

UNIT-6

Plant fibres used as surgical dressings

Points to be covered in this topic

- INTRODUCTION
- PLANT FIBRES
 - ❖ Cotton
- ANIMAL FIBRES
 - ❖ Silk
 - ❖ Wool
- REGENERATED FIBRES
 - ❖ Rayon
- SUTURES
- LIGATURES
- SURGICAL DRESSINGS

6.1 INTRODUCTION

In pharmacognosy, fibres is defined as a material that is composed of thin and continuous strands obtained from natural sources. With reference to plants, these are elongated, most commonly sclerenchyma-supporting plant cells with thick cellulose walls and a well-organized structure known as plant fibres. In pharmacognosy, fiber is defined as a material that is composed of thin and continuous strands obtained from natural sources. With reference to plants, these are elongated, most commonly sclerenchyma-supporting plant cells with thick cellulose walls and a well-organized structure known as plant fibres. In medical practice, they are widely used in medical settings to create effective and comfortable dressing materials for wound care.

6.1.1 Fibres obtained from various sources fall into the following categories:

- 1. Plant fibres:** Jute, Flax, Banana, Cotton, Hemp
- 2. Animal fibres:** Silk, Wool
- 3. Regenerated and synthetic fibres:**
 - **Fibres regenerated from carbohydrate materials** - Artificial silk or rayon or re-generated cellulose.
 - **Fibres regenerated from protein materials** - Aridil (groundnut protein), Fibrolin (milk casein).
 - **Synthetic fibres** - Nylon, Terylene, Orlon.

6.2 PLANT FIBRES

6.2.1 Cotton

Synonyms: Raw cotton, Purified cotton, Absorbent cotton

Biological source

It consists of the **epidermal trichomes** or hairs of the seeds of various species of



Gossypium

Family: Malvaceae

Geographical source

- Cotton is cultivated in the U.S.A., India, Africa, the West Indies, and Egypt.
- In India, it is cultivated in Gujarat, Rajasthan, Maharashtra, Punjab, Andhra Pradesh, etc.

Morphological characteristics

CHARACTERISTIC	DESCRIPTION
Colour	Raw cotton (slightly brownish), purified cotton (White)
Odour	Odourless
Taste	Tasteless
Size	2.5 to 4.5 cm in length

Method of preparation

Cotton is a widely grown crop in tropical countries for its fibres. The plant, after flowering, bears fruits known as capsules (3-5-celled). Each capsule contains numerous seeds. The seeds covered with hairs are known as bolls. The bolls are collected, dried, and taken to the ginning press, where the trichomes are separated from the seeds. The short and long hairs are separated; short-length hairs 'linters' are used for the manufacture of absorbent cotton, and long hairs are used for the preparation of cloth.

Chemical constituents

Raw cotton consists of 91% cellulose, wax, oil, fat, and 7-8% moisture. Absorbent cotton consists of almost pure cellulose ($C_6H_{10}O_5$).

Chemical test

1. Moist with a N/50 iodine solution, and when nearly dry, add 80% sulfuric acid. A blue color is produced.
2. With cuoxam solution (ammonical copper oxide solution), raw cotton dissolves with the formation of balloons on the surface, leaving a few fragments of cuticle, whereas absorbent cotton dissolves with uniform swelling.
3. Cotton is insoluble in dilute sodium hydroxide solution and hydrochloric acid.



Absorbent cotton

Uses

It is used in surgical dressings to absorb body fluid, blood, and pus and prevent bacterial infection.

6.3 ANIMAL FIBRES

6.3.1 Silk

Biological source

These are the fibres made from the cocoons spun by the larvae of *Bombyx mori* which feed on **Mulberry leaves**.

Family: Bombycidae

Geographical source: Silk is manufactured in India, Japan, Italy, China, and France.

Morphological characteristics



Bombyx mori

CHARACTERISTIC	DESCRIPTION
Colour	Yellow
Odour	Odourless
Size	5 to 25 microns in diameter and about 1200 meters in length.

