UNIT

1

Herbs, Biodynamic Agriculture and Indian System of Medicine

HERBS AS RAW MATERIALS

INTRODUCTION

The rapidly growing importance of healthcare, beauty, and vitality, especially in developed countries, leads to an increase in demand for cosmetics, cosmeceuticals, para pharmaceuticals, diet supplements, and nutraceuticals. A variety of ingredients are used in their production, but most of them, or at least a significant part, are based on herbs. As a result, medicinal herbs for cosmeceutical have evolved to a separate high-growing market segment. The most important producers of herbs are China, India, and Egypt. The area of herbal cultivation in each of these countries amounts to about 20 million hectares. In Poland, such plantations occupy only 30,000 hectares. However, Poland is becoming a more and more important producer of herbal raw materials of good quality at least in the European Community. In addition to the cultivated herbs, there are also plants with prohealth properties obtained directly from nature. Currently, around 2000 species of medicinal and aromatic plants are traded worldwide and over 200 species are grown and harvested in Poland. The processing of herbs and other plants used in medicine, cosmetics and diet supplementation requires maintaining high standards of microbiological purity. At an early stage of production, the herbs are thoroughly selected so that the sick and damaged plants are separated and then they are precleaned to remove mineral impurities and insects. The next stage is focused on the microbiological purity of production materials usually, there are a lot of microorganisms on the plants that may develop. Many physical and chemical methods are used to disinfect herbs. Unfortunately, currently used methods have significant disadvantages. A lot of the results in the modification of the chemical composition of processed plants so that they lose their valuable components and biological properties. The appropriate method should result in a high level of microbiological purity on the one hand and minimize the side effect of modifying the chemical composition on the other hand.

TERMS RELATING TO HERBAL MEDICINES

Herbs: As per WHO, herbs are crude plant materials that may be entire, fragmented, or powdered. Herbs include, e.g. the entire aerial part, leaves, flowers, fruits, seeds, roots, barks (stem or root) of trees, tubers, rhizomes, or other plant parts

Herbal materials: As per WHO, herbal materials include, in addition to herbs, other crude plant materials. These other plant materials can be, e.g. gums, resins, balsams, exudates, and other such matters. Herbal materials may also be referred to as "medicinal plant materials".

Herbal preparations: As per WHO, herbal preparations are produced from herbal materials by physical or biological processes. These processes may be extraction (with water, alcohol, supercritical CO_2), fractionation, purification, concentration, fermentation, and other processes. They also include preparations made by processing herbal materials with a natural vehicle or steeping or heating them in alcoholic beverages and/or honey, or other materials. Herbal preparations include simply comminuted (fragmented) or powdered herbal materials as well as extracts, tinctures, fatty (fixed) or essential oils, expressed plant juices, decocts, cold and hot infusions, among others.

Finished herbal products : As per WHO finished herbal products consist of one or more herbal preparations made from one or more herbs (i.e. from different herbal preparations made of the same plant as well as herbal preparations from different plants. Products containing different plant materials are called "mixture herbal products"). Finished herbal products and mixed herbal products may contain excipients in addition to the active ingredients. However, finished products or mixture herbal products to which chemically defined active substances have been added, including synthetic compounds and/or isolated constituents from herbal materials, are not considered to be "herbal".

Herbal dosage forms: Herbal dosage forms are herbal products in the forms in which they are marketed for use or taken by the patient, the production of which typically involve simple preparation procedures using herbal materials (such as packing dried root or leaf powders into capsules or herbal tea bags) or herbal preparations (such as grinding freeze-dried extracts into powders). The herbal dosage forms may contain substances originated from a single herb or a combination of herbs.

TERMS RELATED TO HERBAL PROCESSING PRACTICES

Processing: The processing of herbal materials refers to a series of post-harvest treatments applied to crude medicinal plant materials. Processing includes primary processing, such as sorting, cleaning, and drying.

Primary processing: Primary processing refers to a series of simple preparatory procedures that may be performed at the harvest/collection site, including sorting, garbling, cleaning, and drying. For herbal materials that do not require further processing before use as decoction materials or as starting materials for manufacturing of finished products, the primary process may also include cutting, sectioning, or comminution.

Secondary processing: Secondary processing refers to the preparative steps applied to herbs in addition to the primary processing before they can be used as direct decocting materials for immediate treatment or as starting materials for manufacturing finished products. They are considered important pharmaceutical techniques in the herbal industry, through which, purity of raw herbs is assured (such as removal of foreign matters, prevention of microbial and insect infection/infestation), the therapeutic properties of raw herbs are improved (such as enhancement of efficacy or reduction of toxicity) for clinical applications. The secondary processing procedures may vary from

one herbal material to another, depending on the characters of the active ingredients as well as the therapeutic target.

Special processing: Special processing is an extension of the secondary processing in which a set of prescribed procedures is employed to treat a particular herbal material for specific purposes such as detoxification or ensuring clinical effects of that herbal material or resulting herbal preparation. The special processing procedures vary from one herbal material to another, depending on the characters of the active ingredients as well as the therapeutic target intended to be treated.

Adjuvants: Adjuvants are adjunctive substances used during the herbal processing procedures alongside the herbal materials, including to alter the pharmacological/ therapeutic properties of the herbal preparations or neutralize/reduce toxicity. Common adjuvants include wine, vinegar, honey, milk, and others.

TERMS RELATING TO HERBAL PREPARATIONS

Extraction: Extraction is a separation process in which medicinally significant portions of plant chemical constituents and tissues are removed from other plant metabolites and the insoluble cellular marc by using selective solvent(s) (which is sometimes called the menstruum). Herbal extracts include decoctions, infusions, fluid extracts, tinctures, and powdered extracts. The herbal preparation so obtained may be ready for use as a medicinal agent, or it may be further processed to afford finished products such as tablets and capsules.

Extract: The extract is a general description of the concentrated preparation of herbal materials obtained by dissolving the active constituents in a suitable solvent and subsequent evaporation of all or nearly all of the solvent. If the extract is completely freed from the solvent (dried) and obtained either as fine or granular powder, it is called a powdered extract.

Decoction: A decoction is a liquid preparation made by boiling herbal materials with water. This is probably the most common method of preparing herbal drugs in many traditional medicine systems.

Infusion: Infusion is a liquid preparation made by extracting herbal materials with either cold or hot water without boiling. Other solvents such as edible oil or vinegar may be used.

Fluid extract: The fluid extract is a liquid preparation from herbal materials made by maceration or percolation in alcohol or wine. Typically, a fluid extract is made in such a ratio that one part (e.g. one milliliter) of the liquid contains one part (e.g. one gram) of the original herbal materials.

