Topic: TEXTILES AND CLOTHING

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MAN-MADE FIBERS

These include viscose rayon, polyester and nylon.

Viscose Rayon

Viscose Rayon - The Versatile Fiber is the result of the work of Cross, Bevan and Beadle of England, who in 1892 made the first viscose solution.

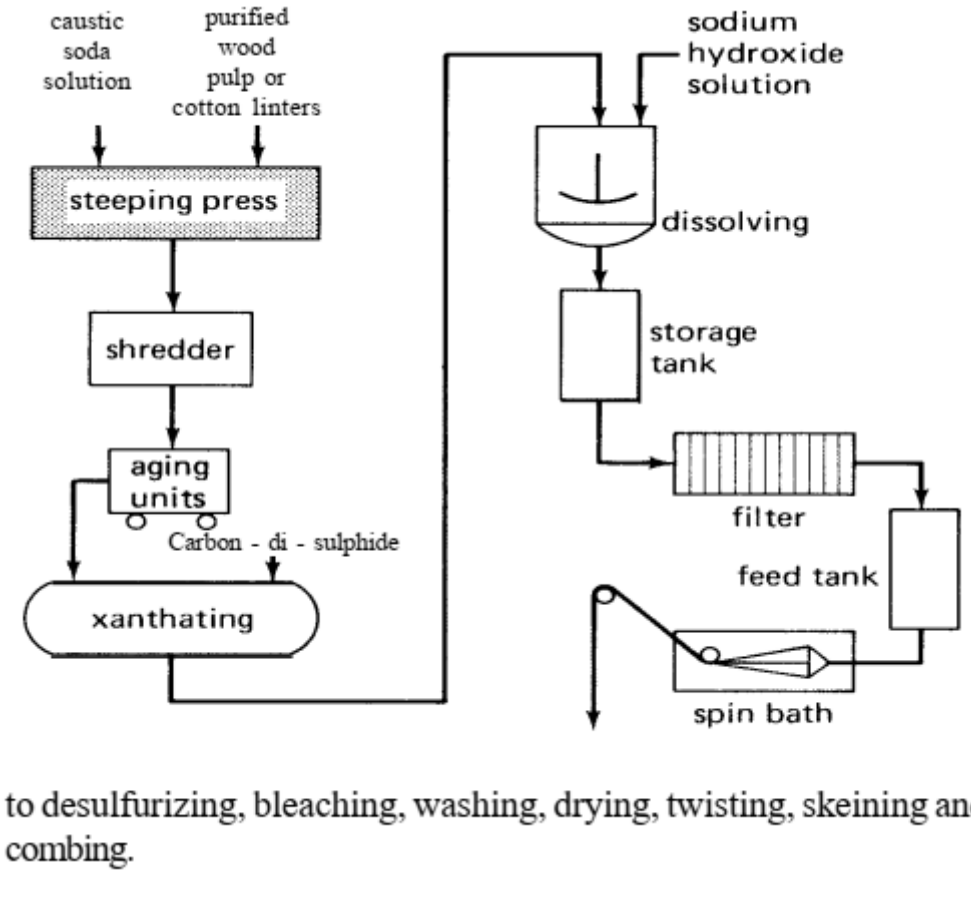


Fig. 1 -Flow Diagram Showing Processes in Viscose Rayon Manufacture

Manufacture

There are three main steps in making rayons. They are,

1. To obtain pure cellulose from the raw material.

2. To form a thick, thread - like liquid from the cellulose.

3. To spin the liquid into hardened filaments of regenerated cellulose.

For viscose, **spruce wood** or **cotton linters**, which yield the cellulose, are used as raw materials. They are treated with caustic soda and carbon bi sulphide to form a thick liquid.

Spinning: The liquid is forced through a spinneret into an acid bath to harden the long filaments, which are stretched and twisted to form the yarn. This is called **wet stretch spinning.** The stretching makes the fibers stronger and the acid and other chemicals in the bath cause the cellulose to re-form or to be regenerated.

Delustering : The filaments have metallic luster, if not treated. They are delustered by putting a white pigment in powder form into the spinning solution. Dyeing may be carried out after the yarn is spun or pigments may be added to the spinning solution.

