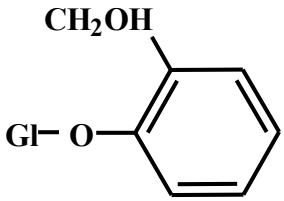
Alcoholic – phenolic-Aldehyde glycosides

1- Salicin:

Salicin is classified as:

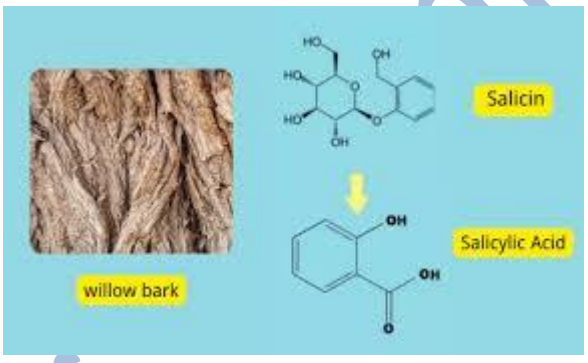
1- **Alcoholic glycoside**, as it contains free **primary alcoholic group**.

2- **A phenolic glycoside,** as its **aglycone is phenolic** in nature.



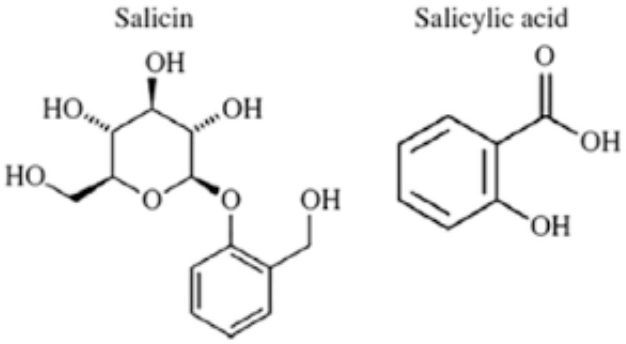
Salicin

- **Salicin is a phenolic glycoside composed of salicyl alcohol linked to β-D-glucose, naturally isolated from *Salix fragilis* (willow bark) and Populus species.**



- **Salicylic acid is a phenolic acid (o-hydroxybenzoic acid). Salicin is a prodrug, while salicylic acid is an active aglycone form.**

- Salicin is hydrolyzed by **the enzyme emulsin enz.** into **saligenin** (Salicyl alcohol) **and glucose**.



Salicin is used for many years as a remedy in the treatment of fever and rheumatism. It is now used as an analgesic-antipyretic in case of periodic fever. It is better tolerated in the stomach than sodium salicylate, aspirin and other antipyretics and anti-inflammatory agents, which have largely displaced in medical practice.

Q/ Why is salicylic acid used topically while salicin is used orally in herbal therapy?

Salicylic acid has strong keratolytic properties, making it effective in dermatology (acne, psoriasis, warts).

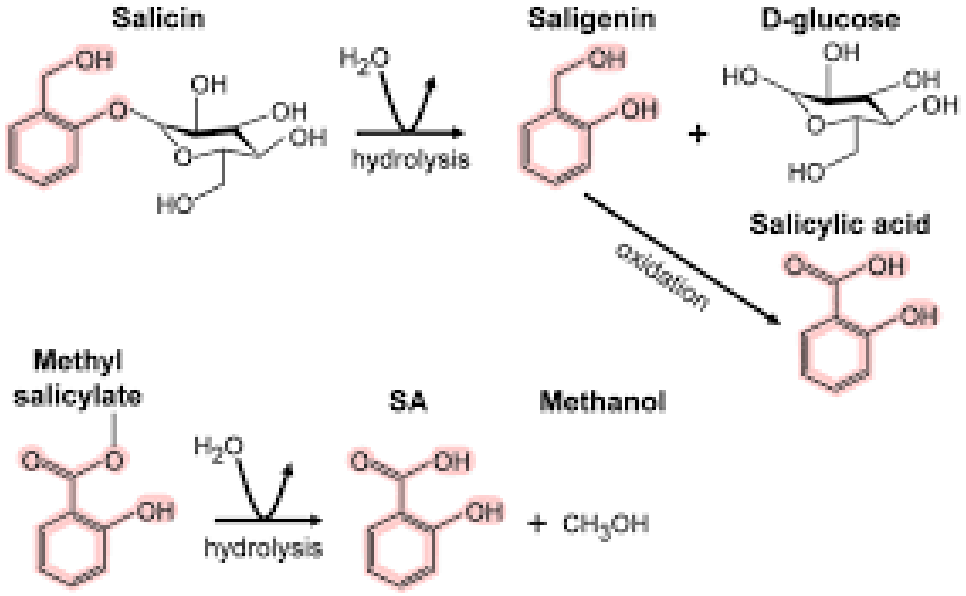
Salicin must undergo systemic metabolism to salicylic acid, producing systemic anti-inflammatory effects, making it useful orally in arthritis and fever, with fewer gastric side effects than pure salicylic acid.

