Herbal drug technology

Processing of herbal raw materials

Presented by:
M. Abinaya ,
Lecturer.

FUNCTIONS

- Enables the crude drugs to maintain their stability during transport and storage.
- Helps to remove any foreign organic matter and substitutes
- Helps the crude drugs to meet the standard pharmacopoeial req.

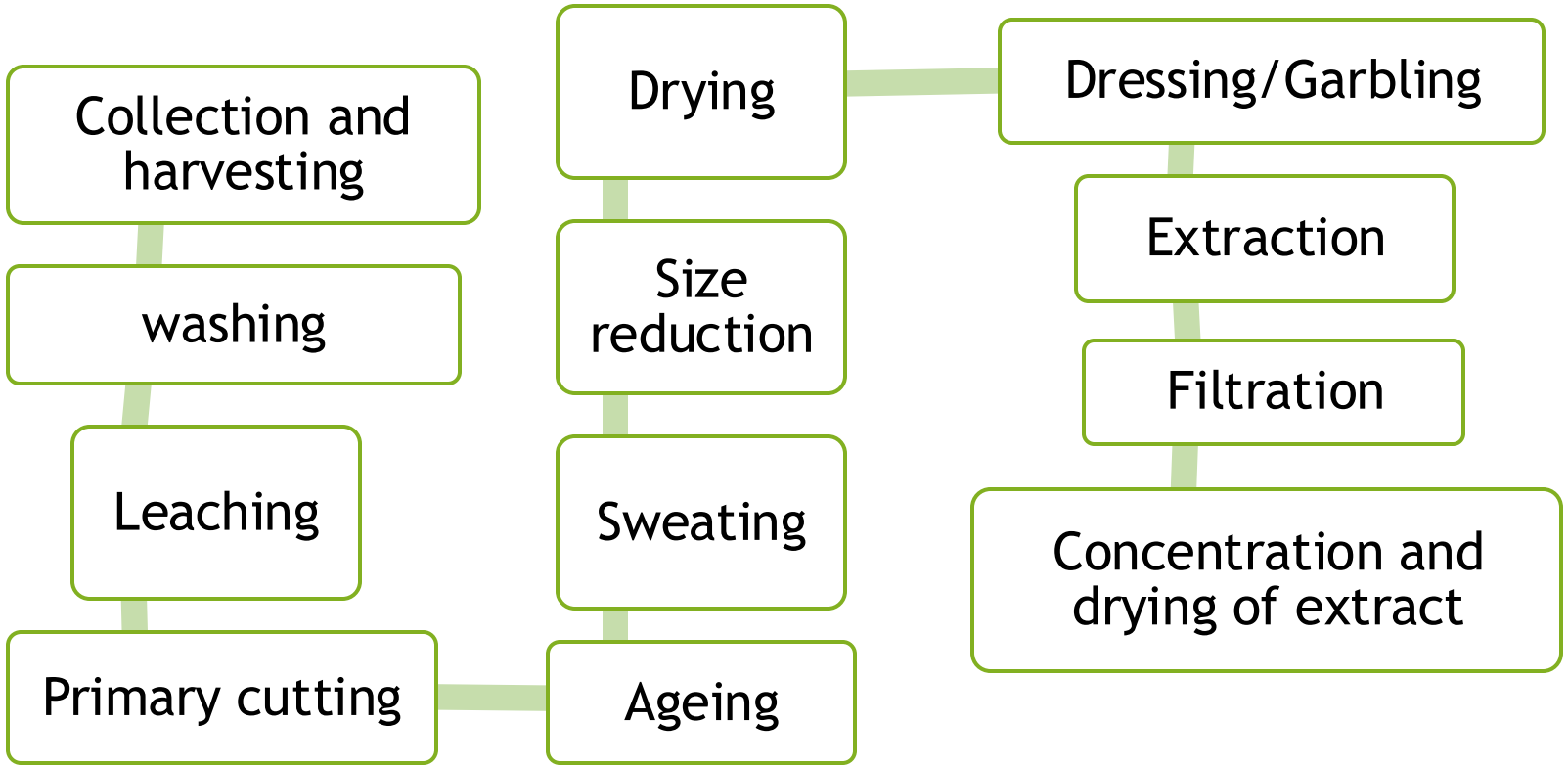
STAGES INVOLVED IN PROCESSING

Primary processing - Herbs into herbal materials

Secondary processing - Herbal materials to herbal preparations

Processing of herbal materials or herbal preparations into herbal dosage forms

STEPS INVOLVED IN PROCESSING



I. COLLECTION AND HARVESTING

Harvesting should be done at an appropriate time i.e., when the active constituents of the drug are maximum. It is usually carried out in the morning hours. The technique varies depending upon the plant part to be harvested. Harvesting should preferably be done by skilled workers, which ensures the collection of genuine drugs with improved quality.

Roots and Rhizomes

- Roots are collected in spring before the vegetative process stops, and then are transversely or longitudinally sliced for easy drying.
- Rhizomes are collected when they have a rich amount of food material and chemical constituents.
- Roots are dug up at the end of summer season by mechanical devices like diggers or lifter. After harvesting, they are thoroughly washed (to remove any adhering matter) and dried.
- Bulbs are dug up after the autumn or fall season ,when the plant withers. The bulbs are also harvested by mechanical devices like diggers or lifters.
- Bark of the plant(like cinnamon) is harvested after the rainy season because the dampness in the atmosphere facilitates in its easy removal.

Leaf and Flowering Tops

- These are collected before their maturity (i.e., flowering stage), e.g., senna, digitalis, vinca, belladonna, etc.; Leaves are harvested when they are fully grown.
- while aloe leaves are collected when they have become adequately thick.

Flowers

- These are collected in the morning hours of dry weather during pollination, or before their full expansion, e.g., saffron, clove buds, chamomile, arnica, etc. Flowers are harvested before they bloom completely, as higher concentrations of essential oils are present in buds. Flowers are usually harvested by a device known as seed stripper. Example: Clove buds are harvested by beating the plant with bamboo sticks.

Barks

