Chapter 10

RESINS AND BALSAMS

The term "resin" is applied to indicate a group of related solid or semisolid substances of very complex chemical nature and variable chemical composition. These substances, however, have somewhat common physical and. solubility properties. Any strict definition of a resin is not possible. In general, these substances are brittle secretions or exudations of plant tissues, either produced normally or as the result of pathogenic conditions (sometimes induced intentionally to produce the resin).

Properties of resins

Resins are hard, transparent or translucent brittle substances. They are generally heavier than water (sp. gr. 0,9 - 1,25). They are amorphous (rarely crystallisable). On heating at a comparatively low temperature, resins soften and finally melt forming sticky or adhesive fluids; when heated in a closed vessel, they decompose and yield chiefly hydrocarbons; but when heated in the air, resins burn readly with a smoky flame, owing to the large amount of carbon present in their structure.

Resins are insoluble in water and insoluble in petroleum ether, with few exceptions e.g. colophony. Resins dissolve more or less completely in alcohol, chloroform and ether.

Chemically, resins are complex mixtures of resin acids, resin alcohols, esters, resin phenols and resenes. Some scientists believe that resins are oxidation products of terpenes. They may be considered as final products in metabolism.

They are rich in carbon and contain little oxygen in their molecules, but not contain any nitrogen. Most resins undergo slow change on keeping ; they darken in colour and become less soluble due to slow oxidation. They are not pure chemical substances, but consist of a mixture of numerous substances.

Occurrence in plants

In plants, resins occur in different secretory structures, resin cells (ginger), schizogenous or schizolysigenous ducts or cavities (Pinus) and glandular hairs (cannabis).

Resins are performed in the plant as normal physiological products, but the yield is sometimes increased by injury as in case of Pinus. Many products e.g. benzoin and balsam Tolu,

are not formed by the plant until it has been injured i.e. they are of pathological origin. The secretion from naturally occurring secretory structure is called primary flow, to distinguish it from abnormally formed secretory structures which is called secondary flow.

Resins are usually produced in ducts or cavities, sometimes they do not occur in specialized secretory structures, but impregnate in all the elements of a tissue.

Resins are often associated with volatile oils in more or less homogeneous mixtures; the mixtures being known as oleo-resins. These are, therefore, liquid or semiliquid substances depending on the amount of volatile oil present.

Resins are often associated with with gums (gum-resins) or with oil and gum (oleo-gum-resins). They may also be combined in a glycosidal manner with sugars.

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

The term "balsam" is often wrongly applied to oleoresins and should be reserved for such substances as balsam of Peru, balsam of Tolu and storax, which contain a high proportion of aromatic balsamic acids.

Two general classes of resinous substances are recognized and this classification is based on the method used in preparing them:

1. **Natural resins**, occur as exudates from plants, produced normally or as result of pathogenic conditions, as for example by artificial punctures e.g. mastic; or deep cuts in the wood of the plant e.g. turpentine, or by hammering and scorching, e.g. balsam of Peru.
2. **Prepared resins**; are obtained by different methods. The drug containing resins is powdered and extracted with alcohol till exhaustion. The Concentrated alcoholic extract is either evaporated, or poured into water and the precipitated resin is collected, washed and carefully dried.

In the preparation of oleoresins ether or acetone having lower boiling point are used. The volatile oil portion is removed through distillation. When the resin occurs associated with gum (gum-resins), the resin is extracted with alcohol leaving the gum insoluble.

Resins are classified in three different ways:

1. Taxonomical classification, i.e. according to botanical origin, e.g. *Berberidaceae* resins.
2. Classification according to predominating chemical constituent; e.g. acid resins, resene resins, glycosidal resins; etc.
3. Resins may be classified according to the portion of the main constituents of the resin or resin combination; e.g. resins, oleoresins, oleogumresins, balsams.

Examples of resins and resins combination:

- **Resins**: colophony.
- **Oleoresins**: ginger.
- **Oleo-gum-resins**: asafoetida, myrrh.
- **Balsams**: benzoin, balsam of Tolu, balsam of Peru.

COLOPHONY or **ROSIN**.

It is a solid resin obtained from *Pinus sylvestris* L., Fam. Pinaceae. Colophony fuses gradually at about 100°C and at a higher temperature burns with a smoky flame, leaving not more than about 0,1 % of ash. The alcoholic solution of colophony becomes milky-white on addition of water; and on heating fragments of rosin in water, they form a sticky mass.

