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ANALYSIS OF DOUBLE FACE FINISHED COTTON PROPERTIES FOR BED SHEET APLICATIONS

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ABSTRACT

This work aims to study the influence of softeners and non-slip finishes in the comfort of multifunctional bed sheets for the season spring/summer, or used all year round in mild or warm temperatures. For this, different concentrations of softeners and non-slip products were applied to 100% cotton taffeta fabrics. Each finishing was applied on a single face of the textile and combined by application by a double face process. The evaluation of the mechanical and thermal properties of the finished bed sheets was studied. This application can be important, for persons that are resting in bed during long periods of time, preventing pressure ulcers.

Keywords: bed sheets, softeners, non-slip finishes, mechanical properties, thermal properties.

INTRODUCTION

The friction plays an important role in the prevention of pressure ulcers as well as in the comfort levels provided specially for those with limited or inexistent sensing capacity (Gossens, 1997, Gerhardt, 2008; Zhong 2006).

It is possible design a bed sheet that will reduce friction between body and the bed sheet and increase friction between the bed sheet and the mattress cover. In this way, bed sheet will remain in its position and the body will easily slide during the needed repositioning for inspection by caregivers and prevention for the development of pressure ulcers.

Pressure Ulcers develop when there is excessive pressure on a bony prominence for a long period of time, which may compress the tissue and blood vessels between the bone and the support surface. This compression, when prolonged, can cause ischemia, and eventually necrosis of the tissues (Fontes et al., 2012). See Figure 1 for an example of the development of an ulcer (Fontes et al. 2013).

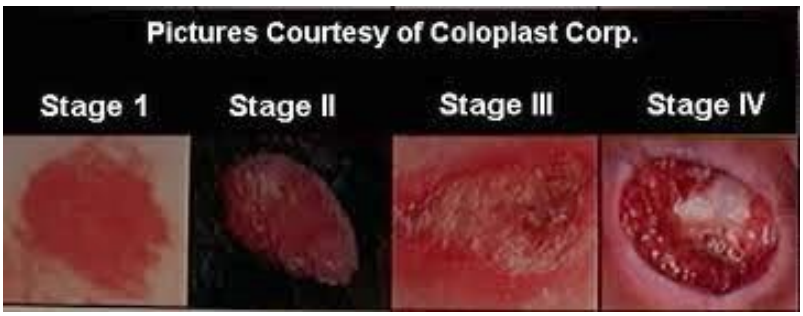

Fig.1 - Representation of of the development of an ulcer

The smooth, soft and flexible properties of textiles can be improved using softeners application. Softening is a mandatory process in home textiles production (Abreu et al, 2014). On the other hand, the friction increasing can be obtained using non-slip products (Schindler, 2004).

The study of applying non-slip finish, is made in order to increase friction to help prevent or reduce the possibility of formation of creases, contributing to the overall feeling of comfort for the user of finished bed sheets. Nevertheless, this finishing is uncommon and their conjugation in the same product is innovative.

The present study reports the double face finishing of cotton bed sheet with cationic softener and anti-slip auxiliary product. The properties related to comfort of materials are evaluated. Thus, friction coefficient, abrasion, wear resistance, thermal insulation, air, water and water vapour permeability are measured according to standard tests and the obtained results analyzed in terms of average and variance homogeneity, using Scheffé test and Snedecor F test respectively.

EXPERIMENTAL DETAILS

This work aims to study the influence of softeners and non-slip finishes in the mechanical and thermal properties of multifunctional bed sheets for the season spring/summer, or used all year round in mild or warm temperatures.

For this, different concentrations of softeners and non-slip products were applied to 100% cotton taffeta fabrics (Table 1). Each finishing was applied on a single face of the textile in the first phase and combined by application on each face process in the second phase.

Table 1 - Concentration and type of softeners and non slipping finishes

	SAMPLE	FINISH	IONICITY	CONCENTRATION
	0	Without finish		
Phase 1	1A	Non-slip finish	Anionic	5 gL^{-1}
	1B			40 gL^{-1}
	1C			80 gL^{-1}
	2A	Non-slip finish	Cationic	10 gL^{-1}
	2B			40 gL^{-1}
	2C			80 gL^{-1}
	3	Softner	Anionic	30 gL^{-1}
	4	Softner	Non-ionic	40 gL^{-1}
	5	Softner	Cationic	30 gL^{-1}
	6	Softner	Non-ionic	30 gL^{-1}
Phase 2	2B+5	Non-slip finish + Softner	Cationic	40 gL^{-1} + 30 g/L^{-1}

These finished sheets can be important, for persons that are resting in bed during long periods of time, preventing pressure ulcers.

The performed tests during this research are in table 2.

Table 2 - Tested properties

Property	Symbol	Unit
Friction Coefficient	μ	$\mu_{KINETIX}$
Thermal conductivity	λ	W/mK
Thermal diffusivity	α	m^2s
Thermal absorptivity	b	$Ws^{1/2}/m^2K$
Heat flux	q_{max}	W/m^2
Air permeability		$l/m^2/s$
Water vapour permeability		$g/m^2/day$
Abrasion resistance		Scale 1-5
Tear resistance		N
Contact angle		º
Crease recovery angle		º
Compression	WC-Compression energy	**Nm/m^2**
	RC-Resilience	%
	EMC-Compression at 10 cN/cm^2	%
	T_0-Thickness with pressure 0,5 cN/cm^2	mm
	T_m-Thickness with pressure 10 cN/cm^2	mm

RESULTS AND CONCLUSIONS

In identical results between the different products and/or concentrations, the choice fell on the sample with lower production cost.

The results showed that the best results with respect to the desired conjugated effect was obtained with the application of 40 gl^{-1} of non-slip cationic product and 30 gl^{-1} of cationic softener.

The frictional properties and wear resistance showed significantly different values when compared to the unfinished samples.

The bed sheet functionalized with the two finishing's, combined on same sheet but in different sides, showed statistically significant changes in the friction coefficient and in water vapour permeability. The average values for the remaining properties tested did not changed significantly when compared with the obtained for samples with individual treatments.

In conclusion, the comfort level of bed sheets is improved.

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