ANNALS OF THE UNIVERSITY OF ORADEA
FASCICLE OF TEXTILES, LEATHERWORK

RESEARCH ON TRANSFER OF LIQUID WATER ABSORPTION OF KNITED STRUCTURES FOR SOCKS DESTINATION

VLAD Dorin[1], BARBU Ionel[2], SZABO Monica[3]

[1] Lucian Blaga University, Engineering Faculty, MEI Department, Postal address, 550024, Sibiu, Romania,
E-Mail: dorin.vlad@ulbsibiu.ro

[2,3] Aurel Vlaicu University, Engineering Faculty, AIITT Department, Postal address, 333120, Arad, Romania,
E-Mail: ionelbarbu@yahoo.com szabomonica@yahoo.com

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

Abstract: *For to adjust the heat, body removes heat. Depending on physical effort, it gives more or less moisture. Moisture removed from the body should be taken from the skin and directed outwards through clothing. This can be due to moisture absorption ability, and because of the capillary effect.*
This study is a part of a very extensive work on the influence of characteristics and raw materials, knitted structure and density on comfort properties of socks.
If a high level of perspiration, moisture liquid, it is important that it be removed as quickly from skin and clothing led outside. From here can evaporate into the environment. This is achieved through the capillary effect of fabrics that may effectively transport moisture. Storage capacity and moisture transfer of a textile depends on the composition and structure.
In laboratory conditions, methods for assessing the behavior of textiles against moisture is applied differentially depending on the state humidity: vapor or liquid. With this method of determining the capacity of absorbing water by capillary action, samples have dimensions of 200/200 mm and at one end is immersed in water. The samples knit were made in two versions of the fineness machine.

Key words: *Knitted structures, socks, physical properties.*

1. INTRODUCTION

For to adjust the heat, body removes heat. Depending on physical effort, it gives more or less moisture. Moisture removed from the body should be taken from the skin and directed outwards through clothing. This can be due to moisture absorption ability, and because of the capillary effect [1], [2], [3], [4], [5].

This study is a part of a very extensive work on the influence of characteristics and raw materials, knitted structure and density on comfort properties of socks.
If a high level of perspiration, moisture liquid, it is important that it be removed as quickly from skin and clothing led outside. From here can evaporate into the environment. This is achieved through the capillary effect of fabrics that may effectively transport moisture. Storage capacity and moisture transfer of a textile depends on the composition and structure. [6], [7], [8], [9].

2. METHOD AND PROCEDURE

In laboratory conditions, methods for assessing the behavior of textiles against moisture is applied differentially depending on the state humidity: vapor or liquid [1], [2], [3].

With this method of determining the capacity of absorbing water by capillary action, samples have dimensions of 200/200 mm and at one end is immersed in water. [10,11] The other end is fixed to a horizontal support pins - Figure 1.

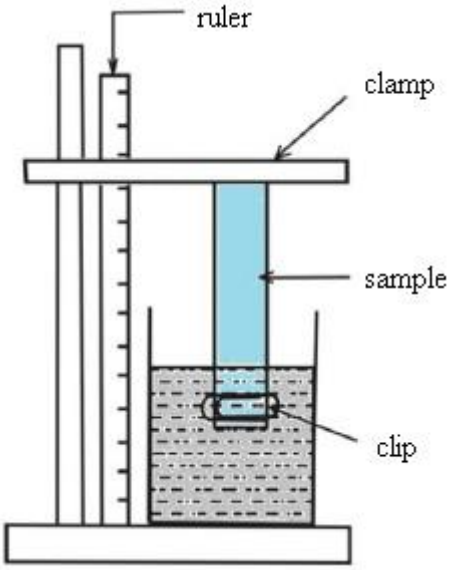

Fig.1*: Installation for determining water absorption capacity by capillarity [24]*

The ability of capillary water absorption of fabrics can be determined in two ways:

1. Measure the height of water rise in a predetermined period of time (3 min.) [26], [27], [28];
2. Determine the time required for the water to climb over a distance of 50 mm on the sample of textile material [26], [27], [28].

