

(Resins and Resin Combinations)

- **Resins** are amorphous products with a complex chemical nature, they are usually formed in schizogenous or in schizolysigenous ducts or cavities and are end products of metabolism.

Figure- 1: A naturally occurring resin



Physically, resins are usually hard, transparent, or translucent and when heated, they soften –and finally melt. They are insoluble in water but dissolve in alcohol or other *organic* solvents. On evaporation these solutions deposit the resin as a varnishlike film. Resins burn with a characteristic, smoky flame.

Chemically, they are complex mixtures of resin acids, resin alcohols, resinotannols, esters and resins. Some investigators believe that resins are oxidation products of the terpenes.

- **Resins often occur in more or less homogeneous mixtures of :**

- 1- **Entire resin:** benzoin.
- 2- **Volatile oils (oleoresins):** ginger and capsicum.
- 3- **Gums (oleo-gum-resins):** asafetida and myrrh.
- 4- **Glycosidal combinations (glucosins or glycosins):** jalap and podophyllin.

- **The principal constituents of resins may be classified as follows.**

1- Resin Acids:

These contain a large proportion of oxyacids in either free or ester state as resin esters. They are soluble in aqueous solutions of the alkalis. Their metallic salts are known as resinates (commiphoric acid in myrrh).

2- Resin Alcohols (Resinol) and resin phenols (Resinotannols):

The resin alcohols occur in the free state and as in combination with simple aromatic acids (benzoic, salicylic, cinnamic, and umbellic acid). The following are examples of resinols: benzoresinol from benzoin and storesinol from storax.

3- Resenes:

Complex neutral substances that are devoid of characteristic chemical properties. They do not form salts or esters and resist hydrolysis by alkalies.

4- Glycoresins:

These are complex mixtures sugars and complex resin acids on hydrolysis, as with the resin of jalap.

5- Balsams:

Are resinous mixtures that contain cinnamic acid, benzoic acid, or both, or esters of these acids. Peru balsam, Tolu balsam, and styrax are typical balsams.

➤ Biosynthesis of resins:

Many resins are considered to arise by oxidation of polymerized terpenoid metabolites.

Acetate and mevalonate are incorporated into some resins. The aromatic acids in balsams are undoubtedly formed by way of the shikimic acid-phenylpropanoid pathway.

Phenylpropanoid precursors are involved in the formation of more complex resin components.

The lignan, podophyllotoxin, which presumably arises via an oxidative coupling of 2 cinnamic acid residues.

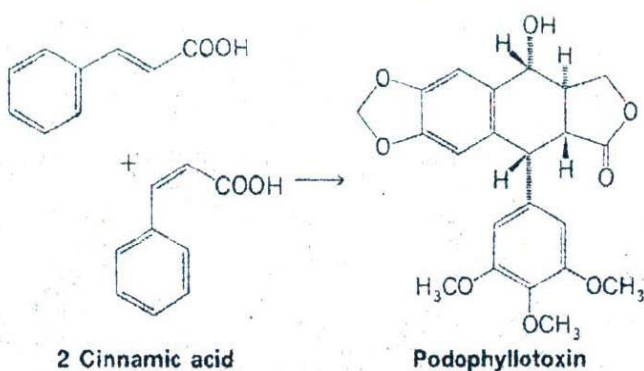


Figure- 2: Proposed biosynthetic origin of podophyllotoxin.

➤ Extraction methods of pharmaceutical Resins:

Pharmaceutical resins are usually obtained by:

(1) Extracting the drug with alcohol and precipitating resin in water, as with resins of jalap.

- (2) Separating the oil from oleoresin by distillation, as with rosin from turpentine and copaivic resin from copaiba.
- (3) Collecting the natural product that has exuded as oleoresin through natural or artificial puncture from which the natural oil has partially evaporated in atmosphere as with mastic.



Figure- 3: Methods for resins extraction

➤ **Plants containing resins:**

1- Rosin or colophony:

Is a solid resin obtained from *Pionus palustris* Miller and other species of *Pinus* Linné (F. Pinaceae).

Rosin usually occurs as shiny, sharp, angular fragments that are translucent, the natural amber-colored, and often covered with a yellowish dust. Rosin is hard, brittle, easily pulverized

Constituents: Rosin contains from 80 to 90% of the anhydrides of abietic acid; sylvic acid, which is probably a decomposition product of abietic acid; sapinic acid; pimaric acid and other acids; and resene, a hydrocarbon.

