

# FUNDAMENTALS OF TEXTILES

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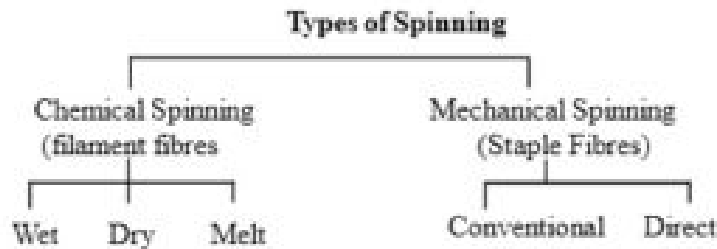
## UNIT 2: YARNS

### 🚧 Basic principles of yarn making:

Spinning and its classification on different fiber types depends on some parameter of fiber kind. **Spinning** is the process of drawing out and twisting of a group or bundles of fibres into a continuous thread or yarn of sufficient strength to be woven or knitted into fabrics.

### Spinning process and its classification

1. Chemical spinning – filament fibres
2. Mechanical spinning – for the short staple fibres

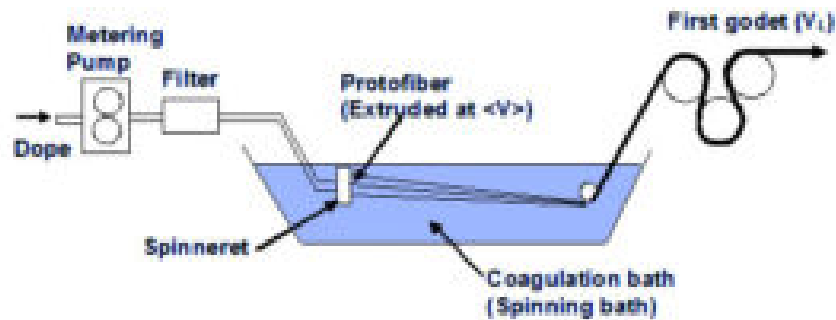


### Types of spinning

#### 1. Chemical spinning

Chemical spinning operations are generally used to make man-made filament fibers to yarns. A viscous solution is extruded through a nozzle like die called a spinneret. Man-made fibers are made into yarns by chemical spinning. There are three types of chemical spinning. They are:

- **Wet spinning:**



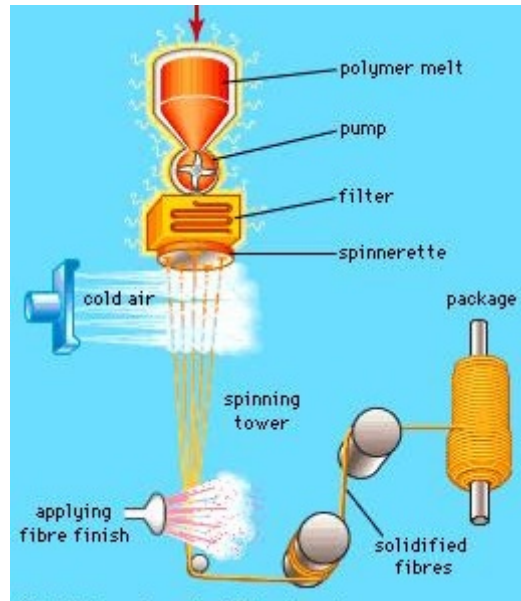
Wet spinning method is

formed for manufacturing polymer blend into a yarn or thread. This is one manmade fiber manufacturing system. From fiber to yarn it is very carefully done.

The first commercial method for manufacture of manmade fibre is wet spinning of cellulosic fibre-rayon. This process involves the use of appropriate liquid solution which is pumped through small nozzle called spinneret, into a chemical bath that coagulates the extruded solution of endless strands of filaments. These coagulated continuous fibers are drawn out of bath, purified by washing, dried and then wound onto spools. The construction of spinneret decides if it is a monofilament, if one hole, Multifilament if many holes are present in the spinneret. The amount of twist given to the processed yarn will affect texture and strength.

- **Dry spinning**

Here is a short description of Dry spinning method of yarn manufacturing process.



