Lecture 4

# Medicinal Plant

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# Polyphenol

- Compounds that have one or more hydroxyl groups connected straightway to the ring of an aromatic. The whole category is based on the arrangement of phenol (Figure 1).
- It may be classified into simple phenolic molecule and extremely polymerized compounds.

# Polyphenol

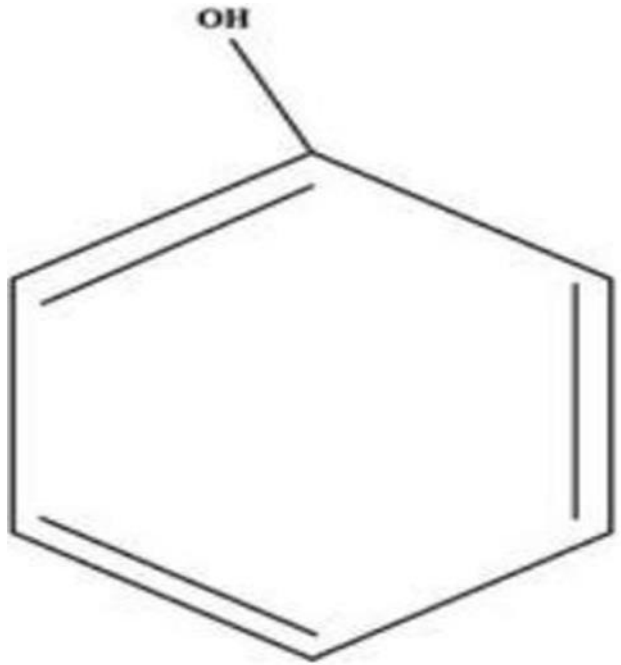


**Figure 1: Phenol**

# Types of phenolic compounds (PC)

| Structure | Class |
|---|---|
| C6-C1 | simple phenolics |
| C6-C2 | phenolic acids and related compounds |
| C6-C3 | acetophenones and phenylacetic acids |
| C6-C3 | cinnamic acids, cinnamyl aldehydes, cinnamyl alcohols |
| C15 | coumarins, isocoumarins, and chromones |
| C15 | chalcones, aurones, dihydrochalcones |
| C15 | Flavans |
| C15 | Flavones |
| C15 | Flavanones |
| C15 | Flavanonols |
| C15 | Anthocyanidine |
| C15 | Anthocyanine |
| C30 | Biflavonyls |
| C6- C1- C6, C6- C2- C6 | benzophenones, xanthones, &$$$;tilbenes |
| C6, C10, C14 | Quinones |
| C18 | Betacyanine |
| Lignans, neolignans | Dimers or oligomers |
| Lignin | Polymers |
| Tannins | oligomers or polymers |
| Phlobanhenea | Polymers |

# Polyphenol

- Phenolic compounds [PC] are distributed everywhere in most of the plant tissues which includes the parts such as roots, stems, fruits, seeds, leaves, etc.
- Larger polyphenols are often **concentrated** in leaf tissue, the epidermis, bark layers, flowers and fruits
- Play important roles in the decomposition of forest litter, and nutrient cycles in forest ecology

- Polyphenols are also found in animals. In arthropods, such as insects and crustaceans,
- polyphenols play a role in epicuticle hardening (sclerotization).
- The hardening of the cuticle is due to the presence of a polyphenol oxidase.
- Giving protection against pathogens and predators.
- In vegetables and fruits, PC contribute to color and sensory characteristics

# Biosynthesis and Metabolism

- Phenylpropanoid pathway originates phenolic acids
- Shikimic acid pathway originates gallotannins and analogs
- Phenylalanine and malonyl-CoA originate flavonoids and caffeic acid derivatives

# Classification

- **Polyphenols are divided into groups based on:**

1. the number of phenol rings they contain
2. The structural components that connect these rings

- **Polyphenols are divided into four main categories:**

1. Phenolic acids
2. Flavonoids
3. Stilbenes
4. Lignans

# 1. Phenolic acids

- Phenolic acids are aromatic secondary plant metabolites that can be found all over the plant kingdom.
- **They may benefit health because they function as:**

1. Antioxidants: Preventing cellular damage caused by free-radical oxidation processes. For example: vanillic acid and caffeic acid

- Able to protect against oxidative damage diseases (coronary heart disease and cancers) by intake of fruits and vegetables
- Found in berries, coffee, tea, red wine herbs, spices and olive oil

# 2. Flavonoids

- Flavonoids are a group of plant metabolites; it provides health benefits through :

1. Antioxidant effects

2. Cell signaling pathways

3. Anti-viral

4. Anti-cancer

5. Anti- inflammatory

6. Anti-allergic

Examples: Apigenin, Luteolin

- A wide range of fruits and vegetables contain these compounds, such as onions, blueberries, bananas, dark chocolate and red wine

# 2. Flavonoids

- The six primary subtypes of flavonoids are:

1. Chalcones
2. Flavones
3. Isoflavonoids
4. Flavanones
5. Anthoxanthins
6. Anthocyanins

# 3. Stilbenes

- Stilbene or trans-stilbene is an organic compound, It is a type of polyphenol that comes in two forms such as resveratrol and pterostilbene
- Found in red wine or dark red fruits such as grapes and blueberries
- Prevent and treat different diseases like cancer, due to their:

1. antioxidant
2. cell death activation, and
3. anti- inflammatory

# 4. Lignans

- Plant-based foods such as fruits, grains, seeds, vegetables, red wine, nuts, and coffee

1. Anti-inflammatory effects

2. Antioxidant: properties which act as protection against heart disease

3. Anticancer: by blocking enzymes that are involved in interfering with the growth and spread of tumor cells and hormone metabolism

# Polyphenols Properties

**1.** They include yellow, orange, red, and blue pigments,

**2.** Various compounds involved in food flavor. The major flavors associated with polyphenols are bitterness and astringency..

**3.** Some volatile polyphenols, such as vanillin and eugenol (which is responsible for the characteristic odor of cloves), are extremely potent odorants



THANKS
FOR
LISTENING