Tannins

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Introduction

- **Tannins** are polyphenolic substances found in many plants product of secondary metabolism. Its water-soluble nature allows easy extraction and is useful in various applications in the chemical and pharmaceutical industry.

- **Definition**-the complex,organic,non-nitrogenous,polyphenolic substances of higher molecular weight. They are used as antiseptics and in git diseases like diarrhea and also used in leather industries.

Properties

Pale yellow to light brown-red amorphous substances widely distributed in plants and used chiefly in tanning leather, dyeing fabric, and making ink.

- Their solutions are acid and have an astringent taste.
- They are isolated from oak bark, sumac, and galls.
- Tannins give tea astringency, color, and flavor. Tannins are phenol glycosides.

Physical properties

- Tannins are **non-crystallizable** compounds.
- They are **soluble in water** forming colloidal solutions with acidic reaction and sharp astringent taste.
- They are soluble in dilute alkalis, alcohol, glycerol and acetone, but only sparingly soluble in other organic solvents.
- Their solutions precipitate heavy metals, alkaloids, glycosides and protein (e.g. gelatin).

Medicinal and biological properties

- Tannin-containing drugs **precipitate proteins** and have been traditionally used as **styptics** (stop hemorrhage) and internally for the **protection of inflamed surfaces** of mouth and throat.
- They play an important role in the **treatment of burns**. They form a mild antiseptic protective layer on the surface of the injured skin below which regeneration of new tissue takes place.

- They act as **anti-diarrheals**, although not recommended in this respect as they usually delay elimination of bacterial toxins from the body.

- Tannins have been employed as **antidote** in **poisoning by heavy metals**, **alkaloids** and **certain glycosides** due to their **precipitation as tannates**.
- Recently **tannins as most polyphenols** were proved to have a potent **antioxidant effect**.

Uses

- Dyes
- Fibers
- Glues
- Oils
- Waxes
- Flavoring agents
- Drugs
- Perfumes
- Potential sources of new natural drugs, antibiotics, insecticides and herbicides

Importance of tannins

Medicinal Uses:

Antidote

Antiseptic

Algicidals

Astringents

Anti-carcinogenic

Industrial Uses:

Ink manufacture

Vegetable tanning

Preservatives

Biological Activities:

Inhibition of lipid per oxidation

Decrease in blood urea nitrogen content

Inhibition of plasmin

Lipolysis in fat cells

CLASSIFICATION OF TANNINS

True Tannins

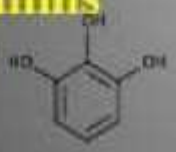
(High molecular weight compounds)

Pseudotannins

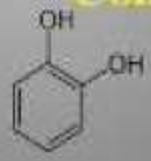
Low molecular weight compounds

e.g. Gallic acid, Flavan-3,4-diol

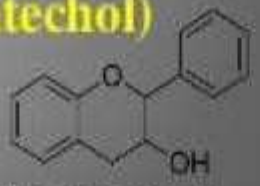
Hydrolysable Tannins (Pyrogallol)



Condensed Tannins (Catechol)

