Brief outline of occurrence, distribution, outline of isolation.

a. Brief outline of occurrence,
b. distribution,
c. outline of isolation,
d. identification tests,
e. therapeutic effects and
f. pharmaceutical applications of

1. Alkaloids,
2. Terpenoids,
3. Glycosides,
4. Volatile oils,
5. Tannins and
6. Resins

a. Brief outline of occurrence,

Term 'alkaloid' was coined by Meissner, in 1819. Earlier using alkaloids for various purposes like poisons, medicines poultices, tea, etc.

Alkaloids are basic nitrogenous products of plant origion. having marked physiological actions when administered internally.

b. distribution, or Classification

TYPE OF ALKALOIDS	EXAMPLE	SOURCE
1. Tropane Alkaloids :	Atropine, Cocaine	Datura, Coca
2. Quinoline Alkaloids:	Quinine, Quinidine	Cinchona species
3. Isoquinoline Alkaloids:	Papaverine, Narcotine	Opium, Ipecacunha
4. Indole Alkaloids:	Strychnine, Brucine	Nuxvomica
5. Phenanthrene Alkaloids:	Morphine, Codeine	Opium
6. Purine Alkaloids:	Caffeine, Theobromine	Tea, Coffee
7. Pyrrole & Pyrrolidine Alkaloids:	Nicotine, Hygrine	Tobacco, Coca
8. Pyridine & Piperidine Alkaloids:	Conitine, Lobeline	Hemlock, Lobella
9. Imidazole Alkaloids :	Pilocarpine	Pilocarpus
10. Steroidal Alkaloids:	Solanine	Kurchi
11. Terpenoid Alkaloids:	Aconitine	Aconite
12. Alkaloidal Amines:	Ephedrine	Ephedra

PURIFICATION OF ALKALOIDS

purification of alkaloids crude extract is done as follows, may vary for individual alkaloids.

(1) **Direct crystallisation from solvent**
It is a very simple method of isolation and may not be useful in case of complex mixtures.

(2) **Steam distillation**
It is specially employed for volatile liquid alkaloids like *coniine, sparteine* and *nicotine*. but otherwise this process is not suitable for alkaloids with high molecular weights.

(3) **Chromatographic techniques**
This method proved to be ideal for separation of a huge number of plant alkaloids. The different techniques of chromatography (thin layer, column, gas liquid, ion exchange chromatography, etc.) are used for separation of individual alkaloids from complex mixtures.

(4) **Gradient pH technique**
Though alkaloids are basic in nature, there are variations in extent of basicity of various alkaloids in same plant. Depending on this character, crude alkaloidal mixture is dissolved in 2% tartaric acid solution and extracted with benzene so that first fraction contains neutral and/or very weakly basic alkaloids. Now, pH of aqueous solution is increased graduated by 0.5 increments to pH 9 and extraction is carried out at each pH level with organic solvent. By this way, the alkaloids with different basicity are extracted and strongly basic alkaloids are extracted at the end.

c. outline of isolation,

Small scale isolation, **of alkaloids. method two**

The other method meant for extraction of alkaloids employs the treatment of the drug with ammonia so as to convert the alkaloidal salts into their free bases. Such liberated alkaloids in free base form are conveniently extracted with organic solvents like ether, benzene, chloroform, etc. The method is not useful for isolating alkaloids with quaternary nitrogen.

c. outline of isolation,

Extraction of alkaloids is based on their basic character and solubility pattern. The normal procedures followed are to treat moistened drug with alkali so as to set free, free base as it exists in salt form and then to separate free base with organic solvent. This is known as Stas-Otto process.

Small scale isolation, **of alkaloids. method one**

First, plant is defatted (remove the fat) leaf using solvent petroleum ether, especially in seed and leaf forms of drugs. Before applying this treatment, alkaloid should be tested for its solubility in petroleum ether. Otherwise, the drug should be pretreated with acid to convert the alkaloids into their salts. This happens in case of extraction of ergotamine from ergot.