Explain why salicin causes less gastrointestinal irritation than aspirin or salicylic acid?

Salicin is metabolized to salicylic acid only after absorption, avoiding direct gastric mucosal irritation..Aspirin releases salicylic acid in the stomach and inhibits gastric prostaglandins, increasing the risk of ulceration.

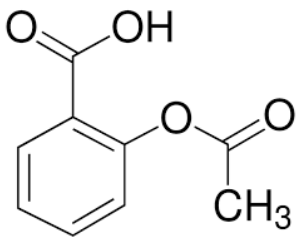
Chemical properties

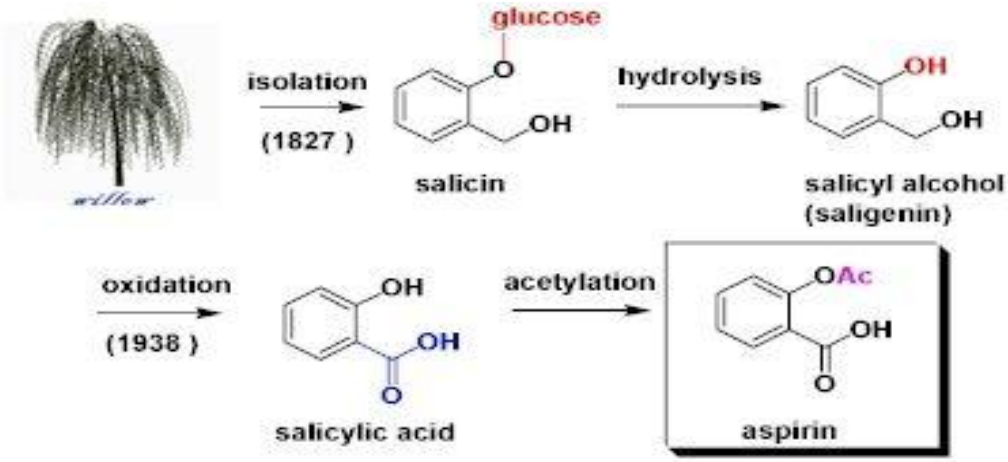
Acid hydrolysis of salicin gives **glucose** and **saligenin.**



Oxidation of **saligenin** gives salicylic acid and this accounts for the medicinal value of salicin.

Salicylic acid acylation gives Aspirin (acetyl S.A)





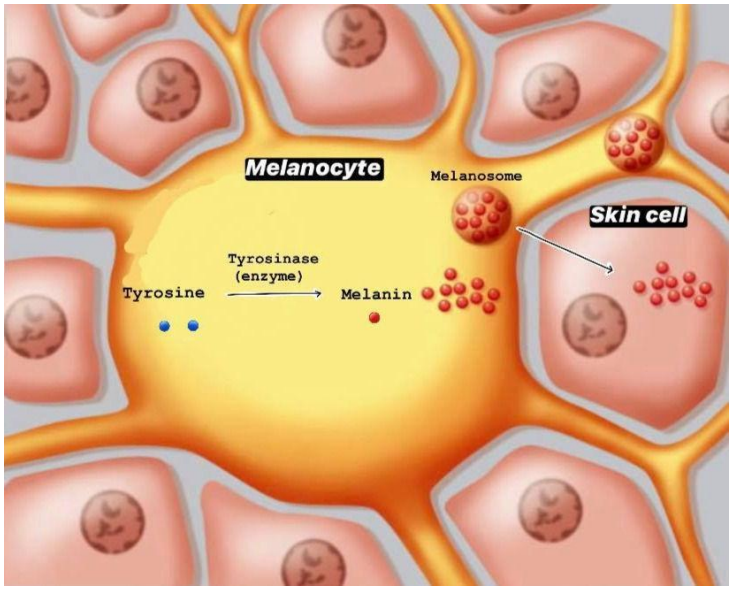
2. Arbutin

- **Explain the chemical nature of arbutin and its natural sources.**

Arbutin is a **phenolic glycoside** composed of **hydroquinone linked to β-D-glucopyranose**. It naturally occurs in plants such as **Arctostaphylos uva-ursi (bearberry)**, **pear leaves**, **cranberry**, and **blueberry**. The glycosidic bond reduces hydroquinone toxicity and modulates release in the body.

