

7. Study of source, preparation and identification of fibres used in sutures and surgical dressings- cotton, silk, wool and regenerated fibre.

A loosely woven cotton dressing for incisions made during surgery, (Medical dressing) : A cloth covering for a wound or sore.

- i. Study of source, ii. Preparation and**
- iii. Identification of fibres used in sutures and surgical dressings cotton, silk, wool and regenerated fibre.**

SUTURES

Sutures are sterile threads, strings or strands specially prepared for use in surgery meant for sewing tissues together. Sutures must possess the following properties.

- (1) Sutures are sterile and cause no irritation.**
- (2) Sutures have finest possible gauge and adequate strength.**
- (3) If absorbable, their time of absorption must be known.**
- (4) Sutures are intended to be used for one occasion only.**

Sutures may be prepared from intestinal tissues and tendons of animals and birds; vegetable fibres; camel hair; human hair; synthetic threads or metallic wires. Depending upon their characteristic of absorption, i.e. digestion in tissues of body, sutures are known as absorbable or non-absorbable sutures.

Various methods are used to sterilize sutures. (to make them free of pathogenic micro-organisms). A few of important methods are chemical sterilization or sterilization by irradiation

Heat sterilization involves two processes and sutures are classified into two categories depending upon heat resistance,

(a) boilable (in anhydrous liquid) and (b) non-boilable.

sterilization should not affect properties of sutures or their utility.

In irradiation method, sterilization is carried out by electron particles or by gamma rays from cobalt 60. The recognized dose of gamma rays treatment is 2.5 megarad

Sutures may be of the following types

(1) Absorbable sutures

- (a) Sterile catgut (small intestine of sheep, ox and appendix of deer)
- (b) Sterile reconstituted collagen suture

(2) Non - absorbable sutures

- (a) Sterile non-absorbable sutures (silk and cotton)
- (b) Sterile linen suture
- (c) Sterile polyamide sutures (nylon)
- (d) Sterile polyester sutures (terylene)
- (e) Sterile braided sutures
- (f) Sterile stainless and silver sutures

(3) Haemostatics

- (i) Oxidised cellulose
- (ii) Absorbable gelatin sponge

USES: Depending on physical and chemical properties and also desired effect, various sutures are effectively used under different conditions. Silk sutures are strong, smooth and safe. It is also available in various diameters. Braided form is compact and has a special advantage of not getting twisted when drawn through body tissues. Nylon sutures are strong enough and enjoy merit of their utility in skin and plastic surgery. Cotton sutures due to their low order of tissue reactivity are preferred, but suffer from poor tensile strength. Linen, though very economical and quite effective, lacks in uniform diameter for practical specially purposes. Kangaroo tendons are used in hernia, while metallic sutures are used in surgery in general.

What are sutures? Give the method of preparation of surgical catgut.

Sutures are sterile threads or strands or fibre used for sewing or stitching together tissues like skin, muscles and tendon by using needle.

Surgical catgut method of preparation Prepared from collagen of healthy animals. The collagen is usually obtained from the sub mucus layer of small intestine of sheep. It should be cleaned and split longitudinally into ribbons. The inner most mucosal layer and outer muscular and serous layers are removed by scrapping. The ribbon contain only sub mucosal layer. One to five such ribbons are stretched under tension and dried. The dried ribbons are polished, cut into suitable sizes and sterilised. Smooth surface ribbons are selected for preparation of catgut. The ribbons are hardened by soaking in solution of chromium solution and dried.

SURGICAL DRESSINGS

The word surgical dressing is used to include all the materials either used alone or in combination to cover the wound. The purpose of application of dressing is to protect the wound and favour its proper healing. A material which holds the dressing in desired position is known as bandage. Fibres are used for the preparation of surgical dressings.

Dressings are meant for the following functions.

- (1) To reduce or prevent infections
- (2) To offer protection to healing wound
- (3) To offer mechanical support to the tissues

Surgical dressings should comply the following requirements as mentioned in Pharmacopoeia.