In second stage, drug may be extracted with polar-solvent like water, ethanol, methanol, aqueous alcohol mixtures or with acidified aqueous solutions. By this treatment, the alkaloidal salts are transferred to polar solvent. It also helps in removing pigments, sugars and other organic secondary constituents.

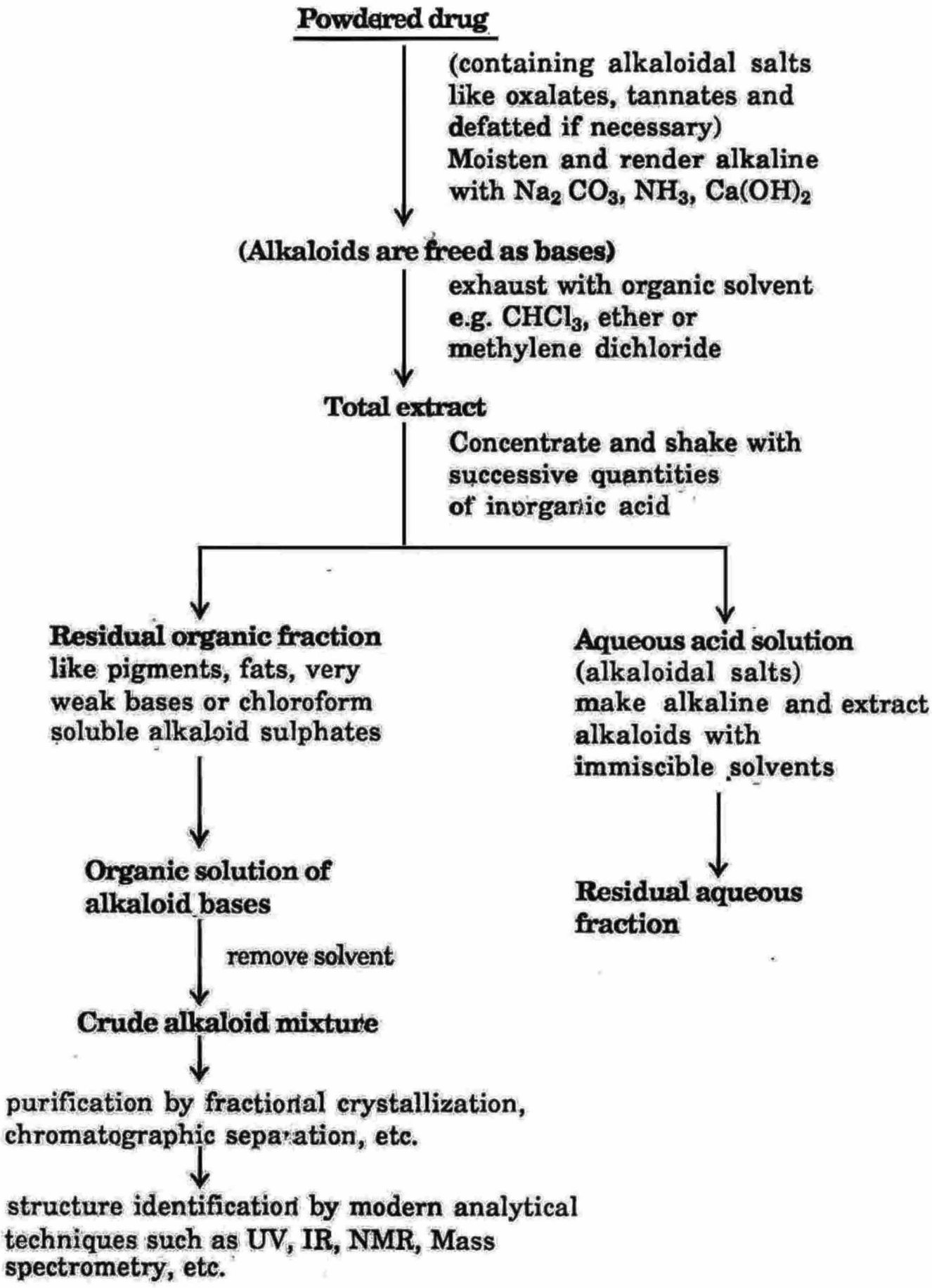
In following stage, alcohol solution is evaporated to a thick syrup and is subjected to partition between aqueous acid solution and an organic solvent. After continuous extraction with organic solvent for some time, aqueous phase is made alkaline with either sodium carbonate or ammonia. The basic aqueous solution is then extracted with convenient organic solvent followed by drying of alkaloid containing solution, normally with sodium sulphate, filtered and evaporated by which a crude alkaloid residue is obtained.

