Finishing agent to reduce fabric pilling

By Dr Naresh M Saraf & Dr Priti B Tayade, Sarex – India

he surface appearance of a textile material is important to the consumer. Pills are an aesthetic and physical irritation. The pilling of textile material fabric refers to an appearance caused by bunches or balls of tangled fibres held on the fabric surface. This unpleasant appearance can compromise the fabric's acceptability for apparel.

Ever since the invention of the loom, fabric producers have observed the phenomenon known as 'pilling' - a process that results in the formation of small fuzzy balls or 'pills' on the fabric surface. In the short term, pilling may lead to unattractive 'fuzzy' fabric. Over time, especially with natural fabrics, it can lead to a complete wear-through of the fabric. Pills are developed on a fabric surface in four main stages: fuzz formation; entanglement; growth; and wear-off.

Textiles are made with yarn, a spun thread used in both knitted and woven fabrics. With every wash, wear and the ticking of time, the tiny fibres that make up the yarn break. These broken fibres ball-up to create pills on the fabric surface. They then proliferate in high-friction areas such as the under-arms, sleeves, bust area, and inner thighs.

Pilling normally happens on the parts of clothing that receive the most abrasion in



A close-up of a pill

day-to-day wear, such as the collar, cuffs, and around the thighs and rear on trousers.

All fabrics pill to some extent but the degree of pilling varies depending on the type and quality of the fabric. The primary drivers of pilling are the physical characteristics of the textile (fibre denier, twist factor of the yarn and fabric construction), the method of textile processing, habits of the textile's wearer and the environment in which the textile is used.

Fine denier fibres tend to pill more as they possess less stiffness. Yarn with a lower twist factor will pill more than yarn with a higher



Pilling on fabric



Application by Exhaust

Application on Garments



-	-
80s and above	20g/l
40s - 60s count	25 - 30g/l
20s - 30s count	30 - 40g/l
For Denim garments	50 - 60a/l

twist factor. Meanwhile, closed weave fabric with a high set pills less. A very tight, compact construction, such as denim, usually pills very little. However, a loosely knitted or woven fabric will show more pilling with both wear and cleaning. Pilling is often more noticeable on knitted fabrics, such as sweaters, than on woven fabric. This is because of the greater distance between yarn crossings in knitted fabrics than in woven ones.

Blended fabric made of both strong and relatively weak fibre tends to pill more as the weaker fibre wears and breaks and the stronger fibre holds the pills onto the cloth. Fabrics and knitted products made from yarns with a synthetic fibre are subject to pilling as a virtue of their considerable strength, flexibility and resistance to impact.

Pilling can critically compromise a textile's acceptability for consumers and hence is the focus of significant industry research. Pilling prevention is an ongoing challenge for manufacturers of cotton, polyester and blended fabrics.

There are many methods for reducing the pilling tendency of the fabric. Physical processes such as shearing, singeing, brushing and thermosetting, chemical processing such as the application of polymers or enzymes, use of anti-static finishes or special treatments such as sanforizing or UV treatment all help to remove pills. Out of these, surface modification using different chemicals is the most acceptable method. Anti-pilling finishes are based on the use of chemical treatments which aim to

Application by Pad-Dry-Cure Process on Stenter



suppress the ability of fibres to slacken and also to reduce the mechanical resistance of synthetic fibres.

Sarex says it has developed an innovative product; Helafin-42, which is used as a finishing agent for cotton, polyester and their blends. It improves resistance to pilling, snagging and also reduces the tendency of seam slippage. Fabric finished with Helafin-42 is resistant to washing and dry cleaning.

Mechanism of Helafin-42:

Fabrics that have very low fibre-to-fibre friction cause pilling during abrasion. This is because, the smooth fibres have a tendency to slip from the yarn and protrude on the surface. The protruded fibres then get entangled during abrasion which generates pills on fabric surface. Helafin-42 increases fibre-to-fibre friction and, as a result, the fibre does not slip from the yarn and does not protrude on the surface, hence there is no entanglement. This keeps the fabric surface free from pills.

Unique features:

- Helafin-42 improves the pilling resistance of fabric
- Ideally suitable for various fabrics including those developed for sheeting, shirting and garments
- It improves the fuzziness of sheeting fabric
- It resists the seam slippage thus making stitched fabric more durable to seam slippage
- It can be applied in finishing with various softeners



to pilling caused by abrasion

Rating: 1 to 5

1 : Poor

5 : Good

Surface Morphological Study by SEM (Scanning Electron Microscope)





SEM image of unfinished fabric Fibre surface roughened due to abrasion

SEM image of Helafin-42 finished fabric Fibre surface appears smooth even after abrasion



Materials and methods

Materials: 100% cotton sheeting fabric Chemicals: Helafin-42

Experimental

The following are the recommended procedures for Helafin-42 application:

Helafin-42 by padding application:

Fabric substrates were padded with 50gpl Helafin-42 with the pick-up of 65-70%. The bath pH was adjusted to 5.0-6.0. After padding, the fabrics were dried at 1600C for two minutes and taken for further evaluation.

Test methods

The finished fabrics were evaluated for the following:

- ASTM D4970 Abrasion and pilling resistance using Martindale Abrasion cum Pilling Tester
- 2. Seam slippage to measure the fabric movement at the seam
- Surface Morphological Study by SEM (Scanning Electron Microscope) to check the efficiency of the finishing agent to abrasion

Results and discussion

1. Surface Morphological Study by SEM (Scanning Electron Microscope)

2. Anti-pilling data

The anti-pilling efficiency of the treated fabric was evaluated with the standard test method: ASTM D 4970 (500 rpm) on Martindale Abrasion cum Pilling Tester - James H. Heal.

3. Seam slippage data

When stress is applied to a seam, the yarns in the fabric slip out of the stitching causing an open seam. This is termed as "seam slippage". Helafin-42 reduces the tendency of seam slippage. Results are shown below:

Fabrics	Seam strength
Untreated fabric	12.17 Lbs
50g/l Helafin-42	32.90 Lbs

4. Treatment effect on fabric

Conclusion

Helafin-42 appears to be a promising chemical treatment that prevails over the pilling problem.