Chapter 8

PLANT PRODUCTS

INTRODUCTION

As well as food and medicines, Plants provide other useful products. Many plant cells form **natural fibres** that strengthen and support the plant. The same properties make them perfect for textiles and paper. Timber from trees is used to build boats, houses and furniture. Palm leaves are woven into basket, hats and mats. People also extract perfumed oils and natural dyes from the flower and leaves of certain plants.

Plants produce long groups of cells, called fibres. These can be used to make textiles, such as cotton, as well as other materials such as paper or felt. All plant fibres are strong, because their cell walls contains tough molecule called cellulose, but to be useful fibres also need other properties, such as flexibility and length.

FIBRES

Natural fibre, any hair like raw material directly obtainable from an animal, vegetable or mineral source and convertible into nonwoven fabrics such as felt or paper or, after spining into yarns, into woven cloth.

A natural fibre may be further defined as an agglomeration of cells in which the diameter is negligible in comparison with the length.

Although nature abounds in fibrous materials, especially cellulosic types such as **cotton, wood, grains and straw,** only a small number can be used for textile products or other industrial purposes.

The fibres as refferred to in pharmacognosy, "are elongated thick walled cells with pointed ends, cell walls of which consists of cellulose and may or may not contain lignin".

The term "Fibre" as used with reference to surgical dressings includes both natural and artificial fibres.

Fibres originating from biological material are made up of long chain molecules. Similarly the synthetic fibres are made up of man-made long-chain molecules.

Fibres obtained from various sources can be categorised as follows :

(a)	Plant fibres	Jute, flax, banana, cotton, hemp
(b)	Animal fibres	Silk, wool
(c)	Regenerated and Synthetic fibres	
(1)	Fibres regenerated from carbohydrate material	Alginate yarn, artificial silk or rayon or regenerated cellulose

(2) Fibres regenerated from Protein materials — Aridil from groundnut protein and fibrolin from milk casein.

(3) Synthetic — Nylon, terylene, orlon

(d) Mineral fibres — Glass, asbestos

Various chemical tests can be applied for the identification of fibres. The microscopical examination is the main criterion to confirm the identity of fibres.

SURGICAL FIBRES

S.No.	Name of Synonym of fibre	Biological Source	Active Constituents	Uses
1	Cotton (Absorbent cotton, Surgical cotton, Medicinal cotton)	Epidermal trichomes of seeds of Gassipium species (Malvaceae)	93 to 94% cellulose and moisture 5-7%	Surgical dressing Filerating media and Insulation
2	Jute (Gunny-bag fibres)	Phoem fibres of corchorus SP Family : Tiliaceae	Cellulose hemicellulose and lignin	Manufacture of tows and gunny bags straining filtration media
3	Flax	Pericyclic fibres of stem of Linum-Usitatissimum Family : Linaceae	Pecto-cellulose	Straining and filtering media,
4	Silk	Fibres obtained from silk worm cocoons of ***Bombyx mori*** Family : Bombycidae	Protein known as fibroin	Sutures, Ligatures
5	Waal	Fibres from flees of Sheep **Quisaries** Family : Bouidae	Protein known as Keratin	In the manufacture of surgical dressings like domette, crepe bandage

A PLANT FIBRES

COTTON

Synonyms : Raw cotton, cotton wool, Absorbent cotton, Surgical cotton

Biological source : Cotton consists of the epidermal trichomes or hairs of the seeds of cultivated species of the Gossiium (*Gossypium herbaceurre, Gossypium barbadense*), Other species of *Gossypium*, Belonging to family Malvaceae.

Purified cotton or absorbent cotton consists of the trichomes as mentioned above, but freed from fatty matter and adhering impurities. It is also bleached and sterilized.

Geographical source : Cotton is produced commercially in U.S.A., Egypt and India. It is also cultivated in various parts of Africa and South America. In India, seven million hectares of land is under cultivation of cotton, of which 30% is irrigated and 70% rainfed.