Speed of ascent of water on the fabric was calculated with: [26], [27], [28]

$$v = h_3 / 3 \text{ [mm / min]} \quad \textbf{(1)}$$

where:

h_3 - the height determined after 3 min. immersion; [mm]

v – speed of climb [mm/min]

The yarns were used for knitted samples:

1MDX – cotton 100%, Tt =30 tex
2MDX - cotton 100%, Tt =25 tex
3MDX - cotton 100%, Tt =20 tex
1DC – organic cotton 100% , Tt =30 tex
2DC - cotton 100%, Tt =25 tex
3DC - cotton 100%, Tt =20 tex
4DC - 50% cotton + 50% soy fiber, Tt =30 tex
5DC - 52% PES + 48% viscose, Tt =30 tex, relative humidity 3,2%
6DC - 52% PES + 48% viscose, Tt =30 tex, relative humidity 3,7%
7DC - 100% Tencel, Tt =30 tex
8DC - 50% bamboo + 50% viscose, Tt =30 tex

9DC - 90% viscose + 10% silk, Tt =30 tex
10 DC – PES 100%, recycled, Tt =30 tex
11 DC – PES 100%, Tt =30 tex

The samples knited were made in two versions of the fineness of machine, variants I and II: the plate jersey structures density 1, GV1, the plate jersey structures density 2, GV2, the plate rib fabric 4:2 density 1, PV1, the plate rib fabric 4:2 density 2, PV2, the plate links with draw links density 1, LV1, and the plate links with draw links density 2, LV2. The yarns for plate structures were PA6.

3. THE RESULTS

The measured values for the height h [mm] of distilled water up to samples a predetermined period of time, have been centralized in Tables 1, 2 si 3 calculating at the same time and the speed v [mm / min] of the water up to samples [1], [2], [3].

Table 1: *Parameter values for GV1 and GV2 structures*

Samples	h_3 (mm)	V(mm/min)	Samples	h_3 (mm)	V(mm/min)
GV1.1MDX	18	6	GV2.1MDX	16	5,3
GV1.2MDX	21	7	GV2.2MDX	18	6
GV1.3MDX	38	12,7	GV2.3MDX	20	6,7
GV1.1DC	26	8,7	GV2.1DC	18	6
GV1. 2DC	21	7	GV2. 2DC	19	6,3
GV1. 3DC	35	11,7	GV2. 3DC	26	8,7
GV1. 4DC	60	20	GV2. 4DC	51	17
GV1. 5DC	56	18,7	GV2. 5DC	51	17
GV1. 6DC	65	21,7	GV2. 6DC	61	20,3
GV1. 7DC	35	11,7	GV2. 7DC	33	11
GV1. 8DC	67	22,3	GV2. 8DC	48	16
GV1. 9DC	43	14,3	GV2. 9DC	41	13,7
GV1. 10DC	84	28	GV2. 10DC	72	24
GV1. 11DC	57	19	GV2. 11DC	36	12

Table 2: *Parameter values for PV1 and PV2 structures*

Samples	h_3 (mm)	V(mm/min)	Samples	h_3 (mm)	V(mm/min)
PV1.1MDX	20	6,7	PV2.1MDX	19	6,3
PV1.2MDX	23	7,7	PV2.2MDX	21	7
PV1.3MDX	36	12	PV2.3MDX	32	10,7
PV1.1DC	29	9,7	PV2.1DC	28	9,3
PV1. 2DC	22	7,3	PV2. 2DC	21	7
PV1. 4DC	63	21	PV2. 4DC	55	18,3
PV1. 5DC	43	14,3	PV2. 5DC	42	14
PV1. 6DC	65	21,7	PV2. 6DC	58	19,3
PV1. 7DC	36	12	PV2. 7DC	35	11,7
PV1. 8DC	76	25,3	PV2. 8DC	47	15,7
PV1. 9DC	54	18	PV2. 9DC	47	15,7
PV1. 10DC	74	24,7	PV2. 10DC	72	24
PV1. 11DC	28	9,3	PV2. 11DC	22	7,3

Table 3: *Parameter values for LV1 and LV2 structures*

Samples	h_3 (mm)	V(mm/min)	Samples	h_3 (mm)	V(mm/min)
LV1.1MDX	13	4,3	LV2.1MDX	12	4
LV1.2MDX	16	5,3	LV2.2MDX	15	5
LV1.3MDX	22	7,3	LV2.3MDX	14	4,7
LV1.1DC	14	4,7	LV2.1DC	12	4
LV1. 2DC	18	6	LV2. 2DC	14	4,7
LV1. 3DC	23	7,7	LV2. 3DC	21	7
LV1. 4DC	67	22,3	LV2. 4DC	52	17,3
LV1. 5DC	38	12,7	LV2. 5DC	37	12,3
LV1. 6DC	64	21,3	LV2. 6DC	53	17,7
LV1. 7DC	33	11	LV2. 7DC	31	10,3
LV1. 8DC	59	19,7	LV2. 8DC	37	12,3
LV1. 9DC	48	16	LV2. 9DC	41	13,7
LV1. 10DC	72	24	LV2. 10DC	68	22,7
LV1. 11DC	47	15,7	LV2. 11DC	29	9,7

