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THE INFLUENCE OF DOUBLING OF TEXTILE MATERIALS THROUGH THERMOFUSING ON THEIR HIDROPHILICITY

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***Abstract**: In the textile industry, the majority of clothing products, especially outerwear products, have some parts doubled up through thermofusing with other textile fabrics, woven or nonwoven, in order to provide some volume of shape, to fix contours, or to confer dimensional stability to the respective area . In this paper, we aim to highlight the influence on hydrofilicity of natural fiber materials of vegetable origin - flax and cotton - and of mixed natural fiber materials, by the process of doubling through thermofusing with chemicalized materials, woven or nonwoven. From laboratory measurements of the moisture absorption ability for these materials, fused or nonfused, woven or nonwoven, we conclude on the influence of these processes on the hydrofilicity of the fused ensemble and over the sanogenetic indicators that any fashion product must ensure for the wearer. Ensuring the comfort and compliance of clothing products is a priority of the producers of fabrics and textile garments. A clothing item should ensure optimum insulation, breathability, moisture absorption and air permeability to give the wearer comfort, wellbeing and safety. We focused on natural fiber materials of plant origin, since they are increasingly being used in the textile industry with beneficial influences on the state of comfort of the wearer.*

***Key words:** hidrophilicity, textile material hidrophilicity, woven chemicalized materials, nonwoven chemicalized materials, thermofusing*

1. INTRODUCTION

The permanent concern of producers of textiles and garments is to get clothing ensembles that do not influence the important characteristics of basic raw materials. The majority of clothing products, especially outerwear products, have some parts doubled up through thermofusing with other textile fabrics, woven or nonwoven, in order to provide some volume of shape, to fix contours, or to confer dimensional stability to the respective areas [1,2,3].The analysis of the influence of technological processes on indicators of comfort eases the selection of compatible materials for the construction of multi-layered clothing ensembles.

2. GENERAL INFORMATION

Hydrophilicity is the ability of a body to absorb water. Fabrics can absorb water quickly, slowly or not at all.

The fabric is a porous surface with a high content of air which is replaced out of micro or macro capillaries in the process of dampening by water [4,5,6].

3. MATERIALS AND METHODS

For measurements in the laboratory, we use Berzelius beakers, distilled water, a graded ruler, an immersed sample support system, samples of dimensions 280 mm x 30 mm, taken on warp and weft direction, materials with canvas fabric structure with compositions of 100% linen, 100% cotton and 64% linen 34% viscose and 2% elastane mixture respectively. For the doubling of base materials through thermofusing, chemicalized woven and nonwoven materials were used, with a composition of wool mixed with polyamides. The woven fabric has twisted warp threads, but weft threads are polyfilamentary.

The method used to determine hydrophilicity for each material and fusing assembly is the immersion method. The samples were previously subjected to humidity $\varphi = 65 \pm 5$ %, and a temperature of $t = 20 \pm 2^{\circ}$ C.

From each material or fusing assembly, 4 samples were taken, on the two directions, warp and weft. The final results represent the arithmetic mean of the determinations [4].

3.1. Methods

The test specimens are immersed in an upright position, at a depth of approximately 20 mm. The aim is to measure the rise of water in the capillaries using the graded ruler. The ascent height readings are recorded after 10, 20 and 30 minutes of immersion.

The speed of ascension is calculated using the following formula: [4]

$$V = h_m / t \quad [\text{mm/min}] \qquad (1)$$

where: h_m = average height of ascension;
t = immersion time;

4. RESULTS

Table 1: *Average ascension height in the capilaries and the speed of ascension for material (1) 100% linen, thermofused with a chemicalized woven material (1') and a chemicalized nonwoven material (1").*

Material / thermofused ensemble	Average ascension height in the capilaries h(mm)						Ascension speed in the capilaries $V=h_3/30$ (mm/min)	
	Warp			Weft			Warp	Weft
	10 min.	20 min.	30 min.	10 min.	20 min.	30 min.		
1 (100% linen unfused)	40.0	55.0	58.0	50.0	60.0	65.0	1.93	2.17
1' (100% linen fused with chemicalized woven material)	0	3.0	5.0	5.0	8.0	10.0	0.17	0.33
1" (100% linen fused with chemicalized nonwoven material)	30.0	60.0	70.0	0	30.0	35.0	2.33	1.17

