

Tannin

Presented by

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1.Tannin- Introduction

It is a secondary metabolite ,it can present in all trees and plant can sows astringent and antioxidant property is known as tannin.

A tannin (also known as vegetable tannin, natural organic tannins or sometimes tannoid, i.e. a type of biomolecule, as opposed to modern synthetic tannin)

is an astringent, bitter plant polyphenolic compound that binds to and precipitates proteins and various other organic compounds including amino acids and alkaloids.

The term tannin (from tanna, an Old High German word for oak or fir tree, as in Tannenbaum) refers to the use of wood tannins from oak in tanning animal hides into leather:

The words "tan" and "tanning" for the treatment of leather. However, the term "tannin" by extension is widely applied to any large polyphenolic compound containing sufficient hydroxyls and other suitable groups (such as carboxyls) to form strong complexes with various macromolecules.

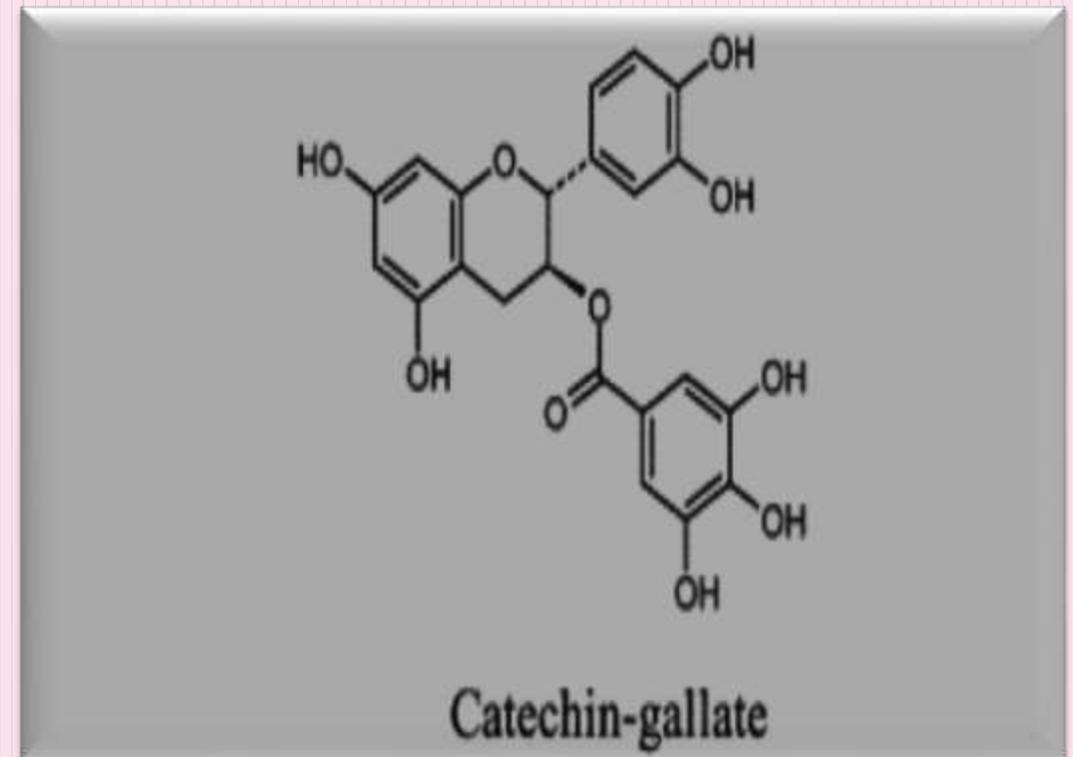
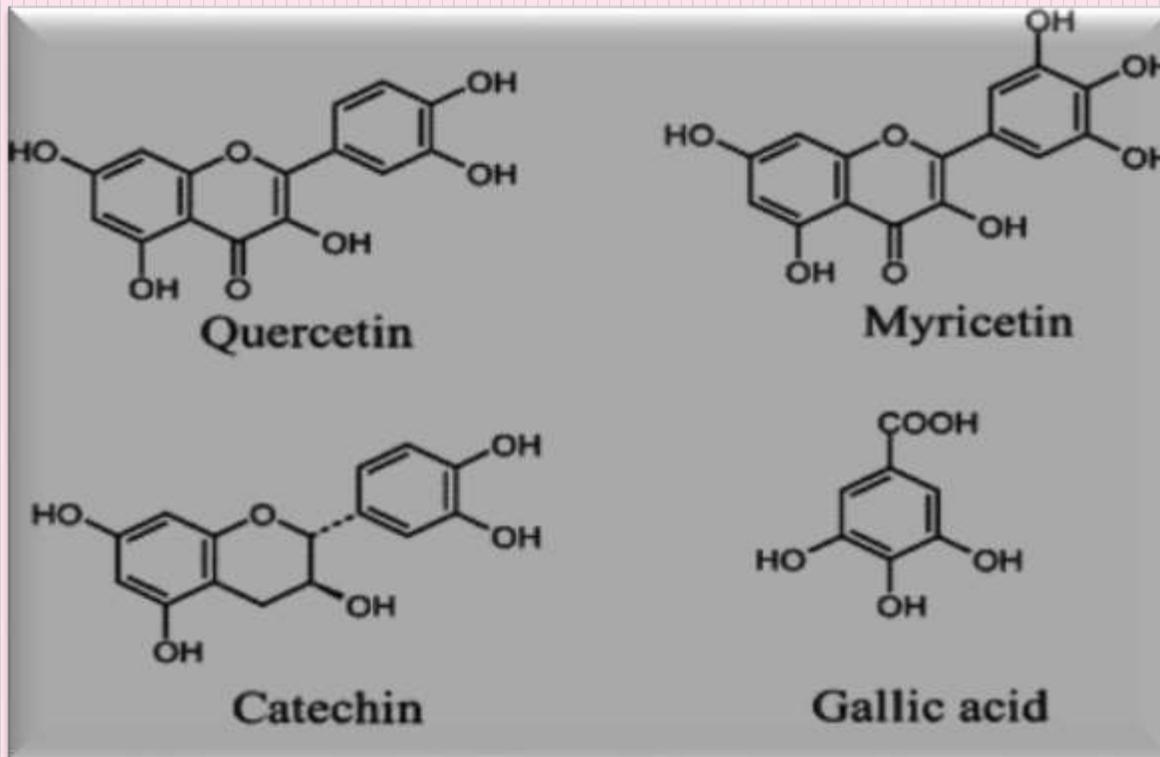
The tannin compounds are widely distributed in many species of plants, where they play a role in protection from predation, and perhaps also as pesticides, and in plant growth regulation.