Tincture: The tincture is a dilute alcoholic extract of herbal materials, typically made up of 1 part of herbal material and 5–10 parts of solvent.

Powder: The powder is a form of herbal preparation processed as dry, granulated, or powdered materials. Extracts, tinctures, or other liquid preparations can be evaporated to dryness to obtain the powders.

Essential (volatile) oil: Essential (volatile) oil constitutes the odorous principles of the plant from which it is extracted. Each essential oil has its characteristic color, odor, and taste.

GOOD HERBAL PROCESSING PRACTICES FOR THE PRODUCTION OF HERBAL MATERIALS

"Processing" is a unique process in the preparation of herbal materials from medicinal plant and plant parts and has been practiced as a material-specific procedure. Historically, this process is as old as that of the use of medicinal plants for the alleviation of human ailments. When the medicinal plant and its parts are obtained through wild collection or cultivation under GACP for medicinal plants, they must be subjected to a series of good practice of post-harvest processing procedures to ensure the maximum safety, efficacy, and desired therapeutic outcome. The exact processing procedures may vary from one herbal material to another. Some consist of only a few simple steps such as sorting, cleaning, and drying, and they are generally referred to as the "primary processing". For herbal materials that are used without further processing, the primary processing may include cutting, sectioning, comminuting, etc. Others may require some more complicated steps such as aging/sweating, baking/roasting, boiling/steaming, and stir-frying, to improve the purity, prevent damage from mold and other microorganisms, detoxify indigenous toxic ingredients, or enhance therapeutic efficacy. Such processing procedures are referred to as the "secondary process" in these guidelines. They may have a significant impact on the quality of the resulting herbal materials. Special processing is an extension of the secondary process, in which a series of special treatment procedures are applied to the herbs for specific purposes such as reduction of toxicity or alteration/modification of therapeutic properties. Examples of herbs (medicinal plants) so processed include *Aconitum* and *Euphorbia* species.

The safety and efficacy of herbal medicines are intricately dependent on the quality of the starting and processed source materials. To assure their quality, good practices for processing herbal materials may be considered. In general, good practices for processing herbal materials mirror the good manufacturing practices for herbal medicine as delineated in the *WHO guidelines on GMP for herbal medicines* with the first step being the post-harvest handling and preparation of the starting medicinal plant materials under sanitary conditions. All critical equipment for processing must be qualified; all processing methods and procedures are standardized (SOP); master formulae, master and batch records documented; and quality control parameters established and adhered to GHPP monograph/SOP protocol on specific herbal material should be developed and implemented.

Purposes and Functions of Processing

Through experiences gained over the centuries, knowledge has been acquired for the development of processing procedures for maximizing the quality and therapeutic value of herbal materials. The final form an herbal medicine takes depends upon the nature of the herb and the nature of the disease to be treated. In general, the processing of herbal materials serves several purposes, such as improving the bioavailability of active components, reducing toxicity and/or side effects, enhancing potency and effectiveness, modifying the therapeutic properties, facilitating storage, and eliminating other undesirable properties.

WHO guidelines on good herbal processing practices (GHPP) for herbal medicines:

1. **Neutralization of toxicity and diminishing side effects:** Herbal materials that possess significant levels of toxicity, highly potent pharmacological actions, or

severe side effects must be pre-treated in certain specific manners to neutralize the toxicity or to reduce the side effects before use. Such a detoxifying process is particularly important for those medicinal plants that are known to contain toxic or undesirable chemical components; they must be properly "cured" to remove those unwanted substances. Through the pre-treatment processes such as "steaming" and "frying", the heat-sensitive toxic components will be degraded. In other cases, processes such as "sweating" and "aging" would result in enzymatic degradation of the toxic ingredients. For example, raw aconite (*Aconitum* species) tuber, containing significant amounts of toxic alkaloids such as aconitine, must be boiled or steamed for hours to hydrolyze aconitine into less toxic derivatives. In the case of cascara (*Rhamnus purshiana*) bark, they have to be aged for at least one year before use, to allow oxidation reaction to occur, by which the strongly laxative hydroxyanthracene glycosides are converted to oxidized compounds of lower laxative potencies.

2. **Modification of therapeutic properties:** Some herbal materials require specific processing to alter their therapeutic properties. For example, rhubarb (*Rheum rhabarbarum*) in its raw form possesses purgative action and is useful as a cathartic. After processing, however, the purgative action is attenuated and the processed rhubarb can be used for other purposes such as anti-inflammation. The specific action of some herbal materials may be reinforced through processing. For example, the unprocessed raw rehmannia (*Rehmannia glutinosa*) root is used to treat fever, hypertension, and skin eruptions; whereas after being cooked in wine, the processed rehmannia is often used for tonic, emmenagogue, and anti-aging purposes. In the case of ginseng (*Panax ginseng*) roots, different post-harvest processing procedures give rise to several processed products, such as "white ginseng" and "red ginseng". "White ginseng" is the material dried by the sun or heat, whereas "red ginseng" is made through a series of steaming and cooking steps. These two types of ginseng products have been shown to exert opposite pharmacological actions on human blood pressure, among other differing therapeutic effects.
3. **Enhancing efficacy and reinforcing therapeutic effects:** The therapeutic efficacy of certain herbal materials can be augmented through specific methods of preparation. For instance, the pain-relieving property of corydalis (*Corydalis yanhusuo*) rhizomes is increased when they are stir-fried with rice vinegar. Similarly, the honey-treated ephedra (*Ephedra* species) would possess stronger antitussive and anti-asthma properties than the unprocessed ephedra, which is mostly used as a diaphoretic.

Processing Techniques and Procedures

Appropriate measures of general processing are dependent on the individual materials. These processes should be carried out in conformity with national and/or regional quality standards, regulations, and norms. These protocols should also comply with the regulatory requirements that apply in the producer and the purchaser countries. The SOP of processing should describe in detail the various operations to be performed on the medicinal plant material, such as sorting, washing, drying, crushing, milling, pulverization, and sifting. They should also include the length of time and temperature, among others. As much as possible, the SOP should be adhered to. If modifications are made, they should be justified by adequate test data demonstrating that the quality of the herbal materials is enhanced and/or not compromised.