- (1) They should be sterilized before use.
- (2) They should be stored in dry well-ventilated place at a temperature not exceeding 25°C.
- (3) Permitted antiseptics in prescribed concentrations be used.
- (4) They should be dyed unless mentioned in the monograph.
- (5) Adhesive products should not be allowed to freeze.
- (6) There should not be any loose threads, fibre-ends in dressings.

British Phcpoeia recognizes following types of surgical dressings.

- (1) **Fibres and related materials** i.e. Viscose, animal, wood cellulose wadding
- (2) **Carded products**, i.e. Absorbent cotton, viscose wadding, etc.
- (3) **Non - extensible, non-adhesive woven products**, i.e, Absorbent muslin; Domette bandage, etc.
- (4) **Non-extensible adhesive woven products**, i.e. Belladonna adhesive plater, Zinc Oxide surgical adhe-tape,
- (5) **Extensible non-adhesive products**, i.e. Cotton bandage, elastic web bandage, etc.
- (6) **Extensible adhesive woven products**, i.e. Elastic adhesive bandage, extension plaster
- (7) **Non-woven products**, i.e. Impermeable plastic surgical adhesive tape, permeable plastic surgical adhesive tape, etc.

In pharmacognosy, term fibre is used with restriction to describe certain characters of plants or animals. With reference to plant, they are elongated thick walled cells with pointed ends, cell walls of which consist of cellulose and contain lignin.

In medical practice, fibre are used as surgical dressings are made of natural or artificial materials^{are}. Apart from three natural sources, plant, animal and mineral, fibres are now synthesized chemically from various materials. Fibres obtained from various sources can be categorized as follows

(A) PLANT FIBRES:

1. Jute,
2. Flax,
3. Banana,
4. Cotton,
5. Hemp and
6. Aridil From Groundnut Protein.

(B) ANIMAL FIBRES:

7. Silk,
8. Wool and
9. Fibrolin From Milk Casein.

(C) MINERAL FIBRES:

10. Glass fibres
11. Asbestos.

(D) SYNTHETIC OR ARTIFICIAL FIBRES:

12. Nylon, (Polyamide)
13. Terylene,
14. Orlon,
15. Alginate Yarn and
16. Artificial Silk Or Rayon
Or Regenerated Cellulose.

Various chemical tests can be used for identification of fibres. on using microscopical evaluation is main criteria to confirm fibers. Commercially, fibres are used in textile industry for weaving cloth, as filtering medium, and also for insulation purpose.

1. Jute,

JUTE

Biological Source It consists of phloem fibres of the stem of various species of *Corchorus* (*Corchorus olitorius* and *Corchorus capsularis* Linn.), family Tiliaceae.

Geographical Source The plants producing jute are cultivated in West Bengal, in the basins of Ganges and in Assam. Jute plants grow successfully in areas having loamy alluvial soil with pH values of 6 to 8.

Chemical constituents fibres are yellowish-brown in colour and contain cellulose (53%), hemicellulose (20%) and lignin (10%).

Chemical test middle lamella is highly lignified and gives red colour with phloroglucinol and hydrochloric acid.

Uses It is used in the manufacture of tows (stupa)*, padding splints, filtering and straining medium. Jute fibres are used for the preparation of coarse bags (Gunny bags).

2. Flax,

FLAX

Biological Source

FLAX pericyclic fibres obtained from stem of plant *Linum usitatissimum*, family Linaceae.

Geographical Source plant is an annual herb and is cultivated in many countries, such as Argentina, Russia, Canada, India, Holland and USA. seeds of plant are good source of fixed oil and mucilage also used medicinally. Fibres are lustrous with sufficient tensile strength. Their length is about 20 - 50 mm. and are with fine pointed ends. The chemical nature of fibres is known to be pecto-cellulose.

Uses fibres were earlier used in manufacture of lint, but at present cotton has replaced these fibres. It is used in preparation of rugs, lace, lawn and filtering medium.