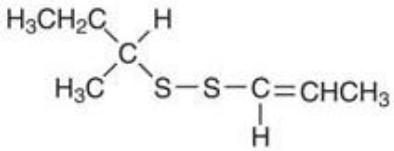
Constituents: Colophony contains resin acids (about 90 %) neutral inert substances known as resenes and esters of fatty acids. The resin acids are isomeric diterpene acids (abietic acid). Colophony has a high acid value 150 - 180.

Uses. The amount of colophony used in pharmacy for the preparation plasters, ointments, etc. is relatively small. Large quantities are employed in the manufacture of linoleum and dark varnishes**,** sealing-wax and printing inks.

ASAFOETIDA .

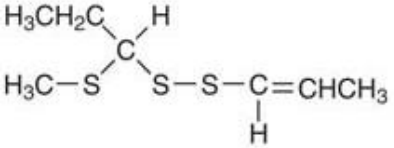
Asafoetida is an oleo-gum-resin obtained by incision from the living-rhizome and root of *Ferula asafoetida* L., *F. foetida* (Bunge) Regel., *F. rubricaulis* and other Persian and Afghanistanian species of *Ferula* (Fam. Apiaceae).

Disulfides



2-butyl-1-propenyl disulfide

Constituents. Asafoetida consists of volatile oil (3-17%), resin (45-60%), gum (up to 25%), and impurities. The volatile oil has a paiticularly bad smell and contains sulfur compounds. The main constituents of the oil (40 %) is the mercaptan $C_7H_4S_2$. The volatile oil contains diallyl disulfide, allyl propyl disulfide and probably diallyl trisulfide, pinene and cadinene. The reddish brown amorphous resin consists of asaresinol ferulate (unstable ferulic acid ester of the phenolic compound asaresinol).



1-(1-methylthiopropyl)-1-propenyl disulfide

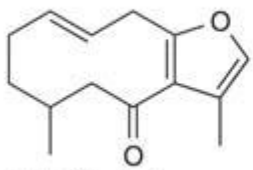
Uses. Asafoetida is used in human medicine (as a carminative, an expectorant, an antispasmodic and laxative) although employed in veterinary work.

Pharmacopoeial and Other Monographs: BHC 1992, BHP 1996, Martindale 35th edition

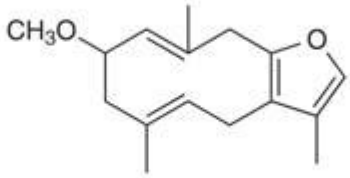
MYRRH

Myrrh is an oleo-gum-resin, obtained from the stem and branches of *Commiphora myrrha* (Nees) and possibly other species of *Commiphora* (Fam. Burseraceae).

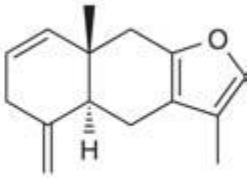
Sesquiterpenes



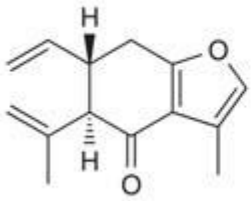
4, 5-dihydrofurano -dien-6-one



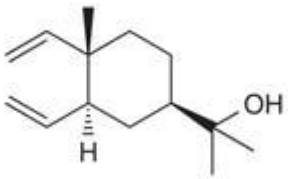
2-methoxy-furanodiene



lindestrene



curzerenone



elemol

Constituents. Myrrh contains 7 - 17 % of volatile oil, 25 - 40 % of resin**,** 57 - 61 % of gum and some 3-4**%** of impurities. The volatile oil contains terpenes, sesquiterpenes, esters, cuminic aldehyde and eugenol. It readily resinifies. The larger ether-soluble portion contains α-, β- and γ -commiphoric acids, the esters of another resin (commiphorinic acid) and two phenolic resins. The crude alcohol-insoluble matter ("gum") contains about 18 % of protein and 64 % of carbohydrate containing galactose, arabinose am glucuronic acrd. This gum is associated with an oxidase enzyme.

Uses Myrrh is used in incense and perfumes. Like many other resins, it has local stimulant and antiseptic properties. It is chiefly employed in medicine in the form of a mouth wash.