Preparation of Harvested/Collected Medicinal Plant Part for Processing

Before general or special processing, the starting raw medicinal plant materials should be inspected and sorted to ensure there is no contamination or cross-contamination by untargeted plants, unwanted plant parts, foreign matters, and obvious damages. Harvested or collected raw medicinal plant materials should be promptly unpacked upon arrival at the processing facility. Before processing, they should be protected from rain, excessive sunlight, moisture, and any other conditions that might cause microbial fermentation and thermal degradation. The unprocessed raw medicinal plant materials should be stored in appropriate containers at an ambient or lower temperature under well-ventilated conditions; as well as protected from insects, rodents, birds, livestock, domestic animals, and other pests. Consistent quality for the finished herbal products can only be assured, if the starting raw medicinal plant materials are defined in a rigorous and detailed manner. For this reason, the crude/raw medicinal plant materials must be adequately documented before the processing procedures to include, as far as possible and at a minimum, the following information;

- The botanical name of the medicinal plant; local name; plant part(s);
- Source (cultivation/wild-growing region);
- Batch (or lot) number;
- Collection (harvest) conditions (e.g. season/month and date; plant part; wet/dry environment);
- Botanical authentication of the source medicinal plant materials;
- Physical appearance such as color, odor, form, sharpness, size, and texture;
- Suitable identification tests such as TLC or other chromatographic fingerprints;
- Assay results, where appropriate, of active ingredient (s) or chemical reference standard(s);
- Limit tests such as ash value, water content, and extractives; and
- Determination of possible contaminants such as pesticides and heavy metals, mycotoxins, and where and when appropriate, radioactivity.

Primary Processing Procedures

Harvested/collected medicinal plants and/or their parts undergo a series of good practice post-harvest (and post-collection) processing procedures, which in the broadest sense include all steps from the immediate on-site primary clean-up of the desired medicinal plant part to its being processed into a form (herbal materials) ready for therapeutic use or as a starting source material for the production of finished herbal products. While the exact processing methods may differ from one herbal material to another, the procedures shall be adopted from those good practice protocols specified in the national pharmacopeia or recommended by other authoritative documents of the end-users country. If no acceptable good processing procedures are available, or modification of existing or reference cited protocols are required, they should be justified by adequate quality control test data that the efficacy of the herbal material is not diminished.

Garbling (Sorting): The garbling process serves as the first step to ensure the purity and cleanness of the medicinal plant materials. After the bulk amount of the desired plant part is harvested or collected, all extraneous and unwanted matters including dirt (e.g. soil, dust, mud, rubbles), impurities (e.g. insects, rotten tissues), and residual

non-medicinal parts must be separated from the medicinal part(s). The process may involve, depending on the plant material, procedures such as removing dirt and foreign substances, discarding damaged parts, peeling (to separate unwanted plant parts from the medicinal plant parts such as removing unwanted root bark from the roots or collecting stem bark from the stem), sieving, trimming, singeing (to remove hairs or rootlets), removal of residuals of unwanted plant parts (e.g. removing unwanted seeds from fruits and stripping leaves from stems). Although sorting may be done by mechanical means in some cases, it is usually performed by hand operation. Only suitably trained staff should carry out this work.

Washing: After sorting, the medicinal plant materials should be cleaned well to remove the remaining soil, dirt, dust, and other unwanted matters from the surface. They, especially roots, rhizomes, and tubers, are commonly washed with clean water, dried soon after harvest/collection. During the washing process, scraping and brushing may be necessary. It is generally recommended not to soak the medicinal plant materials in water for an unnecessarily long period. Change water frequently as required.

Parboiling (Blanching): After washing, certain raw medicinal plant materials may undergo a parboiling or blanching process in which they are put into boiling water for a brief period without being fully cooked. Such a heating procedure may serve several purposes, such as improving the storage life of the processed materials by gelatinizing the starch and preventing mold/insect contamination, and facilitating further processing such as removal of the seed coat of almonds.

Leaching: Some impurities can be removed by the action of running water over raw medicinal plant materials. The length of leaching has to be controlled to prevent excessive loss of other ingredients.

Drying: Unless used in the fresh state, the raw medicinal plant materials are to be dried after being sorted and washed. In general, they must be dried as soon as possible to remove as much moisture as possible to ensure good keeping qualities and to reduce damage from mold and other microbial infestation. 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. The final moisture content for dried herbal materials varies depending on the tissue structure, but should generally be below 12%. Information on the appropriate moisture content for particular herbal material may be available from pharmacopeias or other authorities. Proper drying involves three major aspects: control of temperature, humidity, and air flow. The drying conditions are determined by the nature of the raw medicinal plant material to be dried (tissue structure and chemical composition) and by the desired appearance of the final form. The drying method used may have a considerable impact on the quality of the resulting herbal materials. Hence, the choice of proper operational procedure is crucial. Information on the appropriate drying methods and procedures for particular herbal materials may be available from pharmacopeias or other authoritative monographs. In general, raw medicinal plant materials are most often dried by sun-drying, shade-drying, or by artificial heat. The drying conditions chosen should be appropriate to the type of medicinal plant material. They 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.

Sun-drying: Most medicinal plant materials can be dried in open-air under direct sunshine, provided the climate is suitable for such a practice. The duration of the drying process depends largely on the physical structure of the medicinal plant material and the weather condition. In the case of natural drying in the open air, medicinal plant materials should be spread out in thin layers on drying frames and kept away from possible contaminations such as vehicle exhaust, heavy dust, and rain, as well as protected from insects, rodents, birds and other pests, livestock and domestic animals. The drying frames should be located at a sufficient height above the ground. Efforts should be made to achieve uniform drying within the shortest period to avoid mold formation.

Shade-drying: Some medicinal plant materials can be dried in the shade with or without artificial air flow to avoid direct exposure to strong sunlight. The drying process is slow, but it is preferred to maintain (or minimize loss of) the color of leaves and flowers. Low temperatures (relative to heat-drying) will also preserve most of the volatile and aromatic components from being evaporated.

Drying by artificial heat: Drying by artificial heat is more rapid than open-air drying and is often necessary on rainy days or in regions where the humidity is high. Medicinal plant materials may be dried using ovens, stoves, belt driers, other heating devices, or with open fires. For artificial-heat drying, the temperature, humidity, and other conditions should be governed by the physical nature of the drug and the physical/chemical properties of its active ingredients. Over-heating may lead to an excessive loss of the volatile components and/or decomposition of chemical ingredients. As much as possible, the temperature should be kept below 60°C.

Secondary Processing Procedures

In addition to the primary processing, the *WHO guidelines on GACP for medicinal plants* [WHO] also addressed, albeit very briefly, the fact that some herbal materials require "specific" processing to improve their purity and quality. This section highlights the principles and practices of the commonly used secondary processing techniques. In all cases, good in-process control measures must be employed to assure the quality of the end product. The applicable procedures of the secondary processing nature are as follows.