The astringency from the tannins is what causes the dry and puckery feeling in the mouth following the consumption of unripened fruit or red wine Likewise, the destruction or modification of tannins with time plays an important role in the ripening of fruit and the aging of wine.

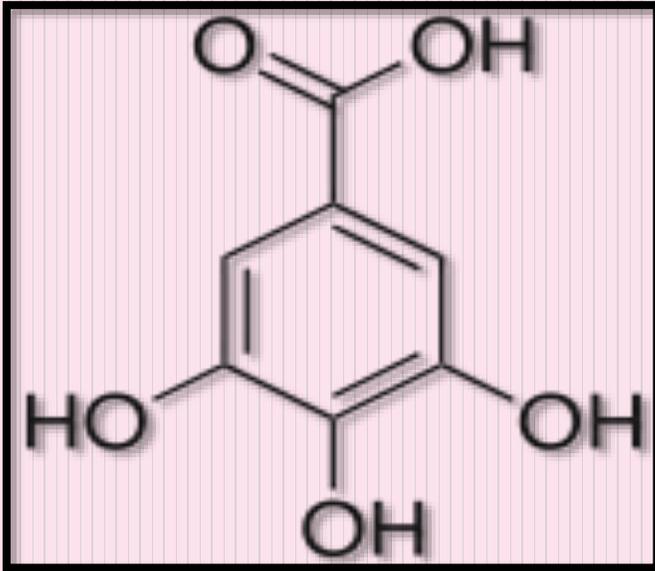
Tannins have molecular weights ranging from 500 to over 3,000 (gallic acid esters) and up to 20,000 (proanthocyanidins).