4. COTTON

SYNONYMS: Raw cotton, Cotton wool, Purified cotton, Absorbent cotton, Surgical cotton.

SOURCE: Cotton consists of epidermal trichomes of seeds

Gossypium herbaceum and *Gossypium barbadense*

FAMILY: Malvaceae.

OCCURANCE: Cotton is grown for purpose of fibres in tropical countries. plant after flowering bears fruits, called as capsules fruit has 3 to 5 cells. Each capsule has numerous seeds. seeds covered with hairs known as bolls. bolls collected, dried taken to ginning press, where trichomes separated from seeds

MORPHOLOGY: Colour : White (due to bleaching)

Odour : Odourless Taste : Tasteless

Size : Cotton fibres are 2.5 to 4.5 cm in length and 25 to 30 micron in diameter.

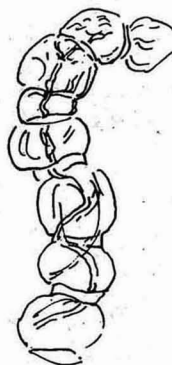
PREPARATION: Purified cotton or absorbent cotton consists of trichomes freed from fatty matter and adhering impurities. It is also bleached and sterilized.



Cotton Plant with Fruit



Cotton Fibre



Raw cotton mounted in cuoxam reagent



Absorbent cotton mounted in cuoxam reagent

CHEMICAL CONSTITUENTS: CARBOHYDRATES- Polysaccharides, Cellulose (90%)

WAX, OIL and FAT in traces Raw cotton contains about 90% of cellulose, 7 to 8% of moisture, wax, fat and remains of protoplasm. Purified cotton or absorbent cotton is entirely cellulose, with 6 to 7% of moisture.

STANDARDS: Absorbent cotton wool I.P. has the following standards :

1. Length of staples : not less than 1.5 cm.
2. Water soluble extractive : not more than 0.5%
3. Ash : not more than 0.5%

It should comply with the test for neps, fluorescence, acidity, absorbency and oxidising substances.

HISTOLOGY: The trichomes are unicellular, flattened and ribbon-like with slightly thickened and rounded apex. They are tubular and hollow.

CHEMICAL TEST:

- (1) Soak cotton fibres in iodine water and dry. Add few ml of 80% sulphuric acid-trichomes assume purple-blue or bluish-green colour (distinction from jute, hemp, wool, silk, nylon, alginate yarn and acetate rayon).
Blue colour is obtained when cotton is moistened with N/50 Iodine and 80% H₂SO₄.
- (2) Ammonical copper oxide solution dissolves raw cotton fibres with the formation of balloons, while absorbent cotton dissolves completely with uniform swelling.
- (3) Cotton is insoluble in dilute sodium hydroxide solution and hydrochloric acid (distinction from silk). It is soluble in 66% sulphuric acid.
- (4) Cotton dissolves in cold 80% H₂SO₄.
- (5) Insoluble in Cold H₂SO₄. 60%, warm 40% HCl
5% KOH, 90% Formic acid, 90% Phenol and Acetone.
- (6) Gives no red stain with phloroglucinol and HCl
- (7) No fumes or odour is liberated when cotton is advanced towards a flame.

USES:

Cotton is used as a filtering medium and in surgical dressings. It is also used as an insulating material. Absorbent cotton absorbs blood, mucus, pus and prevents the wounds from infection of micro-organisms. Insulating Material.

STORAGE:

Absorbent cotton should be stored in cool place. Bacterial contamination makes the cotton friable and brittle. The absorbent cotton should be wrapped in wrappers so as to prevent the dust and microbial contamination. Heat and long storage make absorbent cotton non-absorbent.

4. Cotton,

(Absorbent cotton,	Epidermal trichomes of	93 to 94 per cent	Surgical dressing
Surgical cotton,	seeds of <i>Gossypium</i>	cellulose and	Filtering media and
Medicinal cotton)	species	moisture – 5 - 7	insulation.
	(Malvaceae)	per cent	

(B) ANIMAL FIBRES:

7. Silk,

8. Wool and

9. Fibroin From Milk Casein.

(B) ANIMAL FIBRES:

7. SILK

SOURCE: Silk fibres obtained from the cocoons of *Bombyx mori* (Mulberry silkworm) and *Bombyx antheraea*

FAMILY: Bombycidae (Order Lepidoptera).

