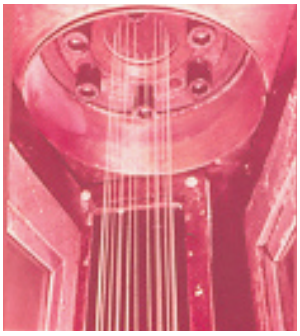
Regenerated Fibers

Regenerated fibers were the first manufactured fibers that were "invented." Regenerated fibers can be traced back to their source materials, most are plant-based (cellulose). Modified fibers were developed later—one step further in processing to make fibers with different properties.

This section focuses on cellulose-based regenerated fibers. Protein-based regenerated fibers, for example *azlon*, are not common. Milk, a protein, is being developed as a fiber, but "milk" fabrics are a long way off. The Federal Trade Commission (FTC) is currently (2026) considering approving "chitin" as a generic fiber—one source is crustacean (crabs, shrimp) shells.

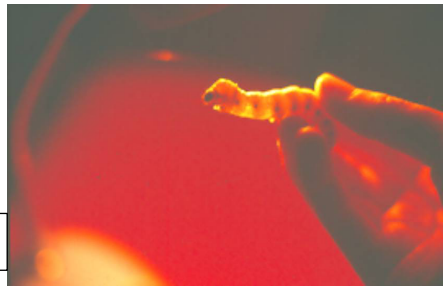
Most manufactured fibers (regenerated and synthetic) use the same 3-step process. It took a long time for scientists to figure out how to mimic mother nature to make fibers. As you read the three steps, think of the silkworm making silk fibers:

1. "Mix up" a solution or "dope" that is the basic material of the fiber.
2. Push the solution through a spinneret.
3. Solidify the streams of dope as they emerge from the spinneret.



Spinneret (looks like a shower head) with fiber solution being pushed through holes.

Silkworm



From K. LaBat photo collection

The advantage is that the extruded fibers can be long and continuous (long staple) or chopped into small lengths (short staple). Ability to control length means that fibers can mimic natural fibers like silk (long) and cotton (short).

Rayon

Rayon was the first regenerated fiber and is made from cellulose. It was introduced in 1924 with the first "rayons" called "artificial silk." Consumer confusion about performance resulted in government action to communicate and certify fiber differences. Wool labeling was already regulated with the Wool Products Labeling Act (WPLA) covered in the web section on wool. The United States *Federal Trade Commission* (*FTC*) introduced the *Textile Fiber Product Identification Act* (*TFPIA*). Other countries have similar regulations for fiber products. See the PDF on generic fibers and trade names for TFPIA basics. For TFPIA detailed information (current and historic) go to:

https://www.ecfr.gov/current/title-16/chapter-I/subchapter-C/part-303

Go to "Threading Your Way Through the Labeling Requirements Under the Textile Fiber Products Identification Act" for basics for businesses:

https://www.ftc.gov/business-guidance/resources/threading-your-way-through-labeling-requirements-under-textile-wool-acts

Rayon—cellulose source:

- *rayon* and *viscose rayon*
- *rayon from bamboo*—often labeled bamboo

Rayon typically is made from wood pulp. The *viscose rayon* process is the most common using toxic chemicals to dissolve the cellulose. When the "dope" is the desired "viscosity" it is forced through a spinneret into sulfuric acid—very caustic—which solidifies it. The United States no longer produces *viscose rayon*. However, viscose rayon fabrics are available in the United States. The fabrics are generally considered safe to wear, but some people have a dermatological reaction to trace chemicals.

Rayon from bamboo. Bamboo is a cellulose-based plant. The most prevalent bamboo process is like processing viscose rayon—using chemicals to break down the bamboo and then spinning the dope through a spinneret.

According to FTC, this type of "bamboo" must be labelled *rayon from bamboo*, but is often labelled "bamboo." It is typically made into soft, lightweight fabrics imitating lightweight cotton or silk fabrics. Bamboo can also be processed like flax (linen) with fabric hand and appearance similar to linen fabrics.

Rayon Properties:

Inexpensive: Rayon was initially developed to control fiber production and reduce costs. It is one of the least expensive fibers.

Easy to blend with other fibers: Rayon fibers may be blended with other fibers to incorporate different properties.

