FABRICS AND PILLING

Pilling is an undesired effect, which involves the formation of balls of tangled fibers, on the surface of the fabrics. The pilling causes aspects of "prolonged use" in very short periods of time, when this effect is accused.

Therefore, the pilling effect always will be avoided, and should be taken into account from initial conception of the fabric:

choice of fiber, yarn structure, fabric structure, and finishing operations.

Pilling occurs particularly in fabrics that containing synthetic fibers, and which the fabric structure are "open" as knit.

Pilling formation sequence, can be represented as follows:
To eliminate or minimize the pilling formation, can be applied to the fabrics finishing treatments, such as:

**Brushing**, in order to remove loose fibers, and to prepare the fabric surface for subsequent shearing.

![Brushing Image](image1)

**Singeing**, to eliminating hairiness of the fabric surface, by burning.

![Singeing Image](image2)

**Shearing**, after brushing, to cut the fabric surface fibers (hairines).

![Shearing Image](image3)
Now, with the use of the garment, may appear pilling effect. To prevent pilling effect, we must contemplate many parameters involved in the design and construction of the fabric.

Parameters:

- Parameters affecting the fibers.
- Parameters affecting the yarns.
- Parameters affecting the fabric.
- Parameters affecting dyeing and finishing operations.

Parameters affecting fibers:

Fiber type:

The **synthetic fibers** have a greater pilling formation, than natural fibers. This is due to its high strength and flexibility. The fibers do not break, and remains on the surface of the fabric (pilling).

Fiber fineness:

Finer fibers (less dTex), higher hairiness and therefore, greater capacity of pilling formation.
Fiber crimped:

A higher fiber crimped level, tendency to migrate the fibers to the surface of the yarn or fabric, is reduced. Also less tendency of pilling formation. The crimped increases the friction coefficient of fiber to fiber, reducing pilling.

Fiber section:

Smooth sections, make easier the migration of the fibers, and therefore the formation of pilling. Lobed sections minimize migration, by increasing the friction coefficient of fiber to fiber.

Fiber length:

A shorter length of the fibers, increases the pilling formation, as it will more readily migrate to the yarn surface, and therefore to the fabric surface.
Friction coefficient:

A higher friction coefficient, less pilling formation. There are resins that when are applied on the fabric, they can reduce the pilling formation, because increases the friction coefficient between the fibers.

Fiber tenacity:

Tenacity, can be expressed as the specific resistance of a fiber, and it is measured in cN/Tex.

A higher tenacity, it is more difficult to produce detachment of pilling of the fabric surface, because the fiber is not broken easily.

For example, polyester fibers are so called "low pilling" which are a polyester fibers, with lower tenacity values, to facilitate the breakage of the fiber, and therefore the detachment of the pils from the fabric surface.

Parameters affecting yarns:

Linear mass:

A greater yarn count, more fibers per section number, and therefore greater pilling formation. There will be more loose fibers.
A same yarn count, less capacity of pilling formation, those that are formed with fibers of greater length.

Yarn twist:
A more yarn **twist**, less pilling formation, because the fibers are more closely related, and therefore will disadvantage the possibility of migration to the yarn surface.

**Yarn finishing:**

A singeing yarn, without surface hairiness, they will have a lower capacity of pilling formation. The yarn haven’t got the fibers on the surface.

**Different fibers length mixtures:**

In a mixture of long and short fibers (eg cotton), the short fibers tend to migrate to the yarn surface, and provide excessive surface hairiness aspects, and therefore, undesirable aged aspects.

**Different materials mixtures:**

The different materials mixtures, they can have an influence the pilling formation. When we mixing different fiber fineness, the finer will be on the inside of the yarn, while the thicker and shorter, migrate to the outside of the yarn. Normally, the pilling formation occurs in a different materials mixture, is greater than would occur in the 100% composition.

**Example:**

To obtain a gray blend with wool and polyamide, where the polyamide that will tend to form pilling, we should not be:

- Dye wool to white.
- Dye poliamide to black.

We will see a lot of black pilling balls.

Should therefore dyed both, wool and polyamide, to black and white respectively, then mixing them in appropriate proportions, to minimize the appearance of pilling can be formed.

**Parameters affecting fabric:**

We can distinguish between woven fabrics, and knitted fabrics.

**Woven fabrics:**
A higher linked coefficient of the fabric structure, less pilling formation. Closed fabrics, or greater weight/square meter fabrics, less pilling formation.

Knitted fabrics:

A mayor relajación, más compacidad, y por lo tanto menor formación de pilling. Relaxed fabrics are more compacts, and therefore, its pilling formation will be less.

When the mesh length are large, is greater its pilling capacity of formation.

A heavier weight (weight/square meter) of the fabric, less pilling formation.

At higher coverage factor, less pilling formation.

Also influences the "gauge" of the loom, which is directly related to the weight/square meter of the fabric.
**Dying and finishing parameters:**

**Scouring and desizing:**

Complete removal of waxes and lubricants of the fibers and yarns, will decrease the capacity of pilling formation, removing substances that favor the sliding of the fibers, and therefore the pilling formation.

**Dye and dyeing process used:**

En general, procesos de tintura largos, y con alta fricción del tejido (procesos en cuerda), tendrán tendencia a una mayor formación de pilling.

Generally, long dyeing processes, and high friction on the fabric, (rope processes), will have a greater tendency to pilling formation.
Dry heat setting (stenter):

Both the vaporized as heat setting, reduce the tendency to pilling formation, due to the "fixed" of the fibers in a certain position, so as to prevent further movement or migration to the external areas of the yarn or fabric.

Thermo fixed fabrics, have less tendency to pilling formation, that not thermo fixed fabrics.

Softening:

Softeners reduces fiber-fiber friction coefficient, and increases the tendency to pilling formation.

Antipilling finishing:

They are finished products in resins form, which act as binder or fixing fibers, preventing their migration to the surface of yarns and fabrics, and therefore, minimizing the pilling formation.