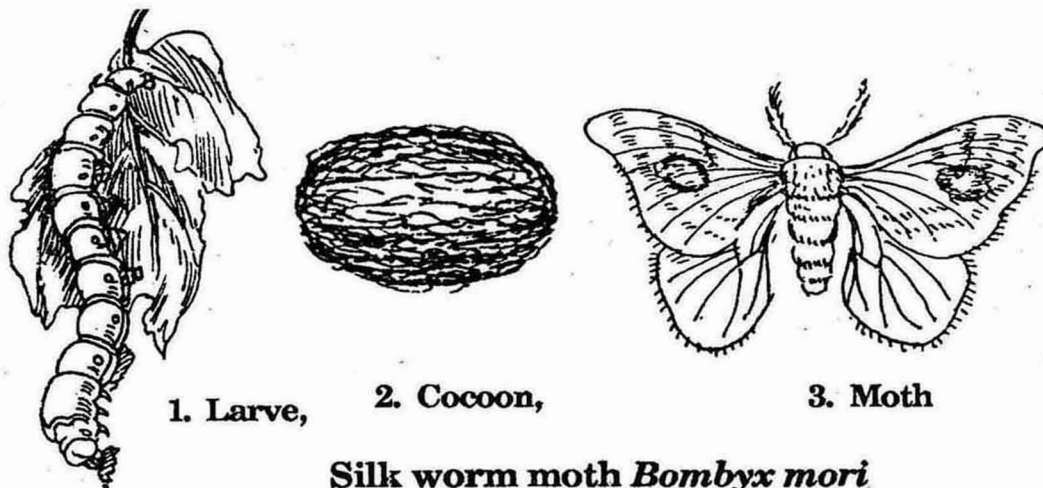
OCCURANCE: Larve, of silkworm produce silk fibroin fibres from glands in their mouth. This fibroin gets united with a gum-like secretion known as sericin and forms cocoon.

PREPARATION:

Cocoon, are heated at 60 to 80°C by exposing to steam. Further exposed cocoons are immerced in hot water to dissolve gum and to separate the fibres.

MORPHOLOGY:

Silk fibre is 5 to 25 microns in diameter 1200 metres in length. Silk thread is solid, smooth and yellow in colour. Silk is soluble in cuoxam, H₂SO₄ and Conc. HCl (distinction from wool).



CHEMICAL CONSTITUENTS:

Silk contains a protein known as fibroin.

CHEMICAL TEST:

Fibroin on hydrolysis yields amino-acids glycine and alanine. It does not contain sulphur and hence the test with lead acetate is negative.

USES: Special type of sutures, sieves ligatures prepared from the silk.

8. WOOL

SOURCE: Wool or wool fibres are obtained from fleece of sheep *Ovis aries*,

FAMILY: Bovidae, order Ungulata.

OCCURANCE: Hairs, forming fleece of sheep are removed at shearing time.

PREPARATION: Processed to remove the wool fat and dirt, clean and defatted wool is subjected to bleaching, washed again and dried.

MORPHOLOGY: Wool hairs are smooth, elastic, lustrous, curly, hygroscopic and slippery to touch. Wool hairs have tendency to cling together.

When observed under high power, wool shows cuticle, cortex and medulla.



A

(A) sheep



B

(B) Wool fibre

Ovis aris Linn, Source of wool and wool-fat

CHEMICAL CONSTITUENTS:

Wool contains sulphur containing protein known as keratin. Keratin is rich in amino-acid cystine.

CHEMICAL TEST:

Wool is insoluble in 66% sulphuric acid, conc.HCl and cuoxam.