Properties:
Microscopic Appearance

The longitudinal appearance of regular viscose rayon exhibits uniform diameter and interior parallel lines called striations. In cross section viscose fiber shows highly irregular or serrated edges. The presence of delusterants is indicated by spotted effect

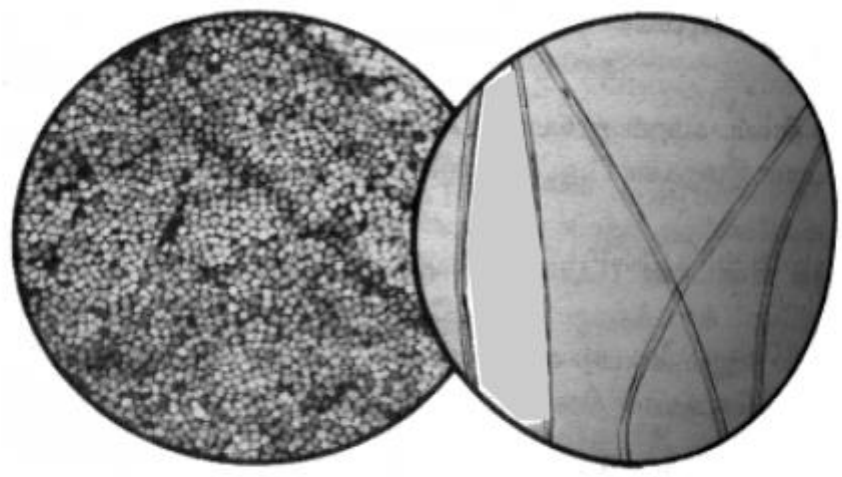


Fig. 2 - Microscopic Appearance of Viscose Rayon

Physical
1. Viscose rayon though resembles silk in appearance, its physical and chemical properties are quite different. However, some properties are like those of cotton.

2. Viscose is absorbent, a burn rapidly, is not elastic, it has low dry strength, much reduced strength when wet and greater stretch.

Thermal
1. Rayon fibers burn rapidly with a yellow flame and give a light grey residue.

2. Afterglow results after extinguishing the flame.

3. Very high temperatures disintegrate the fibers.

Chemical

1. Rayon fibers disintegrate in acids.

2. Strong alkali solution causes rayon to swell and produce a loss of strength.

Biological

1. Mildew and bacteria damage the fibers.

2. Silverfish also destroys rayon fibers.

Uses

Rayon fibers are used extensively in apparel and home furnishing fabrics. It is also used in automobile tyres and various industrial applications. Simple, complex and textured yarns can be made from rayon fibers.

Polyester

During the early stages of fundamental research for Du Pont was done by the Carothers team on polyester fibers. In 1941, J.R. Whinfield **and** J.T. Dickson of Calico Printers Association introduced a successful polyester fiber. Dacron polyester has become one of the most used of all synthesized fibers.

Manufacture

Polyester are the product of the reaction between a **dihydric alcohol** and **dicarboxylic acid**. Ethylene glycol and terephthalic acid polymerize by condensation reaction to form the polyester polymer. Dimethyl terephthalate is more frequently used than terephthalic acid because it is easily obtained in pure form. The resultant molten polymer is forced through spinneret and then cooled where it solidifies. It is later cut into small chips, dried and stored until needed for filament formation. The fibers can be used for weaving or knitting.