Pharmacopoeial and Other Monographs: BHC 1992, BHP 1996, BP 2009, Complete German Commission E, ESCOP 2006, Martindale 35th edition, Ph Eur 6.4, USP29/NF24.

BENZOIN .

Benzoin is the balsamic resin obtained from the incised stems of *Styrax benzoin* Dryand. (Fam. Styraceae), known in commerce as Sumatra bezoin or *Styrax tonkinensis* (Pierre) Craib ex Hartwich. known in commerce as Siam benzoin.

Constituents. Sumatra benzoin contains free balsamic acids (cinnamic and benzoic) and esters derived from them. Also present are triterpenoid acids. The content of total balsamic acids based on the dry alcohol-soluble matter, is at least 30 %, and the amount of cinnamic acid is usually about double that of benzoic acid. Up to about 20 % of free acids may be present. The major constituent (about 75 %) seems to be the ester coniferyl benzoate. Coniferyl alcohol (3-methoxy-4-hydroxy cinnamyl alcohol), is found in the cambial sap of both gymnosperms and angiosperms. Other constituents are free benzoic acid, triterpenoid acids and vanillin.

Uses. Benzoin when taken internally, acts as an expectorant and antiseptic. It is mainly used as an ingredient of friar's balsam, or as a cosmetic lotion prepared from a simple tincture.

Pharmacopoeial and Other Monographs: BP 2009, Ph Eur 6.4.

BALSAM OF TOLU

Balsam of Tolu is the balsam obtained by incision from the trunk of *Myroxylon toluifera* Kunth. (Fam. Fabaceae).

Constituents. Balsam of Tolu contains about 80 % of resin derived from resin alcohols combined with cinnamic and benzoic acids. The drug is rich in free aromatic acids and contain! about 12 - 15 % of free cinnmmic acid and about 8 % free benzoic acid. Other constituents are esrers, such as benzyl benzoate and benzyl cinnamate and little vanillin. Distilled with water, good fresh balsam of Tolu yields from 1,5 to 3,0 % of a very fragrant volatile oil containing toluene, styrol, and free benzoic and cinnamic acids.

Tolu contains from 35 - 50 % of total balsamic acids calculated on the dry alcohol-soluble matter.

Uses : Balsam of Tolu has antiseptic properties due to the cinnamic and benzoic acids contained in it. It is a common pleasant ingredient of cough mixtures to which it is added in the form of syrup or tincture.

Pharmacopoeial and Other Monographs: Ph. Eur. 6.4, BP 2009.

BALSAM OF PERU.

Balsam of Peru is the balsam exuded from the beaten and scorched trunk of *Myroxylon balsamum* (L.) Harms var. *pereirae* (Royle) Harms. (Fam. Fabaceae*).*

Constituents : Balsam of Peru consists essential oil fluid portion mixed with a dark resin**.** The fluid portion constitutes from 56 - 96 % of the drug, and consists chiefly of the balsamic esters, benzyl benzoate and benzyl cinnamate in the proportion of about 3 to 2, although cinnamyl cinnamate is also present. The drug usually contains about 28 % of resin, which is said to consist of peruresinotannol combined with cinnamic and benzoic acids, the alcohol peruviol, and small quantities of vanillin and free cinnamic acid.

Uses. Balsam of Peru is used internally as an antiseptic and expectorant. Applied externally, it acts as an antiseptic dressing for wounds and as a parasiticide especially in scabies.

Pharmacopoeial and Other Monographs: Ph. Eur. 6.4, BP 2009.

STORAX

Purified storax is a balsam, obtained from the wounded trunk of *Liquidambar orientalis* Mill. (Fam. Hamamilidaceae, oriental sweetgum), known in commerce as Levant storax, purified by dissolving in hot alcohol filtering and evaporating the solvent at as a low temperature as possible.

Constituents. Storax is very rich in free and combined cinnamic acid and is, in this respect, one of the richest drugs known. After purification, it yields 30 - 47 % of total balsamic acid (cinnamic acid). By steam distillation storax yields oily liquid containing phenylethylene. The resinous portion of the drug consists of storesinol, an amorphous, white substance which is present both free and combined with cinnamic acid.

Uses. Storax is used as a stimulant, an expectorant and antiseptic, resembling in these respects balsam of Peru, benzoin etc. It is chiefly used in the preparation of friar's balsam.