Cutting, sectioning, and comminution: When thoroughly dried, the herbal materials are processed by cutting and sectioning into convenient sizes and shapes for storage, direct use as decoction pieces, and/or further processed for the manufacture of finished herbal products. Where applicable, the herbal materials should be cut or sectioned into specific shapes or forms, or comminuted/pulverized into powder form according to common practice found in herbal medicines. Decoction slices or pieces available in the many member states for use as herbal medicines are herbal materials processed only by cutting, sectioning, slicing, or comminution/pulverization. White ginseng products presented as root pieces or in powder form prepared from naturally dried roots of *Panax ginseng*, marketed as herbal medicines, are good examples of herbal materials derived from a simple processing procedure.

Aging/Sweating: The aging process refers to storing the herbal materials for some time after being harvested or collected from the field before use. It is generally done under the sun or in the shade for up to a year, depending on the specific herbal material.

During the process of aging, excessive water is evaporated and enzymatic reactions (such as hydrolysis of the glycone portion from glycosides) may occur to alter the chemical composition of the herbal material. For example, cascara sagrada (*Rhamnus purshiana*) bark should be aged for at least one year (or artificially heated to speed up the process) before use in medicinal preparations, to curtail the strong irritating effects that may cause vomiting and upset stomach. A similar process known as sweating involves keeping the herbal materials at a temperature of 45–65°C with high humidity for an extended period, from one week to a couple of months, depending on the plant species. The herbal materials are usually densely stacked between woolen blankets or other kinds of cloth. The sweating process is considered a hydrolytic and oxidative process in which some of the chemical ingredients within the herbal materials are hydrolyzed and/or oxidized. For example, vanilla beans (*Vanilla planifolia*) are well known to undergo repeated sweating between woolen blankets in the sun during the day and packing in wool-covered boxes at night for about two months, during which the vanilla pods lose up to 80% of the weight and take on the characteristic color and odor of the commercial drug.

Baking/Roasting: The baking/roasting process is a dry-heating procedure using indirect, diffused heat, where the herbal materials are put in a heating device, often embedded in bran or magnesium silicate (talc) powder to ensure even heating on the entire surface at an elevated temperature for some time. Some herbal materials are wrapped in moistened papers during the roasting process. The exact temperature used and duration of baking/roasting vary from one herbal material to another. Some are baked or roasted until the surface color turns yellowish-brown; some may be further heated until charred. For example, the processing procedure of nutmeg (*Myristica fragrans*) and kudzu (*Pueraria lobata*) root requires being roasted together with bran.

Boiling/Steaming: The boiling process involves cooking the plant materials in water or another liquid solvent such as vinegar, wine, milk, or animal urine. In the steaming process, herbal materials are kept separate from the boiling water but have direct contact with the steam, resulting in a moist texture to the herbal materials. Such treatment is often done by placing the herbal materials in a steamer or a special utensil equipped with a flat frame hanging over boiling water. In some cases, the herbal materials are premixed with excipients substances such as wine, brine, or vinegar before being steamed. The boiling/steaming process serves to soften plant tissues, denature enzymes present in the herbal materials, and/or to thermally degrade selected chemical constituents. At the same time, the excipients, if used, are absorbed into the plant tissues to become an integral part of the processed herbal materials.

For example, *Polygonum multiforum* root is often steamed in the presence of a black-bean decoction to enhance its tonic effects. Boiling the rhizome of *Acorus calamus* in cow's urine can enhance its anti-convulsant activity. On the other hand, boiling the raw materials such as *Croton tiglium*, *Abrus precatorius*, *Nerium indicum*, *Gloriosa superba*, and *Semecarpus anacardium* in cow's milk would reduce the levels of their toxic ingredients and thus diminish the toxicity of the herbal materials.

Stir-frying: Stir-frying is a process in which the herbal materials are put in a pot or frying pan, continuously stirred, or tossed for some time under heating, until the external color changes, charred, or even carbonized. Depending on the medicinal plant species, the stir drying process may require the addition of adjuvants such as wine, vinegar, honey, saline, and ginger juice, which would be infused into the herbal matrix to become an

integral part of the processed herbal material. To ensure even heating on the surface of the herbal materials, sand, rice, bran, talc, or clay can be admixed with the herbal material during stir-frying.

For example, liquorice (*Glycyrrhiza glabra*) root and rhizome and *Astragalus membranaceous* roots are often stir-fried with honey for the preparation of decoction slides, whereas the *Salvia miltiorrhiza* root is stir-fried with wine. In the case of ginger, fresh ginger is often stir-fried together with sand until the surface color turns brown. In other instances, ginger can be further stir-fried over the intense fire to a carbonized state.

Fumigation: Fumigation by sulfur dioxide has been employed in post-harvest handling of some medicinal herbs to preserve color, improve fresh-looking appearance, bleaching, prevent the growth of insects and overcome decays caused by molds. Thus the process has been frequently applied to herbal materials of light and bright colors to avoid "browning". Due to concerns about the undesirable residues, such a process should be avoided as much as possible. If the process is required, all relevant regulations (e.g. limits on sulfur residue) should be compiled.

Selection of Processing Method

Herbal materials derived from the same species but processed by different methods may show significant differences in quality and therapeutic property, owing to the influence of the treatment process on the chemical composition. It is not uncommon to find different processing methods for the same medicinal plant/plant part, depending on the intended use. For example, raw (unprocessed) liquorices is used as an antitussive and expectorant; but after being stir-fried with honey and ghee, the processed liquorices become a tonic drug to be used for replenishing body strength. Before processing, consult the national or regional regulatory standards and other literature sources to decide on the most appropriate method to use. Once a method is adopted, adhere to the SOP to ensure batch-to-batch consistency. For industrial production, method validation should be adopted as part of the SOP.

Only suitably trained staff should carry out the work, which should be conducted following the SOP and national and/or regional regulations in both the grower/collector and the end-user countries.

Temperature: In processing procedures that involve heating, the temperature used is critical. Make sure the required temperature is achieved during the process. In some cases, pre-heating the equipment (e.g. oven, frying pan, and steamer) and/or the additives (such as sand, bran, and rice) is required before putting in the herbal materials. When heating equipment (e.g. electric oven) is used, the heating device should be regularly calibrated.