2. Structure and classes of tannins

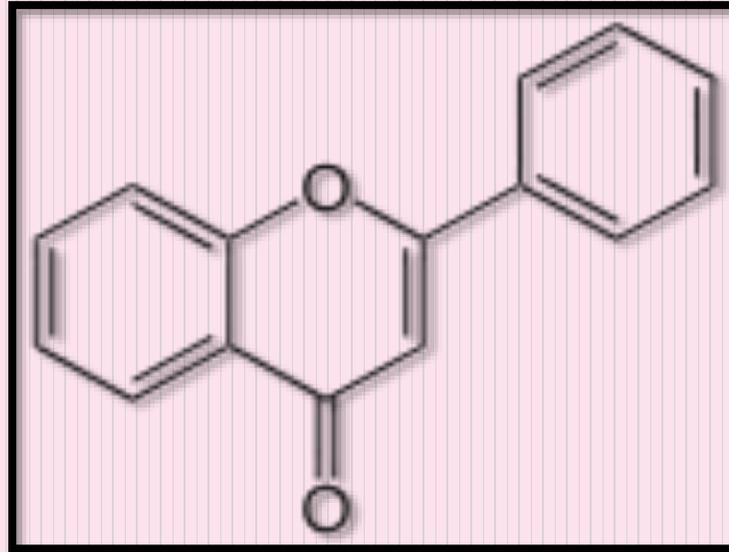
There are three major classes of tannins¹ Shown below are the base unit or monomer of the tannin. Particularly in the flavone-derived tannins, the base shown must be (additionally) heavily hydroxylated and polymerized in order to give the high molecular weight **polyphenol** motif that characterizes tannins. Typically, tannin molecules require at least 12 hydroxyl groups and at least five phenyl groups to function as protein binders.