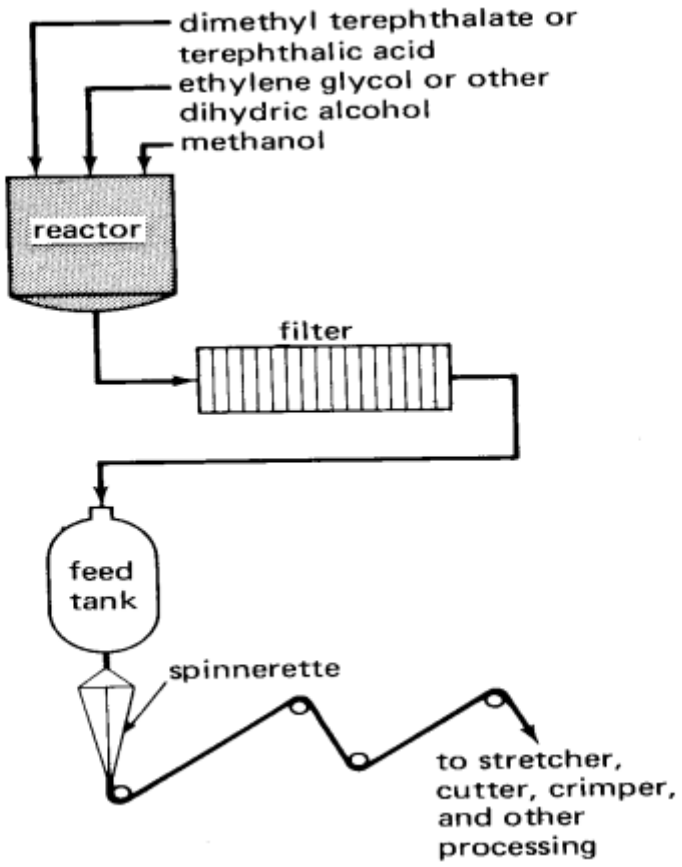


Fig. 3- Flow diagram Showing Processes in Polyester manufacture

Properties

Microscopic Appearance

The longitudinal view of polyester exhibits uniform diameter, smooth surface and a rod-like appearance. The cross-section of regular polyester is round

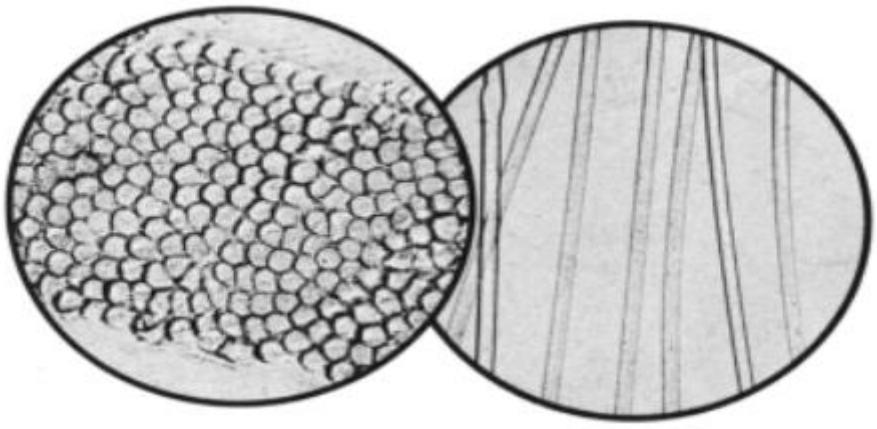


Fig. 4 - Microscopic appearance of polyester

Physical

1. Polyester is transparent and white or off - white in colour. The fiber strength varies due to differences in the formulation of the polymer.

2. There is no loss of strength when the fiber is wet.

3. Polyester has good elasticity, resilience and wrinkle resistance.

4. The fibers are heat-set to prevent shrink and stretch during use.

5. Polyester like cotton and linen has high degree of wick-ability. This wicking property carries exterior moisture through to the inside, or body perspiration through to the outside.

Thermal

1. Polyester will burn and produce a dark smoke and an aromatic odour

2. It forms a grey coloured bead.

3. Heat setting is essential if polyester fabrics are to possess the easy-care, wrinkle free properties.

Chemical

1. Polyester has good resistance to weak than strong alkalis.

2. It is not affected by acids, but prolonged exposure to strong acids at high temperature may destroy the fiber.

3. It is resistant to organic solvents.

4. Polyester exhibits good resistance to sunlight when behind glass, but prolonged exposure to sunlight weakens the fiber.

Biological

1. Beetles and other insects cut their way through the fabric.

2. Microorganisms will attack fabrics that have been applied with finishes.

Uses

Polyester fibers have immediate consumer acceptance because of their easy-care and wrinkle-free properties. They require no-ironing, easy to launder and quick to dry. Polyesters are not only used as apparel but also in industrial use items such as laundry bags, calendar sheeting, press covers, conveyor belts, fire hoses, fish netting, ropes and protective clothing. An important use of polyester is for surgical implants.