Duration of procedure/treatment: It is also critical to control the time of procedure/treatment of the herbal materials. Both over and under-treatment will affect the quality of the resulting materials. The traditional approach would specify the duration of treatment based on organoleptic alterations such as changes in color, odor, and texture. If a modern method or instrument is used, the timing should also be accurately controlled.

Use of adjuvants: Any adjuvant (e.g. wine, vinegar) used in the processing procedures should be of the required/appropriate quality. The exact amounts and quality of these adjuvants used (the ratio of herbal material and the adjuvant) should also be consistent from batch to batch.

Special Processing Procedures

For herbal materials derived from toxic medicinal plants, general primary and/or secondary processing is insufficient to reduce or attenuate their adverse effects. Such herbal materials require further specific (special) processing procedures before they can be used for therapeutic purposes. These special processing procedures serve as a means to detoxify or neutralize the toxicity, or to reduce the side effects. Such processes are particularly important for those medicinal plant parts that are known to contain toxic or undesirable chemical components; they must undergo proper processes to have the unwanted substances degraded. On the other hand, several herbal materials require special methods of processing to enhance their therapeutic efficacy or to modify their therapeutic properties for the treatment of other disease conditions. The following are examples of special herbal material processing.

Detoxification: Aconite (*Aconitum* species) root even after having undergone general processing, is an extremely lethal substance and should not be taken in the crude form. Only after proper processing procedure can the toxicity of aconite root be reduced and become suitable for use in herbal medicine. The specific process generally involves boiling in water or steaming, or both, to significantly reduce the content of aconitine and related alkaloids. Nux-vomica (*Strychnos nux-vomica*) seeds are specifically processed by frying or boiling in water or other media such as cow's milk and ghee to reduce the contents of its toxic ingredients, strychnine, and brucine.

- *Pinellia ternata* tuber: To reduce the gastrointestinal irritant property, the raw herb is soaked in a solution containing glycyrrhiza and calcium oxide at a pH ≥12. Alternatively, the raw herb is soaked in the water together with potassium aluminum sulfate, or boiled in water together with ginger and potassium aluminum sulfate.
- *Arisaema erubescens* rhizome: The raw herbal material is first soaked in the water together with potassium aluminum sulfate for several days, followed by cooking with ginger and potassium aluminum sulfate to reduce the strong irritant effect on the respiratory and gastrointestinal tracts. An alternate method for processing *Arisaema* rhizome is by steaming with animal bile.
- *Euphorbia kansui* and *E. pekinensis* herb: Processing by frying with vinegar to degrade the toxic components that cause severe vomiting and diarrhea, and central nervous system poisoning.
- Seeds of *Xanthium sibiricum*, *Ricinus communis,* and *Croton tiglium* are often processed by stir-frying to degrade their contained toxic proteins.
- Cascara sagrada (*Rhamnus purshiana*) bark: Following primary post-harvest processing, the bark is aged (stored) for at least one year before use as a laxative. During the aging period, natural enzymatic action reduces the drastic cathartic potency of its active glycoside constituents to a non-toxic level.

Enhancement or Modification of Therapeutic Properties

- Ginseng (*Panax ginseng* and *Panax quinquefolius*): Fresh ginseng is converted to red ginseng through a series of repeated steaming procedures to afford a product with altered pharmacological actions or different therapeutic effects.
- *Corydalis yanhusuo* rhizome is stir-fried or cooked with rice vinegar to enhance its pain-relieving property for use as an analgesic agent.

- *Rehmannia glutinosa* root: The unprocessed herbal material is used to treat fever, hypertension, and skin eruptions; whereas after being cooked in wine, the processed rehmannia is used as a tonic, emmenagogue, and anti-aging drug.

Use of adjuvants: Common adjuvants used during the special processing procedures include wine (e.g. rice wine, wheat wine, and sorghum wine), vinegar, honey, ginger juice, liquorice extract, brine, etc. Under special circumstances, other auxiliaries such as human/cow urine, cow/goat milk, animal bile, butter, cow's ghee, goat fat, black bean extract, coconut water, etc. have been used. The use of animal parts/products in any processing procedures should be evaluated for safety and contamination before use.

BIODYNAMIC AGRICULTURE

INTRODUCTION

Biodynamic agriculture was born when Dr. Rudolf Steiner gave eight lectures about a new method of agriculture to a large group of farmers in Germany, in 1924. Rudolf Steiner was an Austrian philosopher and scientist whose thought was very much influenced by oriental philosophy, especially Buddhism, Hinduism, and the Vedic scriptures. Out of this influence and his studies was born Anthroposophy or the wisdom (knowledge) of the human being. Dr. Rudolf Steiner explained how modern science and therefore, chemical agriculture was based on the study of dead things in laboratories, rather than on the observation of living nature and the complex relationships constantly changing therein. Among this web of life, he also included the cosmos with its moving planets and stars, and he spoke of how in the past, farmers instinctively knew about the effects of this movement on the life of plants and also animals and human beings. As modern human beings, we must find this connection once more to understand how to work best with nature, but this time in a very conscious, measurable way. Today many people around the globe concentrate on understanding and recording the effects of the cosmos on our planet Earth, including Maria Thun in Germany who publishes a planting calendar for gardeners and farmers to use. Rudolf Steiner introduced a few preparations based on homeopathic medicine to enhance the beneficial cosmic influences on plants and the soil and encouraged people to experiment and find new ones as well. Life is a study of energy from the coarse to the fine, and biodynamics is primarily concerned with the higher forces, the finer energies and how they influence plants, animals, and human beings. This knowledge and work with the life forces brings balance and healing to the soil, and, therefore, to anything that grows in that soil and every being that eats those plants.

According to some researchers, biodynamic agriculture is an ecological and sustainable system of producing agricultural products, particularly food for humans, that professes to respect all creation. "It includes many of the ideas of organic farming, and at the core focus are mystical anthroposophical ideas of the soil and the life on and in it as a living, sentient system." According to some scientists, "A basic ecological principle of biodynamics is to conceive of the farm as an organism, a self-contained entity. A farm is said to have its individuality. Emphasis is placed on the integration of crops and livestock, recycling of nutrients, maintenance of soil, and the health and wellbeing of crops and animals; the farmer to is part of the whole." Biodynamic agriculture could be considered an advanced organic farming system.

Main Effects of Using Biodynamic Agriculture

- To increase the vitality of food
- To regenerate natural resources such as the soil (by restoring the organic matter present in the soil), the seeds, and the water
- To create a personal relationship with the world in which we live, with the nature of which we are a part, and to learn to work together
- Most of all, to be of service to the earth and its beings by aiding nature where it is weak due to constant use.