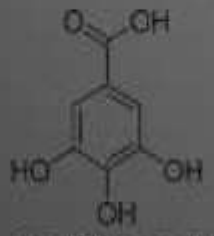


Complex tannins



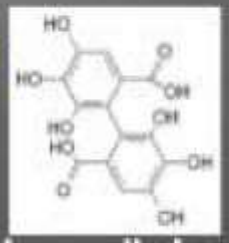
Flavan-3-ol

Gallitannins



Gallic acid

Ellagitannins

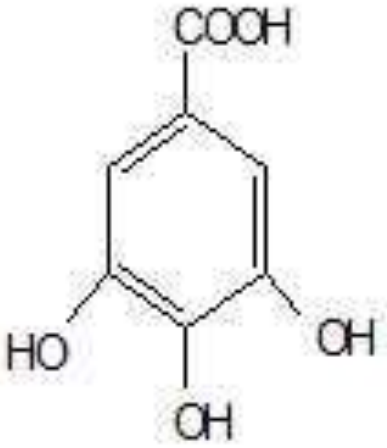


Hexahydroxydiphenic acid

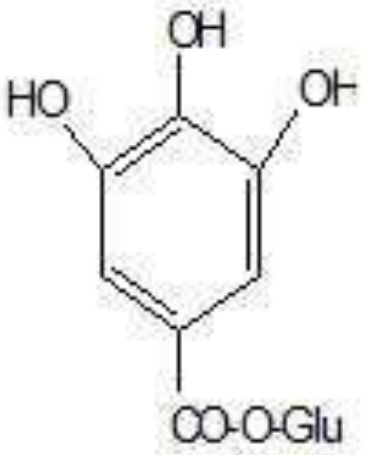
Classification

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

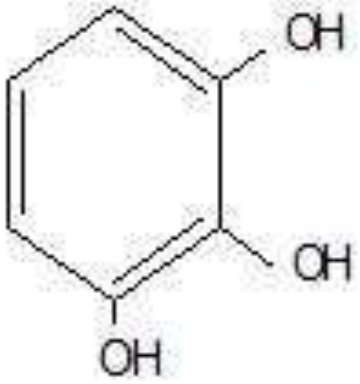
- **Hydrolysable tannins** :
- As the name indicates, these tannins are **hydrolyzed** by **acids or enzymes** quickly and the products of hydrolysis are Gallic acid or ellagic acid. On dry distillation, Gallic acid and other components get converted to pyrogallol. They respond to ferric chloride solution, producing blue colour. The examples of hydrolysable tannins are- Gallo tannin in nutgall, rhubarb, amla, clove and chestnut; ellagi tannin from oak, myrobalans and pomegranate bark.



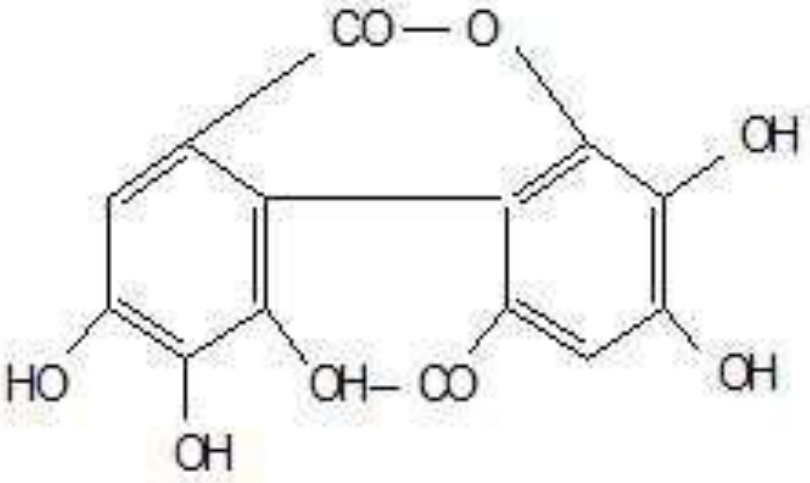
Gallic Acid



Glucogallin



Pyrogallol



Ellagic Acid

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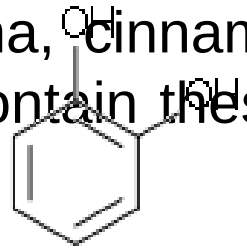
- **Condensed tannins :** They are also called as **non-hydrolysable** tannins, phiobatannins or proanthocyanidins. They are much **resistant to hydrolysis**. They are related to flavonoid pigments, because they are formed via derivatives of flavones, like catechin or flavan-3-ol or flavan-3,4-diols. Unlike the hydrolysable tannins, on treatment with enzymes or mineral acids, they are polymerized or decomposed into red colored substances called phlobaphenes. which are insoluble in water and indicate the typical brownish-red colour of many plants and drugs colour. On dry distillation they yield **catechol**. Tannins with ferric chloride produce brownish-green. They are distributed in different parts of plants. The green tea and hamamelis leaves, cinchona, cinnamon and wild cherry bark, pale and black catechu contain these types of tannins.



Catechol

Continued..

- **Pseudo tannins-** This is not as such a separate group of tannins, but may be treated as **sub group** because they do not obey to goldbeaters skin test and are low molecular weight compounds.

Chlorogenic acid in coffee and nuxvomica, ipecacuanhic 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.

Tannin containing drug

❖ Hydrolysable tannin

1. Myrobalan
2. Bahera
3. Amla
4. Arjuna

❖ *Non- hydrolysable tannine*

1. Ashoka
2. Black catechu
3. Pale catechu
4. Pterocarpus

Extraction and Isolation of tannins

- The various types of the methods of extraction depending upon the source of tannins are employed. As the tannins are high molecular weight compounds so it becomes difficult to isolate the tannins in pure form. Thus the solvents used are the mixture of polar, non-polar and semi-polar solvent like alcohol, ether,water,acetone etc.