Description

Colour - White (due to bleaching)

Odour- Odourless

Taste- Tasteless

Size - Cotton fibres are 2.5 to 4.5 cm in length and 25 to 35 micron in diameter

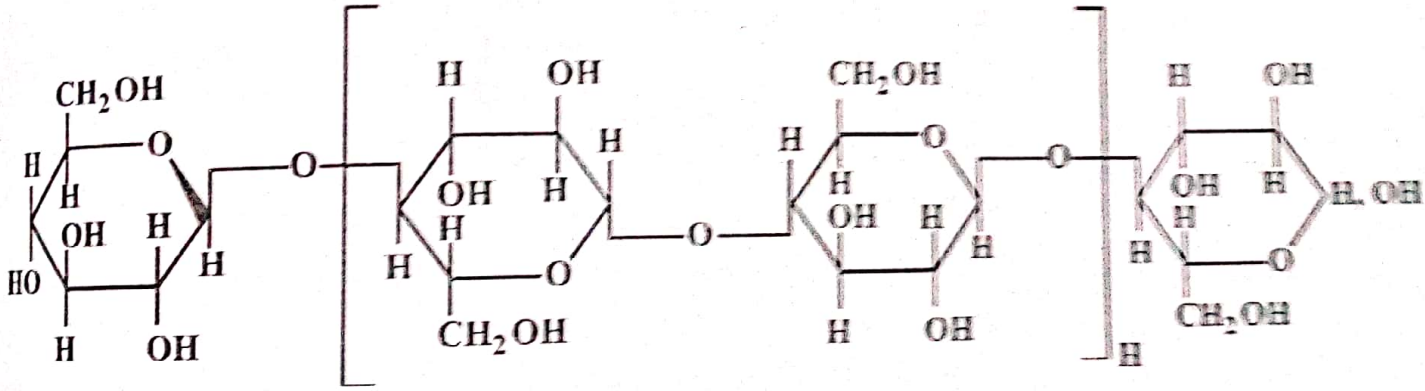
It is free from pieces of leaves, seed coat, foreign matter and dust. It may be slightly off-white in colour, if sterilized.

Standards :

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

1. Length of Staples - Not less than 15mm
2. Water soluble extractive - Not more than 0.5%
3. Sulphated ash- Not more than 0.5%

Chemical constituents : Raw cotton contains about 90% of cellulose, 7 to 8% of moisture, wax, fat and remains of protoplasm. Purified cotton on absorbent cotton is entirely cellulose, with 6 to 7% of moisture.



Cellulose Chain

Chemical Tests :

1. Soak cotton fibres in N/50 iodine water and dry. Add few ml. of 80% w/w H_2SO_4. Trichomes assume blue or bluish colour (distinction from jute, hemp, wool, silk, nylon, alginate yarn and acetate rayon).
2. Ammonical copper oxide solution (cuoxam reagent) dissolves raw cotton fibres with the formation of balloons, while absorbent cotton dissolves completely with uniform swelling.
3. Cotton is insoluble in 5% potassium hydroxide solution and hydrochloric acid (distinction from silk).
4. On ignition, cotton burns with a flame give very little odour or fumes, does not produce a bead and leaves a small white ash; distinction from acetate rayon, alginate yarn, wool, silk and nylon.

5. In cold sulphuric acid (80% w/w) cotton dissolves; distinction from oxidized cellulose, jute, hemp and wool.
6. In cold sulphuric acid (60% w/w) cotton, is insoluble/distinction from cellulose wadding and rayons.
7. It does not give red stain with phloroglucinol and hydrochloric acid, distinction from jute, hemp and kapok.

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 injections.

JUTE

Synonym : Gunny

Biological Source : It consists of phloem fibres of the stem of various species of the 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. The jute plants grow successfully in areas having loamy alluvial soil with pH values of 6 to 8.

