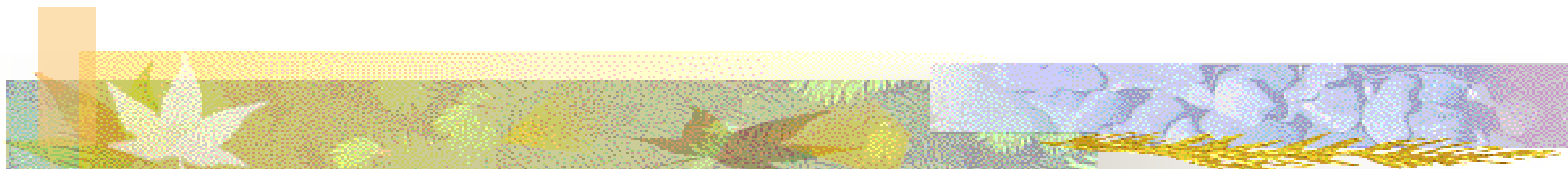




Environmental Science and Health Department



Lec. 3 Plant parts used and Dosage forms

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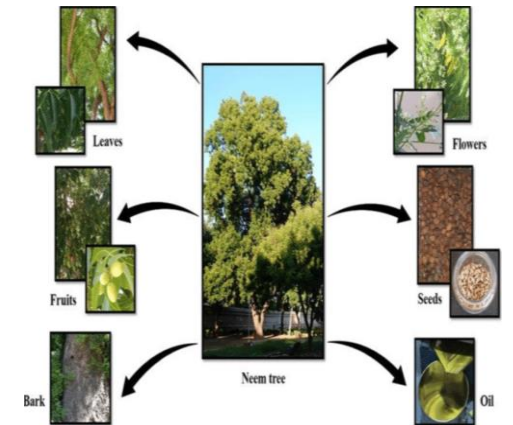


Outline

- ❖ Plant Parts used
- ❖ Dosage Forms
- ❖ Use of medicinal plant products
- ❖ Medicinal plant products can be administered in the following ways:
- ❖ Phytotherapy, pure chemical compounds and dietary supplements aromatic plants.

Plant Parts used

Different parts of a plant (**leaves, roots, bark, fruit or seeds**) often contain quite different active ingredients, so one part may be **toxic** and another one **quite harmless**.



Root

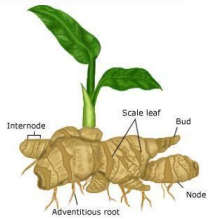
Many species' fleshy or woody roots (or outer root bark) are used medicinally and may be fibrous, fleshy or solid **liquorice (*glycyrrhiza glabra*)**



Rhizome (rhiz- or rhizoma).

A rhizome is a woody or fleshy elongated stem that usually grows horizontally below the ground, forming leaves above the ground and roots into the ground.

Ginger (*Zingiber officinale*)



Bulb {bulbus).

A bulb is a fleshy structure comprising numerous layers of bulb scales, which are **leaf bases**. Bulbs popular for medicinal use include **onion** (*Allium cepa*) and **garlic** (*Allium sativum*).



Tuber (tub. or tuber).

A tuber is a swollen, fleshy structure below the ground, usually of **stem** origin but often partly stems and partly roots. Tubers of **autumn crocus** (*Colchicurn autumnale*) are well-known examples.



Bark (cort. or cortex).

The bark is the outer protective layer of a tree trunk, formed by layers of living cells just above the wood itself. **High concentrations of active ingredients** are found in **bark**, hence its frequent medicinal use, willow bark (*Salix species*)



Wood (fig. or lignum).

Thick stems or the wood itself are used. Examples include **sandalwood** (*Santalum album*).



Leaf (fol. or folium).

Leaves alone may be used (folium), or leaves may occur in a mixture of **petioles** and **twigs** (herba).



Stems (stip., stipes or stipites)

Stem tips are sometimes specified. An example is the maidenhair tree (*Ginkgo biloba*; *Ginkgo folium*), where only the leaves are used.



Aerial parts (herba).

All aboveground parts are harvested and used, often while the plant's is in flowers. An example is **St. John's wort** (*Hypericum perforatum*).



Flowers (flos).

Flowers are popular in traditional medicine, e.g., **Roman chamomile flowers** (*Chamaemelum nobile*).



Fruit (fr. or/ruetus).

Amongst the most commonly used ones are the small dry fruits. Dried, whole fruits may be used, such as **milk thistle achenes** (*Silybum marianurn*).



Seed (sera, or semen).

Seeds are contained within a fruit and are sometimes used on their own: castor oil plant (*Ricinus communis*) and fenugreek seed (*Trigonellafoenum-graecum*).



Gum (gummi).

Gums are solids consisting of mixtures of polysaccharides. They are water-soluble and partially digested by humans. An example of such an exudates gum is gum Arabic (from **Acacia Senegal**; *Gummi acaciae*)



Resins (resina).