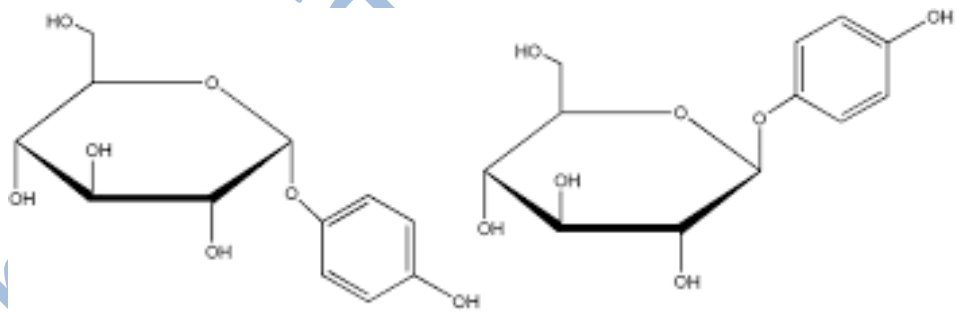
- **Mechanism of action of arbutin in skin-lightening therapy.**

➢ Arbutin inhibits **tyrosinase enzyme**, blocking the conversion of **tyrosine to melanin**, leading to decreased pigmentation. It acts competitively with tyrosine and slowly releases hydroquinone inside the skin, providing a safer skin-lightening effect with fewer side effects compared to direct hydroquinone.



- **α-Arbutin** shows **greater tyrosinase inhibition**, **higher water solubility**, and **better stability** than **β-arbutin**, making it more potent in cosmetic formulations. β-Arbutin, the naturally occurring form, is less stable and less effective but more widely available in botanical extracts.

(In arbutin chemistry, the terms α-arbutin and β-arbutin refer to two stereoisomeric forms (different orientation of the glycosidic bond between glucose and hydroquinone).)

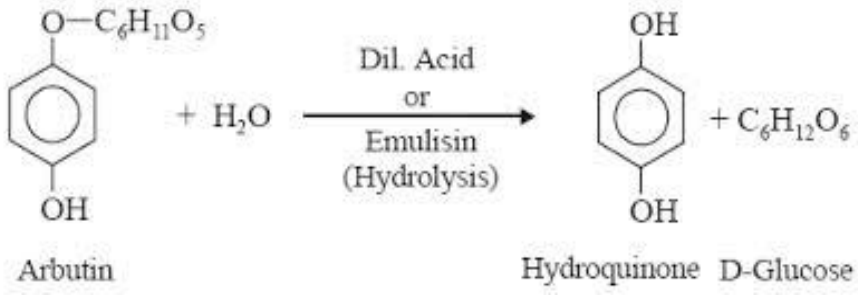


- **cosmetic applications of arbutin and mention safety considerations**

Arbutin is used in creams, serums, and topical formulations for **hyperpigmentation**, **melasma**, **age spots**, and **post-inflammatory pigmentation**. It is generally safe at

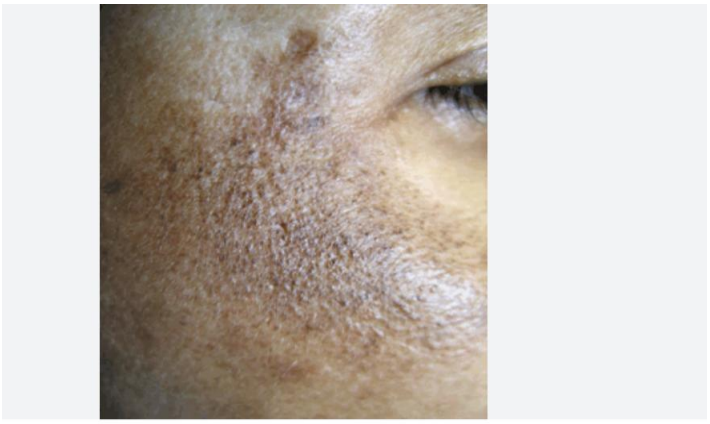
recommended doses; however, **excessive use** or **enzymatic hydrolysis** may release hydroquinone, potentially causing **irritation** or **cytotoxicity**, especially on damaged skin

When hydrolyses with acids or with emulsin it yields glucose and hydroquinone.



Q/ Why is arbutin preferred over hydroquinone in many cosmetic regulations?

Answer:
Arbutin provides **controlled release** of hydroquinone, **reduced cytotoxicity**, and a **better safety profile**, leading many regulatory authorities to prefer it in cosmetics. Hydroquinone is restricted in many regions due to risks of **exogenous ochronosis**, irritation, and potential carcinogenic effects when misused.



