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Fibres and Fabrics

16.1 Materials for Clothing and Textiles

Clothes and textiles can be made from different materials. Most of them are made from fabrics which are composed by a variety of fibres.

16.1.1 Textile Fibre Classification

Generally, types of fibres are classified based on their sources. There are three main groups of fibres. They are namely natural, regenerated and man-made fibre.
16.1.2 Natural Fibres

(a) Plants

(i) Cotton

Cotton fibres are seeds hair. Very fine fibre, flattened tube like thread. Sea-Island cotton is the longest cotton fibre and Asian cotton is the shortest.

<table>
<thead>
<tr>
<th>Fibre identification - burning test</th>
<th>burns quickly with afterglow</th>
</tr>
</thead>
<tbody>
<tr>
<td>Properties</td>
<td>strong and durable</td>
</tr>
<tr>
<td></td>
<td>poor elasticity and creases easily</td>
</tr>
<tr>
<td></td>
<td>can be damaged by strong acids</td>
</tr>
<tr>
<td>Clothing comfort</td>
<td>cool to wear</td>
</tr>
<tr>
<td></td>
<td>good moisture absorption</td>
</tr>
<tr>
<td></td>
<td>dries slowly</td>
</tr>
<tr>
<td>After care</td>
<td>can be boiled and ironed at high temperature</td>
</tr>
<tr>
<td></td>
<td>may shrink</td>
</tr>
<tr>
<td>Typical fabric</td>
<td>calico, corduroy, denim, gingham, drill, terry toweling</td>
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</table>

(ii) Flax / Linen

Fibres are extracted from the stalks. Coarse fibre bundle, cylindrical shape with nodes / joints.

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<thead>
<tr>
<th>Fibre identification - burning test</th>
<th>burns quickly with afterglow</th>
</tr>
</thead>
<tbody>
<tr>
<td>Properties</td>
<td>very strong fibre and durable, even stronger when wet</td>
</tr>
<tr>
<td></td>
<td>brittle and poor in flexibility</td>
</tr>
<tr>
<td></td>
<td>creases badly</td>
</tr>
<tr>
<td></td>
<td>can be damaged by strong acids</td>
</tr>
<tr>
<td>Clothing comfort</td>
<td>cool to wear</td>
</tr>
<tr>
<td></td>
<td>absorbs water quickly and fast drying</td>
</tr>
<tr>
<td>After care</td>
<td>can be boiled and ironed at high temperature</td>
</tr>
<tr>
<td></td>
<td>may shrink</td>
</tr>
</tbody>
</table>
(b) Animals

(i) Wool

Wool is a kind of animal fibre taken from fleece of sheep and goats. Wool fibre is light, ranges from fine to coarse, surface with overlapping scales and crimps. The finest and softest wool comes from Merino sheep.

| Fibre identification - burning test | - small and sputtering flame, self-extinguishing  
- smell like burning hair  
- black residue with friable cinder |
|-----------------|--------------------------------------------------|
| Properties      | - medium strength and not very durable  
- excellent resilience  
- felting occurred when affected by heat and moisture  
- weakened by alkalis and damaged by chlorine bleach |
| Clothing comfort| - warm to wear  
- good moisture absorption  
- water repellent |
| After care       | - will shrink and felt  
- cannot be bleached by chlorine bleach  
- iron at moderate temperature  
- do not tumble dry or dry in direct sunlight |
| Typical fabric   | - felt, tweed, gabardine  
- Woolmark, Woolmark Blend, Wool Blend |

(ii) Hair

Hair fibres possess similar structure and properties as wool. The care of hair fibres is also very similar to that of wool. Hair fibres include camel hair, mohair, cashmere, alpaca, llama, vicuna and angora (rabbit hair).

(iii) Silk

Silk is obtained from cocoons of silkworm larvae. Silk is triangular in cross-section with round corners, smooth and rod like surface with some striations.

| Fibre identification - burning test | - small flame, slowly self-extinguishing  
- smell like burning hair or horn  
- black residue with friable cinder |
<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>Properties</td>
<td>- strong, durable, light and elastic</td>
</tr>
</tbody>
</table>
|                | - weakened when wet  
|                | - fairly crease-resistant  
|                | - damaged by alkaline and chloride bleach  
| Clothing comfort | - both cool and warm  
|                  | - good moisture absorption  
| After care     | - wash with gentle detergents with minimum  
|                |   agitation and cool rinse  
|                | - cannot be bleached by chlorine bleach  
|                | - do not tumble dry or dry in direct sunlight  
|                | - iron with dry iron at low temperature  
| Typical fabric | chiffon, crepe, satin, voile  

16.1.3 Regenerated Fibres

The basic principle of producing regenerated fibres is the dissolution of cellulose and the regeneration of fibres through fibre spinning. The process produces filament yarns which can be chopped into staple to imitate natural fibres. Recently, renewable resources such as bamboo are used for regenerated fibre production.

