

TANNINS

1. INTRODUCTION

Tannins are defined as, "Complex poly hydroxy phenolic compounds that are very difficult to separate since they don't crystallize and they are of plant origin". Tannins are complex polyphenols that are either bind, precipitate or shrink proteins. Seguin in 1976 introduce the term tannins when he was studying the chemical constituents of galls. Basically tannins are derived from tanning industry because of extensive use in tanning industry. They are used as astringent in tanning industry.

2. OCCURRENCE OF TANNINS

Tannins are usually distributed throughout the plant kingdom and localized in specific plant parts such as roots, leaves, bark and stem. They are commonly found in both gymnosperms as well as angiosperms.

3. PROPERTIES OF TANNINS

- They are non-crystallizable compounds.
- They are soluble in water and sparingly soluble in organic solvents.
- They cause precipitation of solution of gelatin, alkaloids and glycosides.
- They give blue or green color with FeCl_3 .
- They cause precipitation of proteins and are resistant to proteolytic enzymes.
- With FeCl_3 hydrolysable tannins give blue precipitate and condensed tannins give green precipitates.

4. USES OF TANNINS

Tannins are used in medicines as well as in industry.

4.1. Medicinal Uses

4.1.1. Astringent Action

Due to its property of precipitation of proteins, it is of therapeutic importance.

4.1.2. Treatment of Burns

The protein-tannins complex is resistant to proteolytic enzymes. During treatment of burns, when tannin bearing drugs are applied to skin, the proteins of exposed tissues are precipitated and form antiseptic and protective coat under which regeneration of tissues take place.

4.1.3. Alkaloidal Poisoning

Tannins are used as antidote in alkaloidal poisoning by inactivating the alkaloids by the formation of insoluble tannates.

4.1.4. Detection of Compounds

Because of their precipitating property, solution of tannins is utilized in laboratory reagents for detection of gelatin, proteins, alkaloids.

4.2. Industrial Uses

4.2.1. Manufacturing of Inks

As tannins produce deeply colored compounds with iron salts, they are used in the manufacturing on commercial scale. For example Iron gall ink is produced by treating a solution of tannins with iron sulfate.

4.2.2. In Leather Industries

On industrial scale, they are used in tanning industry where they act as preservative for leather due to their antiseptic properties and convert the animal hides into leather due to astringent property.

5. PRECAUTION

Prolong use of certain tannins may have carcinogenic effect e.g. if tea is used without milk, it can cause esophageal cancer. When milk is added in tea, proteins of milk form a complex with tannins of tea and are inactivated and tea is safe to use.

6. CLASSIFICATION OF TANNINS

There are two types of Tannins.

- True Tannins
- Pseudo Tannins

6.1. True tannins

These are the tannins which have molecular weight of 1000-5000 and they give gold beater's test, also precipitate proteins and give other tests for identification of tannins. True tannins are further classified into two types.

- Hydrolysable tannins
- Non-hydrolysable tannins (Condensed)

6.1.1. Hydrolysable Tannins

As the name indicates, this type of tannins is hydrolyzed by enzymes such as tannase. They are formed from several molecules of phenolic acid such as Gallic acid and Ellagic acid (phenolic acids). Hydrolysable tannins give blue color with FeCl_3 solution. They were formerly known as pyrogallol tannins because on dry distillation, they are converted to pyrogallol.

Hydrolysable tannins are further classified into

- Galli tannins
- Ellagi tannins

6.1.1.1. Galli tannins

These on hydrolysis yield gallic acid e.g. plants containing galli tannins include Clove, Rhubarb and Hamamelis.

6.1.1.2. Ellagi tannins

These on hydrolysis yield ellagic acid. Plants containing ellagi tannins include Eucalytus, Nutgalls.

6.1.2. Non-hydrolysable Tannins (Condensed Tannins)

These are the tannins which are more resistant to breakage than hydrolysable tannins. On treatment with acid or enzyme, they are decomposed into insoluble compounds known as Phlobaphenes. Condensed tannins on dry distillation yield catechol, so they are also called as catechol tannins. They give green color with FeCl_3 e.g. drugs containing condensed tannins include Catechu, Kino, Cinnamon and Cinchona.