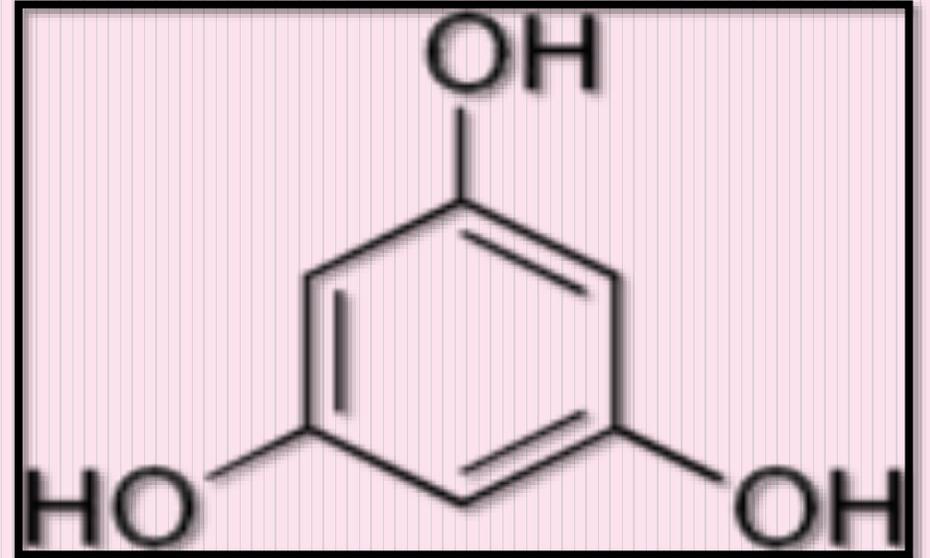
2.1 Base Unit



Gallic acid



Flavone



Phloroglucinol

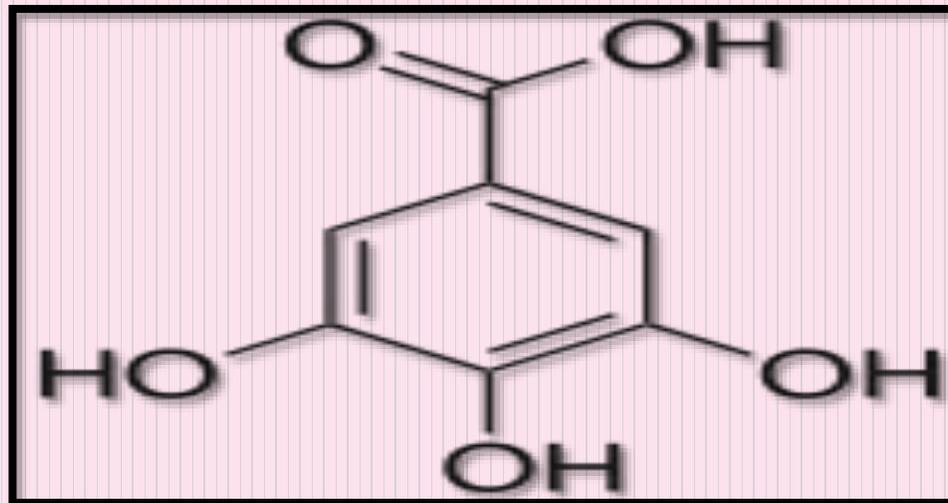
3. Function of tannins in plants

- ❖ Tannins are considered the source of energy through their oxygen content.
- ❖ They serve as a protective to the plant (plant antiseptics).
- ❖ They may have function in respiratory activity, i.e. in the mechanisms of hydrogen transfer in plant cells.
- ❖ Tannins play an important part in the acceptance of many foods and beverages by consumers e.g. tea, cocoa.

4. Classification of tannins

4.1 Hydrolysable tannins

- ❖ Hydrolysable tannins are esters of a sugar (or related polyol) and of a variable number of phenolic acid molecules. The sugar is most generally glucose.
- ❖ The phenolic acid is either gallic acid, in the case of gallitannins, or Ellagic acid, in the case of the tannins conventionally referred to as ellagitannins.
- ❖ Ellagic acid can arise by lactonization of hexahydroxydiphenic acid (= HHDP) during chemical hydrolysis of the tannin.
- ❖ Hydrolysable tannins were formerly known as pyrogallol tannins, because on dry distillation gallic acid and similar components are converted into pyrogallol.



❖ Biosynthetically, gallic acid (= 3,4,5-trihydroxybenzoic acid) arises from the metabolism of shikimic acid.

Examples of drugs containing Hydrolysable tannins: Gallitannins: rhubarb, cloves, Chinese galls, Turkish galls, hamamelis, chestnut and maple. Ellagitannins: pomegranate rind, pomegranate bark, eucalyptus leaves, and oak bark

4.2 Condensed tannins (proanthocyanidins)

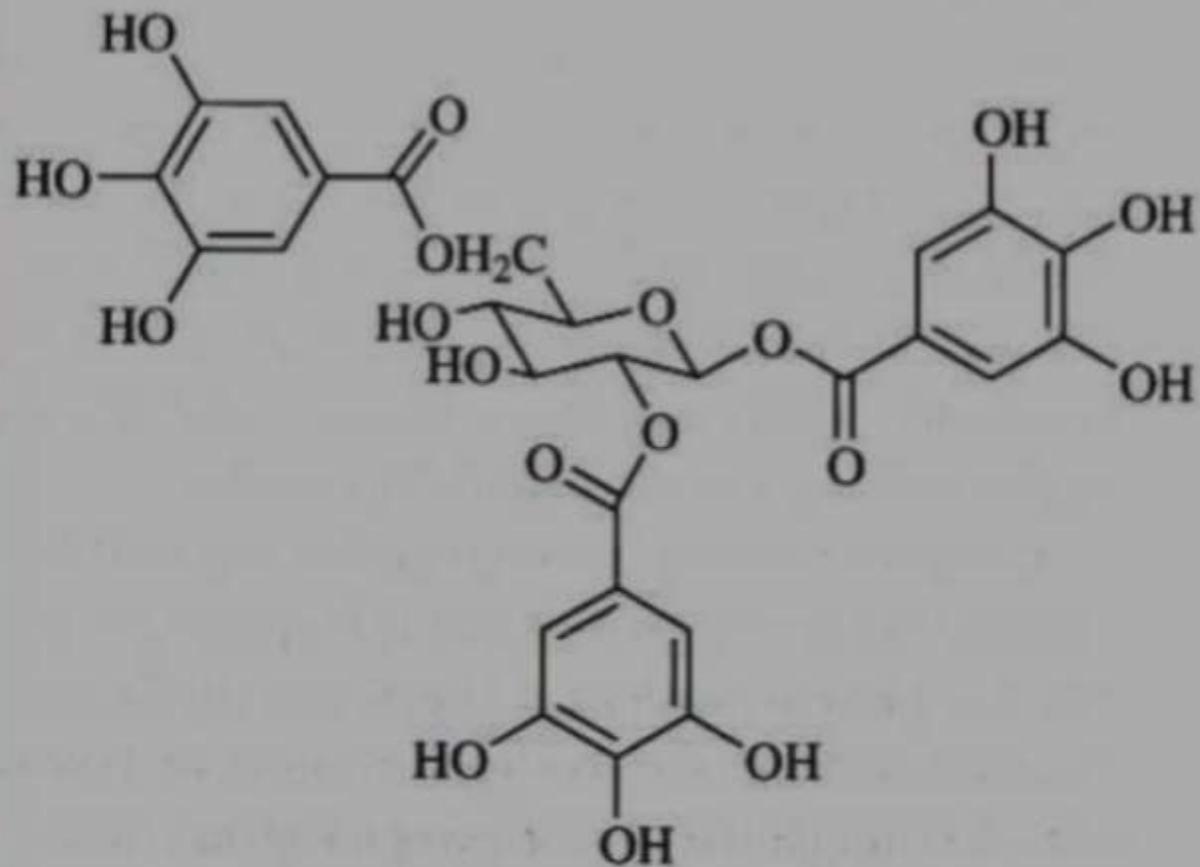
Condensed tannins or proanthocyanidins are polymeric flavans. They consist of flavan-3-ol units linked together by carbon-carbon bonds, most often 4→8 or 4→6, which result from coupling between the electrophilic C-4 of a flavanyl unit from a flavan-4-ol or flavan-3,4-diol and a nucleophilic position (C-8, less commonly C-6) of another unit, generally a flavan-3-ol.

