

الجامعة المستنصرية

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قسم علوم الحياة

المرحلة الثالثة

فرع فطريات ونباتات طبية

أيض ثانوي - نظري

Plant secondary metabolism

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السعر:

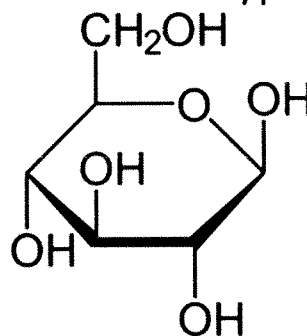
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is a molecule in which a sugar is bound to another functional group via a glycosidic bond. Glycosides play numerous important roles in living organisms. Many plants store chemicals in the form of inactive glycosides. These can be activated by enzyme hydrolysis, which causes the sugar part to be broken off, making the chemical available for use. Many such plant glycosides are used as medications. In animals and humans, poisons are often bound to sugar molecules as part of their elimination from the body.

OR organic natural compounds present in a lot of plants and some animals, these compounds upon hydrolysis give one or more sugars (glycone) form and non sugar (aglycone) or called genin. The first glycoside ever identified was amygdalin, by the French chemists Pierre Robiquet and Antoine Boutron-Charlard, in 1830.

- The hydroxyl group of aglycone may be alcoholic or phenolic and in some cases amines also.
- The sugars involved in glycosides are of different types, but



most commonly it is β -D-glucose

- The other sugars found are galactose, mannose, rhamnose, digitaxose, cymarose, etc.
- Plants produce only β -glycosides
- The linkage between glycone and aglycone is called glycosidic linkage.

- **Properties glycosides.**

1-Solids non-volatile, colorless crystalline and amorphous visits taste some sweet taste.

2-Generally soluble in water and alcohol and insoluble in ether, although some were dissolved in organic solvents such as acetone and chloroform solubility complexity of the chemical composition vary glycone and aglycone.

- **Uses of glycosides as Medicines .**

Of not less glycosides much about alkaloids in medical benefits and effects of physiological and even play an important role in human life and treatment of many diseases, and glycosides saved the lives of millions of people it is a stimulant and tonic for the heart and the Organization of the heart beat of this named cardiectimi ex. Digoxin and Rutin Which strengthens the walls of blood vessels weak and prevent the bleeding ,glycosides laxative كملين (Sennosid) and glycosides analgesic for pain Salicin .

Classification

Glycosides can be classified by the glycone, by the type of glycosidic bond, and by the aglycone.

1- By glycone /presence of sugar

If the glycone group of a glycoside is glucose, then the molecule is a glucoside; if it is fructose, then the molecule is a fructoside ; if it is glucuronic acid, then the molecule is a glucuronide; etc. In the body, toxic substances are often bonded to glucuronic acid to increase their water solubility; the resulting glucuronides are then excreted.

2- By type of glycosidic bond

Depending on whether the glycosidic bond lies "below" or "above" the plane of the cyclic sugar molecule, glycosides are classified as α -

glycosides or β -glycosides. Some enzymes such as α -amylase can only hydrolyze α -linkages; others, such as emulsin, can only affect β -linkages.

There are four type of linkages present between glycone and aglycone:

1-C-linkage/glycosidic bond, "nonhydrolysable by acids or enzymes"

2-O-linkage/glycosidic bond

3--N-linkage/glycosidic bond

4-S-linkage/glycosidic bond

3- By aglycone

Glycosides are also classified according to the chemical nature of the aglycone. For purposes of biochemistry and pharmacology, this is the most useful classification.

A- Alcoholic glycosides.

An example of an alcoholic glycoside is salicin, which is found in the genus salix نبات الصفصاف. Salicin is converted in the body into salicylic acid, which is closely related يرتبط to aspirin and has analgesics; k , antipyretic خافض حرارة, and anti inflammatory effects مضاد للالتهابات.

B- Anthraquinone glycosides.

These glycosides contain an aglycone group that is a derivative of anthraquinone. They have a laxative effect. تأثير مسهل They are mainly found in dicot plants except the Liliaceae family which are monocots. They are present in senna السنامي, rhubarb راوند and Aloe species الصببر. Antron and anthranol are reduced forms of anthraquinone.