4. CONCLUSIONS

By analyzing the results from the tables 1, 2, and 3 and figures 2, 3 and 4 it can be observed that:

1.The water's speed of ascension of the is direct proportional with the height's ascension;

2.The 100% cotton knitted fabrics present lower values of the speed of ascension (for all analyzed structures), higher values are recorded for the recycled polyester structures (10DC);

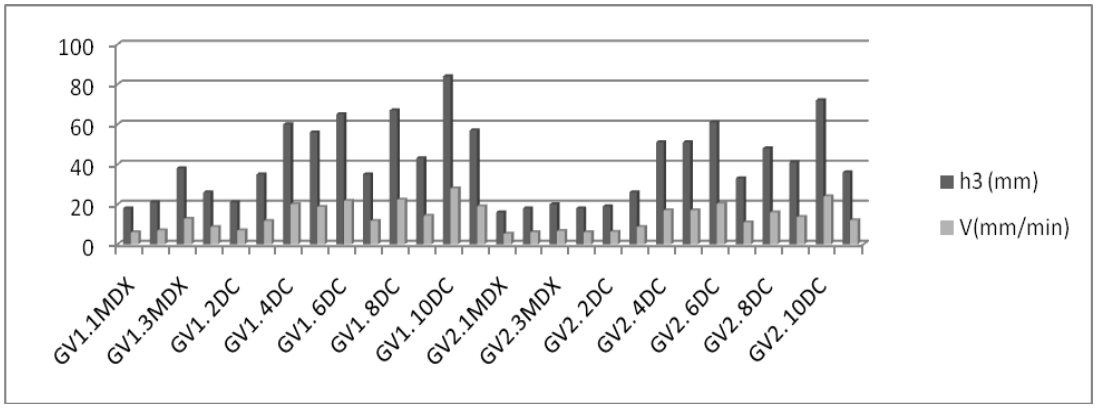

Fig. 2*: The parameter values for the fineness of the machine for GV structures*

3.In all versions analyzed, the height of ascension and speed of ascension values, are higher on the step density I, compared with step density II;

4.For the same type of raw material and same step density I, the plate jersey structures present the highest values regarding the speed of ascension;

5.For the knitted fabrics LV1.1MDX, LV1.2MDX, LV1.3MDX , obtained from the same raw material (100% cotton + polyamide 44/12x2 dtex), during a modification of the yarn's fineness, from 50/1 Nm to 40/1 Nm, the height of ascension decreases with 37,5%, and during a modification of the yarn's fineness, from 40/1 Nm to 34/1 Nm, the height of ascension decreases with 23%;

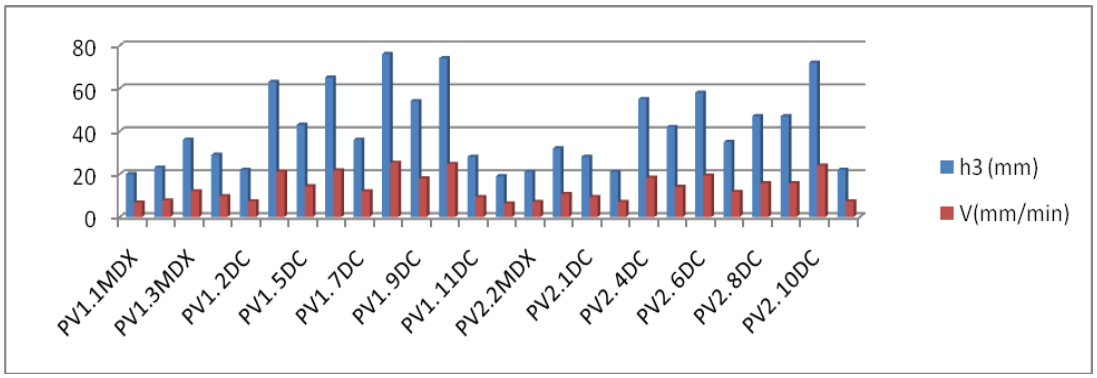

***Fig. 3**: The parameter values for the fineness of the machine for PV structures*

6.For the knitted fabrics types GV1.5DC and GV1.8DC, obtained from mixed fabrics, the percentage of 52% polyester increases the capillary effect with 19.64%;