Preparation : The plants grow well in alluvial soil and requires damp and warn climate. Jute fibres are prepared in the month of july when the plants are in flowering stage. The stems are cut, leaves are removed and stem are tied into bundles. These stem bundles are submerged into a water tank or pool for ten to twenty one day and are covered with straw to protect from direct sun rays. This process is called retting. The retting process facilitates the separationn of the bark from the wood and the strands of phloemm fibres from the surrounding softer tissue. The fibres are separated from the wood by beating the ends of stems. The separated fibres are cleaned by jerking them backward and forward on the surface of water. The fibres are dried and bleached by hanging them in sun. The jute fibres are graded according to its colour, strength and length. The fibres are of white to brown and 1-4mm long.

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

Chemical Test : The middle lamella is highly liquified and gives red colour with phloroglucinol and hydrochloric acid. Indicating the presence of lignin.

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).

HEMP

Synonyms : Cannabis Indica, Indian hemp, Ganja, Charas, Marihuana.

Biological source : Cannabis consists of dried flowering and fruiting tops of the pistillate plants of *Cannabis sativa* Linn.

Family : Cannabinaceae

Geographical source : Tropical parts of India as Maharashtra, North India, Bengal, also Africa and America

Chemical constituents :

1. Resin
   (i) Cannabidiol
   (ii) Cannabiodolic acid (Sedative and antibiotic)
   (iii) Cannabinol
   (iv) Cannabigerol
   (v) Cannabichromene and
   (vi) Tetrahydro cannabinol (THC)
2. Volatile oils
3. Trigonelline
4. Choline

Uses : Hemp is used to make a variety of commercial and industrial products including rope, clothes, food, paper, textiles, plastics, insulation and biofuel.

The bast fibers can be used to make textiles that are 100% hemp, but they are commonly blended with other organic fibers such as flax, cotton or silk, to make woven fabrics for apparel and furnishings.

Due to its high tensile strength, bast fibres are ideal for such specialized paper products as : tea bags, industrial filters, currency paper or cigarrette paper and textiles (the original Levi's jeans were made from Hemp cloth).

HALLUCINOGENS

Halluconiogens are natural and synthetic (synthesized) substances that, when ingested (taken into the body), significantly alter one's state of consciousness. Hallucinogenic compounds often cause people to see (or think they see) random colours, patterns, events and objects that do not exist. People sometimes have a different perception of time and space, hold imaginary conversations, believe they hear music and experience smells, tastes and other sensation that are not real. The other names of hallucinogens are cartoon acid, Microdot, and magic mushrooms.

Many types of substances are classified as hallucinogens, solely because of their capacity to produce such hallucinations. These substances are sometimes called psychedelic or mind expanding drugs. They are generally illegal to use in the United States, but are sometimes sold on the street by drug dealers. A few hallucinogens have been used in medicine to treat certain disorders, but they must be given under controlled circumstances. Hallucinogens found in plants and mushrooms were used by humans for many centuries in spiritual practice worldwide. Unlike such drugs as barbiturates and amphetamines (which depress or speed up the central nervous system (CNS) respectively), hallucinogens are not physically addictive (habit forming). The real danger of hallucinogens is not their toxicity (poison level), but their unpredictability. The actual causes of such hallucinations are chemical substancces in the plants. These substances are true narcotics. Contrary to popular opinion, not all narcotics

are dangerous and addictive. A narcotic is any substances that has a depressive effect, whether slight or great on the CNS. People have had such varied reactions to thes substances, especially to lysergic acid diethylamide (LSD) that it is virtually impossible to predict the effect of a hallucinogen that will have on any given individual. Effects depend upon the person's mood, surroundings, personality and expectation while taking the drug.