C- Phenolic glycosides.

Here, the aglycone is a simple phenolic structure. An example is arbutin found in the Common Bearberry Arctostaphylos uva-ursi. عنب الدب It has a urinary antiseptic effect تأثير مطهر.

D- Flavonoid glycosides.

Here, the aglycone is a flavonoid. Examples of this large group of glycosides include :

يستخلص من الثمار غير الناضجة للحمضيات الليمون الاخضر وقشور البرتقال
Hesperidin (aglycone: Hesperetin)

Rue (Rute graveolens) نبات السذب

Rutin (aglycone: Quercetin)

Among the important effects of flavonoids are their antioxidant effect. They are also known to decrease capillary fragility. تقليل نفاذية الاوعية الشعرية

e-Steroidal glycosides or cardiac glycosides.

Here the aglycone part is a steroidal nucleus. These glycosides are found in the plant genera Digitalis, Scilla, and Strophanthus. They are used in the treatment of heart diseases.

f-Coumarin glycosides

In this case, the aglycone is coumarin. An example is apterin, which is reported to dilate تمدد the coronary arteries as well as block calcium channels. Those obtained from dried leaves of Psoralia corylifolia have the main glycosides psoralin and corylifolin.

g -Saponins

These compounds give a permanent froth مستحلب مع مادة دهنية when shaken with water. They also cause hemolysis of red blood cells. Saponin glycosides are found in liquorice عرق السوس. Their medicinal value is due to their expectorant effect طارد للبلغم.

H- Thioglycosides

As the name implies, these compounds contain sulfur. Examples include sinigrin, found in black mustard خردل الاسود, and sinalbin, found in white mustard خردل الابيض.

I-Cyanogenic glycosides

DESTRUCTIVE DISTILLATION : Organic substances such as wood or resin

- **Medical use**

- 1- used medically expelling the gases eliminates the pain of colic and bloating in children تستعمل طبيا كطاردة للغازات فيزيل الأم الممغنص والانتفاخ عند الاطفال
- 2- used in some medicines kids and give taste and smell acceptable such as anise, peperment oil تستعمل في بعض الاطفال لاعطائها طعما ورائحة مقبولة لديهم مثل زيت اليانسون والنعناع . ادوية
- 3- used as a spice for foods such as oil cumin and cardamom, nutmeg and other تستخدم كتوابل للاطعمة مثل زيت الكمون والهيل وجوزة الطيب وغيرها
- 4- . Some of the volatile oils are used as a disinfectant, such as thyme بعض الزيوت الطيارة تستخدم كمواد مطهرة مثل الزعتر
- 5- Some volatile oils have anti fungi and bacteria.
- 6- Some volatile oils used to remove dental pain and gums such as clove oil,Eugenol one of the most important compound clove oil بعض الزيوت الطيارة تستخدم لازالة الام الاسنان واللثة مثل زيت القرنفل احد اهم مركبات زيت القرنفل
- 7- Some of volatile oils used as a repellent expectorant such as eucalyptus oil تستخدم بعض الزيوت الطيارة كمادة طاردة للبلغم مثل زيت اليوكالبتوس
- 8- Some considered laxative such as anise oil بعضها تعتبر ملينة مثل زيت اليانسون

- **CHEMISTRY of volatile oils**

Chemical constituents of volatile oil may be classified into two groups. a. Terpenes b. Phenylpropanoids

A. TERPENES

- 1- Natural products whose structures may be divided into isoprene units.
- 2- These units arise from acetate via mevalonic acid.
- 3- These are branched chain 5 carbon units containing 2 unsaturated bonds.
- 4- Made up of head to tail condensation of isoprene units. If i. 1 isoprene unit present= hemiterpene (C₅H₈) . 2 isoprene unit present= monoterpenes (C₁₀H₁₆) . 3 isoprene unit present= sesquiterpene (C₁₅H₂₄) . 4 isoprene unit present= diterpene (C₂₀H₃₂) . 5 isoprene unit present= triterpene (C₂₅H₄₈) Majority of the terpenes are monoterpenes in volatile oils.

