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Glycosides and their Roles in Plants

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INTRODUCTION

Number of medicinal plants containing organic constituents in conjugation with a sugar moiety.It can be 1or2. Such compounds are called as glycosides. They exert therapeutically significant effect on human and animals.Traditionally used in modern medicine because of their cardio tonic, purgative, analgesic, anti-arrhythmic, demulcent action. Organic natural compounds present in a lot of plants and some animals, these compounds upon hydrolysis give one or more sugars (glycone) β- form and non sugar (aglycone) or called genin. It is more important in medicine than a lot of drugs. It occur in higher plant tissues in very small amounts and also fungal and bacterial cells (exuded in medium) and animals. Glycosides formed by a biochemical reaction that makes a water insoluble compound more polar than a water soluble molecule. Man forms them in the liver as part of the process of detoxification and they are excreted via urine. The mammalian glycosides are simple compounds whereas plant glycosides are much larger and chemically more complex. They are more important in medicine than a lot of drugs.

Definition:- glycosides are define as organic compound from plants and animal source, which on enzymatic hydrolysis gives one or more sugar moieties along with anon sugar moiety. Sugar moiety is called glycon and non sugar moiety is called aglycon or genin.

Classification:-

1) Based on the chemical nature of non sugar moiety :-

- Anthraquinoneglycoside : - anthraquinone moiety as aglycon . Ex: senna
- Sterol or cardiac glycoside: - aglycon portion is steroid molecule. Ex: digitalis
- Saponine glycoside
- Cyanogentic glycoside Ex : white cherry bark
- Isothiocynate glycoside Ex: black mustard.
- Flavonoid glycoside Ex: rutragraveolens, citrus bio flavonoid
- Coumarin glycoside or furanocoumarine glycoside:- Ex : celery fruit
- Aldehyde glycoside Ex: vanilla pods
- Phenol glycoside Ex salcive
- Steroidal glycoside
- Glucosidal bitter or miscellaneous glycoside Ex salix species

2) based on the nature of sugar moity:-

- Glucoside : sugar portion is glucose
- Rhamnoside : sugar portion is rhamnose
- Pentoside sugar portion is pentose
- Fructoside sugar portion is fructose
- Arabinoside sugar portion is arabinose

3) Based on linkage between glycon and aglycon portion:-

OH groups reacting with any of the following medicates like, OH, CN, SH, NH product in aglycon part

a) C-glycoside:

Glycon-OH + HC –aglycon -->glycone-c-aglycon +H2O

Some of the anthraquinone glycoside like cascaroside in cascara, aloin in aloes shows the particular linkage.C-glycosides are called aloin type glycoside present in aloes. They do not hydrolyzed by heating with dilute acid or alkalis but by oxidative hydrolysis with Fecl3. cochical contains c-glycoside in the form of coloring matter called carminoic acid

b) O-glycoside

They are common in higher in plants Ex senna, rhubarb

They are hydrolyzed by treatment wit acid or alkali into glycon and aglycon portion.

c) S-glycoside

They occurrence of this glycoside is restricted to isothiacyanate glycoside like sinigirin in black mustard formed by the condensation of sulphohydryl group aglycon to OH group of glycon.

d) N-glycoside

They most typical representation of this is nucleoside where the amino group reacts with OH group of ribose or deoxyribose resulting into N-glycoside

4) based on therapeutic nature of glycoside:-

- Cardiac glycoside EX : Digitalis
- laxative glycoside EX : Senna
- Anti-ulcer glycoside EX : Liquorice
- Bitter glycoside EX : Quassia wood

General characteristics

1) Glycoside contains sugar but still the physical, chemical and therapeutic activity is based on aglycon portion. Sugar facilitates the absorption of the glycoside helping it to reach the site of action
2) Glycoside are crystalline, amorphous substance which are soluble in water, and dilute alcohol but in soluble in the CHCl3 and ether. The aglycon moiety is insoluble in non polar solvent like C6H6
3) When a glycosides has a lot of sugars its solubility in water decrease.
4) Glycosides are easily hydrolyzed by mineral acids, water and enzyme. They show optical activity normally they are levorotatory

5) Glycoside can not reduce fehling's solution until they are hydrolyzed
6) They are believed to facilitates growth and protection of plant
7) Most of them have bitter taste.(except: populin, glycyrrhizin, stevioside).
8) Odorless except saponin (glycyrrhizin).

Role of glycosides in the plants

1. Converting toxic materials to non or less toxic.
2. Transfer water insoluble substances by using monosaccharide.
3. Source of energy (sugar reservoir).
4. Storing harmful products such as phenol.
5. Regulation for certain functions (growth).
6. Some have beautiful colours (pollenation process).
7. Some glycosides have antibacterial activity, so they protect the plants from bacteria and diseases.
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Isolation of Glycoside

The method by which glycoside are isolated is called stas-otto method. The drug containing glycoside is finely powdered and subjected to successive extraction in a soxhlet apparatus with alcohol or suitable solvent.During this method at first take drug containing glycoside, finely powdered that, and it is extracted with alcohol or water by using soxhlet apparatus. After extraction, collect the extract and treat with lead acetate to precipitate tannins after that filter it and to the filtrate pass H2S gas, no lead acetate the precipitate as lead sulphide as this is toxic. Now after the extract again filter.The filtrate is subjected to fractional crystallization, distillation or chromatography gives pure component and the extract molecular structure is determined by the spectrophotometer, Ultra Red assays, Infra red , NMR and mass spectroscopy etc.

Importance

Natural plant-derived glycosides are used for various therapeutic purposes. Increased knowledge of beneficial or toxic effects is warranted. This is particularly relevant for plant sterols for which beneficial and potentially harmful effects have been reported. Better insight is needed regarding the biological effects, bioavailability and metabolism of glycosylated sterols prior to any clinical use in prevention/treatment of diseases. This may also hold for other plant metabolites. The therapeutic value of infusion of glycosidases in treatment of inherited deficiencies in man has been demonstrated for a number of diseases. In recent years, production of such glycosidase increasingly occurs in plant platforms that offer several advantages. Importantly, the N-glycan composition of plant-produced recombinant enzymes can be very well controlled using genetically modified plants. The ubiquitous plant glycosidases themselves might conceivably find therapeutic applications in humans and might have potential to treat inherited glycosidase deficiencies in man (Kytidou et al., 2018). Overall, ABPs may help to identify plant glycosidases of interest.

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