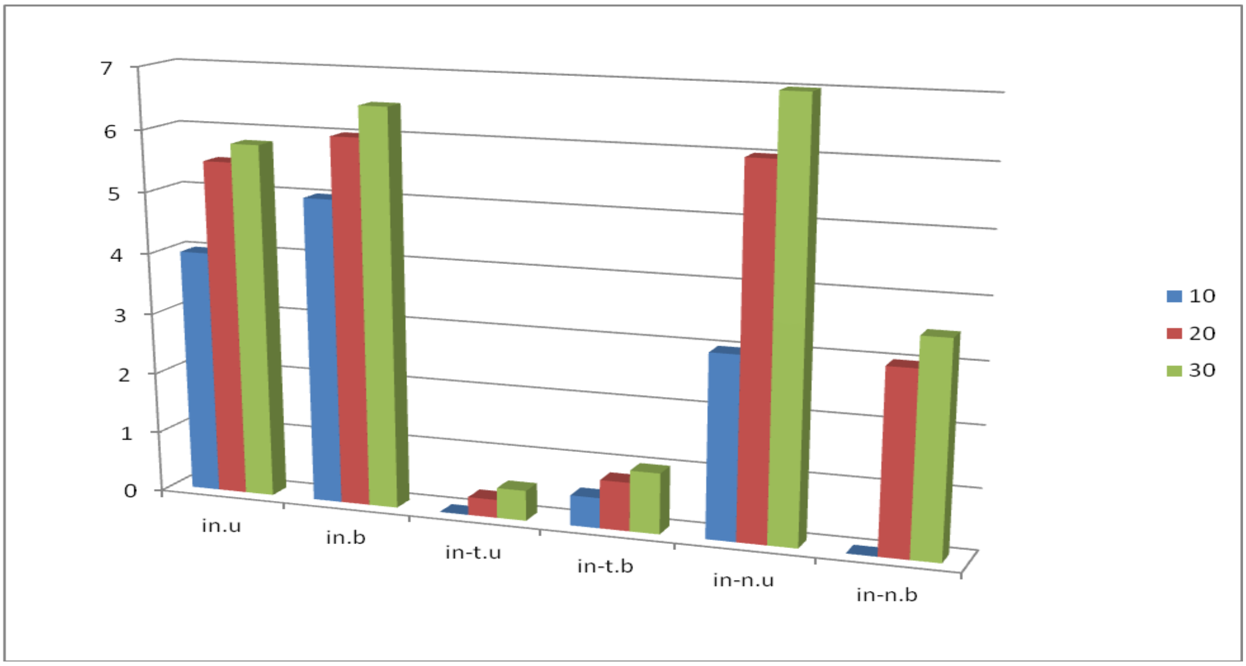

Fig. 1. *Average ascension height of water for the material with a composition of 100% linen, unfused or fused with a chemicalized woven or unwoven material.*

Water absorption capacity is strongly influenced negatively if the material is doubled using a chemicalized woven fabric, both on warp and weft directions. If a chemicalized nonwoven fabric is used, the water absorption capacity is adversely affected in the weft direction but very little in the warp direction. In this direction, the speed of water absorption is increased.

Table 2: *Average ascension height in the capilaries and the speed of ascension for material (2) 100% cotton, thermofused with a chemicalized woven material (2') and a chemicalized nonwoven material (2").*

Material / thermofused ensemble	Average ascension height in the capilaries h(mm)						Ascension speed in the capilaries V=h₃/30 (mm/min)	
	Warp			Weft			Warp	Weft
	10 min.	20 min.	30 min.	10 min.	20 min.	30 min.		
2 (100% cotton unfused)	80.0	95.0	112.0	75.0	92.0	105.0	3.73	3.50
2' (100% cotton fused with chemicalized woven material)	70.0	105.0	120.0	90.0	90.0	102.0	4.00	3.40
2" (100% cotton fused with chemicalized nonwoven material)	90.0	100.0	115.0	75.0	95.0	105.0	3.80	3.50