PROPERTIES OF ALKALOIDS:

a. Higly potent.
b. Colourless, Crystalline, Non-volatile, Bitter.
c. Most are optically active and Leavo rotatory.
d. Insoluble and sparingly soluble in water, completely soluble in organic solvents.
e. Posses curative properties.

c. outline of isolation, **ALKALOIDS**

scheme for alkaloids extraction as follows.



d. identification tests, **ALKALOIDS**

Qualitative chemical tests used for detection of alkaloids are depend on the precipitates as salts of organic acids or with compounds of heavy metals, like mercury, gold, platinum, etc.

1. **Mayer's reagent (potassium mercuric iodide solution) giving cream coloured precipitate;**

2. **Dragendorff's reagent (potassium bismuth iodide solution) giving reddish brown precipitate;**

3. **Wagner's reagent (iodine-potassium iodide solution) giving reddish-brown precipitate. Some alkaloids also give**

4. **Hager's reagent giving yellow coloured precipitates with picric acid and picrolonic acid.**

5. **Individual alkaloid gives colour or precipitate with certain specific reagent also.**

e. therapeutic effects

astrigent, narcotic analgesic, antimalarial, controls uterine haemorrhage, anticholinergic, skeletal muscle relaxant, expectorant, mydriatic, antispasmodic, anthelmentic, local anaesthetic, respiratory stimulant, anticholinergic, emetic, duodenal ulcers, anticholinergic, anti-amoebic, controls motion sickness, bitter tonic, diarrhoea, inflammation of mucous

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a. Brief outline of occurrence,

All terpenoids originated from isoprene units. there are few chemicals in nature, which are found to be composed of both isoprenoid and non-isoprenoid units. They are called as **meroterpenoids.** Such meroterpenoid structures of natural origin are reported in quinine, phylloquinone (vitamin K), tocopherols (vitamin E), cannabinoids and various ergot alkaloids.
(isoprenoid: An oily, volatile hydrocarbon, mero-Part, partial)

b. distribution,

Terpene hydrocarbons are classified as under:

Isoprene* /Hemiterpene	C_5H_8	(isoprene: An oily, volatile hydrocarbon.
I. Monoterpenes	$C_{10}H_{16}$	terpene- An unsaturated hydrocarbon obtained from plants
II. Sesquiterpene	$C_{15}H_{24}$	
III. Diterpene	$C_{20}H_{32}$	hemi-Half
IV. Triterpenes	$C_{30}H_{48}$	mono- One, single
V. Tetraterpenes	$C_{40}H_{64}$	sesqui-One and a half
VI. Polyterpenes	$(C_5H_8)_n$	di-Twice, two, double
		tri-Three
		tetra-Four, with four parts
		poly-Many, multiple.)

General properties of Terpenoids

Since terpenoids occur only in volatile oils, they are colourless liquids or solids with pleasant smell and are insoluble in water, but they are soluble in alcohol, organic solvents and fixed oils. They readily volatilise in steam. Most of them are optically active. Terpenoids normally contain one or more doule bonds and form additive compounds with halogens, nitrosyl chloride and nitrosyl bromide. They get oxidised by oxidising agents.

c. Outline of isolation,

Volatile oils obtained in first step of distillation contain number of mono and sesqui-terpenoids. During fractional distillation of volatile oils, monoterpenoid hydrocarbons get distilled first followed by their oxygenated derivatives. Physical methods, chemical methods (treating with sodium bisulphite, phenylhydrazine, Tilden's reagent, Grignard's reagent), distillation under reduced pressure and several types of chromatographic methods are used for their isolation. Proper adsorbents are used and then the chromatogram is eluted suitably.