B . PHENYLPROPANOIDS

- 1- They are formed via shikimic acid phenylpropanoid route These compounds contain phenyl ring with an attached propane side chain.
- 2- Many of the Phenyl propanoids found in volatile oils are phenols or phenol ethers.

● CLASSIFICATION OF VOLATILE OILS

1. Hydrocarbon volatile oils
2. Alcoholic volatile oils
3. Aldehydic volatile oils
4. Ketonic volatile oils
5. Phenolic volatile oils
6. Phenolic ether volatile oils
7. Oxide volatile oils
8. Ester volatile oils
9. Miscellaneous volatile oils زيوت طيارة اخرى

● DIFFERENCE BETWEEN VOLATILE OIL AND FIXED OIL Volatile oils

VOLATILE OILS VS FIXED OILS

Volatile oils	Fixed oils
Volatilize at room temperature	Don't get volatiles at room temperature
Obtained by distillation	Obtained by extraction
Leave no spot after evaporation	After evaporation, do leave spot
Cannot be saponified	Can be saponified
Mixtures of oleoptenes and stereoptenes	Esters of fatty acid with glycerol
High refractive index	Low refractive index

In this case, the aglycone contains a cyanide group, and the glycoside can release the poisonous hydrogen cyanide if acted upon by some enzyme. An example of these is amygdalin from almonds seed. بذور اللوز المر

- **glycosides importance for plants**

1-have an important role to play in the Champions toxicity ابطال سمية of some of the material and then converts تحويلها it to glycosides

2-Its presence in seeds and parts of plants considered as a store of energy they provide for the growth of the seeds and to provide plants of construction materials for plant synthesis.

3- When the plant wound for some reason the glycosides a defensive role against some types of microbes and trying to prevent its entry into the plant.

4- Association with the sugar helps to ease the process of spread of plant nutrients.

They evaporate when exposed to the air at ordinary temperatures so they are called volatile oils, ethereal oils or essential oils ,They are called essential oil because volatile oil represent the essences of plants.

Essential oils are volatile fragrant compounds obtained from plants through the process of extraction. Plant materials from seeds, roots, flowers, leaves, stems, bark, and resin can be used to extract the essential oil of the plant. Extraction can be done with fresh or dried plant material.

- How volatile oils consist

Oils consist by secondary product bio processes and collects in special vascular structures such as:

1- Glandular hairs الشعيرات الغدية F. *Labiataceae* العائلة الشفوية

Ex. Mint النعناع

2- Oil glands الغدد الزيتية F. *Rutaceae* عائلة السببية

Ex. Citrus (Lemon, orange).

3- Oil ducts القنوات الزيتية F. *Umbelliferaceae* العائلة الخيمية Ex.

Anise

اليانسون

- PROPERTIES OF VOLATILE OILS

1- High refractive index معامل الانكسار عالية

2- Optically active بصريا نشط

3- Immiscible with water امتزاج مع الماء

4- Soluble in ethers, alcohol and most organic operties of volatile oils

- The presence of volatile oils in the plant

All are located in the part of plant or in some of its parts, such as Menthol oil resides in the leave and clove oil resides in the flowers and oil anise زيت اليانسون in seeds either cinnamon oil زيت الدارسين resides in the bark.

- Physiological functions of the volatile oils for plant

1. attract insects, which helps to pollinate the flowers and increase production.

2- Some volatile oils works to repel insects for the defense plant, some plants have volatile oils unpleasant smell.

3- The removal of products biological processes and put out tissue plant.

METHODS OF OBTAINING VOLATILE OILS

The method of obtaining volatile oils depends upon the condition of plant materials.

Oil production can be divided into three major ways

- i. Distillation
- ii. Solvent extraction
- iii. Mechanical expression

Specialized methods are:

- i. Ecuelle Method
- ii. Enfleurage
- iii. Destructive distillation

ECUELLE METHOD : It is used to obtain citrus oils

ENFLEURAGE : In this method, an odorless fixed oil or fat is spread in a thin layer on glass plates