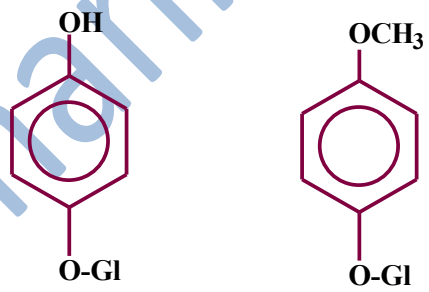
Hydroquinone-induced exogenous ochronosis: a
...report of four cases and usefulness of dermoscopy

- **It is used as diuretic and also has bactericidal action. This activity is due to the hydroquinone given by hydrolysis.**

Arbutin is hydrolyzed in alkaline urine → releases hydroquinone

Urinary tract irritation → reflex diuresis Hydroquinone causes mild irritation of urinary mucosa, stimulating kidneys & increasing urine flow

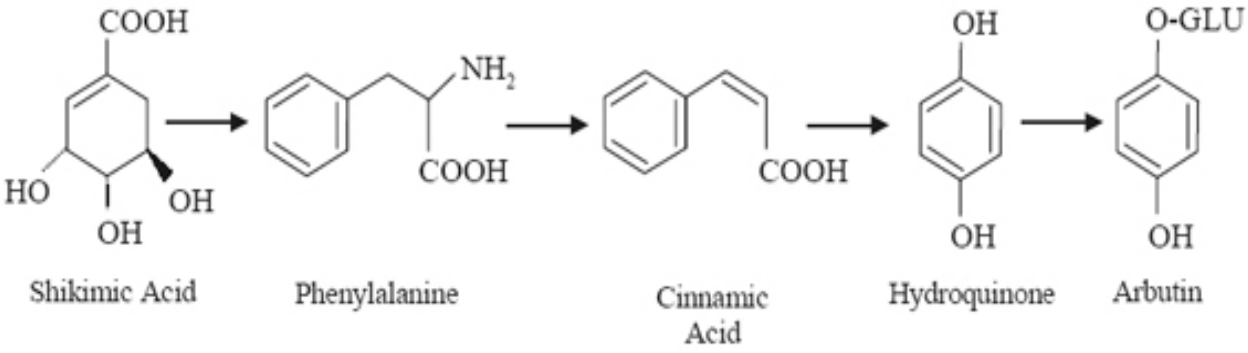
Uva ursi leaf contains also methylarbutin (the methyl ether of arbutin), that also contributes to the diuretic and urinary antiseptic action of the leave.



Arbutin **Methylarbutin**

Biosynthesis of arbutin:

Arbutin is biosynthesized from shikimic acid through cinnamic acid as follows:



Shikimic Acid | Phenylalanine | Cinnamic Acid | Hydroquinone | Arbutin

Images of Uva ursi

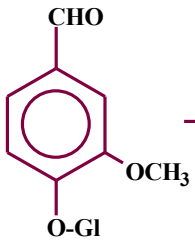
Aldehyde glycosides

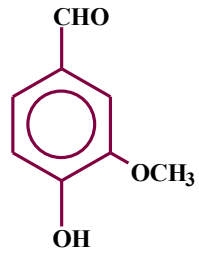
Glucovanillin (avenein):

Glucovanillin is a glycosidal constituent of green vanilla pods (*Vanilla tahitensis)*.

The fruits of the plant (pods) are collected and carefully cured. To permit enzymatic action on the glycoside with the liberation of vanillin (the aglycone) which is the principal flavouring constituent of the pods.

Vanillin chemically is 4-hydroxy-3-methoxy-benzaldehyde & is widely used as a flavouring agent. It may be obtained from **vanilla pod** or prepared from the glycoside **coniferin**, **lignin** or from the **phenolic volatile oil constituents eugenol.**





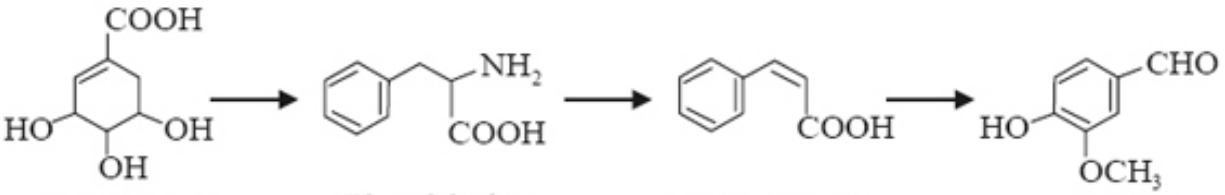
Glucovanillin Vanillin

Green vanilla beans, on the plant

Images of vanilla pods & trees

Biosynthesis of vanillin:

Vanillin is biosynthesized from shikimic acid via cinnamic acid



Shikimic Acid Phenylalanine Cinnamic Acid Vanillin