

## UNIT - I

# 1

## Herbs as Raw Materials

### **Syllabus**

*Definition of herb, herbal medicine, herbal medicinal product, herbal drug preparation Source of Herbs Selection, identification and authentication of herbal materials Processing of herbal raw material.*

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## 1.1 Definition

**Herbs:** The word herb derived from Latin word '*herba*', according to botany herbs means the herbaceous plants. According to pharmacognosy herbs means tender parts of plant axis (stem, leaf, flower, fruit). Herb term includes the leafy green or flowering parts of plants, grass, green stalks or blades which are used as aromatic, flavoring, food garnishing and medicinal purpose. From the prehistoric time herbs used as medicine. It also consists of flowers, buds, bark, seeds, leaves or many other parts of a plant which are usually come from leafy and green part of the plants. Example: Thyme, Rosemary, Lavender, Coriander, Dill.

**Herbal medicines :** It is also known as herbalism or phytomedicines. It includes the study of pharmacognosy branch, in that use of medicinal plants. Herbal medicines may include the modern standards of usefulness testing of herbs and medicines, which are obtained from natural sources, few high-quality clinical trials and standards for purity or dosage exist.

**Herbal medicinal products :** It is also known as phytopharmaceutical products or any medicinal products, which containing one or more active ingredients in small quantity from herbal origin containing complex nature for several different uses.

**Herbal drug preparations :** Herbal drugs preparations are prepared by different processes like infusion, decoction, maceration, distillation, expression, fractionation, purification, concentration and fermentation. These herbal preparations made up from herbal drugs includes whole plant or parts, powdered herbal drugs, tinctures and extract, fatty oil, essential oils, expressed juices and processed exudates of herbal material.

## 1.2 Sources of Herbs Selection

Plant is a major source of herbs. As herbal treatment contains minor side effects, it become more popular in civilization along with herbs are obtained from nature it is safer than any other medicinal agent. Due to that use of herbs tremendously increases from last two decades. As per the ancient scholar, many health-related problems, internal disorders which are difficult to cure can be only treated with the help of herbs. Worldwide, people used thousands of herbs for their treatment. They are not only used for medicinal purpose but also have different uses like natural dye, pest control, food, perfume, tea and so on. As our life become more techno savvy, due to that we move away from natural things. We are a part of nature so we cannot escape from it.

During the metabolic pathway herbs produces the chemical entities. They are classified into two categories i.e. primary metabolites and secondary metabolites.

- 1) **Primary metabolite :** All plants having capacity to produced primary metabolite

which are participate into their life processes like growth respiration and reproduction. They perform the intrinsic function in plants.

Examples : Sugar, Fats, Amino acids.

- 2) **Secondary metabolites** : Only some plants having capacity to produces secondary metabolites. They are not involved in life processes but are require for survival of plant in environment. They are biosynthetically produced from primary metabolites. This are unique resources for pharmaceuticals, food additives, and fine chemicals. Secondary metabolite having wide applications in medicine, agriculture, pharmaceutics and manufacturing industry. They have many functions like anticancer, antidiabetic, antifungal, antibacterial and remedy to treat heart disease.

### **1.3 Selection, Identification and Authentication of Herbal Materials**

Herbal medicine contains active chemical constituent, which is useful for their specific pharmacological activity. It contains the combination of many chemical constituents together, due to that they become more complex. As they having complex nature, the identification and quantification of herbal medicines is very difficult and the detection of adulteration is very challenging.

Criteria for the selection of reference substances and quality control of herbal medicines should take into account that various ingredients may have different levels of influence on the final quality, safety and efficacy. For this reason, the order of selection of the substances for identification and quantification should follow the rules presented below :

- 1) If that having constituents with known therapeutic activity they are used as markers.
- 2) If the activity is not known but they having recognized pharmacological activity they should be used as markers.
- 3) If above both cases not applicable identification will be done by authentication and it analyzed by using marker substance(s) containing other characteristic constituent(s).

