Pilling of Textiles: Causes and Remedies

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Pilling is serious problem of textile industry. A finished fabric may have pleasing handle and a clean surface but, when converted into garments, pills are formed during wearing as well as washing, due to the rubbing action. First, entanglement of loose fibre, which protrudes from the surface, takes place. This further develops into a ball-like appearance, anchored to the fabric surface by a few unbroken fibres. This creates an old or second-hand look, and a loss of aesthetic appeal.

Pilling is more prevalent for fabrics made from polyester/cotton or polyester/viscose blends, though it can occur with wool, polyester/wool and cotton fabrics.

Before we look for solution, let us first identify the problem. With the introduction of polyester fibre, polyester/cotton and polyester/viscose blends became very popular, due to their durability, aesthetics and wearing comfort. Unfortunately the advantages of these blends were marred due to their pilling tendency, which was found to be more than with natural fibres.

Surprisingly, this problem was not reported for fabrics and garments made from polyester filament. This is because filaments do not abrade and break easily and therefore cannot migrate on the surface, whereas for short staple fibres, friction during wear and washing

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easily brings the fibres to surface, leading to pill formation.

Theoretically following steps take place during pill formation.

1 Fibres are drawn to the fabric surface as a result of some mechanical action and these fibres form fuzz in that area.

2 The fuzz entangles into pills, which are attached to fabric surface due to an anchor fibre.

3 Pills wear-off under continual mechanical actions during rubbing, laundering, wearing and cleaning.

Pills can form for any staple fibre, whether synthetic or natural, including cotton and wool but the problem is more prominent in case of polyester staple fibre. This is because the high strength and flex life of polyester fibre prevents pills from easily wearing off. These fibres also attract foreign particles easily, due to their electro-static properties, leading to ease of pill formation.

Pilling is promoted by a number of factors such as fibre length and denier, low twist, hairy and bulky yarns, single yarn, type of weave, type of finish, etc.

Let us look at these factors in more detail.

1 Pill formation rate – Pill formation is a dynamic process in which pills are constantly formed and wear off. If the formation rate is greater than the break-off rate, then pills build-up on surface. The formation rate will depend upon the number of fibres in the yarn, fibre length, fibre cross-section, yarn twist, fabric construction, etc. Any factor, which allows fibres to migrate to the yarn surface, will increase formation rate.

2 The longer the staple length, the lower the pilling tendency, because there are fewer fibre ends protruding per unit area. Also, long fibres can be more firmly secured in the yarn.

3 Coarser fibres are rigid and hence these have a lower tendency to pill.

4 A circular cross section with smooth fibre surface allows the fibre to migrate to the surface of a fabric and form pills. Irregular cross sections reduce pilling.

5 Low-tenacity fibre will increase pill wear-off rate.

6 High crimp reduces pilling tendency.

7 Air-jet-spun yarns are better than ring-spun yarns. During ring spinning, longer fibres tend to stay in the center of the yarn and shorter fibres at the outside of the yarn, leading to pilling. OE yarns are worse than ring-spun yarns.

8 The finer the count of yarn, the less is the pilling tendency. However, in case of P/W blends it is observed that with same blend ratio, the finer the yarn, the more polyester fibre is on the surface, leading to more pilling.

9 High twist leads to more compact yarn with fewer protruding fibres. Fibre mobility is also reduced, hence less pilling.

10 In blends, the higher the polyester content, the more pilling occurs.

11 The less hairy the yarn, the less pilling occurs.

12 Fabrics or material made from single yarn pills more readily than that made from two-ply yarns.

13 Knitted fabrics undergo pilling more easily than woven because, in knitted fabrics, a greater amount of yarn surface area is exposed. A tightly woven fabric has a lower tendency to pill.

14 Plain-weave fabrics exhibit less pilling than twills due to the greater number of inter-lacings and short cross length compared to twills.

15 Finer fabrics with low GLM exhibit pilling more easily than heavy fabrics.

Thus, various fibre, yarn and fabric parameters contribute to the pilling problem. Ideally, selecting the best parameters of each can reduce pilling but in many situations these restrictions can affect other desirable characteristics of the fabric.

Control of pilling

Following methods are adapted to control pilling

1 Selection of fibre; manufacturing of yarn and fabric based on low pilling tendencies.

2 Prevention of abrasion during batch processing by using suitable lubricating agent like Lubsoft or saracrease C in pretreatment as well as in dyeing on jet machines.

3 Use of Glauber's salt instead of common salt in reactive dyeing of cotton and polyester/cellulosic blends on jet dyeing machines.

4 Proper heat setting of polyester/cellulosic and polyester/wool blends to set the yarn, and use of proper overfeed.

5 Shearing and cropping with brushing to eliminate surface fibres and protruding fibres.

6 Singeing on both surfaces to remove surface fibres. Singeing two or more times for better results.

7 In the case of polyester and polyester/cellulosic blends, causticisation for partial degradation of polyester component will reduce the strength of polyester fibres so that pills are easily removed.

8 Biopolishing of cotton and polyester/cellulosic blends using Biopol SI and, and of wool or polyester/wool blend using suitable enzyme.

9 Treatment of polyester/cellulosic, polyester/wool and cotton with special auxiliary Saraglow-CL in jet dyeing, and for garments in drum washing, to remove surface fibres.

10 Use of optimum concentration of silicone softeners to avoid excessive softness and lubricity, which otherwise could promote migration of fibres on to the surface, and hence pilling.

11 Finishing with special finishing agents such as:

- **Sarafeel-JY/Sarafeel-763** – Special silicone formulation to impart softness and improve pilling resistance by film formation.
- **Sarasoft-MR** – Polymeric finishing agent based on silicone with film forming characteristics. Can also improve abrasion resistance.
- **Garfinish-AS** – Special finish for antipilling and antisnag effect. Can be incorporated with conventional finishing recipe.
- **Sarapeach AM** – Polyurethane based finishing chemical which also improves abrasion resistance.

Conclusion:

Pilling cannot be completely eliminated due to various requirements demanded by consumers, such as softness, suppleness, comfort, etc, but it surely can be controlled, provided we take preventive as well as curative measures.

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