Natural hallucinogens are formed in dozens of psychoactive plants, including the peyotecactus, various species of mushrooms and the bark and seeds of several trees and plants. Marijuana and hashish- two substances derived from the hemp plant (cannabis sativa)- are also considered natural hallucinogens although their potency (power) is very low when compared to others. Marijuana a green herb from the flower of the hemp plant is considered a mild hallucinogen. Hashish is marijuana in a more potent, concentrated form. Both drugs are usually smoked. Their effects include a feeling of relaxation, faster heart rate the sensation that time is passing more slowly, and a greater sense of hearing, taste, touch and smell.

MEDICAL USES OF HALLUCINOGENS

Hallucinogens have been studied for possible medical uses, including the treatment of some forms of mental illness alcoholism and addiction to the drug opium. They have also been given to dying patients. Most of these uses have been abandoned, however. A synthetic form of the active chemical in marijuana, tetrahydro cannabinol (THC) has been approved for prescription use by cancer patients, who suffer from severe nausea after receiving chemotherapy (treatment cancer with drugs). THC is also used to reduce eye pressure in treating severe cases of glaucoma. Phencyclidine (PCP) is occasionally used by veterinarians as an anaesthetic and sedative for animals.

Some of the important plant hallucinogens are as follows : Belladonna (*Atropa belladonna*) California poppy (*Eschscholzia californica*), Daturas (*Datura sp.*), Fennel (*Foeniculum vulgare*), Henbane (*Hyoscyamus niger*), Lobelia (*Lobelia inflata*), Nutmeg (*Myristica fragrans*), Tobacco (*Nicotiana tobacum*), worm wood (*Artemisia absinthium*), etc.

TERATOGENS

These agents can cause a birth defect by permanently altering the structure and/or function of organs exposed to them during development.

There was reportedly 510,000 deaths in 2010 due to congenital defects of all the birth defects, teratogens constitute to about 10% and other factors include genetic defects, poor maternal nutrition, infection and environmental toxins.

If a plant teratogenic toxin has to exert it effect, it has to be present in a high enough dose, have the ability to cross the placenta and manifest it's effect during a specific time of gestation. These toxins can even cause fetal death or gross abnormalities. Based on their mehcanisms, they can cause vascular disruption, oxidative stress and can target specific receptors and enzymatic sites and cause endocrine and central nervous system (CNS) disruption and may affect a single anatomical feature or an entire system.

Teratogens are compounds that induce cogenital defects through insult to a developing conceptus. Plant teratogens affecting livestock has not moved forward in a systematic way nor has it been an overby " crowded" field of investigation even through teratoglogy itself is a burgeoning field. Practical consideration require that attention be directed to the

following. The plants responsible for the deformities must be identified as when this information is coupled with a consideration of the general principles that relate to introduction of congvenital deformities by teratogens, then progress can be made on the practical level of reducing incidence.

- **Principles Governing Introduction of Congenital Defects by Teratogens :** It is new recognized that certain plants ingested by livestocks during pregnancy are responsible for some of the common congenital defects of livestock.
- **Principle no. 1 :** Genotype determines susceptible genetic inheritance is not responsible for teratogen-induced defects, but there is nontheless considerable variation to teratogen susceptibility among genotypes.
- **Principle no. 2 :** Teratogen must reach the conceptus or produce an influence which does because virally are unbound chemicals in maternal plasma have access to the conceptus across the placenta, the important consideration is wheather they or their metabolites reach the conceptus.
- **Principle no. 3 :** Deformities induced by Teratogens are Dose Dependent. Factors that determine dose of plant teratogens to that determine dose of plant teratogens to the conceptus in livestock include the following- amount of the plant eaten, amount liberated from the ingesta, amount surviving degradation in the rumen and elsewhere in the gut, amount absorbed into the maternal circulation, amount surviving metabolism in the dam, amount passing the plaecnta and reaching the circulation of the conceptus and finally, amount reaching the site of insult at the susceptible gestational period.
- **Principle no. 4 :** A teratogen can produce death ratbar than deformities at high doses, many teratogens either will the conceptus or the dam, so in livestock, a higher incidence of abortions or resorptions may accompany or signal a problem with plant.
- **Principle no. 5 :** The conceptus must be exposed at the susceptible development period during development of a conceptus or the dam, so in liverstock gastrointestinal period but particularly during first the rod, for a teratogen to induce a specific deformity, it must exert its influence at exactly the right moment in gestation.
- **Principle no. 6 :** Teratogens exert their effects by specific mecbanismms, structurally dissimilar teratogens may influence the same mechanism and give rise to similar deformities as weu.