This process involves use of fiber liquid solution which pumping through spinneret into an air chamber. The air reacts with extruded streams, of liquid fiber causing them to solidify. These coagulated fibers drain out of chamber, twisted, or processed then wound onto spools. Eg. Acetate

There are other ways of dry spinning method. But this is the universal method of dry spinning. This is a conventional method of spinning. Now a days modern manufacturing process are following. Dry spinning is used for polymers that have got to be dissolved in solvent. It differs in this the curing is achieved through evaporation of the solvent. This is often typically achieved by a stream of air or chemical element as a result of there's no causative liquid concerned, the fiber ought not to be dried, and also the solvent is additional simply recovered. Acetate, triacetate, acrylic, modacrylic, polybenzimidazole fiber, spandex, and vinyon square measure created via this method.

- **Melt spinning**

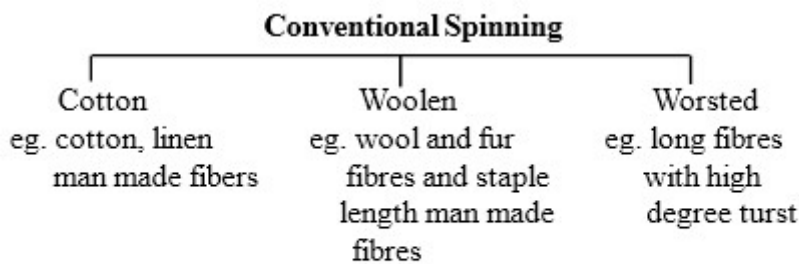
In this process, the thermo plastic fibre forming polymer of the fibre forming material is melted and then extruded through a spinneret. The molten fibrous material is cooled and solidified fibres are then collected on a take-up wheel. The fibres are stretched in the molten and solid states, which assists the orientation of the polymer chains along the fibre axis. Meltspun fibres can be extruded through a

spinneret in different cross-sectional shapes, including circular, trilobal, pentagonal and octagonal as per the orifice design of the spinneret. The cross sectional or the physiological features of the fibres are responsible for some characteristic physical properties of the fibres. For example, trilobal-shaped fibres are capable of reflecting more light, which gives a lustre to the fabrics. Pentagonal-shaped and hollow fibres are soil and dirt resistant and are used in making carpets and rugs. Octagonal-shaped fibres offer glitterfree effects, while hollow fibres trap air, creating better insulation. The most popular fibre forming polymers such as polyethylene terephthalate and nylon 6-6 are melt-spun in high volumes. Nylon fibre, olefin fibre, polyester fibre, saran fibre, and so on are some of the thermoplastic synthetic fibres manufactured through melt spinning.

## 2. Mechanical Spinning

Mechanical spinning refers to a multistep procedure in which machines physically manipulate and spin fibres into yarns. There are two types of mechanical spinning. They are-

- Conventional spinning.



Basically conventional spinning involves sorting and blending, formation of web for ease of handling, alignment of fibers, stretching of fiber bundles and actual spinning of fibres into yarns.

### Conventional spinning method of yarn manufacturing

- Sorting and Blending
- Picking
- Carding

- Drawing
- Roving
- Spinning

## **Sorting and Blending**

The first step in conventional spinning of staple fibers is sorting and blending. Bales of fibres are loosened and fluffed. Impurities such as dirt and leaves are removed and fibers are blended to product specifications.

## **Picking**

It is the second step in conventional spinning. The fibers are formed into web like sheets for ease of handling. These fiber webs are called laps. The forming of staple fibers into laps is called picking.

## **Carding**

The fiber web is fed into a carding machine, which straightens the fibers and partially arranges them into parallel rows. The aligned fiber web is then formed into a long, untwisted rope called a sliver . The process of separating and aligning the fibers is called carding.

## **Combing**

When only long, smooth staple fibers are desired the short fibers are removed from the slivers in a combing machine. Removal of short fibers and alignment of the remaining long fibers into parallel rows is called combing.

As only long fibers are used, combing increases luster and strength. Thus a fabric composed of yarns than that has been combed will be more expensive than a fabric composed of yarns that have only been carded.

## **Drawing**

The drawing process uses four sets of rollers, each set rotating at faster rate of the previous set several slivers are combined and pulled into one long, then slivers. If

further blending is desired, slivers of different fibers may be combined in the drawing process.

## **Roving**

In roving the drawn slivers are pulled to approximately one fourth of their original diameter and slight twist is added. Hence roving is process that reduces the slivers to a size suitable for spinning.