Method of preparation

The natural protein, or fibroin, is secreted from the salivary glands. The glands in the mouth of the silkworm larvae manufacture the silk fibroin fibres. This fibroin gets united and forms a cocoon. These cocoons are heated to 60–80 °C by exposing them to steam. Then cocoons are put into hot water to dissolve the gum and separate the fibres.

Chemical constituents

Raw silk mainly consists of 65% fibroin, 22% sericin, and 11% moisture. Fibroin hydrolyzes the amino acids glycine and alanine. Sericin can be removed by boiling in a soap solution, known as the degumming process.

Uses

It is commonly used for sieves, sutures, and ligatures due to its unique properties.

6.3.2 Wool

Synonyms: Animal wool, Sheep wool.

Biological source

Wool or wool fibres are obtained from the fleece of sheep *Ovis aries*.

Family: Bovidae

Geographical source: Wool is manufactured in India, Australia, Russia, the U.S.A., and Argentina.



Ovis aries

Morphological characteristics

CHARACTERISTIC	DESCRIPTION
Colour	Whitish-yellow
Odour	faint and characteristic
Taste	bland

Method of preparation

Shearing involves the removal of the sheep's hair. Wool is divided into five groups: bellies, crutchings, fleece, pieces, and locks. After that, a lot of grease and grime are removed. In order to remove the grease for processing, alkali and detergent are typically used for scouring. After treating the wool with hydrogen peroxide for bleaching, it is thoroughly cleaned, spread out on wire netting, and air dried.

Chemical constituents

It consists of a sulfur-containing protein, keratin. Keratin is rich in sulfur, containing amino acid cystine.

Chemical test

1. When wool fibres are treated with Millon's reagents (Mercury: Nitric Acid: HCl, 1:1:2), they give a brownish-red color due to the proteinous nature of the drug.
2. When lead acetate is added to the solution of wool in caustic soda, a black precipitate is formed due to the higher sulfur content.

Uses

Use as a filtering and straining medium and in the production of dressings such as crepe bandages.

6.4 REGENERATED FIBRES

Regenerated fibres are textile fibres made from the cellulosic parts of the plants by dissolving in chemicals.

6.4.1 Rayon

Synonyms: Viscose rayon, Regenerated cellulose

Source

It's an artificial fiber made of regenerated cellulose that has been treated with carbon disulfide after wood pulp cellulose has been dissolved in a sodium hydroxide solution.

Preparation of rayon

It is produced exclusively by the viscose process. The cellulose of coniferous wood in the form of pulp is processed to give viscose rayon. The pulp contains about 80-90% of cellulose and hemicellulose. The cellulose is treated with sodium hydroxide to get sodium cellulose. It is further treated with carbon disulfide and sodium hydroxide to produce a viscous solution of sodium cellulose xanthate.

After ripening, this solution is forced through the fine nozzles into the bath of sodium sulfate and sulfuric acid to form continuous filaments. The filaments are drawn together to form the yarn. The yarn is desulphurized, bleached, washed, twisted, and then dried.

Chemical constituents

It consists chiefly of cellulose, 0.03% of sulphur and 10% of moisture.

Uses

- It is mainly used for the preparation of gauze.
- Other surgical dressings and making fabrics.
- It is used in the production of disposable wipes, cotton swabs, and makeup-removing pads.



Cotton swabs

- It is also used as a filtration medium in various applications.

6.5 SUTURES

Sutures are sterile threads, used to hold together the edges of a wound or incision to promote healing.



Sutures

They are commonly used in surgeries.