When lead acetate is added to solution of wool in caustic soda, black precipitate is formed showing high sulphur content

USES: Wool is used as filtering and straining /

medium and in manufacture of dressing like domette and crepe bandages and flannel.

(C) MINERAL FIBRES:

10. Glass fibres

11. Asbestos.

(C) MINERAL FIBRES:

10. GLASS FIBRES:

Fibres contain sand; silica with oxides of aluminium, calcium, boron and magnesium these are non reactive by all reagents in identification of fibres. They melt at high temperature and form a transparent bead. They are used in filter fabrics and splinting material.

11. ASBESTOS.

They contain mainly hydrated magnesium silicates. Rock asbestos is white, yellow or green in colour. It is highly refractive and do not fuse when heated. It is used as a filtering medium and for bacterial filters.

(D) SYNTHETIC OR ARTIFICIAL FIBRES:

12. Nylon, (Polyamide)

13. Terylene,

14. Orlon,

15. Alginate Yarn and

16. Artificial Silk Or Rayon

Or Regenerated Cellulose.

(D) SYNTHETIC OR ARTIFICIAL FIBRES:

12. NYLON, (POLYAMIDE)

It is polymer of adipic acid and hexamethylene diamine.

The fibres are highly lustrous to dull, white or coloured. When applied to flame, the fibre melts with formation of bead. It is soluble in 5 M hydrochloric acid and insoluble in acetone. It is soluble in 90% formic acid and phenol (90%), which distinguishes it from fibres of biological origin. It is used for filter cloths, sieves and non-absorbable sutures.

13. TERYLENE:

It is a polymer of ethylene glycol and terephthalic acid, whereas orlon is a polymerized acrylonitrile. Terylene is distinguished from nylon and it retains its structure on boiling with phosphoric acid. It is used for artificial grafts.

14. ORLON,

15. ALGINATE YARN and

16. ARTIFICIAL SILK OR RAYON OR REGENERATED CELLULOSE.

SYNONYMS: Regenerated cellulose, viscose rayon

SOURCE: Rayon is an artificial fibre, made of regenerated cellulose

OCCURANCE: Cellulose of coniferous wood in form of pulp is processed

PREPARATION: Cellulose of coniferous wood's pulp is processing generates viscose rayon, pulp has 80–90 % of cellulose and hemicellulose. cellulose is treated with NaOH to get sodium cellulosate.

further treating with carbon disulphide (CS₂) and (NaOH)

sodium hydroxide will yield viscous solution of sodium cellulose xanthate.

After ripening, this solution is passed through the fine nozzles into a bath of sodium sulphate and sulphuric acid to give continuous filament. This filament is drawn together to form yarn and desulphurized, bleached, washed twisted and then dried.

STANDARDS: Rayon contains 10% moisture and do not lose absorbency on storage like cotton.

USES; Used in making fabrics and surgical dressings and viscose rayon absorbent wool.

• **Identification Tests :**

Sr. No.	Experiment	Cotton	Non-Absorbent cotton	Wool	Silk	Nylon	Polystyrene
1 (a)	Absorbency : Dissolve the cotton sample in water over the surface.	Soaked immediately	Does not Soaked				
(b)	Dissolve the sample in cuoxam	Soluble immediately	Soluble with ballooning	Soluble	Soluble	Insoluble	Insoluble
2	Ignition : Advance slowly toward flame or heat in crucible			Brown gas alkaline to litmus	Brown gas alkaline to litmus	Melts having hard bead	Melts having hard bead
3	Solubility : Dissolve the sample in 80% H_2SO_4			Insoluble	Soluble	Soluble	Insoluble
4	Iodine Test : Moisten the sample with iodine solution (N/50) followed by drop of 8% H_2SO_4			Yellow colour	Yellow colour		
5	Warm air in a test tube with picric acid			Permanent yellow stain	Permanent yellow stain	No permanent yellow stain	No permanent yellow stain
6	Warm with Million's reagent			Red stain	Red stain	No red stain	No red stain

• **Result :** The given sample is identified as dressing fibres.