

Brief outline of occurrence, distribution, isolation, identification tests, therapeutic activity and pharmaceutical application of glycoside

GLYCOSIDE

Definition: Glycosides may be defined as the organic compounds from plants or animal sources which on enzymatic or acid hydrolysis give one or more sugar moieties along with nonsugar moiety. The sugar moieties is called as glycone and the non sugar moiety is known as aglycon or genin. Chemically they are the acetyls or sugar ethers which is formed by interaction of hydroxyl group each of non-sugar and sugar moieties with a loss of water molecule. The linkage between glycon and aglycones is called glycosidic linkage.

Properties:

- They are crystalline or amorphous substances, which are soluble in water and dilute alcohol, but insoluble in chloroform and ether.
- The aglycon moiety is soluble in non-polar solvent like benzene or ether.
- The glycosides are easily hydrolyzed by water, mineral acid and enzymes.
- They are optically active, normally with laevo rotator effect.
- They do not reduce Fehling solution until they are hydrolyzed.

Classification

Glycosides are classified as follows:

- a. According to the nature of sugar moiety
- b. According to the chemical nature of aglycone
- c. According to the therapeutic activity
- d. According to the glycosides linkage

Classification based the nature of sugar moiety

A. Glycosides are classified according to the nature and kind of sugar in glycosides.

Example: Glucoside is a glycoside where glucose is a sole sugar component.

In Rhamnoglucoside glycoside, rhamnose and glucose are sugar part.

In Galactosides glycoside, galactose is the sugar part.

In Ribosides glycosides, Ribose is the sugar part.

Classification based on the nature of non sugar (aglycon) moiety

This classification is based on the chemical nature of aglycon (non sugar moiety) such as:

- a) Anthraquinone or anthracene glycosides
- b) Sterols or cardiac glycosides
- c) Saponin glycosides
- d) Cyanogenetic or cyanophoric glycosides
- e) Isothiocyanate glycosides
- f) Flavonoids flavonols glycosides
- g) Coumarine and furano coumarin glycosides
- h) Aldehyde glycosides
- i) Phenol glycosides
- j) Steroidal glycosides
- k) Glycosides bitter or miscellaneous glycosides

Classification based on therapeutic or pharmacological action:

This type of glycosides act therapeutically action on particular organ or against particular ailments.

Examples:

Cardiac glycosides: Such glycosides act on heart or cardiac muscle (example- digitalis).

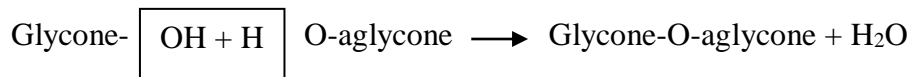
Purgative glycosides: Such glycosides have anthraquinone ring which have definite structure activity relationship which act as purgative principle.

Bitter glycosides: Such glycosides have bitter taste.

Classification based on glycoside linkage

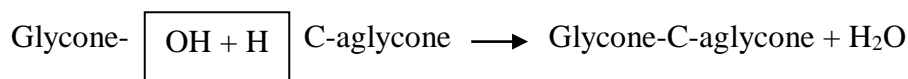
This classification is based on linkage between glycon and aglycon part. This linkage is formed by interaction of –OH group of glycone and hydrogen atom of the radicals like CH, -OH, -SH, -NH present on aglycon part. Hence by elimination of one water molecule, a linkage or bridge is formed. And the type of glycosides formed is named by putting the element as prefix like oxygen (O-glycosides), sulphur (S-glycosides), nitrogen (N-glycosides), carbon (C-glycosides).

Oxygen (O-glycosides): When sugar moiety is attached to oxygen atom.



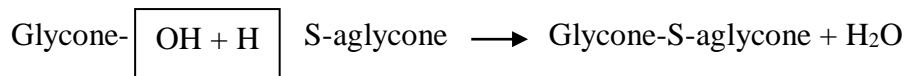
Ex: Senna, Rhubarb

Carbon (C-glycosides): When sugar moiety is attached to carbon atom

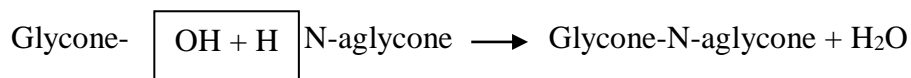


Ex: Cascara, aloe

Sulphur (S-glycoside): When sugar is linked to sulphur atom



Nitrogen (N-glycosides): When sugar moiety is linked to amino group



Isolation of glycoside

- Glycosides are polar compounds due to the presence of one or more sugars in the molecule. The polarity is determined by both the number and types of sugar and the structure of aglycon.
- Most of the glycosides can be extracted with polar solvents such as acetone, ethanol, methanol.
- Glycosides in which the aglycon-sugar link is made via an oxygen, nitrogen or sulphur atom, then it can be hydrolyzed by boiling with dilute acid.

- When there is a c-c link between the aglycon and sugar then the glycoside is resistant to acid hydrolysis, but it can be broken down by the action of iron chloride (ferric chloride) and acid reflux.

Stas-otto method

- The powder drug containing glycosides is extracted by continuous hot percolation using alcohol in Soxhlet apparatus below 45 °C, during which various enzymes are deactivated due to heating.
- Then the extract is treated with lead acetate to precipitate tannins and non glycosidal impurities.
- The excess of lead acetate is precipitated as lead sulphide by passing hydrogen sulphide (H₂S) gas through the solution.
- The extract is filtered, concentrated to get crude glycoside.
- Using fractional solubility, fractional crystallization and chromatographic technique, they are purified.
- Characterization of isolated purified compounds is done by IR, UV, NMR and Mass spectroscopy and elemental analysis.

Test for presence of anthracene-derivative glycosides in crude drug

Borntrager test:

- Boil 200 mg of the test material with 2 ml dilute sulphuric acid in a test tube for 5 minutes.
- Centrifuge or filter while hot, pipette off the supernatant or filtrate, cool and shake with an equal volume of dichloromethane.
- Separate the lower dichloromethane layer and shake with half its volume of dilute ammonia.
- A rose pink to red color is produced in the ammoniacal layer.

Modified Borntrager test:

- Boil 200 mg of the test material with 2 ml of dilute sulphuric acid and 2 ml of 5 % aqueous ferric chloride for 5 minutes.
- Centrifuge or filter while hot, cool and extract with dichloromethane.
- Separate the lower dichloromethane layer and shake with half its volume of dilute ammonia.
- A rose pink to red color is produced in the ammonical layer.

Test for the presence of cardenolide glycosides in crude drug:

Keller-killiani test:

- To 2 ml extract, add glacial acetic acid, one drop 5 % FeCl₃ and concentrated H₂SO₄.
- Reddish brown color appears at the junction of the two liquid layers and upper layer appears bluish green.

Test for saponin glycosides

Foam test:

Shake the drug extract or dry powder vigorously with water. A persistent foam is observed.

Heamolytic zone:

Add drug extract or dry powder to one drop of blood placed on glass slide. Heamolytic zone appear.

Test for cyanogenetic glycosides

Guignard reaction or sodium picrate test:

- Soak a filter paper strip first in 10 % picric acid, then in 10 % sodium carbonate and dry it.
- In a conical flask place moistened powdered drug and cork it.
- Place the above filter paper strip in the slit of cork.
- The filter paper turns brick red or maroon.

Test for coumarin glycosides

Test-1: Alcoholic extract when made alkaline, it shows blue or green fluorescence.

Test-2: Take moistened dry powder in test tube. Cover the test tube with filter paper which is soaked with dilute NaOH, and keep it on water bath. After some time expose the filter paper to U.V light. It shows yellowish –green fluorescence.