Uses: stiffening agent in cerates, plasters, and ointments, in veterinary medicine as a diuretic, the manufacture of varnishes paint dryers, printing inks, soap, sealing wax, floor coverings, and numerous other products.

2- Podophyllum (mayapple or mandrake) :

Podophyllum consists of the dried rhizome and roots of *Podophyllum peltatum* Linné (F. Berberidaceae).

Podophyllum resin is also known as podophyllin and is the powdered mixture of resins removed from podophyllum by percolation with alcohol.

The precipitated resin is washed twice with water and is dried and powdered. It has a slight, peculiar, bitter taste and is highly irritating to the eye and to mucous membranes in general.

Constituents: Podophyllum contains 3.5 to 6% of a resin whose active principles are lignans. These include podophyllotoxin (20%), α -peltatin (10%), and β -peltatin (5%), a number of lignan glycosides are in the plant. Podophyllum yields not less than 5% of podophyllum resin.

Peltatins account for the purgative effects of the drug, while the trans lacton ring in its structure account for its antimitotic actions.

Uses: Podophyllum possesses drastic purgative properties. Its resin is also employed as an antimitotic and caustic.

Treatment with mild alkali produces epimerization with formation of the stable *cis* isomers, which are physiologically inactive.

3- Jalap:

Jalap or jalap root is the dried, tuberous root of *Exogonium purge* (F. Convolvulaceae).

Jalap resin is prepared by extracting powdered jalap with an alcohol-water mixture. The precipitated resin is washed with hot water, collected, and dried. Jalap resin occurs as yellowish brown masses or powder.

Constituents: Jalap yields not less than 9% of resins, 8 to 12% volatile oil; starch; gum; and sugar. The resin contains number of glycosides, such as ipurganol, phytosterol glycoside and jalapin, a mixture of acidic glycosides. It also contains α -methyl esculetin and palmitic and stearic acids.

Use: Jalap is a cathartic and is generally considered a hydragogue and a drastic purgative.

4- Mastic:

Mastic, mastiche, or mastich is the concrete resinous exudate from *Pistacia lentiscus* Linné (F. Anacardiaceae).

The resinous juice collects in cavities in the inner bark. Long incisions are made in the trunk and in larger branches, through which the resin exudes. The resin finally collects in small tears on the outside.

Constituents: mastic contains about 90% of a resin, consisting of α -resin (mastichic acid), which is soluble in alcohol, and β -resin (masticin), which is insoluble in alcohol, and a volatile oil, 1 to 2.5%, which has the balsamic odor of the drug and consists chiefly of (+)-pinene. A bitter principle is also present.

Uses: Mastic is used in the form of a dental varnish to seal cavities.

5- Kava: Kava or kava-kava is the dried rhizome *and roots of Piper methysticum* Forster (F. Piperaceae).

Constituents: large quantities of starch, 5 to 10% of a resin from which 6 different, closely related styrylpyrones has been isolated in pure form: yangonin, desmethoxyyangonin, kawain, dihydrokawain, methysticin, and dihydromethysticin.

Uses: Pharmacologic studies have shown that all of the kava pyrenes are more or less potent, centrally acting skeletal muscle relaxant. In addition to inducing changes in motor function and reflex irritability, they possess antipyretic and local anesthetic properties. It's kind of like a natural Xanax®.

6- Cannabis (Indian hemp, marihuana, or pot):

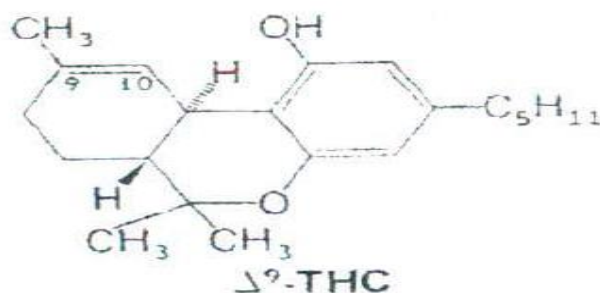
It consists of the dried flowering tops of the pistillate plants of *Cannabis sativa* Linné (F. Moraceae).

Cannabis was used in China and India, spread slowly through Persia to Arabia where the resin was known as **hashish**.

Constituents: Indian cannabis yields 20% or more of resin; Mexican cannabis 15% or less; Kentucky hemp 8% or less; Wisconsin hemp 6% or less.

Indian cannabis yields 15 to 20% of a resin that contains the major active euphoric principle (-)-trans-tetrahydrocannabinol, commonly referred to as -THC.