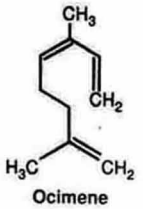
I. MONOTERPENES

A. Acyclic monoterpenes (acyclic- having an open chain structure)

Eg. 1. ***Ocimene , Myrcene.***

2. ***Geranial , Neral.*** *(aldehydic)*

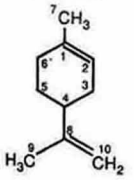
3. ***Geraniol , Nerol.*** *(alcoholic)*



Ocimene

B. Monocyclic monoterpenes

Eg. ***d-Limonene, α-Terpinene, β-Terpinene ,***
α-Phellandrene , β-Phellandrene. *(hydrocarbons)*
α-Terpineol, Menthol *(alcohol)*
Perillaldehyde, Phellandral. *(aldehydes)*

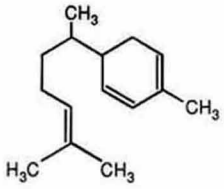


d-Limonene

II. SESQUITERPENES

A. Monocyclic sesquiterpenes: *Eg.* ***Zingiberene***

B. Bicyclic sesquiterpenes: *Eg.* ***Cadalene, Santonin.***



Zingiberene

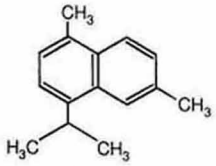
III. DITERPENES

A. Acyclic **diterpene.** *Eg. Phytol*

B. Monocyclic diterpene. *Eg.* ***Vitamin A.***

C. Bicyclic diterpene. *Eg.* ***Manool***

D. Tricyclic diterpenes. *Eg.* ***Abietic acid, Podocarpic acid***



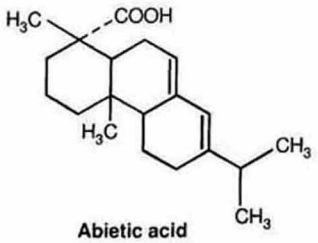
Cadalene

IV. TRITERPENES

A. Acyclic, triterpene. *Eg. Squalene*

B. Tetracyclic, triterpenes. *Eg.* ***Lanosterol, Agnosterol,***

C. Pentacyclic, triterpenes. *Eg.* ***α-Amyrin class, α-Amyrin, Ursolic acid,***
Asiatic acid, β-Amyrin, Glycyrrhetic acid,
Lupeol, Betulin,



Abietic acid

e. therapeutic effects

Terpenoids by property have pleasant flavour and compounds of tremendous importance in perfumery, cosmetics, soaps, incense - sticks, foods, pharmaceuticals and beverage industries

Therapeutically, they show wide spectrum of activities like antiseptic, stimulant, carminative diuretic, anthelmintic, analgesic, antirheumatic, aromatic, counter-irritant, etc.

Apart from flavour in food and pharmaceutical industries, they are also used as insect repellant, insecticides, pesticides and deodorants.

f. pharmaceutical applications of

They are isolated by steam distillation, Direct solvent extraction and Fat absorption commonly they are used as Flavouring agents, perfumery industry and in pharmaceutical industry.

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a) Brief outline of occurance

Define glycosides. Write a note on Cardiac glycosides.

Glycosides are naturally occurring organic compounds of plant and animal origin which yield on hydrolysis a sugar portion-**glycone** and non-sugar portion -**aglycone**.

Glycosides ⟶ **Glycone** + **Aglycone**

They are formed by condensation of hydroxyl group of a aglycone and hemi acetal hydroxyl group of sugar.

Glycosides are colourless, crystalline or amorphous solids substances, they are non–reducing, optically active and laevo rotatory soluble in chloroform ether.

They are present in any part of the plant like Leaves–Digitalis, Seeds–Strophanthus, Bitter almond, Rhizome Rhubarb, Bark–Quilla. They are present in the families of Scrophulariaceae, liliaceae, Leguminoseae, Cruciferae and rosaceae.

b) Distrubition, Classification of Glycosides

They are mainly classified depending on chemical and pharmacological actions of Aglycone.