6.2. Pseudo tannins

These are the phenolic compounds which occur with tannins and have low molecular weight as compared to true tannins and they don't give gold beater's test. Although they precipitate proteins and give other tests for identification of tannins e.g. pseudo tannins include "Catechin" and "Chlorogenic acid" from coffee. Coffee allergy is due to chlorogenic acid because it has antigenic property. There are some products of coffee in market which are free of chlorogenic acid.

Difference between True Tannins & Pseudo Tannins

True Tannins	Pseudo Tannins
<ol style="list-style-type: none"> 1. High molecular weight. 2. Give Goldbeater's test. 3. Include hydrolysable and condensed tannins. 4. Do not give test for Chlorogenic acid e.g. Ellagi tannins, Galli tannins. 	<ol style="list-style-type: none"> 1. Low molecular weight. 2. Not give goldbeater's test. 3. No classification. 4. Give test for Chlorogenic acid test. e.g. Chlorogenic acid

7. TEST FOR IDENTIFICATION OF TANNINS

7.1. Gold beater's skin test

Soak a small piece of gold beater skin (membrane prepared from intestine of Ox) in HCl, rinse with water and place in a solution of tannins to be tested for 5 minutes. Skin is washed with distilled water and transferred to the solution of FeSO_4 . Brown or black color on skin is produced due to presence of tannins.

7.2. Gelatin test

Solution of tannins is mixed with gelatin solution and NaCl. Gelatin is precipitated.

7.3. Phenazone test

Aqueous extract of drug containing tannin is mixed with sodium acid phosphate. Filtered, heated and cooled. Filtrate is treated with phenazone solution. As a result tannins precipitated.

7.4. Test for Chlorogenic acid (Pseudo tannins)

Extract of chlorogenic acid is treated with aqueous ammonia and exposed to air. Green color is produced indicated the presence of chlorogenic acid.

8. DRUGS CONTAINING TANNINS

8.1. Hamamelis

Botanical origin:

Hamamelis virginiana

Common name:

Witch zeal

Part used:

Dried leaves

Collection:

Leaves are collected throughout the summer and are dried in open air under shade to preserve their green color.

Constituents:

It contains galli tannins, ellagi tannins, free gallic acid and volatile oils

Uses:

Used as astringent and as haemostatic agent.



8.2. Nut Galls

Botanical origin:

Quercus infectoria

Local name:

Mazophal

Part used:

Excrescence (outgrowth) or Galls obtained from twigs of Oak tree



Collection and formation of Galls

The insects (Gall waspe, *Cynips tinctoria*) lay eggs on twigs. Larvae come out from eggs and enter into the soft epidermis near the growing points of twigs. The larvae secrete an enzyme that stimulates abnormal growth of vegetable tissues around the larvae. The larvae remain in the gall for 5-6 months. The mature insect bore the covering of gall and escapes away from the gall. The color of gall changes from bluish grey to white. During this process, the galls are collected. Galls are spherical in shape with projections.

Constituents:

It contains Gallo-tannic acid, gallic acid, ellagic acid and starch.

Uses:

- Used as Astringent
- Used in tanning or dyeing industry
- Used in manufacturing of ink
- Used as antidote for alkaloidal poisoning
- Used in decubitus ulcer (ulcer of backside due to prolong bed rest, also called bed sores)

8.3. Catechu

There are two varieties of catechu.

- ⊖ Pale catechu
- ⊖ Black catechu

8.3.1. Pale Catechu

Botanical origin:

Uncaria gambier

Part used:

Dried aqueous extract obtained from leaves

Constituents:

It contains Catechin, catechu-tannic acid, catechu red and fixed oil, waxes

Uses:

- Used as Astringent
- Used in tanning and dyeing industry



8.3.2. Black Catechu

Botanical origin:

Acacia catechu

Part used:

Dried extract prepared from heart wood

Constituents:

It contains catechu-tannic acid, catechol, catechu red.

Uses:

- Used as Astringent
- It has digestive properties
- Used in Pan masala
- Externally used in the eruption of skin.



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