Historical Development

Agriculture is the basis of human life. We need to grow food simply to eat each day, and to sustain our bodies, our minds, our souls, and our spirit! Throughout human history, one can see that our music, our art, our songs, our crafts, and our tools have all been born out of our work with the land. But in the last hundred years and always faster in the last few decades, we are losing our connection to our source of life. Chemical farming is a product of the world wars when the leftover chemicals used for weapons and warfare were then discovered to be useful for pest control and as fertilizers. The source of agricultural chemicals is fossil fuel from the earth, which is not sustainable and very soon will not be available anymore. The green revolution in the 1960s and 1970s also introduced hybrid seeds which are unable to produce their seeds once grown, thereby creating a dependency of the farmer on hybrid seed companies. These hybrid seeds also produce much weaker plants that need higher doses of pesticides and fertilizers. The recent introduction of genetically modified (GM) seeds (which go hand in hand with specific herbicides, pesticides, and fertilizers) is the latest threat to the balance and well-being not only of the earth but also of us human beings. There are great economic interests tied to GM seeds, and unfortunately, this creates irresistible pressure on developing countries to accept and legalize the use of these seeds. Today we are painfully aware of the effects of chemical farming on our health, on farmers' economic life, on the vitality of the soil, and the well-being of all plants and animals. In many places, the soil is getting hard and unable to renew itself so more and more chemical fertilizers are needed to grow crops, creating huge debts for the farmers. New pests and diseases, resistant to chemical pesticides, are appearing, as are unknown diseases and disorders affecting animals and human beings. We are facing a global disaster, of which many people are becoming aware. The biodynamic method of agriculture started very slowly but is becoming increasingly popular in the last few decades, all over the world. There are biodynamic associations of farmers and gardeners and certifying bodies that guarantee the product being sold by issuing a Demeter certificate.

Important of Biodynamic Agriculture

The foundation of biodynamic agriculture is the instruction of Rudolf Steiner, especially eight lectures given by him in Silesia, Germany in 1924, shortly before his death. The series of lectures presented were to European farmers who asked him for advice and help after seeing the degradation of plants, seeds, and land caused by artificial fertilizers. These lectures are now known as the agriculture course and published as the Spiritual Foundations for the Renewal of Agriculture. At the time, steiner believed that the introduction of chemical farming was a major problem. He found that seeds had dramatically less vitality and that land that previously grew the same crops year

after year now had to rotate crops to avoid problems. Plants that formerly gathered their nutrients and minerals from the earth now had become dependent on the dead chemical fertilizers for their minerals and as people ate these weak plants they also lost their will. Steiner believed the food of his society was degrading, and he thought the causes of the problem were man-made fertilizers and pesticides, but he did not believe this was because of the physical (biological or chemical) properties of the materials involved. However, Steiner disapproved of the spiritual flaws of these materials. The biodynamic agriculture developed by Steiner, therefore, is intended to be regenerative, i.e., it is intended to 'heal' the earth. It could be considered more beneficial than simply sustainable agriculture. Steiner "considered the world and everything living in it as primarily spiritual, the physical and thus chemical or biological processes involved were secondary. He also believed that living matter was different from dead matter, a viewpoint commonly referred to as vitalism." Many of Steiner's writings describe energy flows that radiated from the earth similar to the so-called Odic force. Another important element of the biodynamic concept is that the entire farm is a living system. For that reason, a farm should be a closed system which the preparations introduced by Steiner nourish. Plant and animal diseases are not to be addressed in isolation, because they are better viewed as symptoms of complications with the whole farm system. It should be noted that the term "biodynamic" was not invented by Steiner, but by his supporters. The biodynamic method today is practiced worldwide with millions of acres under biodynamic cultivation. Biodynamic growers strive to create a self-sufficient farm, growing their food and animal feed, saving seeds, and so on. Helping form a self-contained organism or individuality consists of growing the right number and kinds of plants and animals, producing enough manure and compost to spread back on the fields, and creating a closed-loop of fertility.

Principle and Advantages

To establish a system that brings into balance all factors which maintain life, the following areas are considered.

Substance and Energy: Life is more than just chemicals; it depends on the interaction of matter and energies. For example, plants need light and warmth as well as earth and water to grow. The interaction of substance and energy forms a balanced system. We live not only from the substance, but also from energy, and so we need to eat food that will provide the energy. Only plants that have grown in a balanced soil can give us energy (through trace minerals, enzymes, growth hormones) as well as substance.

Soil: To produce healthy, vital plants, one must concentrate mainly on the structure and the life of the soil—the nutrients, the trace elements, the microorganisms, the worms, and other animals present in the soil. But primarily, the soil is a living system of connections and relationships. If the soil is balanced in its life forces, the plants growing in it will be stronger, healthier, and higher in quality. No chemicals are necessary. In terms of structure, the soil should be crumbly, friable, well-aerated, and deep to be fertile.

Organic matter: To create this balanced, living soil, what is required is the skillful use of organic matter. This is done by building compost heaps and using biodynamic compost preparations.

Humus: This mysterious, magical substance supports life and is the carrier of all that the plants need to grow. It holds the fertility of the soil stably and retains water. Humus is completely digested crude organic matter—rich, dark, and moist with a fresh odor. This is the base for building up the soil and fostering its formation should be the priority when converting to biodynamic farming.

Cow manure: This is a very special substance given to us by the holy animal cow which is essential for healthy soil life. Cow dung is special because of the lengthy digestion process of the cow which adds many beneficial bacteria to the substance. It is used in building the compost heaps as a starter for its nitrogen content and in preparing the biodynamic preparations.

Cosmic forces: Recognizing and working with the influences of heavenly bodies on plant growth by using the preparations and following the sowing calendar.

Biodynamic preparations: These simple, natural, homeopathic preparations are used to enhance the effects of the planets and silica and lime on the soil and the plants, and also to enhance the breaking-down process and potential life forces in the compost heaps. Dr Steiner gave two preparations to be sprayed directly on the soil or the plants (numbered 500 and 501), and six preparations to be used when making compost (numbered 502 to 507).

Crop rotation: Crop rotation, proper soil cultivation, and other organic farming methods: Intelligent planning to let the soil rest after heavy-feeding crops (such as potatoes, tomatoes, cabbage), by sowing green manures (legumes, clover) and covering the soil (grass, clover) so that it may build up its humus content and nitrogen levels; also mulching to improve soil structure, water and temperature balance in the soil, and to control weeds; companion planting to enhance growth and to control pests; using herbal tea sprays, special tree paste for fruit trees, creating raised beds, disturbing the soil as little as possible by shallow digging/ploughing and avoiding stepping on it or working it when wet, especially clay soils.