#### **1.3.1 Technique and Methods for Selection Herbal Materials**

- i) **The randomized approach** : The randomized approach without any criteria. The randomized surveys consist in random selection and collection of plant species for study, according to availability of plant. It is generally carried out in regions with high diversity and the probability of finding novel and substances, bioactive substances are definitely higher in this plant species that had never

been investigated. This type of selection provides an endless source of new structures, as nature is a vast world of chemicals.

- ii) **The ecological approach :** The ecological approach is based on field observations and consists of observations of interactions between organism in their ecological environment. This approach searches for secondary metabolite and biological activities and it may be performed by the selection of young leaves for a given species, or between different species that are shade resistance and non-shade resistance, among other characteristics through little explored, it has achieved excellent results. Secondary metabolites present in plant species have biological functions which can defend their use in the development of therapeutic resources for humans.
- iii) **The chemo systematic approach :** The strategy is based on chemo systematic, a system created by professor Otto Richard Goytlieb (1982) to organized and understand the plants. This system includes identifying groups of chemicals present in plants, considering the taxonomic organization of these plants for example, a plant containing antispasmodic indole derivatives used as an active principle in the development of antimalarial drugs. This strategy can bring some uncertainty and is not significance enough to guide the development of a phytomedicine product and to supposed use, as well as it does not confirm the safety and efficacy of the derivatives proposed for the development of the products. This approach includes selection of a species from family or genus, for which some phytochemicals knowledge of at least one species of the group is known.
- iv) **The ethnoguided approach :** It consists of selecting plant species according to the suggestion of specific population groups in certain circumstances of use; highlights the search for the locally built knowledge regarding their natural resources and their application in their health systems.

### **1.3.2 Identification and Authentication of Herbal Material**

From the beginning of civilization, a greater number of populations used traditional herbal and herbo-mineral drugs to improve the health from disease condition. As per the WHO 80 % of total world population rely on the natural medicine for treatment. From the beginning the identification and authentication of herbal drug is problematic because of its complex nature, composition and properties while using them for medicinal purpose. The proper identification and authentication are necessary for the protection of consumers, because use of wrong herb may be ineffective towards the treatment or it may worsen the condition and in some cases it may cause the death of patient. Ideally identification should be done at authorized research center by using the knowledgeable expert and

authentication should be start from at the stage of harvesting and end with the plant material to the finished product. Herbal drugs are usually processed parts of several parts of plants, such as roots, stems, leaves, flowers, fruits, seeds, etc. Due to world wide popularity of herbal drugs increases, their adulteration/substitution aspects are gaining importance at the commercial level.

Conventionally, herbal drugs are authenticated by people by their physical appearance, smell and/or taste. Some of these methods till a date we are using for authentication of herbs. The sophisticated method for identification of herbs include inspection under microscope to examined and analyzed the drug, which gives an idea regarding shape and content of various plant cells. The methods based on organoleptic markers or anatomical characters are imprecise many times. Now a days analytical methods like chromatography, which includes thin-layer chromatography, high- performance liquid chromatography, or liquid chromatography has been used for herb authentication.

Identification tests should be specific for the herbal material and are usually a combination of three or more of the following :

- i) Macroscopical characters
- ii) Microscopical characters
- iii) Chromatographic procedures
- iv) Chemical reaction

Authentication is basic starting point for developing of dosage form from raw herbs. It is especially useful in cases of drugs are frequently substituted or adulterated with other varieties which are morphologically and chemically impossible to differentiate. Various herbs still difficult to identify and authentify based on their morphological or histological characteristics and use of these drugs may be unsuccessful or it may aggravate the condition.

Various steps involve in authentications are as follow :

1. **Taxonomical method** : It is a basic step involve in the identification and authentication of botanical materials entails classical botanical methodologies for collection and documentation of the plant at its source. The botanical origin of the drug is identified and its scientific Latin binomial (i.e. genus species) name is determined based on this method. It is the first step for authentication. Information such as botanical name, vernacular names, site of collection of plant material, details of collector, habitat, season of collection, altitude and part collected etc. are the essential prerequisites even before authentication.
2. **Herbarium specimen** : The sample of collected material should be kept as a

specimen sample in a herbarium or a research institute for future references.