- ❖ Unlike hydrolysable tannins, these are not readily hydrolyzed to simpler molecules and they do not contain a sugar moiety.
- ❖ Biosynthetically, flavonoids are derived from acetate and shikimate pathways.
- ❖ Condensed tannins occur due to polymerization (condensation) reactions between flavonoids.
- ❖ The polymers may include up to 50 monomer units.
- ❖ On treatment with acids or enzymes condensed tannins are converted into red insoluble compounds known as phlobaphenes. Phlobaphenes give the characteristic red colour to many drugs such as red cinnamon bark.

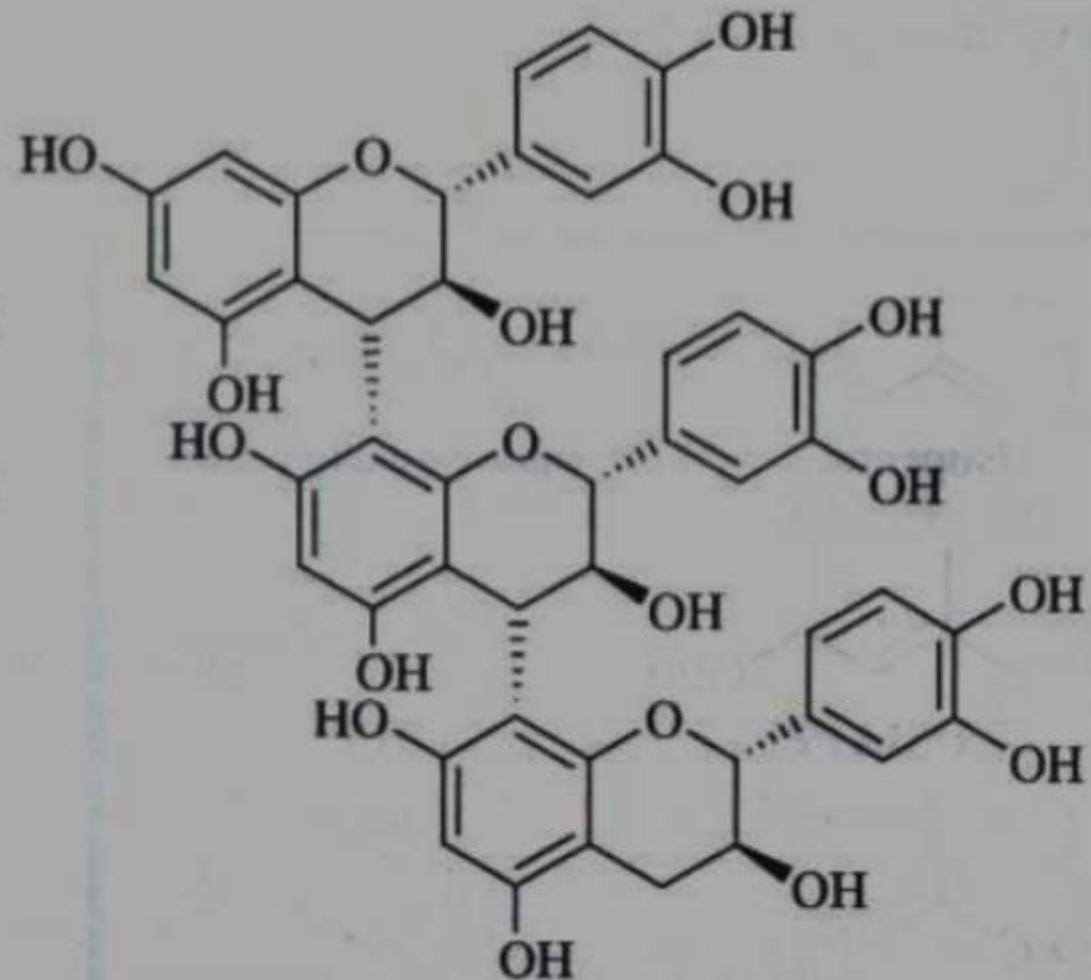
Examples of drugs containing Condensed tannins:

Some drugs (e.g. tea, hamamelis leaves and hamamelis bark) contain both hydrolysable and condensed tannins. The following are rich in condensed tannins.

- (1) Barks: cinnamon, wild cherry, cinchona, willow, acacia, oak and hamamelis
- (2) Roots and rhizomes: krameria (rhatany) and male fern
- (3) Flowers: lime and hawthorn
- (4) Seeds: cocoa, guarana, and kola
- (5) Leaves: hamamelis, hawthorn and tea, especially green tea
- (6) Extracts and dried juices: catechu, acacia and mangrove cutches



Hydrolysable tannin (trigalloyl glucose)



Non-hydrolysable tannin (flavonoid trimer)

4.3 Pseudotannins

They are compounds of lower molecular weight than true tannins and they do not respond to the goldbeater's skin test.

Examples of drugs containing Pseudotannins are:

Gallic acid: Rhubarb

Catechins: Guarana, Cocoa

Chlorogenic acid: Mate, Coffee

Ipecacuanhic acid: ipecacuanha

5. Properties and tests of tannins

- ❖ Tannins are soluble in water, dilute alkalis, alcohol, glycerol and acetone, but generally only sparingly soluble in other organic solvents.
- ❖ Solutions precipitate heavy metals, alkaloids, glycosides and gelatin.
- ❖ With ferric salts, gallitannins and ellagitannins give blue-black precipitates and condensed tannins brownish-green ones. If a very dilute ferric chloride solution is gradually added to an aqueous extract of hamamelis leaves (which contains both types of tannin), a blue colour is produced which changes to olive-green as more ferric chloride is added. Other useful tests are the following:

1. Goldbeater's skin test

Soak a small piece of goldbeater's skin in 2% hydrochloric acid; rinse with distilled water and place in the solution to be tested for 5 min. Wash with distilled water and transfer to a 1% solution of ferrous sulphate. A brown or black colour on the skin denotes the presence of tannins. Goldbeater's skin is a membrane prepared from the intestine of the ox and behaves similarly to an untanned hide.

2. Gelatin test

Solutions of tannins (about 0.5-1 %) precipitate a 1% solution of gelatin containing 10% sodium chloride. Gallic acid and other pseudotannins also precipitate gelatin if the solutions are sufficiently concentrated.

3. Phenazone test 4. Test for catechin 5. Test for chlorogenic acid

6. Medicinal and biological properties

The applications of tannin-containing drugs are limited, and result from their affinity for proteins.

- ❖ Tannin-containing drugs will precipitate protein and have been used traditionally as styptics and internally for the protection of inflamed surfaces of mouth and throat.
- ❖ They act as antidiarrhoeals and have been employed as antidotes in poisoning by heavy metals, alkaloids and glycosides.

