Subject: Fabric Studies

Unit 1 - Introduction to textile materials

Quadrant 1 – e-Text

Learning Objectives

The learning objectives of this unit are:

- Define basic textile materials such as fibres, yarns and fabrics.
- State the applications of textile materials.
- Classify the major types of textile fibres.
- Recognise various textile fibres.
- Match the textile fibres with their suitable end uses.
- List the different types of yarns.
- Describe the various types of yarns.
- Choose the yarn type for a given end use.
- State the popular methods of making fabrics.
- Recognise dyed and printed fabrics.

1.1 INTRODUCTION

The term ‘Textile’ is originally a Latin word meaning ‘woven’. Presently it is applied to all kinds of textile fibres, yarns and fabrics. Clothing is one of the essential needs of mankind. The clothes we wear become the major application of textiles. Textile materials find application in almost all walks of life we come across from morning till we go to bed. We find them in the tooth brush bristles, the carpet we step on, the sofa we sit, the dress we wear and the bed we sleep. Modern 21st century textiles are not restricted to apparel and home furnishing, but finds huge presence in high end applications like firefighting suits, sutures, conveyor belts etc.

Fiber is the smallest unit of a fabric. There are varieties of textile fibres derived from various natural and man-made sources. These fibres are spun into continuous strands called as yarns, by imparting twist. Yarns are usually converted into fabrics, either by weaving or knitting. Yarns may also be plied and used for certain applications as in sewing and embroidery threads. Weaving involves interlacing of yarns, whereas, knitting involves interlooping of threads. The process of weaving fabric from threads has a rich history dating back to the Vedic era. Most of the fabrics used in clothing or home furnishing are either woven or knitted.

1.2 MAJOR APPLICATIONS OF TEXTILE MATERIALS

1. Apparel: refers to textiles used in dress materials
   E.g. blouses, trousers, shirts, saris, scarves etc.
2. Home furnishing: refers to textiles used in home interiors
   E.g. sofas, cushion covers, curtains, carpets etc.
3. Industrial textiles refer to textiles used in end uses other than apparel or home interiors like civil engineering, medical products, automobiles etc.
   E.g. bandages, filters, ropes, luggage, parachutes etc.

1.3. FIBRES

Fibres are short flexible substances having high length to width ratio. They are fine, hair like substances which form the building block of any textile material. Textile fibres must possess certain physical and chemical features to enable further manufacturing processes to become a useful product. They must be readily available and economical.
Textile fibres may be broadly classified as shown below:

**Natural Fibres**

These are fibres derived from natural sources like plants or animals.
Plant fibres

Plant fibres may be obtained from *stem, leaf, seed* or *husk* part of the plant. They are also called as cellulosic fibres. All plant fibres have good water absorbency. Hence, they are preferred for making products that require hydrophilic characteristics like diapers, towels etc. They are also good conductor of heat hence, found to be ideal for summer wear. Most of the plant fibres have low resiliency hence, the fabrics made out of them wrinkle badly. Natural fibres except Silk are usually available in the form of short fibres in the range of few inches.

Classification of fibres:

Fibres obtained from stem part of the plant are known as bast fibres. Examples: Flax, hemp, jute, ramie. Examples of leaf fibres are Manila, Sisal and Pina.

Cotton is the most popular seed fibre.

Coir is derived from the husk of a Coconut.

Animal fibres

Based on their chemical composition, they are also called as protein fibres. Major animal fibres are Wool and silk. The hair is sheared from Sheep and Silk is obtained from Silkworm. Animal hair fibres are usually preferred for winter wear, because of their excellent heat retention property. Wool has good drape, resiliency, texture and hand, thus making it as popular suiting fabric. Some of the special animal hair fibres sheared from various animals across the globe are Alpaca, Angora, Camel, Cashmere, Llama, Mohair, and Vicuna. They are generally used for luxury products owing to their unique properties like softness, lustre and fineness. Fibres of indefinite length are called as filaments. Silk is the only natural filament.
Man-made fibres

Man-made fibres are manufactured either from chemicals or from natural sources. In the early 19th century with increasing demand for textile fibres, they began to be manufactured mostly with the objective of imitating silk. Early manufactured fibres like Viscose, Nylon, and Acetate produced silk like fabrics.