Resins are excreted by specialised cells or ducts in plants. They consist of a mixture of essential oils and polymerised terpenes, usually insoluble in water. Examples are **mastic** (*Pistacia lentiscus*— used as an adhesive for dental caps).



Fatty oil (oleum)

These are non-volatile vegetable oils pressed from the seeds or fruits of plants that are insoluble in water. Oils are described as acylglycerides. **Castor oil** (from *Ricinus communis* seeds) is an example with direct medicinal properties. Others (olive oil) are used as carriers in liquid formulations and ointments.



Essential oil (aetheroieum).

These are **volatile oils**, usually extracted from plants through a process of steam distillation. They consist mainly of monoterpenoids, sesquiterpenoids, phenylpropanoids and coumarins and are of considerable importance as active ingredients of medicinal plants. Examples are **peppermint oil** (from leaves of *Menthae piperitae aetheroieum*)



Dosage Forms

Extracts are liquid, powdered or viscous **crude mixtures of chemical compounds** extracted from plant material using water or organic solvents such as alcohol (ethanol). As a result, the extract contains only the soluble fraction of the **plant material (usually about 20%** of the total weight), and the non-soluble (**fibrous**) **residues (about 80%) are waste.**

Volatile oils are extracted by **steam distillation** or, less often, by **solvent extraction**. The herb-to-extract ratio (**HER**) is typically **5:1** for **standard extracts** or **100:1** for a herb with **1% essential oil**. The extract originates in tradition but is still commonly used today.



Special extracts are extracts in which the extraction conditions are modified and manipulated. **Mixtures** are medicinal products containing **two or more plants** or **herbs** that act individually, additively or synergistically to restore or maintain health. In traditional Chinese medicine and African traditional medicine, medicinal plants are typically used in mixtures, rarely on their own.

Teas are **infusions** (see below) prepared by **steeping** herbs in **boiling water**. The word "tea" is derived from t'e, the name of **black tea** (*Camellia sinensis*) in the southern Chinese Amoy dialect.

Tea mixtures (species) are fixed combinations of herbs (**usually 4-7**) containing **active components** (herbs of significant importance for the indication). (components added to improve the **mixture's taste, smell or colour**). **Species are sedative** (sedative tea or nerve tea).



Decoction refers to a preparation made by adding **cold water** to the required amount of **drug**. It is **then heated** to boiling and simmer for **five to ten minutes**, then strained.

Infusion refers to a preparation made by adding **boiling water** to the required amount of drug, which is allowed to steep **for five to ten minutes** before it is strained. Such a preparation is often loosely referred to as "**tea**".

Maceration refers to a preparation made by adding **cold water** to the required amount of drug, which is allowed to soak **at room temperature** for **six to eight hours** before it is strained.



Tincture is an **alcoholic solution** (usually containing 30 to 70% water) prepared from medicinal plant material. The herbal mixture is extracted for a **specified period**, then pressed and/or strained to **separate the liquid and solid materials**. A mother tincture is often prepared **using 70% ethanol**, and the solution is then diluted with clean water to a predetermined herb-to-extract ratio.

Instant teas are **dry (powdered) herbal extracts** that are usually mixed with carrier substances such as **sucrose, lactose or maltodextrin** to add bulk, **reduce viscosity** and **improve solubility**.

Tea bags are **filter bags** that **pack** a predetermined quantity (dose) of herbal material or herbal mixture.



- **Juice** is prepared by **crushing freshly harvested plant** parts in water and then **expressing** the juice.



- **Syrup** is a viscous preparation containing about **66% sucrose (not less than 50%)**. Saturated sugar solutions are free of **microorganisms** because no free water necessary for microbial growth is available. Syrups are mainly used as **flavouring** agents to **mask the unpleasant taste of other ingredients**. They are slowly sipped as cough remedies to allow maximum contact with inflamed mucous membranes.



- **Glycerides** may be prepared using **glycerol** as the solvent instead of alcohol.



Medicinal oils are fatty or liquid waxes mixed with medicinal extracts intended for **internal or external use**. Garlic oils are often prepared in this way. In aromatherapy, it is customary to **dilute essential oils** in some **carrier oil**, such as **olive oil, almond oil or jojoba oil** (the last-mentioned is actually not an oil but a liquid wax).



Granules are produced by **binding powders or powdered extracts into small units**, using suitable excipients such as gelatin, lactose or sucrose solutions. Granules may be used as such or are more often **compressed into tablets** or included in **capsules**.



Capsules are **small containers**, usually made from **gelatin**, that contain medicinal products or extracts in a predetermined dose and protect them from air, light and moisture.



Tablets. Uncoated tablets are made by **compression of powdered** active material after addition of a suitable inert excipient or binder (to provide the bulk) and sometimes also other additives to improve **colour** and **flavour**, or disintegrator's or ensure that the tablet rapidly **dissolves when placed in water**.

Pills are made by cutting **semisolid** preparations into small portions of predetermined **size** or **weight**, **shaping** or **rolling** the portions before allowing them to harden.