1) Cardiac Glycosides Eg :Digitalis, Squill
2) Cyanogenetic Glycosides Eg :Bitter almond
3) Saponin Glycosides Eg :Dioscorea and liquorice
4) Anthracene Glycosides Eg :Senna and Aloe
5) Isothiocyanate Glycosides Eg :Mustard
6) Flavonoid Glycosides Eg :Licories

d) Identification tests,

1) **Keller–Killiani Test :** Glycoside is dissolved in glacial acetic acid. Add a drop of ferichloride and sulphuric acid which forms lower layer. A reddishbrown is produced at the junction of two liquids. This is due to presence of cardiac glycosides. Also the upper layer becomes bluish green colour.

2) **Borntragens Test :** Powdered drug is boiled with sulphuric acid and filtered. Filterate is extracted with any organic solvent like ether, chloroform benzene. After extraction organic solvent layer is separated by pipette and add ammonia. The ammoniacal layer becomes pink to red colour. This is due to the presence of Anthraquinone glycosides. Glycosides are commonly used as Cardiotonic: Digitalis and squill. Purgative: Senna and aloe. Sweetening agent: Glycyrrhiza.

3) **Write a Chemicals tests for Cardiac Glycosides** – (5) marks

1 gm powdered digitalis + 10ml 70% alcohol boil for 3 minutes.

- Filter & to the filtrate add 5ml of water & 0.5 ml of Strong solution of lead acetate & filter
- The filtrate is treated with equal volume of chloroform & evaporated to yield extract
- The extractive is dissolved in glacial acetic acid & after cooling 2 drops ferric chloride soln is added
- These contents are transferred to a test tube containing 2 ml of Conc. Sulphuric acid
- A reddish brown layer acquiring bluish green colour after standing is observed due to presence of digitoxose

Chemical test for Ipecacuanha (Antidysentric)

Ipecacuanha 2.5 gm powder + 20ml HCl + 5ml H_2O → shake → Filtrate + 0.5 gm potassium chlorate → yellow colour gradually changing to red after standing.

Confirms presence of Emetine.

e) Therapeutic effects

Glycosides which act on heart are called as cardiac glycosides. These gly strengthen heart muscles by increasing force of contraction.

f) Pharmaceutical applications of glycosides.

Write a note on Cardiac Glycosides.

Glycosides which act on heart are called as cardiac glycosides. These glycosides strengthen heart muscles by increasing force of contraction. Chemically these are steroids or cyclopentanephenantherane derivatives. Eg–Digitalis and Squill. Cardiac glycosides are classified into two types depending upon the chemical structure of Aglycon.

1) **Cardenolides :** These glycosides are having 5 membered unsaturated lactone ring at C_{17} position. They are called as C_{28} glycosides or cardenolides. Eg : Digitalis

2) **Bufadienolides :** These glycosides are having six membered unsaturated lactone ring at C_{17} position are called as C_{24} glycosides of Bufadienolides. Eg : Squill.

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a. Brief outline of occurrence,

What are volatile oils ? Write their importance.

Ans : Volatile oils are odourous constituents of the plants. They are liquid, lipophile, volatize, with characteristic smell. They will volatize or evaporate when exposed to atmosphere at an ordinary temperature and so they are called as ethereal or essential oils.

Volatile oils are usually lighter than water and their specific gravity is less than one. They have high refractive index and show optical rotation. Nearly insoluble in water but they dissolve in 1: 230 parts of water, which produce the characteristic taste and smell to the water they are soluble in alcohol and Other.

Volatile oils are present in entire plants or almost in any part of the plant as leaf eucalyptus, bark--cinnaman, seed cardaman, fruit--Fennel and Coriander and subterrean parts. They are present in glandular trichomes, endogenous oil ducts and oil canals.

Natural orders such as Labiateae, Rutaceae, Myrtaceae, Cauraceae, Piperaceae and Zingiberaceae.