Identification test

- **1. Gelatin test:**
- To a solution of tannin, aqueous solution of 1% gelatin and 10% sodium chloride are added. **A white buff colored** precipitate is formed. Conforms the presence of tannins and pseudo tannins
- **2. Goldbeater's skin test:**
- A small piece of goldbeater skin (membrane prepared from the intestine of an ox) is soaked in 20% hydrochloric acid, rinsed with distilled water and placed in a solution of tannin for 5 minutes. The skin piece is washed with distilled water and kept in a 1% solution of ferrous sulphate. A **brown or black colour** is produced on the skin due tob presence of tannins.
- **3. Phenazone test:**
- A 10ml of aqueous extract of a tannin and sodium acid phosphate is heated and cooled and filtered. A 2% solution of phenazone is added to the filtrate. A bulky colored precipitate is formed.

Continue..

- **Match stick test (Catechin test):**
- A match stick is dipped in aqueous plant extract, dried near burner and moistened with concentrated hydrochloric acid. On warming near flame, the matchstick wood turns pink or red due to formation of phloroglucinol.

Test with ferric chloride-To the solution of tannins add ferric chloride solution. A blue,black,violet or green precipitate or colour confirms the presence of tannins.

DRUGS CONTAINING TANNINS

CATECHU

- Synonyms – Pale catechu, gambier, kattha
- Biological source – It consists of the dried aqueous extract prepared from the leaves of *Uncaria gambier*
- Family - Rubiaceae

- Chemical constituents –
- It contains tannins like catechins and catechu tannic acid
- It contains flavonoids like quercetin and fluorescent substances Gambier fluorescein.
- It also contains catechu- red, pyrogallol, fixed oil and waxes

- Uses –
- Used as an astringent
- Used in the treatment of diarrhoea
- Used in the preparation of lozenges

BLACK CATECHU

Synonyms- Catechu nigrum, Catechu

- Biological source –
- It consists of the dried aqueous extract prepared from heart wood of *Acacia catechu* and *Acacia chundra*
- Family - Leguminosae

- Chemical constituents –
- It contains tannins like catechins and catechu tannic acid
- It contains flavonoids like quercetin.
- Others like Catechu- red and gum
- Uses –
- Used as an astringent, used in diarrhoea
- Used as a cooling and digestive agent

ACACIA CATECHU, *Willd.*

TANNIC ACID

Synonyms- Galla, Blue galls, Aleppo galls

- Biological source –

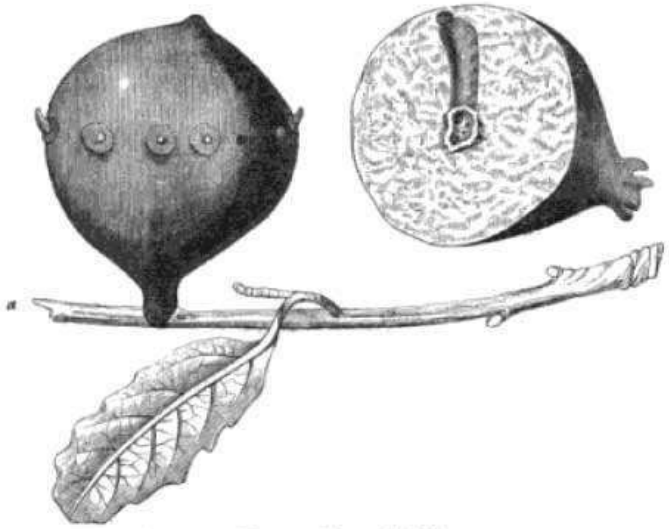
  It is obtained from the nutgalls. Galls are vegetable outgrowths found on the young twigs of *Quercus infectoria*

- Family - Fagaceae

- Tannic acid is a hydrolysable tannin and yields Gallic acid and glucose on hydrolysis

- Uses –
- Used as an astringent
- Used externally in the treatment of burns
- Used as an antidote for alkaloid poisoning

FIG. 157. *b*



Mecca or Bussorah Galls.

a, Branch bearing a gall. *b*, Section of a gall.