Suppositories are oblong, tablet-like products that are intended for inserting into the **rectum**, **vagina** or urethra and left there to melt. Herbal products are rarely used in this form



Ointments, pastes and gels are semisolid preparations for external applications containing medicinal substances in a suitable carrier (watery or oily solvents).



Lozenges or **pastilles** are variously shaped tablet-like products intended for **sucking** or **chewing** so that the active substances are slowly released in the mouth. These products are not made by compression but are cut or **moulded** from **semisolid**, usually sugary masses. **Sucrose** is often the main constituent, together with smaller quantities of gum (e.g. gum Arabic).



Note: Although modern galenic forms, such as tablets or pills, look respectable and are easy to swallow, it can be challenging to provide an adequate dose of an extract, mainly if an extract contains several compounds that need a higher dosage for optimal efficacy. The old-fashioned tea might be a more appropriate dosage form in such a case.





Use of medicinal plant products

The chemical compounds in medicinal plants need to be **researched sufficiently for the product to be effective.**

The ease with which active ingredients can **enter human cells** or the **bloodstream** (bioavailability) depends on the **polarity, stability** and **other chemical characteristics** of the compounds involved, as well as **the route of administration.**

Some active compounds, for example, **pass through the digestive tract without being resorbed** but are **highly active** when **injected** directly into the **bloodstream.**

Volatile compounds may be effective when **inhaled** (as in **aromatherapy**) but practically **inactive** when taken **orally.**



Medicinal plant products can be administered in the following ways:

■ **Oral Infusions,**

tinctures, decoctions, syrups and tablets are often taken orally (by mouth) or sometimes sublingually (under the **tongue**).

■ **Nasal**

Powdered material {or suspensions) may be snuffed-drawn up into the nasal passages, where the active compounds are **resorbed through the mucosa**.

■ **Topical**

Lotions, oils or creams containing medicinal plants and their extracts are applied **directly to the skin**, where the active compounds are resorbed.

■ **Rectal**

Liquid preparations may be administered as **enemas**. The active compounds are effectively resorbed by the **mucus membranes** of the **rectum**.



■ **Smoking and steaming**

Smoke from **burning material** is **inhaled**, and the active compounds **are resorbed through the lungs** {in the same way **nicotine** is resorbed while smoking). **Volatile oils** of medicinal plants are **inhaled** similarly by **steaming** them **in boiling water**.

■ **Bathing**

Herbs or **herbal extracts** may be added to **bath water**.

■ **Subcutaneous or intramuscular injection**

Some phytomedicines (often pure chemical entities derived from medicinal plants) are **injected directly into the bloodstream**. Interestingly, some compounds may **be inactive** when taken by **mouth** yet **highly active** when **injected**.

For example, the **Menispermaceae alkaloids** are traditionally used as muscle-relaxant **dart poisons**; however, the meat from the **killed animal** is **harmless when eaten**.



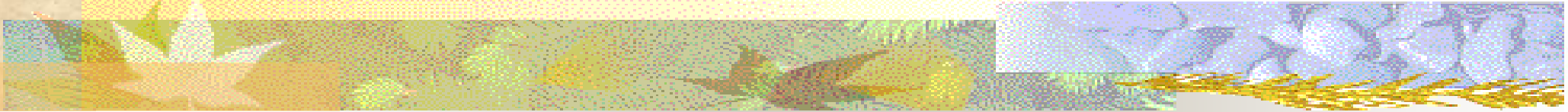
Phytotherapy, pure chemical compounds and dietary supplements

Herbal drugs or so-called **botanicals** generally have a **wide therapeutic window** (i.e. the **effective dose** differs markedly from the **toxic dose**). With most medicinal plant **products sold** today, ingesting sufficient material to reach dangerous or life-threatening toxicity levels is almost impossible. In contrast, **pure chemical** compounds are highly concentrated, and the desirable dose is easily exceeded.

When a **new herbal** product is **developed**, the traditional dosage form and route of administration are **carefully considered**. A plant safely consumed as a tea may be unsuitable for human use as a **tincture**. The alcohol (ethanol) may dissolve poisonous substances not present in tea.

Most **phytomedicines** are used for **short periods** (up to **three weeks**) against self-terminating illnesses (conditions that will generally clear up even without treatment).

The value of medication is to **alleviate the symptoms** or to **shorten the recovery time**.



There are notable exceptions, where several weeks are required for the **remedy** to become effective. This is true where products are used in the supportive **treatment of chronic conditions**, such as **mild depression**, **poor blood circulation**, **mild asthma** and some forms of **diabetes**. An example is *Hypericum* preparations, used in the supportive treatment of **mild depression**. **Crude herbal drugs** are rarely used for **severe health conditions** (except in some.

Third World countries where people have limited access to **modern medicine**) but rather carefully **tested** and **standardised** modern phytomedicines (or isolated compounds extracted from **crude drugs**). It is important to note that treating any **severe or chronic ailments** should only be done within the safeguards of the traditional healthcare system and under the supervision of a qualified healthcare professional.



Any
Question