May be *solution dyed*: An advantage of manufactured fibers is that many substances, including dye, can be added to the dope. Solution-dyed fibers don't fade or discolor.

Dimensional instability (shrinkage): Rayon can shrink when washed and dried. Off-setting the lower cost of the rayon fiber is the need to "dry clean only."

Low wet strength: Rayon fabrics distort (often stiffen) and lose shape when submerged in water.

Low resilience: Rayon is not resilient resulting in fabrics that wrinkle easily.

Modified Cellulosics

Think of modified fibers as processes "modified" to overcome regenerated rayon's production and performance problems.

Modified cellulose:

- modal rayon
- lyocell
- acetate

PLA, and *triacetate* are also modified cellulosic generic fibers but are less common so I won't cover them in this short course.

Modal rayon is known as a "second-generation" rayon that improves on some of the properties of first generation (regenerated) rayons. In addition, the process is less toxic.

Properties:

Soft and lightweight: Often described as more silk-like compared to viscose rayon.

Moderately resilient: More resilient than viscose rayon with less tendency to wrinkle and lose shape.

Good absorbency and wicking: Produces comfortable fabrics often used in luxury underwear, sleepwear, and bedding.

Greater wet strength than rayon: Can be machine-washed with cold water and tumble dry low to moderate heat. Bleach can weaken the fiber.

Lyocell was developed to overcome some of the disadvantages of rayon. It uses a "closed-loop" method with solvents recovered and reused resulting in an eco-friendly process*. The first brand name was *Tencel*. You may see *Tencel* alone on a label, but TFPIA requires that the generic, lyocell must be listed also—*Tencel lyocell.*

Properties:

Absorbency and wickability: lyocell is naturally absorbent. Absorbency translates to comfort in hot and humid climates. Lyocell also promotes wicking—moving moisture along the length of the fiber. These two properties result in apparel that is less likely to build-up bacteria resulting in "stinky" fabric—good for underwear and athletic clothing.

Durability: lyocell has good tensile strength but can be damaged by high heat and abrasive manipulation—best to hand wash with mild soap. Minimize machine drying.

Lightweight and soft: Often used to substitute for lightweight and soft silk and cotton fabrics.

Blends with other fibers: Bends well with other fibers to adapt other fiber properties—like polyester for durability and less wrinkling.

Hygienic: Claims that lyocell is "hygienic" relates to the absorbency and wickability properties.

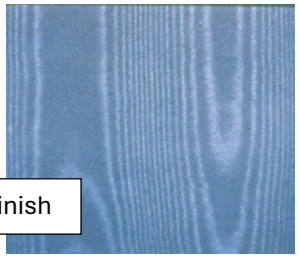
Biodegradable: As cellulose based, the fiber is biodegradable.

*Not all lyocell is "eco-friendly" which depends on the production process. It is difficult for consumers to sort out the differences. Lyocell fabrics are sustainable if using: 1) Responsibly sourced raw materials from sustainably managed forests (*Forest Stewardship Council* certification or similar). The sustainable sources eucalyptus and bamboo are the preferred raw materials. 2) Process uses non-toxic dyes and chemicals, and minimal water use.

Acetate

Acetate is cellulose based. It was the first "thermoplastic" fiber meaning it reacts to heat by becoming pliable. The property distinguishes acetate—with positive and negative fabric performance characteristics. A fabric made with thermoplastic fibers can be embossed with shapes or textures, pleats and creases can be heat-set in, etc. A typical fabric using this property is *acetate moire' taffeta fabric*. A disadvantage is that fabrics can be distorted (melted) with heat—caution with a hot iron!

Embossed "box" texture



Taffeta with heat-set moire' finish

Properties:

Round fiber cross-section: As the "melted" dope is extruded through a round spinneret hole, it holds its shape as it cools. Round cross-sections reflect light directly—fabrics are shiny. Acetate satin is a less-expensive alternative to silk satin.

Fairly low strength: Most products are occasional use, like formal dresses, so low strength is OK.

Low absorbency: Typically labelled "dry clean only."

Prone to "fume fading" unless *solution dyed*: Fume fading is a permanent color change due to exposure to natural gases in the air. Stored acetate garments may change color only in exposed areas, like shoulders on hanging garments. In solution dyeing, color (dye) is added to the dope (solution) before the fiber is extruded, locking in the color.