(a) Acetate

Acetate is made from cotton linters. Acetate is white fibre with longitudinal, striations and irregular cross-section.

| Fibre identification - burning test | - burns quickly and melts in a flame  
|                                     | - with an acidic smell  
|                                     | - with hard and black residue  
| Properties                        | - low strength, even weaker when wet  
|                                     | - poor elasticity  
|                                     | - creases and shrink easily  
|                                     | - melts at high temperature  
| Clothing comfort                  | - not very warm  
|                                     | - low moisture absorption  
|                                     | - fast drying  
| After care                         | - sensitive to dry heat  
|                                     | - do not bleach and tumble dry  
| Typical fabric                     | brocade, satin, taffeta  

(b) Viscose Rayon

Viscose rayon is made from wood pulp. Viscose rayon is white, lustrous fibre with irregular cross section.
16.1.4 Synthetic Fibres

Synthetic fibres refer to fibres obtained from petroleum. New fibres have evolved based on chemicals extracted from corn, sugar beet, soya bean, etc.

(a) Polyester
Polyester is white fibre with different cross sections - round, tri-and multilobal, oval and hollow.

(b) Nylon
Nylon is transparent and resembles a glass rod with round cross section.
| Properties                  | - very strong and durable  
|                            | - good elasticity and wrinkle resistant  
|                            | - melt at high temperature  
|                            | - affected by concentrated acids and sunlight  
| Clothing comfort           | - poor moisture absorption  
|                            | - windproof and water repellent  
| After care                 | - wash in cool water  
|                            | - do not bleach and tumble dry  
|                            | - iron at low temperature  
| Typical fabric             | Nylon 6, Nylon 6,6  

(c) Acrylic
Acrylic fibre is commonly used as wool substitute as its resilient resembles to that of wool but without felting and shrinkage tendency. Acrylic fibres crimp with striations and may be smooth or twisted surface.

| Fibre identification - burning test | - shrinks and burns with a sooty flame  
|                                     | - with melting, dripping and forms black beads  
|                                     | - pungent smell  
|                                     | - hard and unbreakable residue  
| Properties                         | - strong and durable when compare with cotton and wool  
|                                     | - moderate elasticity and wrinkle resistant  
|                                     | - melts at high temperature  
| Clothing comfort                   | - warm, insulating qualities similar to wool  
|                                     | - low absorbency  
|                                     | - fast drying  
|                                     | - prone to static  
| After care                          | - wash in cool water  
|                                     | - iron at low temperature  
| Typical fabric                     | Usually blended with other fibres, such as cotton, linen, viscose rayon, wool and silk  

16.1.5 Ways to Produce New Textile Materials

**Blending**
Blending is mix two or more fibres together. The advantage of fibre blending is that poor properties of one component can be compensated by good ones of the other component. For example, some natural fibres shrink and wrinkle after laundering. Blending with man-made fibres can reduce shrinkage and wrinkle of natural fibres.
16.2 Fabric Construction

Fabric is constructed from yarns. Yarns are threads which are made from smaller threads. Fabrics are readily made materials for the production of various kinds of textile products.

16.2.1 Types of Fabrics

Fabrics are constructed from yarns. Basically, there are two main types of fabrics, woven and knit fabric. They are produced completely differently and they certainly possess different properties.

(a) Woven Fabrics

Woven fabrics are made from interlacing two sets of yarns at a right angle. The process is called weaving. Yarns parallel to length are called warps. Yarns parallel to width are called wefts.
(b) Knit Fabrics

Knit fabrics are formed by interlocking yarn loops. The process is called knitting. The direction is called course. The direction parallel to length is called wale.
(c) Non-Woven Fabrics
The formation of non-woven fabrics is by compressing fibres together through:
- mechanical bonding
- glue
- heat fusion

16.2.2 Colouration

(a) Dyeing

(b) Printing
Flatbed screen printing

Rotary screen printing
16.2.3 Finishing

(a) Mechanical Finishing
   - raising
   - calendaring
   - embossing
   - fulling

(b) Chemical Finishing
   - water repellency
   - water proofing
   - stain resistance
   - antibacterial finishing
   - antistatic finishing
   - nanotechnology (e.g. stain proof finishing, antimicrobial finishing, odorless textile, fragrance release finishing, skin care finishing)