7. Uses

- 1. This section needs additional citations for verification. Please help improve this article by adding citations to reliable sources. Unsourced material may be challenged and removed.**
- 2. Tannins are an important ingredient in the process of tanning leather. Oak bark, mimosa, chestnut and quebracho tree have traditionally been the primary source of tannery tannin, though inorganic tanning agents are also in use today and account for 90% of the world's leather production.**
- 3. Tannins produce different colors with ferric chloride (either blue, blue black, or green to greenish-black) according to the type of tannin. Iron gall ink is produced by treating a solution of tannins with iron(II) sulfate.**
- 4. Tannin is a component in a type of industrial particleboard adhesive developed jointly by the Tanzania Industrial Research and Development Organization and Forintek Labs Canada. Pinus radiata tannins has been investigated for the production of wood adhesives.**
- 5. Condensed tannins, i.e. quebracho tannin, and Hydrolyzable tannins, i.e., chestnut tannin, appear to be able to substitute a high proportion of synthetic phenol in phenol-formaldehyde resins for wood particleboard.**
- 6. Tannins can be used for production of anti-corrosive primer, sold under brand name-Nox Primer for treatment of rusted steel surfaces prior to painting, rust converter to transform oxidized steel into a smooth sealed surface and rust inhibitor.**
- 7. The use of resins made of tannins has been investigated to remove mercury and methylmercury from solution. Immobilized tannins have been tested to recover uranium from seawater.**

8. Medical uses and potential

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2. When incubated with red grape juice and red wines with a high content of condensed tannins, the poliovirus, herpes simplex virus, and various enteric viruses are inactivated.
3. In tissue-cultured cell assays tannins have shown antiviral, antibacterial and antiparasitic effects.
4. Tannins isolated from the stem bark of *Myracrodruon urundeuva* may offer protection against 6-hydroxydopamine-induced toxicity. Souza et al. discovered that the tannins isolated from the stem bark also have anti-inflammatory and antiulcer activity in rodents, showing a strong antioxidant property with possible therapeutic applications.
5. Foods rich in tannins can be used in the treatment of HFE hereditary hemochromatosis, a hereditary disease characterized by excessive absorption of dietary iron, resulting in a pathological increase in total body iron stores.

9. Tannin contain in crude drug

❖ Hydrolysable tannin

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

❖ Non- hydrolysable tannine

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

9.1 Hydrolysable tannin

9.1.1 Myrobalan

Synonyms-harde , haritaki.

Biological source- it consist dried frute of plant terminalia chebula belonging to family combretaceae

Geographcale source-india , asam , mharashtra

Morphological character-

Colour-yellowish colur

Odour-odourless

Taste-astringent

Size-20 to 25 mm long

Shape-ovate

Chemical constituents-it can consist gallic acid and ellagic acid ,main chemical constituent is chebulegic acid and chebulinic acid.

Chemical test-in presence of tannin protein get ppt , in presence of metal tannin get ppt.[lead acetate – white ppt]

Use-astrigent , laxative, antihelminthic, ayurvedic prepration triphla

9.1.2 Bahera

Synonyms -Baheda

Biological source- it consist dried frute of plant terminalia belirica belonging to family combretaceae

Geographical source-India, sri-lanka, Malaya

Morphology-

Colour-brownish colur

Odour-odourless

Taste-astringent

Size-1.5 to 2 mm long

Shape-ovate

Chemical constituents-it can consist pyrogallole gallic acid and ellagic acid.

Chemical test-in presence of tannin protein get ppt , in presence of metal tannin get ppt.[lead acetate – white ppt]

Use-astinging , laxative , dyspepsia , diarrhea , purgative.

9.1.3 Amla

Synonyms – Emblica, Indian goose berry

Biological source – it consist of fresh as well as dried fruits of plant emblica officinallis belonging to family Euphorbiaceae.

Geographical source - India, Pakistan, U.S.A. Sri Lanka , myanmar

Chemical constituents – chemically it can contain vitamins C & vitamins E it also contain hydroliasable tannin, gallic acid, ellagic acid.