3. **Macroscopic method** : Macroscopic identity of botanical materials is based on parameters like shape, size, color, texture, surface characteristics, fracture characteristics, odor, taste and such organoleptic properties that are compared to a standard reference material.
4. **Microscopic method** : Microscopy is used to determine the structural, cellular and internal tissue features of botanicals. It is usually used to identify and differentiate two herbals that are similar. This is the commonly used technique, convenient, quick and can be applied to proprietary medicines too. An example of a botanical that can utilize microscopic techniques to aid in its identification is star anise. As the name suggests, star anise is star shaped fruits that taste like anise; originally a native of southern China, it has now been introduced throughout the tropics and subtropical Eastern Asia.
5. **Physicochemical methods** : Physicochemical parameters include total ash, water soluble ash, acid insoluble ash and sulphated ash. These values of the individual drugs or the proprietary medicines can be compared with the standard values of Indian pharmacopoeia and thus the identity can be ascertained.
6. **Spectroscopical methods** : Initially the use of infrared (IR) spectroscopic method is restricted only for structural elucidation of isolated compounds from the herbal matrices. It is also found useful in phytochemical studies as a “fingerprinting” device, for comparing a natural with synthetic sample. With the advance of computer technology, chemometric method has become a leading tool among the scientific communities towards faster analysis and shorter product development time. Among others, an unsupervised pattern recognition technique such as Principal Component Analysis (PCA) is the most often used method for handling multivariate data without prior knowledge about the study samples.
7. **Chromatographic methods** : High Performance Liquid Chromatography (HPLC), Capillary Electrophoresis (CE) and Thin Layer Chromatography (TLC) are the most commonly used analytical methods for herbal products. The analysis of volatile compounds by gas chromatography is very important in chemical analysis of herbal medicines.
8. **Chemical fingerprinting** : A chemical fingerprinting is a unique pattern that indicates the multiple chemical markers within a sample. The European Medicines Agency (EMA) defines chemical markers as chemically defined constituents, or group of constituents of herbal medicinal product which are of interest, regardless whether they possess any therapeutic activity. The quantity

of a chemical marker can be an indicator of the quality of herbal medicine.

The study of chemical markers is applicable to many research areas, including authentication of genuine species, search for new resources or substitutes of raw materials, optimization of extraction and purification methods, structure elucidation and purity determination.

9. **Molecular markers** : Molecular markers generally refer to biochemical constituents, including primary and secondary metabolites and other macromolecules such as nucleic acids. DNA markers are reliable for informative polymorphisms as the genetic composition is unique for each species and is not affected by age, physiological conditions as well as environmental factors. DNA can be extracted from fresh or dried organic tissue of the botanical material and hence the physiological form of the sample for assessment does not restrict detection. Various types of DNA based molecular techniques are utilized to evaluate DNA polymorphisms. These are hybridization-based methods, Polymerase Chain Reaction (PCR) based methods and sequencing based methods.

## **1.4 Processing of Herbal Raw Materials**

Herbal material become safe for therapeutic applications when they are undergone through unique procedures of preparation called as processing. This method confirms the quality of herbal materials along with their safety and efficacy in clinical settings.

This method involves the following practices :

- i) Processing of herbs into herbal materials
- ii) Processing of herbal materials into herbal preparations; and
- iii) Processing of herbal materials or herbal preparations into herbal dosage forms.

### **1.4.1 Processing of Herbs into Herbal Materials**

“Primary”, “Secondary” and “Special” processes are major three procedure involve in the processing of herbs into herbal material. GMP procedures are follow when processing of herbal materials converts into herbal preparations and processing herbal materials or herbal preparations convert into herbal dosage forms.

#### **Primary Processing :**

Primary processing should be done on the raw material which arrival at processing center, includes cultivation or by wild crafting or field collection which is free from foreign matters or contaminants as well as the procedures of garbling (sorting), washing, and drying. The primary processing may also include cutting, sectioning, and comminution. The herbal plant material should be protected from rain, moisture or any other conditions

that might cause deterioration, herbal material should be exposed to direct sunlight if there is a need.