Other constituents isolated from cannabis resin include cannabiol, cannabidiol, cannabidiolic acid, cannabichromene, cannabigerol, and Δ^8 -trans-tetrahydrocannabinol.



Uses: Δ^9 -THC is available under the name of dronabinol (Marinol®) for the control of nausea in cancer chemotherapy. Cannabis is cultivated to a considerable extent for its bast fibers, hemp, and for its fruits, hempseed; the latter contain about 20% of a fixed oil that is expressed and used in the manufacture of paints and soap.

- **Oleoresins:** Oleoresins are homogeneous mixtures of resins and volatile oils. Depending on the relative amount of volatile oil in the mixture, oleoresins may be liquid, semisolid, or solid.

1- Turpentine (gum turpentine):

Turpentine gum is the concrete oleoresin obtained from *Pinus palustris* Miller and from other species of *Pinus* (F. Pinaceae).

Turpentine is not related to the true gums and mucilages of carbohydrate origin.

Constituents: The drug constituents are volatile oil and resin. It contains not more than 2% of foreign organic matter.

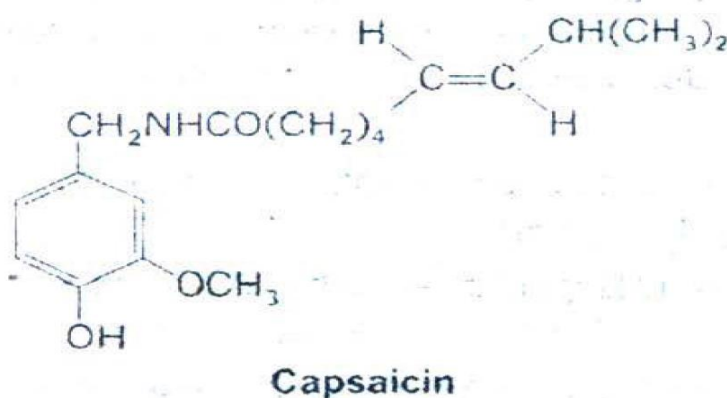
Use. It is employed externally as a counterirritant.

2- Capsicum (cayenne pepper):

Capsicum is the dried, ripe fruit of *Capsicum frutescens* Linné (African chillies), of *C. annum* Linné var. *conoides* Irish (Tabasco pepper), or *C. uinuuiu* var. *longum* Sendt, known in commerce as Louisiana long pepper (F. Solanaceae).

The more tropical the climate, the more pungent the fruit, the medicinal value of capsicum as a rubefacient depends on its pungency.

Constituents: Capsicum contains capsaicin (about 0.02%), an extremely pungent principle, in the disseminations of the fruit. Capsaicin is, a phenol having the formula:



Use: Capsicum is an irritant and a carminative; it is used as a rubefacient and also as a stimulant and a condiment. Capsicum oleoresin has the same properties.

3- Ginger (zingiber):

Is the dried rhizome of *Zingiber officinale* Roscoe (F. Zingiberaceae), known in commerce as Jamaica ginger, African ginger, and Cochin ginger.

Constituents: Ginger owes its characteristic aroma to about 3% of a volatile oil, the principal constituents of which are 3 sesquiterpenes: bisabolene, zingiberene, and zingiberol.

The characteristic pungency of the drug is attributed to ginger oleoresin, from which 2 aromatic ketones, zingerone and shogaol, have been isolated. In addition, ginger contains more than 50%, of starch.

Uses. Ginger is classed as a flavor; it is used as a condiment, an aromatic stimulant, and a carminative.

4- White Pine:

Is the dried inner bark of *Pinus strohus* Linné (F. Pinaceae).

Constituents: The alcoholic extract forms about 30% of the drug and contains tannic acid and an oleoresin. The bark contains considerable mucilage and a small quantity of coniferin; the latter is usually present in the cambial layer of all of the species of *Pinus* as well as in other genera of the Pinaceae.

Uses. White pine has expectorant properties.

5- Copaiba

Copaiba or balsam copaibä is an oleoresin derived from South American species of *Copaifera (Copaiba)* (F. Leguminosae).

Constituents: Copaiba is an oleoresin and contains neither benzoic nor cinnamic acid. It should be noted that the term "balsam" is erroneously applied. It consists of a volatile oil, resin acids, and a small quantity of a bitter principle.

Uses. Copaiba was used as a genitourinary disinfectant. It has diuretic, stimulant, expectorant, and laxative properties.