Peppering: To deal with an unbalanced insect problem, animal pests, or weed problem, one may collect the insects, weed seeds, or dead animal skins, burn them at the appropriate time according to planetary positions, potentize the ash in water as homeopathic medicine, and spray it on the land. This is an effective biodynamic alternative to using chemical sprays.

The farm organism: The more self-sufficient a farm can be, the healthier it will be. The aim is to have a wide variety of plants and animals and to bring something from outside (such as manure, bio-pesticides) only if there is an imbalance that must be rectified, as medicine. At the center of the farm, the organism is the fanner, the human being who observes and has a close relationship to everything on the farm and who makes the decisions. Important aspects of the farm include the water source and balance, prevention of soil erosion by planting trees and hedges which also help in wind protection and providing animal habitat, being aware of insect life and balance which could include looking after honey bees. The farmer, therefore, is responsible for many beings and for fostering correct relationships and is the temporary steward of the land, not the owner.

Weeds, pests, and diseases: Weeds growing in specific places show a deficiency in the soil, as pests and diseases show a shortcoming in agricultural practices. They are

signs for us to understand where the problem is, and help us to rectify imbalances. They are friends, not foes! It is well known and proven that insect pests and diseases will only attack weak plants, There by balancing the situation and stimulating us to be better farmers and gardeners.

Practical Application

- Walk around your land each day, become familiar with all its aspects: Minerals, rocks present, type of soil, wild plants growing, types of weeds, insect life, animals present-day or night, electric wires crossing over the land, underground streams, presence of water, weather patterns, people living on or using the land.
- Establish environmental control: Plant hedges and trees for wind protection, ensure good drainage, be aware of the water quality, use, and collection.
- Introduce soil-protecting crop rotations and cover crops.
- Improve soil cultivation practices.
- Introduce green manuring, carefully plowed or dug under.
- Use mulching wherever possible; the earth likes to be covered and will do it by itself with weeds!
- Build compost heaps and treat them with the preparations—do not waste any organic leftovers—collect everything. First compost manure and all other organic material, and apply only when completely broken down! It can be sieved to re-compost any under-composted bits. Compost branches larger than your wrist separately as this will take much longer to breakdown.
- Use the BD preparations 500 and 501 as necessary, at the appropriate times, on the land and growing plants.
- Use other preparations such as the cow pat pit preparation, Panchagavya, or natural liquid fertilizers (equisetum tea, fermented nettle manure) as needed.

Advantages

- Production of top quality fruits and vegetables, with strong flavors and high levels of nutrients (protein and vitamin content)
- Yields are always above the average level, higher on average than those produced by organic farming, and consistently high throughout the years as opposed to the falling yields obtained by chemical farming as the soil is mineralized and pest populations become unbalanced and become a problem
- Little trouble with livestock and plant diseases
- No spreading of insect pests, and no great economic damage due to their presence: The question of insect pests is one of balance and control which can be restored by proper management such as planting shrubs and trees which will house natural predators

CONVERTING A FARM TO BIODYNAMICS

The important criterion is to sustain the fertility of a farm that lasts for the future. The guidelines to be followed are:

- All short-term manuring use of water-soluble fertilizers for quick growth is discontinued. This not only damages soil structure but also produces nutritionally unbalanced plants.

- Stop all chemical weed control methods that will leave undesirable residues which inhibit the development of active soil life.
- The type of stock carried on the farm is important as it has a unique effect on soil fertility
- Encourage legume growth, earthworm activity, and other soil microorganisms. This is enhanced by the biodynamic preparations. This brings about microbiological life to the soil and exerts a balancing effect on the availability of minerals. They also influence the permanent build-up of humus.
- Need of adequate trees to provide shelter and shade as conservation of moisture, protection from wind and also act as predators.

Preparation

Specific biodynamic measures have now been in use for more than 65 years. Many farmers and gardeners know their effects from practical experience. Experimental evidence has also been produced, which has added to the available empirical knowledge. The measures include two groups of specifically fermented substances, which are called preparations. The first group includes 6 different herbal substances; they are numbered 502–507 and are added in small amounts to manures and composts. So they are collectively called compost preparations. These numbers are arbitrary, having been chosen by those who first produced the preparations. The second group includes the sprays; they are numbered 500 and 501. Although not considered one of the eight main preparations, a ninth preparation, sometimes referred to as 508 is made by boiling the horse tail plant and is applied only in excessively wet years to prevent fungal diseases.

BD 500 Cow Horn Manure

It is fermented cow dung. It is the basis for soil fertility and the renewal of degraded soils. It is buried in Sept/Nov and lifted in Feb/March. This is the period when the earth is breathing in and comic earth forces are most active (winter).

Materials

- Cow horns
- Fresh cow dung from a lactating cow. Average 50–150 gms dung/horn (depends on horn size).

Preparation Process

- Feed cattle with high-quality food for two days before collecting dung for BD 500 (good green fodder and less protein artificial feed).
- Prepare burial pit: 18 inches deep. Pit areas should not be subject to flooding, vigorous root systems, or earthworms. BD 500 takes the character of the soil it is buried in, so good quality earth in the burial pit is essential.
- Collect cow horns—remove any paint.
- Collect fresh dung – reasonably firm.
- Fill cow horns with cow dung in October/November (rather than September due to India's warmer climate).
- Place horns in burial pit, 1 inch apart with the base downwards, surround with 50% compost and soil.

- Cover with soil and bury for 4 to 6 months. If the soil is not rich enough, add compost to an extent of 50% to enhance soil quality.
- Keep burial pit soil moist and shaded, at a temperature of approximately 20°C and free from weeds and earthworms.
- After 4 months check for dung fermentation. Dig up one horn. If the green cow dung has turned into a dark, smooth earthy-smelling humus (BD 500) they are ready to be lifted. Remove the BD 500, use, and store. If not, leave them longer.

Application Process

Apply when the dew is falling (the earth breathes in) i.e. late afternoon or evening descending moon.

- 25 grams BD 500/acre in 15 liters rain/pure warm water (approx. 15–20°C)
- Check water for high calcium, iron, or other minerals
- Stir for 1 hour alternately clockwise and anti-clockwise forming a vortex
- Spray in the late afternoon or evening (just before sunset), when moon is descending
- Spray 4 times a year—during the beginning and after rains, i.e. Feb to May–Nov to Dec.