- These are collected in spring or early summer when cambium is active, so that they can be easily detached from the stem. For example, wild cherry is collected in autumn; cinnamon in the rainy season because the dampness in the atmosphere facilitates in its easy removal. Barks can be collected by the following three methods:

i) Felling: This method involves cutting the tree at base and peeling out the bark.

ii) Uprooting: This method involves digging out the roots and stripping off the barks from roots and branches.

iii) Coppicing: This method involves cutting the tr ees repetitively forobtaining bark.

Fruits

- These are collected either ripe or half ripe, but fully grown. Fruits and seeds of the plant are harvested by seed stripper. Umbelliferous fruits like caraway, coriander and fennel are harvested by uprooting the plant.
- For example,
    i. Cardamom fruits are collected before dehiscence;
    ii. Bael and tamarind are collected after full maturity;
    iii. Caraway, fennel, and coriander are collected after full ripening.

Resins, Gums, and Lattices

- These unorganised drugs are collected when they start oozing out of the plants.
- For example,
    i. acacia gum is collected when it gets adequately hard after 2-3 weeks of making incisions on bark;
    ii. opium an d papaya lattices are collected after the latex coagulates;
    iii. turpentine oleo -resin and Peru balsam are collected from 8 -10 years old plant.

OTHERS

- Fruits and seeds of the plant are harvested by seed stripper.
- Cochineal insects (used as colouring agents) are harvested by brushing them from the cactus plants.
- Red algae or sea weeds used to produce agar are harvested by using long handled forks.
- Devices like mowers are used to harvest peppermint and spearmint.

Table 1.7: Time of Collection for Herbal Drugs

Sr. No.	Plant part	Time of collection	Example
1.	Leaves	Before maturity, before flowering	Digitalis, Vinca, Tea, Belladonna, Senna, Tulsi.
2.	Flowers	Before pollination or maturity, preferably in morning before sunrise	Clove bud, Rose, Chamomile, Arnica, Saffron.
3.	Roots	When aerial growth of plant stops, i.e. spring	Withania, Ginseng.
4.	Rhizomes	When aerial growth of plant stops, when rhizome has maximum reserve food material	Ginger, Turmeric, Jalap.
5.	Stem	After maturity	Kalmegh, Ephedra.
6.	Bark	Spring or early summer, after damp weather when it separates readily from wood	Ashoka, Arjuna.

