



Pharmacognesy II



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Robbers JE, Speedie MK, Tyler VE.)

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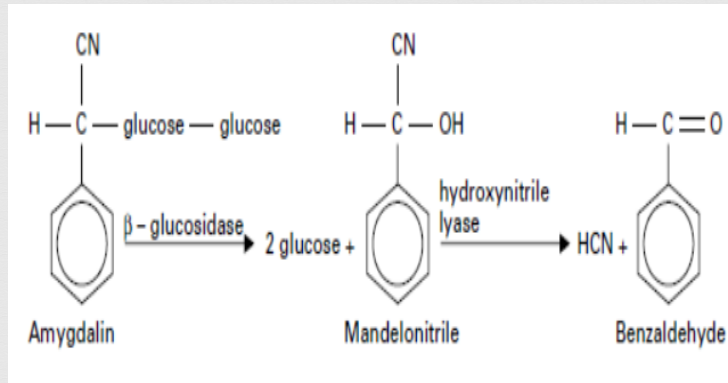
(Cyanophor (or cyangenic) glycosides)

- ☞ Cyanogenic glycosides are the glycosides that yield hydrocyanic acid (HCN) as one of the products of hydrolysis.
- ☞ The group is represented by **amygdalin**, which is found in large quantities in bitter almonds, in kernels of apricots, cherries, peaches, and plums, and prunasin which occurs in *Prunus serotina*.
- ☞ When amygdalin is hydrolyzed it forms two molecules of glucose with benzaldehyde and HCN.

(Cyanophor (or cyangenic) glycosides)

- ❧ The common cyanophore glycosides are derivatives of mandelonitrile (benzaldehyde- cyanohydrin).
- ❧ Both amygdalin and prunasin yield D-mandelonitrile as the aglycone.
- ❧ Preparations from plant materials containing cyanogenic glycosides are widely employed as flavoring agents.

- ❧ The hydrolysis takes place in three steps:
- ❧ 1. Hydrolysis to give one molecule of glucose and one molecule of mandelonitrile glucoside.
- ❧ 2. The second molecule of glucose is liberated with the formation of benzaldehyde-cyanohydrin (mandelonitrile).
- ❧ 3. The mandelonitrile then breaks down with the formation of benzaldehyde and hydrocyanic acid.
- ❧ The hydrolysis steps are catalyzed by the presence of an enzyme emulsin found in almond kernels.



(Hydrolysis of amygdalin)

Wild Cherry

Wild cherry is the carefully dried stem barks of *Prunus serotina* (F. Rosaceae).

Constituents: Wild cherry bark contains a cyanogenic glycoside, prunasin (0-mandelonitrile), prunase, p-coumaric acid, methyl gallic acid, starch, and traces of a volatile oil.

Uses: Wild cherry, in the syrup form, is employed as a flavored vehicle, especially in cough remedies. It has been considered a sedative expectorant, and astringent.

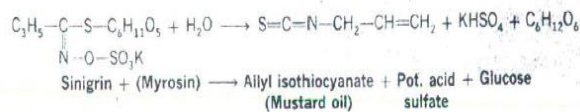


(Isothiocyanate glycosides)

- ❧ The seeds of several cruciferous plants contain glycosides, the aglycones of which are isothiocyanates.
- ❧ Principal among these glycosides are sinigrin from black mustard, sinalbin from white mustard, and gluconapin from ripe seed.
- ❧ When hydrolyzed by the enzyme myrosin, they yield the mustard oils.

Mustard

- ❧ Black mustard, *sinapis nigra*, or brown mustard is the dried ripe seed of varieties of *Brassica nigra* (F. Cruciferae).
- ❧ **Constituents:** Sinigrin (potassium myronate) is the principle constituent, the myrosin enzyme, fixed oil (30 to 35%).
- ❧ Upon the addition of water to the crushed or powdered seeds, the myrosin effects the hydrolysis of the sinigrin, as shown below:





Uses: local irritant and an emetic. Externally, the drug is a rubefacient and vesicant. Commercially, it is used as a condiment.

White mustard

- ☞ White mustard or *sinapis alba* consists of the dried, ripe seeds of *Brassicca alba* (F. Cruciferae).
- ☞ **Constituents:** the enzyme myrosin, and a glucoside, sinalbin, which upon hydrolysis, yield acrinyl isothiocyanate, a pungent-tasting but almost odorless oil that is much less volatile than allyl isothiocyanate. It also contains 20- 25% fixed oil.

(Alcohol glycosides)

☞ Salicin

☞ Salicin is a glycoside obtained from several species of *Salix purpurea* and *S. fragilis*.

☞ **Constituents:** The glycoside, populin (benzoyl salicin) is the principle constituent that is hydrolyzed into D-glucose and saligenin (salicyl alcohol) by emulsin.

☞ **Uses:** Salicin has antirheumatic properties. Its action closely resembles that of salicylic acid, and it is probably oxidized to salicylic acid in the human system.