The man-made fibres manufactured from natural cellulose or proteins are called as regenerated fibres. Examples of regenerated fibres are Viscose Rayon, Acetate Rayon, Lyocell, Polynosic Rayon etc.

The properties of these fibres have major relation to its raw material of production. For example, Viscose Rayon being cellulosic and made from wood pulp has properties similar to Cotton.

Man-made fibres like Nylon and Polyester are produced from petroleum products. Polymers are melted and extruded through tiny holes of a shower like device called as spinneret, producing long strands of fibres. Man-made fibres are usually manufactured in the form of filaments. The properties of man-made fibres may be manipulated depending on the raw materials, spinning method, condition and finishes etc. Some of the most commonly used man-made fibres are Polyester, Nylon, Acrylic, Acetate, Spandex etc. These fibres shrink and melt at higher temperatures. They are found to have high strength and elasticity thus, making durable fabrics. Most of the synthetic fibres possess poor water absorbency.
Influence of major fiber properties on fabric performance and appearance:

1. Strong fibres like Polyester produce strong fabrics with good resistance to rubbing.
2. Absorbency of fibres decides the absorbency, comfort, warmth, static charge buildup of fabrics. Those fibres, which absorb water, are hydrophilic fibres and those which do not absorb water are called hydrophobic fibres. Most of the synthetic fibres are hydrophobic in nature.
3. Fibres with good elasticity produce fabrics with good fit and appearance.
4. Heat conductivity of fibres affects the comfort and warming effect of fabrics. Wool is a poor conductor of heat so they possess insulating characteristics.
5. Fabric luster depends on the fibre texture and luster.
6. Resilient fibres like wool contribute to high wrinkle recovery. Thus, fabric made of wool does not wrinkle.

1.4. YARNS

The process of conversion of fibres into continuous strands of yarn is called Spinning. The fibres are opened, cleaned aligned and twisted to produce a yarn. The properties of yarn play a major role in fabric durability, hand, feel and look.

Classification of yarns based on fibre length:

Yarns are classified according to their fibre length.

Spun Yarns
Yarns made of twisting short fibres are called Spun yarns. Spun yarns usually have a rough fuzzy surface with protruding fibres. Fabrics made of spun yarns are prone to pilling and soil quickly. Generally, spun yarns are given varied twist levels which in turn produce interesting fabric surface textures. Fabrics made of low twist yarns are soft, fluffy and absorbent hence, they are used for making blankets, towels, infant wear etc. Fabrics comprised of high twist yarns like Crepe have good drape and pebble like surface texture.

Filament Yarns

Filament yarns are made by twisting fibres of indefinite length. They produce smooth and lustrous fabrics. As fibre strength is utilized effectively they are stronger than spun yarns. They may be monofilament yarns or multifilament yarns. Monofilament yarns are made of single filament with no twist. Multifilament yarns are made of two or more filaments with slight twist.

Plied Yarns
When two or more single yarns are combined by twisting, they are called plied yarns. Plying of yarns increases the yarn quality like strength, uniformity etc. Plied yarns are widely used in knitting, sewing threads and furnishing fabrics.

**Textured yarns**

Yarns made of synthetic fibres are given moisture, heat or chemical treatment to impart new yarn properties especially, bulk and stretch. Textured yarns have greater cover, breathability, insulation, softer and drier hand. But, they are prone to soil, and have poor abrasion resistance. These yarns are extensively used in blouses, stretch hosiery etc.

**Stretch Yarns**
Yarns that have the capability of stretching are called stretch yarns. It is generally made of the elastomeric fibre Spandex. They stretch to an extent of 300 – 500% of their original length. They may be used either to increase comfort in the garment or used in garments where holding power is required. Major applications of stretch yarns include swimwear, active sportswear, gym clothing, bandages etc.

**High Bulk Yarns**

They are made of specially processed acrylic fibres which has exceptional bulk, loft and softness without stretch. Fabrics made of high bulk yarns are soft and luxurious. They are used for making high bulk sweaters, knitting yarns etc.