7.	Seed	After maturity, washed and freed from pulp	Nux Vomica, Cocoa.
8.	Fruit	Ripe, half ripe or fully mature	Coriander, Dill, Bael.
9.	Resin	Immediately after oozing from plant, in dry weather	Balsam of Peru, Balsum of Tolu.
10.	Gum	After oozing, when it dries or hardens, in dry weather	Acacia, Tragacanth
11.	Latex	After oozing out, after coagulation	Papaya, Opium.
12.	Heartwood	After maturation	Sandal wood.
13.	Pod	After maturation	Senna

Techniques of Harvesting

1) **Binders:** These are used for harvesting drugs which constitute all aerial parts.

2) **Seed Stripper:** This device is used for harvesting flowers, seeds, and small fruits.

3) **Beating with Bamboo:** This technique is used for harvesting cloves.

4) **Brushing:** This technique is used for collecting cochineal insects from branches of cacti.

5) **Handled Forks:** These are used for harvesting seaweeds producing agar.

6) **Mowers:** These are used for harvesting peppermint and spearmint.

7) **Reaping Machines:** These are used for harvesting fennel, coriander, and caraway plants which are uprooted, dried, beaten, or the fruits are separated by winnowing

Table 1.8: Types of Harvesting

Sr. No.	Types of harvesting	Example	Advantages/ Disadvantages
1.	Manual, skilled workers	Flowers, Leaves like tea leaves, vinca, senna leaves, digitalis, belladonna, cinchona.	Selectivity, sorting by hand/ Laborious, time consuming, costly.
2.	Mechanical diggers	Roots, rhizomes, tubers e.g. potato, ginger, sugarcane.	Economic, washing is possible.
3.	Mechanical shakers	Fruits like apple, olive and some flowers.	Free from soil, good quality.
4.	Seed striper, separator	Seeds, barks like cork.	Saves time and labour.
5.	Machine harvester, mowers, thrashers, winnowers	Seeds, grains, some fruits	Saves time and labour.

Washing

- Plant materials are washed with clean water and dried soon after harvest or collection.
- During this process, scraping and brushing is also required sometimes.
- The water containing low concentration of chlorine is also used to prevent microbial contamination.

Leaching

- Removal of impurities from raw herbal plant parts by using running water is known as leaching.
- This method is to be controlled foe excessive loss of active ingredients from plant parts.

Primary cutting

- Harvested bulky raw materials are cutted to smaller pieces (done in collection area) for easy transportation to processing and manufacturing area.

Ageing

- Storing of harvested raw plant materials for a period of time till usage.

Sweating

- Storing of raw herbal plant materials at a temperature of 45-65ºC in conditions of high humidity from one week to few months depending on plant species.
- This process is considered as hydrolytic and oxidative process.

SIZE REDUCTION

- The plant material is reduced to a size between 30 and 40 mesh is optimal, while smaller particles may become slimy during extraction and create difficulty during filtration.
- The objective for powdering the plant material is to rupture its organ, tissue and cell structures so that, its medicinal ingredients are exposed to the extraction solvent.
- The rate of absorption of a drug depends quicker and greater with the smaller the particle size.
- Size reduction maximizes the surface area, which in turn enhances the mass transfer of active principle from plant material to the solvent.
- The physical appearance of market formulations such as ointments, pastes and creams is improved by reducing its particle size.
- Generally, for dried leaves, flowers and whole herbaceous plants, an average particle size of 5-10 mm is adequate for extraction, while for harder materials such as wood, bark, roots, rhizomes and seeds, 0.5-5 mm is recommended.

Types of machines used for grinding plant materials

- **Hammer mill**
- **Knife mill**
- **Tooth mill**
- **Sieving**
- **Blast sifting**

DRYING

- This process is carried out before the crude drugs are marketed. Herbs, leaves and flowers are dried at a temperature range of 20-40°C, while roots and barks are dried at a temperature range of 30-65°C.