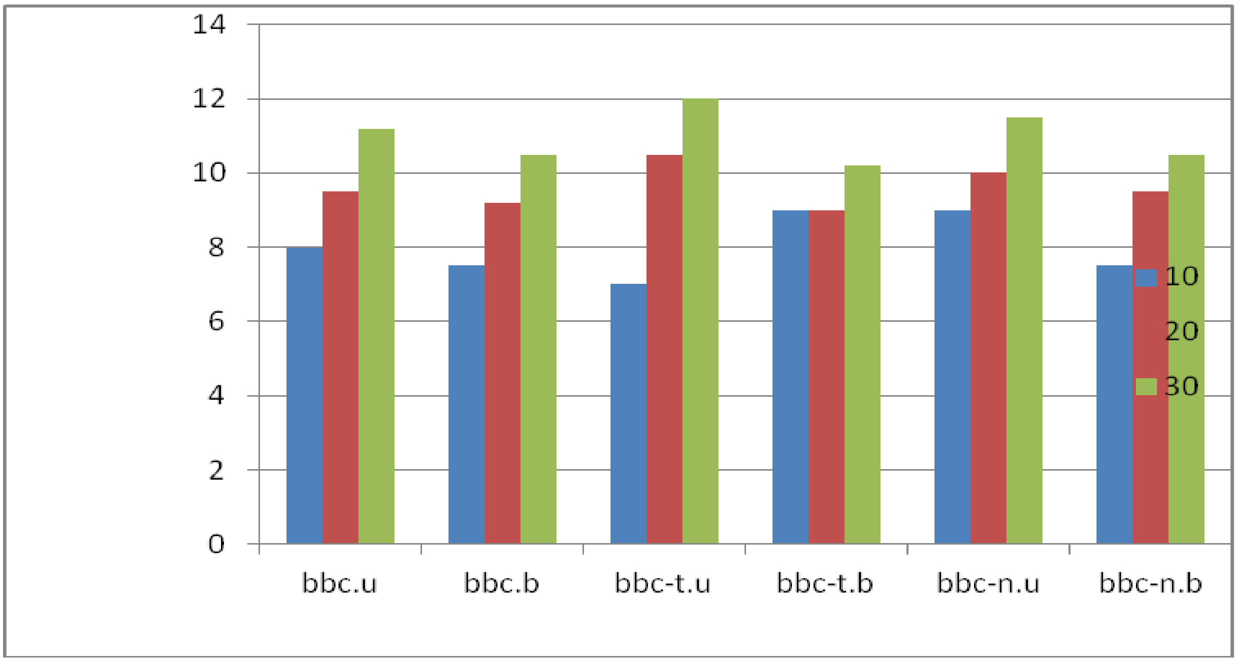

Fig. 2. *Average ascension height of water for the material with a compozition of 100% cotton, unfused or fused with a chemicalized woven or unwoven material*

In the case of fusing 100% cotton, the capacity of water absorption is positively influenced in the warp direction, and negatively but insignificantly in the weft direction.

Table 3: *Average ascension height in the capilaries and the speed of ascension for material (3) mixed linen, thermofused with a chemicalized woven material (3') and a chemicalized nonwoven material (3").*

Material / thermofused ensemble	Average ascension height in the capilaries h(mm)						Ascension speed in the capilaries $V=h_3/30$ (mm/min)	
	Warp			Weft			Warp	Weft
	10 min.	20 min.	30 min.	10 min.	20 min.	30 min.		
3 (mixed linen, unfused)	75.0	88.0	100.0	80.0	90.0	105.0	3.33	3.50
3' (mixed linen fused with chemicalized woven material)	5.0	10.0	10.0	2,0	5.0	5.0	0.33	0.17
3'' (mixed linen fused with chemicalized nonwoven material)	33.0	35.0	35.0	30.0	30.0	30.0	1.17	1.00