Chemically they are mixtures of Hydrocarbons. alcohol esters aldehydes, ketone or oxides. The constituents are terpenes as monoterpenes, sesquiterpenes and diterpenes.

b. distribution, **Classification of volatile oils**

1) Hydrocarbon **volatile oils** Eg : Turpentine oil
2) Alcohol **volatile oils** Eg : Rose oil & pine oil
3) Aldehyde **volatile oils** Eg : Cinnaman & lemon peal
4) Ketone **volatile oils** Eg : Caraway & camphor
5) Phenol **volatile oils** Eg : Clove and Fennel
6) Oxide **volatile oils** Eg : Eucalyptus oil.

c. outline of isolation,

They are prepared by steam distillation, by mechanical methods by extraction with non-volatile solvent or by extraction with volatile solvent

f. pharmaceutical applications of volatile oils

These oils are pharmaceutically used as Flavouring agents to mark the taste and smell of unpleasant medicines perfumery industry spices.

e. therapeutic effects

Therapeutically used as carminative, Digestive, spasmolytic antiseptic, anthelmintic, Externally used as counter irritant, inflammation and Rheumatism as Turpentine oil.

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a. Brief outline of occurrence,

Chemically, Tannins contain mixture of complex organic substances in which polyphenols are present, generally with o-dihydroxy or o-trihydroxy groups on a phenyl ring. Normally Tannins have high molecular weight and do not contain nitrogen.

b. distribution,

The tannins are broadly classified into two groups based on complexity of their chemical nature and according to their behaviour on dry distillation.

(1) **Hydrolysable tannins :** As the name indicates, these tannins are hydrolysed by acids or enzymes quickly and the products of hydrolysis are gallic acid or ellagic acid. On dry distillation, gallic acid and other components get converted to pyrogallol. They respond to ferric chloride solution, producing blue colour. The examples of hydrolysable tannins are gallotannin in nutgall, rhubarb, clove and chestnut; ellagitannin from oak, myrobolans and pomegranate bark.

(2) **Condensed tannins :** They are also called as non hydrolysable tannins, phlobatannins or proanthocyanidins. They are much resistant to hydrolysis. They are related to flavonoid pigments, because they are formed via derivatives of flavones, like catechiin or flavan-3-ol or flavan-3, 4-diols.

Unlike hydrolysable tannins, on treatment with enzymes or mineral acids, they are polymerised or decomposed into red coloured substances called phlobaphenes, which are insoluble in water and indicate the typical brownish-red colour of many plants and drugs.

They are distributed in different parts of plants. The green tea and hamamelis leaves; cinchona, cinnamon and wild cherry bark; male fern rhizome; cocoa, cola and areca seeds; pale and black catechu contain these types of tannin.

Pseudotannins

This is not as such a separate group of tannins but may be treated as sub group because they do not obey to goldbeater's skin test and are low molecular weight compounds. Chlorogenic acid in coffee and nuxvomica, iphecacuanhic acid in ipecacuanha and catechins in cocoa are examples of pseudotannins. The detection test for chlorogenic acid is carried out by extracting the drug with water and treating this extract with ammonia solution, followed by exposure to air which leads slowly to formation of green colour.

c. outline of isolation,

Depending upon the source of the tannins, various modified methods are used for extraction. Methyl alcohol, hot water, acetone and ethyl acetate are the common solvents used for extraction, the extract is filtered and dried under vacuum.

d. identification tests,

Tannins form colloidal solutions with water and are non-crystalline substances. In solution, they show acidic reaction due to phenols. They are also soluble in alcohol, glycerine, dilute alkalies, but practically insoluble in organic solvents except acetone. Tannins exhibit some specific chemical reactions.

1) Solution of tannin precipitates gelatin, glycosides and alkaloids.

2) Tannins are precipitated by salts of copper, tin, and lead.

3) They are precipitated by strong potassium dichromate solution or chromic acid solution.

4) They show colour reactions with iron salts. Ferric chloride gives bluish-black or brownish-green colour and potassium ferricyanide with ammonia gives deep red colour.