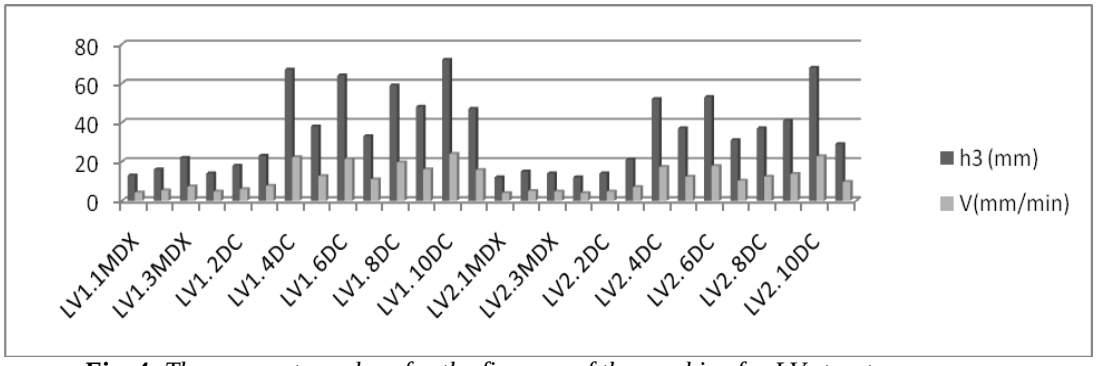

***Fig. 4**: The parameter values for the fineness of the machine for LV structures*

7.For the polyester knitted fabrics, GV1.10DC and GV1.11DC, the height of ascension is higher with 47,36%, in case of version GV1.10DC;

8.For the knitting fabric versions PV1.1MDX and PV1.4DC, the 50% soy percentage increases the capillary effect with 215%;

9.The knitted version PV1.1DC(organic cotton) presents a height of ascension higher with 45%, than the knitted version PV.1MDX

REFERENCES

[1] D. Fărîmă, "*Confortul şi funcţiile produselor textile şi din piele*", Editura Performantica, Iaşi, Romania, 2008

[2] D. Fărîmă, "*Confortul şi funcţiile produselor textile şi din piele*", Îndrumar de laborator, Editura Performantica, Iaşi, Romania, 2008.

[3] D. Fărîmă, "*Confort si performanta in sport*", Ed. Performantica, Iasi, Romania, 2007

[4] N. Özdil, G. Özçelik, G. Süpüren, J. Průchová, "*A study on the moisture transport properties of the cotton knitted fabrics in single jersey structure*", Volume: 19 Issue: 3 / july-september 2009, http://www.tekstilvekonfeksiyon.com/en/a-study-on-the-moisture-transport-properties-of-the-cotton-knitted-fabrics-in-single--jersey-structure-156.html, last accesed: april 2016

[5] L. Rusu, "*Cercetări privind relaţia dintre corp şi tricoturi realizate din materii prime*", Universitatea Tehnica "Gheorghe Asachi" Iaşi, Facultatea de Textile Pielărie si Management Industrial.

[6] A. Das, S.S. Yadaw, "*Study on moisture vapor transmission characteristics of woven fabrics from cotton-acrylic bulked yarns*", Journal of The Textile Institute Volume 104, Issue 3, 2013, http://www.tandfonline.com/doi/abs/10.1080/00405000.2012.725522#.Uhc0GXu5GIU, last accesed: july 2015

[7] U.U. Modibbo, B.A. Aliyu, I.I. Nkafamiya, A.J. Manji, "*The effect of moisture imbibition on cellulosic bast fibres as industrial raw materials*", International Journal of Physical Sciences Vol. 2 (7), pp. 163-168, July 2007, http://www.academicjournals.org/ijps/abstracts/abstracts/abstract2007/Jul/Modibbo%20et%20al.ht, last accesed: february 2016

[8] S.S. Ramkumar, A. Purushothaman, K.D. Hake, D. David, "*Relationship between cotton varieties and moisture vapor transport of knitted fabrics*", Journal of Engineered Fibers and Fabrics Volume 2, Issue 4 – 2007, http://www.jeffjournal.org/papers/Volume2/Ramkumar7-2R1.pdf, last accesed: july 2015

[9] S. Terliksiz, F. Kalaoğlu, S.H. Eryürük, "*Moisture transport properties of double jersey mattress ticking fabrics*", http://dx.doi.org/10.7216/130075992012198504, last accesed: January 2016

[10] *** - **STAS** 6146 – 87 - *Materiale textile. Determinarea capacităţii de absorbţie a apei prin capilaritate*

[11] R. Fangueiro, A. Filgueiras, F. Soutinho, M. Xie, "*Wicking Behavior and Drying Capability of Functional Knitted Fabrics*", in Materials Science, Textiles, http://trj.sagepub.com/content/early/2010/03/18/0040517510361796, last accesed: july 2015.