## **Spinning**

There are three systems of conventional spinning

- 1. Cotton:** The spinning of the cotton yarn is the initial stage of textile product processing. The process of producing yarns from the extracted fibres is called spinning. In this process:
  - The strands of cotton fibres are twisted together to form yarn.
  - The yarn is placed on the rings of the spinning frame and is allowed to pass through several sets of rollers, which are rotating at a successively higher speed.
  - The yarn is rolled by the rollers and wound up on the desired bobbins.
  - This the final stage of spinning the cotton yarn, in which drafting, twisting and winding of the yarn are all completed in one operation.
  - The bobbins filled with yarn are then removed from ring frames and used for processing for bleaching, weaving, etc.
- 2. Woolen:** In terms of yarn count (Nm), coarser counts are generally produced on the woollen system in comparison to worsted spinning.

In woollen spinning there are two types of spinning methods used; these include ring spinning which is similar to what's used to produce worsted yarns, and mule spinning which is unique to the woollen spinning industry.

Generally, blends of coarse micron wool, such as 29 micron Shetland, are ring spun, whilst finer blends (21 micron and finer Lambswool blends) tend to be spun on a mule.

During ring spinning the woollen roving continuously enters the drafting zone on the spinning machine. It is slightly drafted in the region of 20% to 30%, before

entering the twisting zone where a predetermined amount of twist is inserted to produce a singles (1xply) yarn.

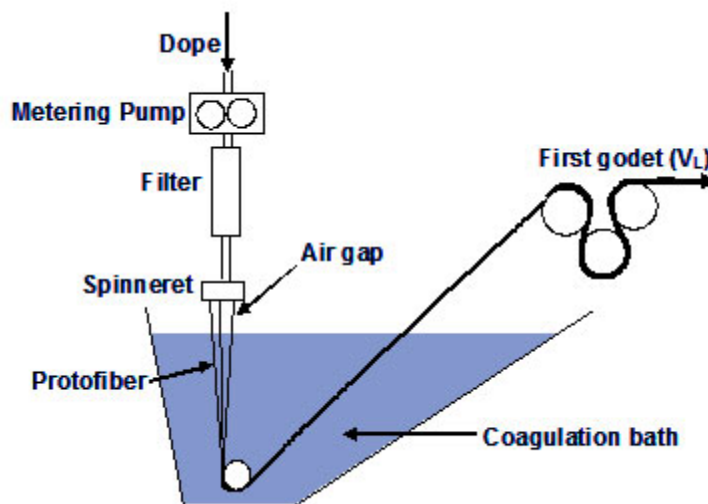
Mule spinning is somewhat different whereby the yarn is formed by a number of intermittent actions, rather than been formed continually.

- 3. Worsted:** During worsted spinning the roving is first drafted, in the drafting zone on the spinning machine, before entering the twisting zone where a predetermined amount of twist is inserted to produce a singles (1xply) yarn.

The yarn is then wound on a winding machine which is fitted with a clearing device, detecting and removing any faults such as thick and thin places, neps and slubs. After twisting, the yarn is then re-wound onto suitable packages either for knitting or for weaving. Wax is applied during the final winding of yarns destined for the knitting industry in order to reduce and even out the yarns' frictional properties, enabling trouble-free knitting.

Longer wool fibres are used in the production of worsted-spun wool yarns for weaving to produce a yarn which is very strong to withstand the rigors of weaving, and also to produce very smooth woven fabrics. Whereas for knitting yarns, shorter fibres are produced to produce more bulky yarns - the more wool fibre ends per unit length of yarn, the more bulky the yarn will be. Too short a fibre length can lead to poor performance of the final product such as pilling in knitwear.

- **Direct spinning**



Direct spinning method of yarn manufacturing process is one of the most used manufacturing processes of yarn. It is used to produce staple yarns/spun yarn from man-made filament fibers. It is less expensive. In the direct spinning, web like structures of filament fibers are stretched and broken at intervals producing long staple fibers. The staple fibers are then drawn into slivers. The remaining spinning process is done by the following steps.

Filament fibres stretched

Breaking > Drawing > Roving > Spinning

Conventional spinning is used to make yarns from natural staple fibres and some man-made fibers. It involves series of machine operations. Direct spinning is used to produce staple yarns from filament fibers.