Methods of drying

a) Air drying

   i. This method of drying plants is carried out by Jusing small fans or windows. Plants are dried in the dark in order to prevent the loss of colours and chemical constituents. The drugs which are air dried contain around 12% of moisture.

b) Natural Drying or Sun-drying

   Natural drying is carried out in two ways,

   i. Drugs are dried under direct sunlight and this method is suitable for those constituents which remain stable upon exposure to light and heat. E.gs: Acacia gum, seeds and fruits.

   ii. Shade drying is preferred when the natural colour of the drugs like digitalis leaves, senna leaves and clove buds as well as volatile oil content of the crude drug like pepper is to be maintained.

c) Pressing of plants:

This process is carried out by pressing the plant parts (like 'flowers) between newspapers and placing weight on them. However, the demerit is that it requires periodic checking for growth of mould.

d) Dehydrating Agents:

They are used to absorb moisture from the crude drugs and therefore facilitate the drying process. Desiccant or dehydrating agents like silica gel and calcium chloride are used for drying digitalis powder to retain its chemical constituents.

e) Drying by Artificial Heat:

It is relatively rapid when compared to air-drying. Artificial drying of crude drugs is carried by,

a) Tray Dryers: This equipment circulates continuous flow of hot air at the desired temperature (usually 40°C) by the mechanism of forced convection. It aids in the removal of moisture from crude drugs especially those which do not contain volatile oil. It is also preferred when deactivation of enzymes is required.
   E.gs: Roots of Atropa belladonna, bark of cinchona trees,leaves of raspberry plant and gums.

b) Vacuum Dryers: This equipme moisture from the crude, drugs at a temperature of 25-30°C by vacuum. This method is used for those drugs which are sensitive to high temperatures.
   E.gs: Tannic acid, leaves of digitalis plant etc.

c) Spray Dryers:

This equipment removes moisture at a very rapid rate from the drug in about 3-30 seconds. This method is used for drying plant and animal constituents rather than drying crude drugs.

E.gs: Latex of papaya fruits, pectin, tannins, acacia, citric acid, extract of coffee seeds, gelatin, starch etc.

Advantages of Drying

- Drying helps to preserve or store drugs for longer durations
- Crude drugs become less susceptible to microorganisms due to the removal of moisture content from them.
- It lowers the activity of enzymes, thereby maintaining the potency of the drug.
- It aids in pulverization (grinding) of the crude drugs.

Dressing or Garbling

- This process is performed after collection and drying in which the crude drugs are scrutinized for the presence of any foreign organic matter or undesirable matter, which is then removed. Undesirable matter include adhering soil, silica, excreta, insects, moulds etc., while foreign organic matter is the undesirable part of the same plant like stems in senna leaves etc. Garbling, therefore helps the crude drug to attain pharmacopoeial standards.

Drugs	Foreign matter to be removed
Lobelia and stramonium	Excess stems
Cloves	Stalks of clove,mother clove,brown clove and exhausted cloves
Caster seeds	Pieces of irons(removed by magnet)
Vinca and senna leaves	Pieces of iron
Aloe	Pieces of iron and stones
Gum acacia	Pieces of bark(removed by peeling)

Packaging

- The various factors considered while packing crude drugs are,
  a) Morphological and chemical nature of the crude drug
  b) Surrounding environmental conditions
  c) Desired temperature and humidity during transportation
  d) Conditions of storage

Drugs	Packaging material
Aloe	Goat skin
Colophony and tolu balsam	Kerosene tins
Colophony	Packed in lumps (to prevent auto-oxidation)
Asafoetida	In tightly-closed containers to prevent the loss of volatile oil.
Cod-liver oil	Light resistance or amber-coloured glass containers
Senna and vinca leaves	Packed as bales(i.e.,pressed tightly together and tied).
Digitalis leaves,ergot and squill	Packed along with desiccating agents(like silica gel)which absorb moisture
Quills of cinnamon bark	Packed one inside the another(to prevent the loss of volatile oil).