Luupinus species could produce the disease, in fact severity of deformities was directly related to the concentration of anagyrine present in the preparation fed, with about 30mg/kg producing a severe effect.

Conium, *Conium maculatum*, both conine and coniceien, two piperidine alkaloids of the plant are the teratogens responsible for the condition, Livestock classes varry in the susceptibility, to both the toxic & teratogenic effects of coniins.

Conc. of the teratogens in the plant is highly variable, thus there is little hope to lower dose by selective grazzingg during a low hazard periods, such as can be done with lupin.

Known teratogenicc plants with unidentified teratogens;

Astragalus, some of the Astragalus plants knwon to cause classical locoismm for example *Astragalus lentigeneus* and *Astragalus pubentisimus*, also induce deformities and abortions in offspring from dams that ingested these plants during gestation.

Nicotiana plants, an interesting teratogenic effect occurs in offspring from sows allowed to graze waste stauss of *Nicotiana taleacum* during gestation.

SUSPECTED TERATOGENIC PLANTS

Datura, Alipald et al (1973) spaculated that an outbreak of arthorogryposis in new born pigs in kansas was due to maternal ingestion of the plant datura stromonium during the second & third month of pregnancy, further more after the plant was eradicated no cases turned up the following year.

Cyanogenic glycoside containing plants two otherwise unrelated plants *Sorghum sudanence* and *Prumus sarotine* which are believed to cause livestock deformities. If the plants prove teratogenic by seeding trials, perhaps the cyanide could be responsible for the deformities in view of the lenew teratogenic propensity of hypoxia & the ability of cyanide to induce the hypoxic state and reported, teratogenicity of amygladin, cyanogenic glycoside in hamsters.

Factors that influence teratogenecity include :

The nature of the teratogenic agent the dosage and the rouge of delivery into the embryo fetus duration & frequency of exposure.

1. **Lupimus :** Food & health related uses.
2. **Senecio :** Contains biocides in the form of alkaloids.
3. **Veratrum :** Used in cancer treatment but contains cyclopamine.
4. **Vinca rosea :** Contains vinblastine & vincristine used for chemotherapy.
5. **Sorghum :** Used as food, biofuel.
6. **Indigofera spicata :** Used as an analgesic & anti-inflammatory drug.
7. **Astragalus :** Used in herbal medicine in traditional chinese and persian medicine.
8. **Colchieum autumnase :** Used as medicine & cancer treatment.
9. **Datura Stromonium,** used for asthma treatment due to presence of atropine.
10. **Asparagus racemosus,** methanolic extracts can cause gross malformations in fetus, can increase the rate of re-absorption in the fetus and may also intrauterine growth.

NATURAL ALLERGENS

Allergens are inciting agents of allergy i.e. the substances capable of sensitizing the body in such way that an unusual response occurs in hypersensitive person. It may be biologic, chemical or synthetic origin.

Common to speak about the substances such as pollens, danders, dust etc. as natural allergens, although the chemical identity of allergen is unknown, but most common and known allergens are protein or glycoprotein and do not have much difference from other immmunogens except perhaps being somewhat smaller in size as well (mol. wt. 10,000-70,000).

- **Allergy :** The allergy (hypersensitivity) may be defined as specific immunologic reaction to an immunogen- a normally harmless substance (allergen), it was first defined in