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Research on Textile and Materials**

November 12-13, 2021, Monastir Tunisia

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DURABILITY AND COMFORT ASSESSMENT OF CASUAL MALE SOCKS

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1. INTRODUCTION

The number of European standards related to testing of knitted fabrics and socks are low [1]. Measuring of thermal comfort of socks is usually conducted on the thermal foot together with the footwear. As, on male socks are placed high demands of usage durability and comfort, it is necessary to expand the research in that field. Therefore, the properties of casual male socks, made of high content of cotton in full plating by yarns of different composition (polyamide 6.6, Lycra/ cotton, Lycra/polyamide 6.6) were compared in this paper, by applying the proposed methodology for evaluation quality of socks according to the standardized test methods. With particular reference to usage properties, it was carried out the assessment of dimensional stability of socks after one and five repeated washing and drying cycles; propensity to surface pilling after 125, 500, 1000, 2000, 5000 and 7000 rubbing cycles, and abrasion resistance by determination of specimen breakdown using the Martindale abrasion tester comparing two methods; as well as testing of thermophysiological comfort of socks before and after five repeated washing and drying cycles by measuring of thermal resistance on the thermal foot.

2. MATERIALS AND METHODS

The investigation was carried out on three groups of calf length fine casual, black coloured male socks of the same size (EU 42). Characteristics of male socks produced are shown in Table 1.

Table 1. Characteristics of three groups of calf length casual male socks

Sock sample	Fibre content (%)			Plating yarn		Weight of sock (g)	Moisture regain (%)	Mass per unit area (g/m ²)
	Cotton	PA 6.6	Lycra	Foot and leg	Toes and heel			
1	78	21	1	PA 6.6	PA 6.6	19.9	6.30	189.9
2	91	6	3	Lycra/cotton	PA 6.6	19.8	6.96	199.9
3	78	19	3	Lycra/PA 6.6	PA 6.6	19.9	6.63	237.6

After the conditioning (at temperature: 20 ± 2 °C and air relative humidity: $65 \pm 4\%$) and sampling of socks (Figure 1 a) of the same weight, the following were determined: dimensional stability in the length and width direction, measured in the foot and leg area of socks after washing and drying (EN ISO 6330 procedure 4N and A), propensity to surface fuzzing and pilling (EN ISO 12945-2), abrasion resistance (EN ISO 12947-2 and EN 13770, method 1 (Figure 1 b)) and thermal resistance on the thermal foot (Figure 1 c).

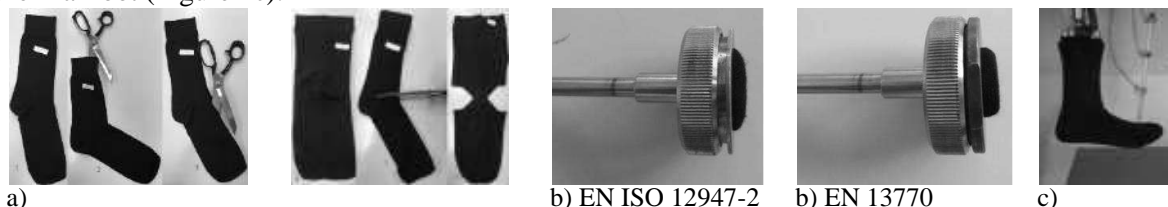


Figure 1. Socks testing: a) sampling, b) samples prepared for abrasion resistance testing, c) thermal foot

3. RESULTS AND DISCUSSION

The results obtained from the investigation are presented in Tables 2 - 5. All tested socks showed shrinkage after washing that affects the thermal resistance also. In the socks of the first and third group was observed somewhat lower propensity to surface pilling, but also higher abrasion resistance

of knit from sole area.

Table 2. Changes in dimensions of socks in the length and width directions

Sock sample	Dimensional stability (%), 1x washed		Dimensional stability (%), 5x washed	
	Length	Width	Length	Width
1	-5	-7	-6	-8
2	-9	-10	-12	-13
3	-2	-9	-6	-11

Table 3. Visually assessed propensity to surface pilling of socks

Number of pilling rubs	Sock sample 1	Sock sample 2	Sock sample 3
125	4	4	4
500	3/4	3/4	3/4
1000	3/4	3/4	3/4
2000	3	3	3
5000	3	2	2/3
7000	2/3	1/2	2

Table 4. Abrasion resistance of heel and sole area of socks - determination of specimen breakdown

Sock sample	EN ISO 12947-2		EN 13770, method 1	
	Description of the endpoint/ number of rubs to reach endpoint			
	Heel	Sole	Heel	Sole
	thinning/35000	thinning/35000	thinning/6500	thinning/6500
	thinning/35000	hole/30000	thinning/6500	hole/6000
	thinning/35000	thinning/45000	thinning/6500	thinning/7000

Table 5. Thermal resistance of socks before and after five repeated washing and drying cycles

Sock sample	R_{ctt} ($m^2 \cdot ^\circ C / W$)		R_{ct} ($m^2 \cdot ^\circ C / W$)		$(R_{ct} / R_{ctt}) \times 100$ (%)	
	Non-washed	5x washed	Non-washed	5x washed	Non-washed	5x washed
1	0.127005	0.134184	0.015870	0.007562	12.676742	5.650739
2	0.131486	0.132872	0.010784	0.009747	8.220660	7.378982
3	0.135114	0.133988	0.012585	0.009688	9.314884	7.239121

Description: R_{ctt} - total thermal resistance of apparatus and sock; R_{ct} - thermal resistance of the tested sock

4. CONCLUSION

On the basis of the results obtained, the applicability of the proposed methodology was confirmed and concluded that when choosing the yarns for production of socks is necessary to consider their comfort and expected durability in the conditions of use.

5. REFERENCES

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