**Fancy yarns**
They are yarns with interesting surface textures and are generally used for decorative purposes. These are yarns are manufactured with certain irregularities like thick places, knots, curls, bumps etc. Typical fancy yarns are tweed yarn, slub yarn, spiral yarn, boucle yarn, chenille yarn, metallic yarn etc.

**Tweed yarns** are spun yarns which have short coloured fibres twisted into it creating heather like effect in the threads.

**Slub yarns** have short untwisted portion at regular intervals having thick and thin places. They are found in drapery and upholstery fabrics.

**Spiral or corkscrew yarn** has two or more plies which may differ in twist, size, type and colour.

**Boucle or loop yarn** has loops protruding from the yarn surface at regular intervals. Fabrics made of boucle yarn create a looped pile effect.

**Chenille yarn** has soft protruding fibre fringes on the yarn surface. They are used in furnishings and apparel, giving an imitation fur effect.

**Metallic Yarns**

The use of metallic yarns in fabrics has been an age old practice. Gold and Silver yarns have been used as metallic yarns in fabrics since ancient times. These yarns have been replaced by aluminium or aluminized plastic yarns in apparel and home furnishing fabrics. Presently, Ultrafine Nylon or Polyester films are being used as metallic yarns and they are found to offer comfort with good luster.
Blended yarns

Yarns made of two or more varieties of fibers are called blended yarns. Different varieties of fibres are combined to optimize various fibre properties. It may be done to get better combination of performance characteristics as in Polyester Cotton blend, where comfort property of cotton is exploited along with durability of Polyester.

Blending may be done to improve uniformity of the yarns or for better texture, hand or fabric appearance. To quote an example, if a little amount of Rayon is mixed with Cotton it gives better luster and softness.

It may also be done to minimize fibre cost.
For example: Acrylic is blended with Wool to minimize the cost.

1.5 Fabrics
Fabric is a flexible textile structure usually made of threads. Clothing fabric of ancient man dating back to thousands of years was made directly from fibres. Primitive methods of making fabric involve applying heat, moisture and physical force to animal fibres. These processes interlock the fibres and make a fabric. Fabrics may be made either by weaving or knitting. The process of making fabric by interlacing two sets of threads is known as weaving and the process of making fabric by interlooping of threads is known as knitting.

The horizontal row of threads are called weft or picks.
The vertical row of threads are called warp or ends.

Horizontal row of loops in a knitted fabric are called as wales.
Vertical row of loops in a knitted fabric are called as courses.

Woven fabrics are flat, rigid and compact. They are produced with different textures, depending on the order of interlacement of threads. Knitted fabrics are stretchable, as the yarn loops offer movement. Knitted fabrics are more comfortable than woven fabrics, because of its ability to stretch. They are bulkier than woven fabrics hence, ideal for insulation and warmth.

Woven or knitted fabrics since olden days have been produced with interesting colours for various applications. Colour is an important marketing attribute of textile material. Colours are usually applied to textile materials, either by dyeing or printing with the help of dyes or pigments. Dyeing is the application of colour on the whole fabric. Printing is application of colour only at certain places creating surface designs on the fabric.

A dyed fabric.
A printed fabric.

There are also varieties of treatments given to fabrics to enhance their physical and functional properties. They are called as fabric finishes. They may be done to impart softness, stiffness or certain characteristics like water repellency, fire retardancy etc.

Understanding the basic components of a textile fabric is important to learn the durability, hand, feel and look of the end product. The manufacturing and finishing of a textile product is a complicated process and hence, requires long term planning.

1.6 Conclusion

To summarize, in this unit, you were introduced to textile materials and fabrics in general, and learnt about the major applications of textile materials.
You were also given an introduction to natural and man-made fibres and learnt about the influence of major fibre properties on the performance and appearance of fabrics.
The section on yarns explained how yarns are produced and classified.
As explained earlier, most fabrics used in clothing or home furnishing are either woven or knitted. Understanding the features of various fabrics is critical to its correct application.