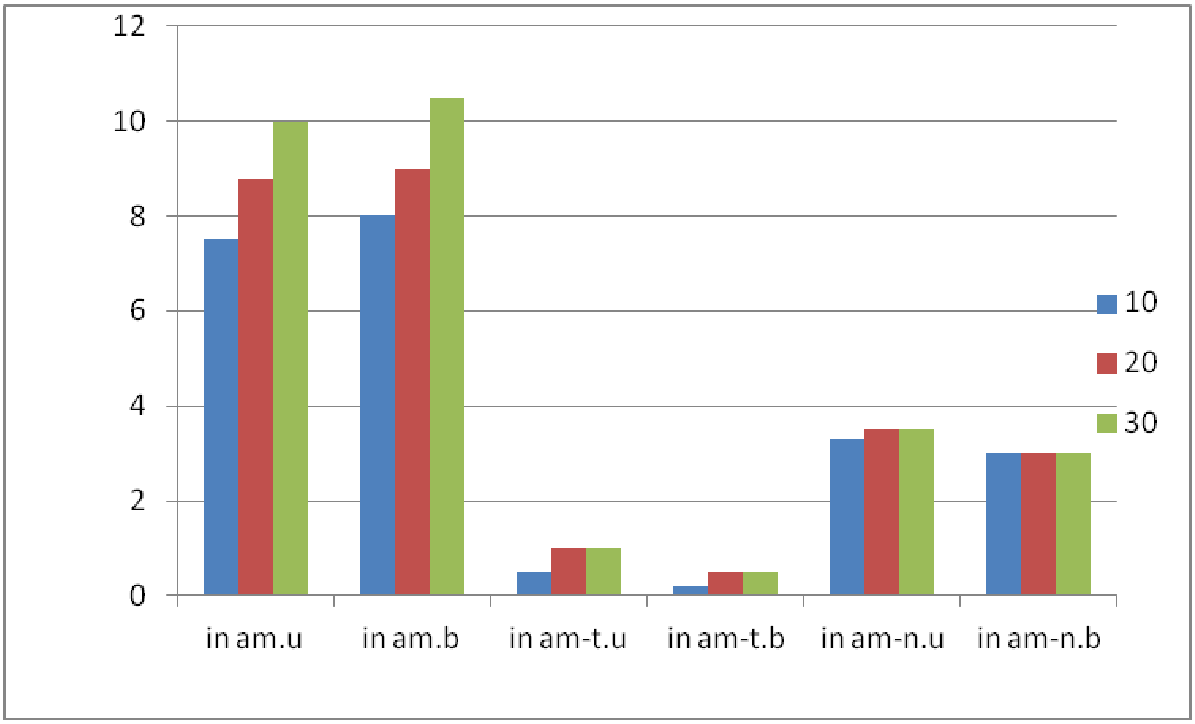

Fig. 3. *Average ascension height of water for the material with a compozition of mixed linen, unfused or fused with a chemicalized woven or unwoven material*.

Water absorption capacity is strongly influenced negatively in the case of fusing with a woven chemicalized fabric and negatively if fused with a nonwoven chemicalized fabric.

5. CONCLUSIONS

Water absorption capacity is strongly influenced negatively if the material is doubled using a chemicalized woven fabric, both on warp and weft directions. If a chemicalized nonwoven fabric is used, the water absorption capacity is adversely affected in the weft direction but very little in the warp direction. In this direction, the speed of water absorption is increased.

In the case of fusing 100% cotton, the capacity of water absorption is positively influenced in the warp direction, and negatively but insignificantly in the weft direction.

Water absorption capacity is strongly influenced negatively in the case of fusing with a woven chemicalized fabric and negatively if fused with a nonwoven chemicalized fabric.

We observed a negative influence on the hydrophilicity of materials that have linen in their composition in both directions (warp and weft), in particular in the case of fusing with a woven chemicalized material. We emphasize that this material with a cloth structure has a composition of wool mixed with polyamides, with twisted warp yarns and multifilament weft yarns.

Fusing 100% cotton material insignificantly affects the water absorption capacity.

From this follows the need to consider the compatibility between materials that form a fused assembly, with the aim of not affecting sanogenetic and comfort parameters.

The analysis of the influence of technological processes on indicators of comfort eases the selection of compatible materials for the construction of multi-layered clothing ensembles.

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