**Secondary Processing :**

Secondary processing is the next step concerned with converting the primary processed herbs into herbal materials by various additional procedures, including aging/sweating; baking/roasting; boiling/steaming; and stir-frying.

**Special Processing :**

This procedure mainly used to reduce toxicity level or to alter or modify their therapeutic activity of specific herbs by employing specialized method followed by the secondary processing.

Example : *Aconitum napellus* herb.

**1.4.2 Processing of Herbal Materials into Herbal Preparations**

For preparation of finished herbal products the herbal materials will undergo further treatment procedures. The active ingredients are usually not purified but rather are obtained along with other components of the medicinal plant part. The active product may isolate in pure form by removal of unwanted or undesired chemical constituents from plant. The different form of herbal preparations is available i.e. extracts, decoctions, tinctures, essential oils and others. The procedure which involve in preparation of above-mentioned preparation are extraction, distillation, fractionation, purification, concentration, fermentation or other chemical/biological methods.

**1.4.3 Processing of Herbal Materials or Herbal Preparations into Herbal Dosage Forms**

As per the use a need, herbal material act as intermediate in process of producing finished products or as final dosage forms used for pharmacological treatment. It is not necessary that to prepare dosage form involve the complex procedures but sometimes simple dosage form produced by using simple procedure, from herbal materials (such as ground powders of raw herbs) or herbal preparations (such as dried extracts) which are ready to administration to the patient. These herbal dosage forms include, decoction, tea bags, granules and syrups, among others.

**1.4.4 Drying**

When the procedure of herbal dosage forms involves the use of dry form of drug. The drug should sort and dry properly by using natural or artificial drying tech. The proper storage conditions also involve the dried state of drug, they must be dried as soon as possible to remove as much moisture as possible to avoid deterioration. Drying will also avoid tissue deterioration and phytochemical alteration caused by the actions of enzymes



and microbial organisms; and will also facilitate grinding and milling and convert the herbal materials into a convenient form for further processing.

To ensure proper drying tech three major steps are involved these are control of temperature, humidity and air flow. As per the nature of raw material (medicinal plant) drying procedures are applied along with desired appearance of the final form. The drying procedure directly proportional to the quality of the resulting herbal materials, hence the choice of correct operational procedure is crucial. The standard book or specific monograph specify the suitable drying methods and procedures for particular herbal materials. In general, raw medicinal plant materials are most often dried by sun-drying, shade-drying, or by artificial heat.

The drying techniques are dependent on the character (e.g. volatility, stability) of the active ingredients and the texture of the plant part collected (e.g. root, leaf or flower). In general, the following drying processes can be adapted.

Drying process classify into two classes :

- A. Natural drying :** By using natural resources for drying, further categories into sun-drying and shade drying.
- B. Artificial drying :** By using artificial resources for drying.

#### **A) Natural drying :**

##### **i) Sun-drying :**

This is simple method of drying. Most of the plants are dried under the sunlight in open-air when climate is suitable for this practice. According to physical structure of medicinal plants and climatic conditions the duration of drying process may get change. In this procedure medicinal plant material should be spread out under the open air in the form of thin layer on drying tray which is protected from insects, rodents, birds, pests, livestock and domestic animals and kept away from the contaminations present in air like vehicle exhaust, heavy dusts, and rain. To attain uniform drying in smaller period of time the drying to avoid the tray should be kept sufficient height above the ground mould development.

##### **ii) Shade-drying :**

Some medicinal plants are susceptible to sun drying process, these can be dried in shade with or without application of air flow. As compare to sun drying process this method is slow but it is preferred to avoid the loss of chemical constituent and maintenance of color of leaves and delicate part like flower. This method avoids the evaporation of the most valuable chemical constituents like volatile oil and aromatic components so ultimately help in preservation of such chemical substances.

**B) Artificial drying :**

This method is more suitable for thermolabile substances which are unable to dry by using natural method of sun-drying. Artificial heat can be generated by the suitable equipment. This is rapid method of drying as compare to open sun drying or air-drying, this is often necessary during rainy days or region having high humidity. The equipment used for drying are ovens, stoves, belt driers, by using direct fire or heating devices. According to physical nature of the drug and physico/chemical properties of active chemical constituents the temperature, humidity and other conditions should be govern in artificial drying. Excessive temperature and over heating may cause the decomposition of chemical ingredients, its untimely results in to loss of the volatile components. During artificial drying the temperature should be maintained less than 60 °C. Thermolabile drug Digitalis like dry by artificial drying method, temperature less than 45 °C.