(Aldehyde glycosides)

☞ Vanilla

☞ Vanilla or vanilla bean is the cured, fullgrown, unripe fruit of *Vanilla planifolia* Andrews, (F. Orchidaceae).

☞ **Constituents:** Green vanilla contains two glycosides:

1- **Glucovanillin (avenein):** which is hydrolyzed by an enzyme during the curing process into glucose and vanillin.

2- **Glucovanillic alcohol:** which is similarly hydrolyzed into glucose and vanilic alcohol, which is, in turn, oxidized to vanillic aldehyde (vanillin).

☞ **Uses:** Vanilla, in the form of vanilla tincture, is used as a flavoring agent and as a pharmaceutical aid. Vanillin is the principal flavoring constituent.

(Lactone glycosides)

☞ Coumarin

- ☞ Coumarin is the lactone of O-hydroxycinnamic acid. It occurs as colorless, prismatic crystals and has a characteristic fragrant odor and a bitter, aromatic, burning taste.
- ☞ Coumarin is rather widely distributed in nature. In tonka beans (1 to 3%), sweet vernal grass (*Anthoxanthum odoratum* Linné, F. Gramineae), sweet clover (*Melilotus albus* Medicus and *M. officinalis* (Linné) Lamarck, F. Leguminosae), sweet-scented bedstraw (*Gaijum triflorum* Michaux, F. Rubiaceae), and red clover (*Trifolium pratense* Linne, F. Leguminosae).

(Lactone glycosides)

- ☞ Bishydroxycoumarin or dicumarol is a drug related to coumarin.
- ☞ It was obtained originally from improperly cured leaves and flowering tops of *Melilotus officinalis* (F. Leguminosae), but it is now prepared synthetically. Dicumarol is an anticoagulant (warfarine).

Hydrolyzable tannins	Non hydrolyzable or condensed tannins
<p>1. Consist of gallic acid or related polyhydric compounds esterified with glucose.</p>	<p>1. Most such tannins result from the condensation of 2 or more flavan-3-ols, or of flavan-3,4-diols. these tannins contain only phenolic nuclei but frequently are linked to carbohydrates or proteins.</p>
<p>2. Such esters are readily hydrolyze to yield the phenolic acids and the sugar.</p>	<p>2. When treated with hydrolytic agents, these tannins tend to polymerize, yielding insoluble, usually red-colored products known as phlobaphenes.</p>

Physicochemical properties of tannins:

- ☞ Tannins are non-crystallizable compounds that form colloidal solution with water, that possess an acid reaction and a sharp "puckering" taste.
- ☞ They cause precipitation of solutions of gelatin and alkaloids, so they are utilized in the laboratory as reagents for the detection of gelatin, proteins, and alkaloids.
- ☞ Tannins are applied as antidotes for alkaloidal poisoning, due to their ability to form an insoluble tannate.
- ☞ They form dark blue or greenish black soluble compounds with ferric salts; and they produce a

Physicochemical properties of tannins:

deep red color with potassium ferricyanide and ammonia. These deeply colored compounds have been used in the manufacture of inks.

- ☞ They are precipitated by salts of copper, lead, and tin and by strong aqueous potassium dichromate (or 1% chromic acid) solutions.
- ☞ In alkaline solutions, many of their derivatives readily absorb oxygen.
- ☞ Tannins precipitate proteins from solution and can combine with proteins, rendering them resistant to proteolytic enzymes (an astringent action in living tissue).

Therapeutic application of tannins:

- ☞ Astringents in the gastrointestinal tract and on skin abrasions.
- ☞ In the treatment of burns.
- ☞ In both applications, the proteins of the exposed tissues are precipitated and form a mildly antiseptic, protective coat under which the regeneration of new tissues may take place.
- ☞ Industrially, the astringent action of tannins is utilized in converting animal hides to leather (give them toughness and anti-septic properties).

Tannin-containing plant materials:

☞ Hamamelis Leaf

☞ Hamamelis leaf or witch hazel leaves are the dried leaf of *Hamamelis virginiana* Linné (F. Hamamelidaceae).

☞ **Constituents:** hamamehtannin, a gallic acid derived tannin, a hexose sugar, a volatile oil, a bitter principle, gallic acid, and calcium oxalate.

☞ **Uses:** astringent and hemostatic properties in hemorrhoidal products,

Preparations for treating insect bites and even teething preparations.



☞ Nutgall:

☞ Nutgall is the excrescence (outgrowth) obtained from the young twigs of *Quercus infectoria* Olivier and allied species of *Quercus* (F. Fagaceae).

☞ The galls arise on young branches of the tree when **gall wasps** sting the oak tree and deposit their larvae. The chemical reaction causes an abnormality in the tree, causing these galls to be formed.

☞ **Constituents:** tannic acid (50 to 70%); gallic acid (2 to 4%); ellagic acid; starch; and resin.

∞ **Uses:** nutgall is the main source for tannic acid used in tanning and dyeing industry, and, formerly, in the manufacture of ink. Medicinally, it has astringent properties.