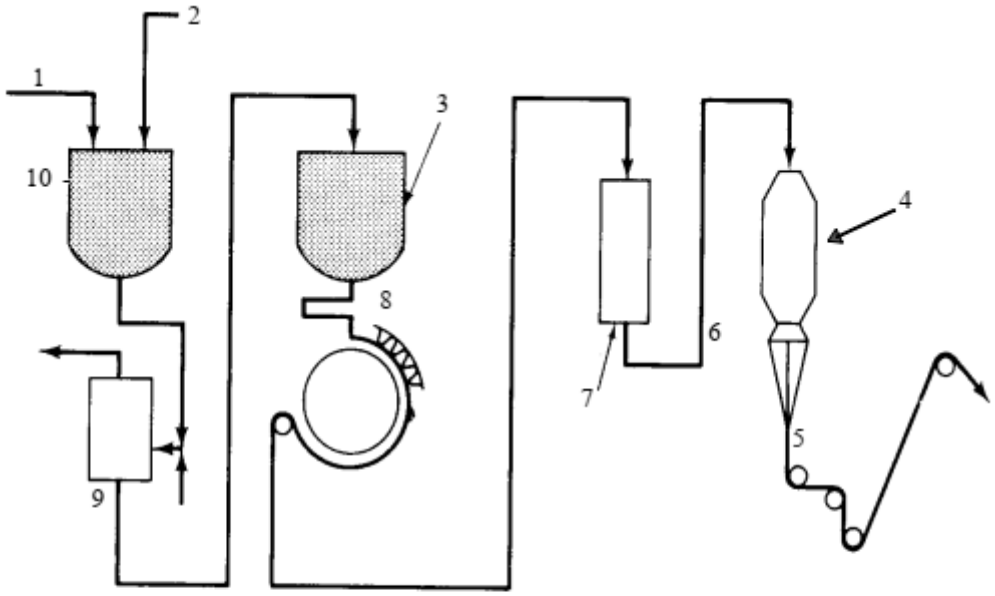
Nylon

Nylon is a man-made fiber developed by Du-Pont company in 1927-29. It was discovered that when a glass rod came in contact with some viscous material in a beaker was pulled away slowly, the substance adhered to the rod and a fine filament was formed which hardened when exposed to cool air. It had excellent stretch ability producing a flexible and strong fiber.

Manufacture:

Nylon 6,6 means it has six carbon atoms per individual molecule. Nylon is made by **linear condensation polymerization** process of the two chemicals, **hexamethylene diamine** and **adipic acid.** After polymerization it is extruded in a ribbon form and chipped into small

flakes or pellets. The polymer is melted and extruded through a spinnerette into cool air. Thus, the nylon filaments are formed which are stretched to give strength and fineness.



1. Adipic acid
2. Hexamethylene diamine
3. Autoclave
4. Pressure chamber
5. Spinneret
6. Air
7. Chipper
8. Water
9. Water
10. Reactor

Fig. 5 - Flow diagram showing process in nylon manufacture

Properties

Microscopic Appearance

Longitudinal appearance of nylon are transparent fibers of uniform diameter. Cross-sectional view of nylon fibers is perfectly round.

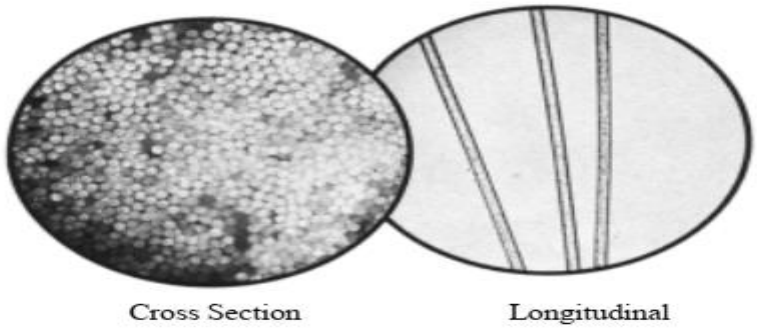


Fig. 6. Microscopic appearance of nylon

Physical

1. Nylon is transparent and can be made bright or dull.

2. It is the strongest of man-made fibers.

3. It has good elasticity, good recovery from creasing and wrinkling.

4. It has low moisture absorbency and resistance to perspiration.

Thermal

1. Nylon melts away from flame and forms a gummy grey residue that hardens as it cools.

2. Nylon is heat set but very high temperatures discolour the fabric.

Chemical

1. Nylon is unaffected by alkalis.

2. Acids disintegrate nylon fibers.

3. Except phenol all other solvents are harmless.

4. Prolonged exposure to sunlight has a destructive effect on nylon and weakens the fabric.

Biological

1. Ants, crickets, and cockroaches will eat nylon fabrics if trapped increases or folds.

2. Mildew has no effect on the fiber.

Uses

Nylon is widely used for apparel, home furnishing and industry. It is a leading fiber in the manufacture of hosiery and lingerie for it wears well, has good elastic recovery, dimensional stability, shape retention and abrasion resistance. It is also used as carpeting materials and upholstery fabrics. To weave or knit a fabric, it is necessary to have yarns. Thus now we move on to the manufacture of yarns from these fibres.