**1.4.5 Special Processing Procedures**

The primary and secondary processing is insufficient to reduced the adverse effect of toxic medicinal plants. This type of herbal material obtained from toxic medicinal plants require special processing procedures before they can be used for medicinal purpose. This procedure mainly used to reduce toxicity level or minimize the side effects along with detoxify the herbal material which is become safe for administration. Many medicinal plants contain toxic or undesirable chemical components, for these plants this type of special process is important. In other hand many medicinal plants require special procedure to enhance their therapeutic efficacy or to modify their medicinal properties, for these plants also this type of special process is important.

The following procedures are including in special herbal material processing :

- i) **Detoxification :** This process helps to reduce the toxicity level. This process generally involves boiling with water, steaming, admixture with ghee or cow milk, soaking in water, cooking, frying and storing or aging for longer period.

**Example :** *Nux vomica* (*Strychnos nux-vomica*) seeds boil with water followed by admixture it with cow milk or ghee.

- ii) **Enhancement or modification of therapeutic properties :** This process helps to enhance the therapeutic properties of herbal material. This process generally involves steaming, stir-fried or cooking with some other ingredient which help to enhance their medicinal properties.

**Example :** *Ginseng* (*Panax ginseng*) : Fresh ginseng is converted to red ginseng through a series of repeated steaming procedures to afford a product with altered pharmacological actions or differing therapeutic effects.

**Uses of adjuvants :**

1. Wine (rice wine, wheat wine, and sorghum wine), vinegar, honey, ginger juice,

liquorice extract, and brine are common adjuvants used for special processing.

2. Under special circumstances, other auxiliaries such as human/cow urine, cow/goat milk, animal bile, butter, cow's ghee, goat fat, black bean extract and coconut water, etc. have been used.
3. The use of animal parts/products in any processing procedures should be evaluated for safety and contamination prior to use.

## Questions

### Multiple Choice Questions :

**Q.1** The earliest known Greek herbals come from Theophrastus of Eresos who in the wrote in Greek *Historia Plantarum*.

- |                            |                        |                            |                      |
|----------------------------|------------------------|----------------------------|----------------------|
| <input type="checkbox"/> a | 12 <sup>th</sup> B. C. | <input type="checkbox"/> b | 456                  |
| <input type="checkbox"/> c | 1981                   | <input type="checkbox"/> d | 4 <sup>th</sup> B.C. |

**Q.2** The Ebers Papyrus (c. 1550 BCE) from ancient Egypt has a prescription for \_\_\_\_\_ applied topically for inflammation.

- ☐ *Cannabis sativa* (marijuana)      ☐ Tobacco
- ☐ Tea      ☐ Thevetia

**Q.3** The word herb is derived from \_\_\_\_\_.

- ☐ a Herbarium                      ☐ b Herba
- ☐ c Herbareum                    ☐ d Harba

**Q.4** To ensure proper drying tech three major steps are involved these are \_\_\_\_\_.

- ☐ a temperature, humidity and air flow
- ☐ b pressure, temperature, air
- ☐ c temperature, pressure, humidity
- ☐ d none of the above

### Answer Keys for Multiple Choice Questions :

Q1	a	Q2	a
Q3	b	Q4	a

**Short Answer Questions :**

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- Q.1** Define
- a. Herb
  - b. Herbal drug preparations
  - c. Herbal medicine
  - d. Herbal medicinal products
- Q.2** Write a difference between primary metabolites and secondary metabolites.
- Q.3** Write a short note on selection identification and authentication of herbal materials.
- Q.4** Explain in detail about technique and methods for selection herbal materials.

**Long Answer Questions :**

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- Q.1** Explain in detail about identification and authentication of herbal material.
- Q.2** Write in details processing of herbal raw materials.