5) **Goldbeater's skin test :** Gold beater's skin is a prototype of tanned fresh skin of an animal and is obtained as a membrane intestine of ox. This membrane is treated with (Hcl) hydrochloric acid, rinsed with distilled water and then placed in tannin solution for 5 minutes. It is followed by washing with distilled water and putting in ferrous sulphate solution. A brown or black colour is developed on the skin due to tannin.

6) Tannins are precipitated by 2% solution of phenazone, tannin solution being prepared with sodium acid phosphate.

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a. Brief outline of occurrence,

Resins are amorphous products of complex chemical nature. These are amorphous mixtures of essential oils, oxygenated products of terpene and carboxylic acids found as exudations from the trunk of various trees. They are transparent or translucent solids, semi-solids or liquid substances containing large number of carbon atoms. Most of the resins are heavier than water. They are insoluble in water, but soluble in alcohol, volatile oils, fixed oils, chloral hydrate and non-polar organic solvents like benzene or ether. They are hard, electrically non-conductive and combustible masses. When heated, they soften and ultimately melt. They are usually formed in schizogenous or schizolysigenous cavities or ducts as end products of metabolism. Chemically, they contain organic acids, alcohols, esters, and neutral resins. Depending upon the type of the constituents of the resin, they are further classified as : 1. Acid resin, 2. Ester resin, and 3. Resin alcohols.

b. distribution, or classification

1. Acid resins

Following are few examples of this type of resins along with their acids; colophony (abietic acid), sandrac (sandracolic acid), copaiba (copaivic and oxy-copaivic acids), myrrh (commiphoric acid) and shellac (alleuritic acid).

2. Ester resins

This group contains esters as the chief constituents of the resins, e.g. benzoin and storax. Benzoin contains benzyl benzoate and cinnamyl cinamate.

3. Resin alcohols

The contents are the complex alcohols of high molecular weight. They are either found in free state or as esters. The examples are balsam of peru with peruresinotannol, gurjan balasam with gurjuresinol and guaiacum resin with guaic-resinol.

Resins in homogenous mixtures are called as *oleoresins*, e.g. copaiba, Canada balsam, capsicum, etc. *Oleo-gum resins* are the homogenous mixtures of volatile oil, gum and resin, e.g. myrrh and asafoetida. *Glycoresins* are made up of resins and sugars and are present in jalap and ipomoea. If the resin contains benzoic acid and / or cinnamic acid, it is called as a *balsam*, e.g. balsam of tolu, storax, balsam of peru, etc.

Resenes: any of various mixtures of neutral alkali-resistant compounds that are found in rosin and other natural resins and that contain carbon, hydrogen, and oxygen —not used systematically .

Resenes : These are the complex natural substances without any specific chemical properties. They are inert chemically. They neither form any salt nor they get hydrolysed. Examples of the drug containing resenes are the gum copal, gutta purcha, asofoetida, colophony and dammar.

Pharmaceutical resins are obtained from the plants by one of the following methods.

1. By extraction with alcohol and precipitation with water, e.g. jalap, podophyllum, ipomoea, etc.
2. By distillation for separation of oil, e.g. copaiba, colophony, etc.
3. By heating the plant part, e.g. guaiacum.
4. As plant exudates by incisions, e.g. myrrh, asafoetida, balsams, etc.
5. By collecting fossil resins, e.g. copal, kauri, etc.

397 **7** Give Example each for Oleoresin and Balsamic resin. Mention Source and Uses

397 **12** What are balsamic resins ? How to distingulsh Sumatra & Siam benzoin?

Resins: Any of a class of solid or semisolid viscous substances obtained either as exudations from certain plants or prepared by polymerization of simple molecules

Balsam: Any of various fragrant oleoresins used in medicines and perfumes

Oleoresins: A naturally occurring mixture of a resin and an essential oil; obtained from certain plants

A classification of resins is as follows :

(1) **Acid resin** — Colophony

(2) **Balsamic resins** — **Tolu balsam, storax, benzoin** *(Any of various fragrant oleoresins used in medicines and perfumes*

(3) **Oleo-resin** — **Copaiba** *(A naturally occurring mixture of a resin and an essential oil; obtained from certain plants)*

(4) **Oleo-gum-resins** — **Myrrh, asafoetida** *(A mixture of resin and gum)*

(2) Balsamic resins BENZOIN

Benzoinum, Sumatra benzoin, Loban

Botanical Source : Benzoin is the balsamic resin obtained from the incised stem of ***Styrax benzoin*** Dryander and *Styrax parallelo-neurus* Perkins.

