✓ All the main anthropometrics dimensions ($I_c$, $P_b$ and $P_ş$) have average values different from an age group to another but inside to interdimensional interval established for those anthropometrical dimension, for female with a medium age but also for the whole sample. This fact demonstrate that female with a medium age group are characterized by different anthropo- morphological characters among the whole selection.
- ✓ The analyze of all statistical parameters demonstrate that the anthropometrical variability for curve dimensions is bigger comparing with the those established for similar measured dimensions, where $P_{BIII}$ wasn't choose as a base criterion for the selection.. For stout female this big variability is explained by the fact that all the biggest values for perimeters are determined by the non-uniformity thickness tissue and those perimeters influence some constructive segments of the pattern;
- ✓ The results of this study can be use to up- date all technical standards, because these documents establish all the body- types for whom the garments are made in industrial system;
- ✓ The human body shape characterization for stout female using some anthropometrics dimensions allow the possibility to guide design activities in order to guarantee dimensional and aesthetically correspondence human body- garment at a high level.

## REFERENCES

1. Filipescu, E. – Anthropometrical indicators in garment construction in men wear, Publishing Performantica, Iaşi, 2003
2. Şerşneva L.P. - Konstruirovanie jenskih platiev, Moscova, Legpromîtizat, 1991.
3. *** STAS 12830 (1990) *Garments. Human body measuring,*