Morphology-

Colour - green

Odour - characteristics

Taste – astringent

Size-1.5 to 2.5 mm diameter

Shape-ovale

chemicale test -

Test of potassium permagnet - **Decolourization**

2,4,dichloroendophenol - **Decolourization** **Amla**

Ferric chlorides - **Bluish black** **colour**

Use - amla is fruite largely used in indian medicine ,it is used as common cold to canser , astingent , laxative , dyspepsia , diarrhea , purgative, , ayurvedic prepration triphla and chyawanprash.

9.1.4 Arjuna

Synonyms-Arjun bark

Biological source-It can consist of dried stem bark of plant terminalia arjuna belonging to family combrataceae

Geogrraphicale source -India , chotta-nagpur region.

Morphology-

Colour – greyish brown

Odour – characteristics

Taste – astringent

Size-1.5 to 2.5 mm diameter

Shape-flats

Chemical constituents- Main chemical constituents is Arjunine, arjunc acid,arjunetine, other is gallic acid , ellagic acid.

Chemical test-in presence of tannin protein get ppt , in presence of metal tannin get ppt.[lead acetate – white ppt]

Use-It is used in cardi tonic , vasodialatores and dceases heart rate. astingent , laxative , dyspepsia , diarrhea , purgative.

9.2 Non- hydrolysable tannin

9.2.1 Ashoka

Synonyms-ashoka bark

Biological source-It can consist of dried stem bark of plant saraca indica belonging to family leguminosae.

Geographical source - India, Pakistan, U.S.A. Sri Lanka , myanma

Morphology-

Colour – raddish brown

Odour – characteristics

Taste – astringent

Size-1.5 to 2.5 mm diameter

Shape-channele.

Chemical constituents-it can cntain ketosterol , phenolic glycocides p₂ , basic moety is catechu

Use- uterine tonic , . astingent , laxative , dyspepsia , diarrhea , purgative.

9.2.2 Black catechu

Synonyms - catechu, Kattha, cutch,

Biological source – it consists of dried aq. extract of heart wood plant acacia catechu belonging to family leguminosae.

Geographical source – India, Pakistan, U.S.A. Sri Lanka

Chemical constituents – it can contain 10% of acacatechin it is diastereomer of 5, 7, 3', 4' tetrahydroxy flavan 3-ol, catechu tannic acid, tannic acid

Morphology- Colour – light brown black

Odour – none

Taste – astringent

Solubility in water – completely. ; **Solubility in alcohol** –soluble.

Chemical test -

1]Catechu + alcoholic vanilline +hydrochloric acid - Pink colour

2]Aq.extract of drug + lime water - Brown colour turn to red

3]Dil.solution catechu + ferric ammonium sulphate solution - Green colour

4]Dip matchstick in Hcl & heat near the flame - Purple colour

5]Potassium permanganate - Decolourisation

Use – astringent, for boiling, ulcers, it is used in cough and diarrhea, cooling & digestive properties.

9.2.3 Pale catechu

Synonyms – gambier ,gambir,catechu

Biological source – it is dried aq.extract of the leaves & young shoots of uncaria gambier belonging to family of rubiaceae.

Geographical source - plant native to south east Asian region like archipelago in Malaysia , singapore and Indonesia.

Chemical constituents – drug containing catechu, catechu tannic acid , catechu red

Morphology-

Colour – reddish brown

Odour – none

Taste – astringent

Chemical test-

1)Lead acetate White Buff ppt (tests 1 to 5 same as above black catechu)

2)Gambier florecin test [alcohol+sodium hydroxide solution+few drops of light petroleum+shake] Green fluorescence
observed in petroleum layer

3)Chloroform extract evaporate to dryness Greenish yellow colour

Use – it is used as astringent of diarrhoea and local astringent in the form of lozenges.

9.2.4 Pterocarpus

Synonyms-bijasal

Biological source- it can consist dried juice of plant pterocarpus marsupium belonging to family leguminosace.

Geographical source-Gujrat, Madhya predesh, uter predesh, bihar.

Morphology-

Colour – ruby red

Odour – characteristics

Taste – astringent

Size-3 to 5 mm diameter

Shape-angular grains

Chemical constituents-70% to 80% kiotannic acid , kino red , k-pyrocatechin.

Chemical test-drug treated with ferrous sulphate shows green colour.

Drug + alkali shows violet colour.

Mineral acid shows ppt.

Use-- it is used as astringent of diarrhoea and local astringent in the form of lozenges. dyspepsia , purgative.

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Thank you

