COMPARATIVE STUDY ON PILLING RESISTANCE STANDARD METHODS

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Textile fabrics are prone to develop balls of fibre on the surface, which are known as pills. The pills are formed during wear and washing, when fibres on the fabric surface "tease out" and become entangled. Under the influence of the rubbing action these loose fibres develop into small spherical bundles anchored to the fabric by a few unbroken fibres [1]. In Figure 1 [2] is represented a typical pill. In Figure 2 [2] pilling formation can be observed.

Figure 1 – A typical pill

Figure 2 – Pilling formation

Such a surface deterioration is generally undesirable, but the degree of consumer tolerance for a given level of pilling will depend on the garment type and fabric end use.

Generally, the level of pilling which develops is determined by the rates of the following parallel processes:

- fibre entanglement to pill formation
- development of more surface fibre
- fibre and pill wear-off

The rates of these processes depend on the fibre, yarn and fabric properties. Extreme situations are fabrics containing strong fibres and fabrics containing weak fibres. On the first case, a consequence of the strong fibre is a rate of pill formation that exceeds the rate of wear-off. This results in an increase of pilling with an increase of wear. With a weak fibre, the rate of pill formation competes with the rate of wear-off. This would result in a fluctuation of pilling with an increase of wear. These examples demonstrate the complexity of evaluating the surface change on different types of fabric.

The determination of the level of pilling is a subjective visual assessment. Due to this it requires extreme care and thorough training in the assessment technique to ensure the rating is accurate.

A variety of test methods and instruments have been developed and devised to measure and predict fabric performance with regard to pilling [3]. Standard test methods that evaluate the tendency of fabrics to pill consist of devices that brush the fabric surface or that randomly tumble them to generate pills.

The aim of this work was to compare four experimental standard methods, to conclude about the similarity among experimental results and to indicate, if possible, the most suitable method for each type of woven textile. The considered test methods were:

- Martindale Abrasion Tester
- ICI Pilling Box
- Atlas Random Tumble Pilling Tester
- Elastomeric Pad

Martindale Abrasion Tester and Pilling Box are experimental methods according ISO standards and more often used in Europe. Atlas Random Tumble Pilling Tester and Elastomeric Pad are test methods according ASTM standards and commonly applied in the United States.

Several different woven textiles were tested:

- 32 fabric samples (different composition, construction and colour)
- 42 knitting samples (different composition, construction and colour)

It was clear, by a statistical approach, that the four methods give different results. For fabric and knitting, the highest level of pilling was achieved with the Martindale Abrasion Tester. Considering the case of fabrics only, Elastomeric Pad and Martindale gave similar results.

Pilling Box and Atlas Random Tumble Pilling Tester gave the lowest level of pill formation, meaning that they are the less aggressive test methods. In the case of cotton flannels, neither of the tested methods seemed to be the most adequate one. A simple wash procedure revealed itself to be a good alternative to determine the level of pilling in this kind of fabrics.

In the case of knitting materials, Martindale Abrasion Tester and Elastomeric Pad were responsible for the highest level of pilling, allowing a clear distinction between them.

References

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