Amla

- **Synonyms:** Emblic Myrobalan Tree,Indian Gooseberry, Emblica, Amalk,Amla,Aonla,Auna.
- **Biological Source:** Amla consists of the fresh or dried fruits of *Emblica officinalis* Gaertn. (syn. *Phyllanthus emblica* Linn). **Family** : Euphorbiaceae.
- **Habitat** : The plant is a middle-sized tree commonly found in the mixed deciduous forests of India,Sri Lanka. China and Malaya.
- **Chemical Constituents:** The principal chemical constituent of Amla is vitamin C (650 - 900 mg/lOO g). It also contains tannins (5%), glucose, pectin. and minerals like iron,phosphorus and calcium. Tannins are mixture of gallic acid, ellagic acid and phyllembin. The presence of the tannins prevents the oxidation of vitamin.

Uses of Amla : .

- Treats frequent urination.
- Hair Loss.
- Helps to improve immunity.
- It is very helpful in skin diseases.
- Helps to accelerate the wound healing process.
- Helps to reduce the risk of cancers.
- It is helpful in improving liver function.
- It acts as an effective natural cure for indigestion, acidity, constipation, gastric troubles, ulcers and flatulence.
- It also acts as anti-inflammatory agent thereby suppresses pain and swelling.
- It provides nourishment to the nerves and is helpful in paralytic conditions.
- It also works as brain tonic and helps to alertness and memory.
- It helps in lowering cholesterol and blood sugar level.
- Lowers the risk of cold, cough and other infections of respiratory tract.

ARJUNA

- **Synonyms** : Arjuna (Sans.); Arjun (H).
- **Biological Source**: Drug is collected from dried bark of Terminalia Arjuna W. & A. **Family** : Cornbretaceae.
- **Habitat** : The plant is found throughout India.
- **Chemical Constituents:**

  Terminalia Arjuna contains Triterpene glycosides, arjunetin, arjunetoside, arjunaphthanoloside, together with oleanolic and arjunic acids, terminic acid, Antioxidants (flavones, tannins, proanthocyanidins) have been isolated from the root bark of Terminalia Arjuna. The bark contains phytosterols (ß-sitosterol), ellagic and oleanolinic acids, magnesium, zinc, copper and tannins. The whole tree is so rich on calcium that even the soil it grows on becomes rich on this element too. Arjuna also contains coenzyme Q10.

ARJUNA

- **Uses :**
- Arjuna bark is used as astringent (causing the contraction of skin cells and other body tissues).
- It is mainly used for both prevention and treatment of heart diseases including angina, heart failure and hypercholesterolemia, hypertension.
- It is also used in treating asthma, impotence and to help bones regain their strength.
- As a diuretic.
- As an antidote.

Ashoka

- **Synonyms** : Ashoka (Hindi); Asoka (Bengali).
- **Biological Source** : Ashoka is the dried bark of stem of *Saraca indica* Linn.
- **Family** : Leguminosae.
- **Habitat** : Ashoka tree is found in central and eastern Himalayas, eastern Bengal. western Peninsula, Burma, Sri Lanka and Malaya.
- **Chemical Constituents** : Ashoka bark contains tannins (6%), catechol, sterol, haemotoxyline, phlobaphenes. organic calcium compound and a keto sterol.
- **Uses:**
- Ashoka bark is used as astringent,
- It is used in uterine infections, biliousness, dyspepsia, dysentery, colic, piles, ulcers, pimples and
- In menorrhagia (excessive mensturation), Dysmenorrhoea.

Bahera

- Synonyms : Beleric Myrobalan; Bahira (Sanskrit).
- Biological Source : Bahera is the dried ripe fruit of *Terminalia bellerica* Roxb. Family : Combretaceae.
- Habitat : The plant is found throughout the forests of India,Burma and Sri Lanka
- Chemical Constituents: Bahera contains tannins (20-25%), phyllemblin, p-sitosterol, mannitol, glucose, fructose, rhamnose, fixed oil (30-40%) and hydrocarbons such as tetratriacontane, ditriacontane and tritriacontane. The fixed oil contains the esters of palmitic, stearic, oleic and linoleic acids.

Bahera

- Use:
- Bahera is analgesic, anti-inflammatory, haemostatic and gives black colour to skin and hair.
- Bahera oil is hair tonic.
- As laxative and anthelmintic.
- Bahera half ripe fruit is purgative and ripe fruit is astringent.
- Bahera is antiemtic and reduces excessive thirst.
- Bahera is used as a blood coagulant due to astringent property.
- Bahera helps in asthma and cough by reducing the inflammation of the bronchi.
- Bahera pulp is an aphrodisiac.
- Bahera pulp is intoxicant.


thank
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