Family : Styraceae.

Geographical Source : Sumatra.

Collection : Benzoin is a pathological resin, secreted in secretory ducts and secretory cells of the tree after injury. Fungus also takes part in the production of benzoin. In Sumatra, benzoin is obtained

Chemical Constituents : Sumatra benzoin contains 23% free balsamic acids containing mainly cinnamic acid. It contains 70 to 80% resin consisting of triterpenoid acids, siaresinolic acid (19. hydroxy oleanolic acid) and sumaresinolic acid (6-hydroxy oleanolic acid) and their esters with balsamic acids at hydroxy group.

It also contains vanillin, styrol (phenyl ethylene) and phenyl propyl cinnamate responsible for the aromatic smell.

Uses : It is used as antiseptic, expectorant, stimulant and healing agent. It is used in the preparation of compound benzoin tincture.

(2) **Balsamic resins SIAM BENZOIN**

Botanical Source : Siam benzoin is the balsamic resin of *Styrax tonkinensis*. It is official in French & many European Pharmacopoeias.

Family : Styraceae.

Chemical Constituents: Siam benzoin contains about 70% crystalline and 10% amorphous coniferyl benzoate. It contains 10% free benzoic acid, 6% D. siaresinollic acid, vanillin & cinnamyi benzoate.

Chemical Tests :

(a) Heat 5 gm. of coarse Sumatra benzoin with 10 ml of 10% potassium permanganate solution in a test tube slowly. In Sumatra benzoin bitter almond smell of benzaldehyde is produced because of oxidation of cinnamic acid present in it, This test is negative in Siam benzoin because of very small quantity of cinnamic acid.

(b) Digest 0 2 gm. of coarse Sumatra benzoin with 5 ml. ether for 5 minutes. Pour 1 ml of the ethereal solution in a porcelain dish containing 2 to 3 drops of sulphuric acid and rotate the dish. Sumatra benzoin shows reddish-brown colour without purplish-tinge. Siam benzoin shows deep purplish-red colour by this test.

Uses : Benzoin is used as antiseptic and expectorant. It is used externally as mild disinfectant. Siam benzoin is used in the preparation of benzointated lard, in perfumery, and in cosmetics and as a fixative.

(2) **Balsamic resins resins BALSAM TOLU**

Balsamum tolutanum, Balsam of tolu, Tolu balsam

Botanical Source : Tolu balsam is obtained by incision on the stem of *Myroxylon balsamum* Linn. *(Myroxylon toluifera)*

Family : Leguminosae.

Chemical Constituents : Tolu balsam contains 75 to 80% resin. Resin contains resin ester of toluresiontannol esterified with benzoic acid and cinnamic acid and 7–8% cinnamein which is a mixture of benzyl benzoate and benzyl cinnamate. About 20% free balsamic acids are found. It also contains vanillin and styrol. Total balsamic acids in the drug, both free and combined, are 35 to 50%.

Chemical Tests :

(1) Dissolve 1 gm. of tolu balsam in 10 ml. of alcohol by heating. The solution shows acidic reaction with litmus and insoluable residue is not more than 4%.

(2) Boil 1 gm. balsam with 5 ml. water, filter and remember the smell of filtrate. To the filtrate add 3 ml. of 1% aqueous potassium permanganate solution and heat and smell. Cinnamic acid present in the balsam is oxidized to benzaldehyde showing bitter almond like smell.

(3) Add few drops of ferric chloride to alcoholic solution of tolu balsam. Green colour is seen because of toluresinotannol.

Uses : Tolu balsam is antiseptic and expectorant and syrup