Sutures may be of following types:

i. Absorbable

Suture will break down and **absorbed by the body over time.**

e.g.-

a. Surgical catgut

b. Sterile reconstituted collagen suture

ii. Non-absorbable

Suture will need to be removed manually after the wound has healed.

e.g.-

a. Sterile non-absorbable sutures (silk and cotton)

b. Sterile polyamide sutures (nylon)

c. Sterile polyester sutures (terylene)

d. Sterile braided sutures

e. Sterile stainless and silver sutures

iii. Haemostatics

A haemostat is a medical device or dressing used to control bleeding from blood vessels in the body.

e.g.-

a. Oxidised cellulose

b. Absorbable gelatin sponge

Uses

- Sutures are commonly used to close the incisions made during surgeries.
- Sutures play a vital role in various plastic and cosmetic surgeries.

6.5.1 Surgical catgut

Source

Catgut is a suture obtained from the **intestines of animals** such as sheep, *Ovis Aries* (Family Bovidae).

It is obtained from the sub-mucus connective tissues of the intestine. Catgut sutures are absorbable, meaning that they are broken down and eventually **absorbed by the body** over time. They are commonly used in various surgical procedures to close wounds or hold tissues together.

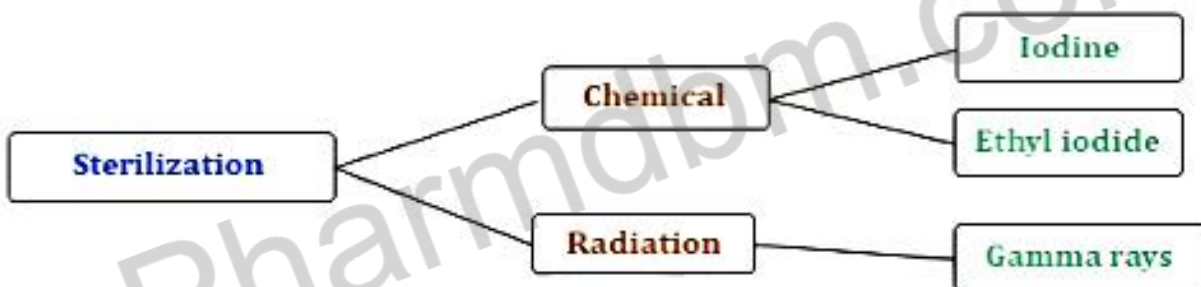


Catgut

Properties

- It has **high tensile strength** to hold together the sewed tissues.
- It has **good flexibility**.
- It is **degraded** by the body's **proteolytic enzymes**.
- It is used as **absorbable suture** for internal surgeries.

Sterilization of surgical catgut



Uses

It is used for all surgical procedures including general closure, Ophthalmic, Orthopedics, Obstetrics/Gynecology and Gastrointestinal surgery.

6.6 LIGATURES

Ligatures It is a sterile strand used to **stop bleeding** by tying the **blood vessels in a safe and successful operation**.

Uses according to types of ligatures

- **Silk ligatures** - Traditionally used in surgeries.
- **Gut ligatures** - Suitable for vessels that require temporary occlusion and do not need permanent ligation.
- **Wire ligatures** - Use where strong and non-absorbable ligation is required.

- **Synthetic ligatures** - Surgeries where long-term vessel ligation is necessary.

6.7 SURGICAL DRESSINGS

The word surgical dressing is used to include all the materials used, either alone or in combination, to cover the wound. A material that holds the dressing in the desired position is known as a bandage.

Surgical dressings are classified as

1. Fibres

e.g.- Absorbent cotton, wool, rayon, silk etc.

2. Fabric

e.g.- Gauzes, bandages and plasters are various forms of fabrics.

3. Bandages

e.g.- These are the products used to retain dressings in place to provide support for application of medicaments to the skin. They are water proof.

i. Non-medicated bandages

Crepe bandage, Domette bandage, Calico bandage, Cotton and rubber elastic.

ii. Medicated bandages

Plaster of Paris

4. Rubber or oil impregnated materials

Zinc oxide self-adhesive plaster etc.

Dressings are meant for following functions

- To reduce microbial contacts and protect against infections.
- To provide mechanical support and heal the tissue.