➤ Oleo-gum-resins

Oleo-gum-resins are mixtures of resin, gum, volatile oil, and, frequently, small quantities of other substances. The principal oleo-gum-resins are myrrh and asafetida.

1- Myrrh:

Myrrh or gum myrrh is an oleo-gumresin obtained from *Commiphora molmol* Engler, from *C. abyssinica* (Berg) Engler, or from other species of *Cominiphora* Jacquin (F. Burseraceae).

Constituents: Myrrh contains a yellow or yellowish green, rather thick, volatile oil, 2.5 to 8% that has the characteristic odor of myrrh resin, 25 to 40%, composed of several constituents, among which are resin acids (α -, β -, and γ -commiphoric acids), resenes, an phenolic compounds, one of which yield protocatechuic acid and pyrocatechin gum, about 60%, consisting of soluble an insoluble portions and forming a mucilage that does not readily ferment (being of the acacia type) and yielding arabinose as one of the products of hydrolysis; and a bitter principle, sparingly soluble in water but soluble in alcohol.

Uses: Myrrh is a protective; it has also been employed as a stimulant and a stomachic. It is used in mouthwashes as an astringent.

➤ **Balsams:**

Balsams are resinous mixtures that contain large proportions of benzoic acid, cinnamic acid, or both, or esters of these acids.

Benzoin is sometimes referred to as a balsamic resin. The medicinal balsams include Tolu balsam, Peru balsam, styrax (Levant and American), and benzoin (Siam and Sumatra).

1- Storax:

Storax is a balsam obtained, from the trunk of *Liquidmbar orientilis* Miller, known in commerce as Levant storax, or of *L. styraciflua* Linné, known in commerce as American storax (F. Hammamelidaceae). Storax is also known as **liquid storax** or styrax.

Constituents: Levant storax consists of about 50% of 2 resin alcohols, α -storesin and β -storesin, which are partly free and partly in combination with cinnamic acid. Storax also contains storesin cinnamate, 10 to 20%; styracin or cinnamyl cinnamate, 5 to 10%, in needle-crystals that are colorless, odorless, and tasteless; phenylpropyl cinnamate, 10%, a liquid with the odor and taste of styrax; volatile oil, 0.5 to 1%; a trace of vanillin; free cinnamic acid, from 2 to 5%; and small amounts of several other substances.

Use. Storax is a pharmaceutical aid for compound benzoin tincture. It has been used as a stimulant, an expectorant, and an antiseptic.

2- Peruvian Balsam (Peru balsam):

Is obtained from *Myrcxylon pereirac* (Royle) Klostzsch (F. Leguminosae). The balsam is a pathologic product and is formed by injury to the trees.

Constituents: The drug contains cinnamein, about 60%, which is a volatile oil consisting chiefly of benzyl cinnamate and a lesser amount of benzyl benzoate; resin esters, 30 to 38%, which are composed mostly of peruresjnotannol cinnamate and benzoate; vanillin; free cinnamic acid; peruviol; and other substances in small amounts.

Uses: Peru balsam is a local protectant and rubefacient; it also is a parasiticide in certain skin diseases. It is an antiseptic and vulnerary and is applied externally either alone, in alcoholic solution, or in the form of an ointment.

3- Tolu Balsam:

Tolu balsam is a balsam obtained from *Myroxylon balsamum* (Linné) Harms (F. Leguminosae). Tolu balsam is sometimes called balsam of Tolu.

Constituents: The drug contains resin esters, 75 to 80%, chiefly tolueresinotannol cinnamate with a small quantity of the benzoate; volatile oil, 7 to 8%, chiefly benzyl benzoate; free cinnamic acid, 12 to 15%; free benzoic acid, 2 to 8 %; vanillin and other constituents in small quantities.

Uses. Tolu balsam is a pharmaceutic aid for compound benzoin tincture. It is sometimes used as an expectorant and is extensively used as a pleasant flavoring in medicinal syrups, confectionery, chewing gum, and perfumery.

4- Benzoin:

Benzoin is the balsamic resin obtained from *Styrax benzoin* (F. Styraceae).

Constituents: Sumatra benzoin contains free balsamic acids chiefly cinnamic 10% and benzoic acid 6%, as well as esters derived from them, triterpene acids especially 19- hydroxyoleanic acid, 16- hydroxycinnamic acid, and vanillin.

Uses: Benzoin possesses anti- septic, diuretic, stimulant, and expectorant properties.