Storage

- Place in glazed earthenware pots with loose-fitting lids.
- Bury in a box surrounded with coir pith, which is kept moist and can be closed.
- Keep in dark and at a temperature of not more than 25°C.
- Use within 1 year.

Effect/result

- Promotes root activity
- Stimulates/increases soil micro-life
- Regulates lime and nitrogen
- Helps to release trace elements
- Increases germination

BD 501 Cow Horn Silica

These are finely ground quartz crystals specially prepared. The crystal should be of good quality, shape, and clear. It is buried similarly to preparation 500 but this time it is buried during the summertime (buried in April/May and lifted in September). This is the period when the earth is breathing out and the cosmic light energy is most active (summer).

Materials

- Cow horn
- Silica quartz crystal–should be clear and well-formed. Average 200–300 gm powdered quartz crystal/horn.

Preparation Process

- Crush silica quartz using a pounding rod, a mortar, and pestle, or hammer.
- Grind to a fine powder between 2 plate glasses.
- First glass—12" square and 9 mm thick with a wooden frame. Second glass—4" square glass plate mounted in a wooden block (handle).

- Ensure that the quartz dust is not inhaled as it could lead to silicosis.
- Masks should be provided while making the preparation.
- Moisten with water to make a stiff paste
- Fill horns with the silica paste
- Bury horns in soil pit, 1 inch apart with the base downwards, surround with 50% compost and soil from March/April (spring equinox) to September (autumn equinox)

Application Process

Apply 501 only after one or two applications of BD 500. Apply when the dew is rising (the earth breathes out), i.e. early morning 6–8 am at sunrise during ascending Moon or Moon opposition Saturn.

- 1 gm silica (enough to cover the small finger nail) in 15 liters of warm quality water
- Dissolve silica in water, stirring for 1 hour before sunrise, alternatively clockwise and anti-clockwise forming a vortex.
- Spray the plants using a low-pressure sprayer (Knapsack 80–100 psi). Spray into the air to fall like a gentle mist over the plants.
- As a general rule, spray twice during the planting cycle; at the beginning and again just before harvest.

Storage

Store in a glass jar with a loose-fitting lid, placed in an open area exposed to sunlight for up to 3 years.

Effect/result

- Enhances light metabolism, photosynthesis, and chlorophyll.
- Helps to improve color, aroma, flavor, and keeping quality of plants.

COMPOST PREPARATIONS 502–507

These are a series of preparations made from various medicinal herbs, in such a way as to enhance their inherent qualities. Experience in India and in many overseas countries of using these preparations in composts and liquid manures has shown that they accelerate the processes of humus formation and as such avoid losses of valuable plant nutrients.

BD 502 Yarrow (*Achillea millifolium*)

This is made from yarrow flowers combined with the bladder of a stag.

Method of Preparation

- The urinary bladder of the stag is used. The stag with its antlers magnifies the effect of the cosmos.
- The smell of the stag bladder and that of the yarrow are similar.
- Cosmos activity of the flower is enhanced by the cosmic activity of the bladder.
- The energies received by a stag from the cosmos through the antlers center around the bladder.
- Start the preparation making under the planetary influence of Venus.
- Blow up the bladder with air when the bladder is fresh.

- Air dry and then collapse.
- At the time of use moisten to make it flexible.
- Cut the bladder, insert a funnel and introduce the flowers till the bladder is packed.
- Moisten the flowers with plant extract, stitch up the slit with cotton thread.
- Store in a closed basket to keep away rodents/pests.

Time of Burial to Lifting

- Hang up in the march to get cosmic influences
- Bury from September to March in a mud pot with earth inside.

BD 503 Chamomile (*Matricuria chamomilla*)

This is composed of the flowers of the Chamomile plant combined with the cow intestine.

Method of Preparation Harvesting

- Pick flowers when petals are horizontal (mid-morning 10 am)
- An ideal flower will have two rows of petals around the cone
- Harvest into a tray as the flowers if left together produce heat
- Use drying trays

Storage

In air-tight containers.

Preparation

- The intestine of a cow or bull can be used
- Do not wash the intestine
- Cut into 15 cm bits
- Run finger along the intestine, like milking a cow, to squeeze out the undigested matter
- Tie cut bits at one end with a cotton string
- Fix funnel to open-end and fill with dry flowers
- Pack not too hard or loose
- Stack the filled sausages into a bundle, which could be placed in a mud pot surrounded by fertile soil.

Time of burial to lifting

Bury in October and let it remain in the soil till Feb/March.

BD 504 Himalayan Stinging Nettle (*Urtica parviflora*) Method of Preparation

- Fill the dried leaves into terracotta pipes or mud pots
- Press well into the containers
- Ensure that the lid is on
- Place the pot under the influence of Mars
  (Moisten dry leaves with the juice of leaves before filling if found dry)

Time of Burial to Lifting

- Harvest leaves in May and September
- Lift the preparation in September after a year

BD 505 Himalayan Oak bark (*Quercus glauca*)

This is prepared by combining the bark of the oak tree with the skull of an animal.

Method of Preparation

- Crush the oak bark
- The skull of any domestic animal may be used
- The link between the skull and bark is their calcium properties
- Further, it is the Ca formation and the skull formation that takes place first in the case of the development of the embryo
- Place the crushed oak bark in the brain cavity of the skull. Block the opening with a well-shaped bone piece.
- Place the skull in a watery environment with weeds and plant muck which would have been damaged by the local diseases that affect the crop. This helps build up the resistance of the plants and follows the principles of homeopathy.
- It should be placed in a location where there is an exchange of water such as a rain drain/swamp.
- It should be noted that a foul smell is emitted on lifting the preparation and removing it from the skull
- This gradually reduces with drying after removal in a dark dry place
- Fungus may form
- Turn over frequently to correct the same

Time of Burial to Lifting

The preparation is placed in September and lifted in March.

BD 506 Dandelion (*Taraxacum officinale*)

It is made from the dandelion wrapped up in a bovine mesentery.

Method of Preparation

- Use the mesentery of the cow. The flower is very sensitive to light and hence it is placed in the mesentery of a cow, which itself is sensitive
- Ensure that extra fat is cut off
- Do not wash the mesentery
- Place the dried flowers in the mesentery and wrap into a parcel and tie with a jute thread
- Place the parcel in a good mixture of soil and compost into a pot
- While lifting the preparation the mesentery may or may not be seen.

Time of Burial to Lifting

- Place in September and lift in March.

BD 507 Valerian (*Valeriana officinalis*)

The juice of valerian flowers is used for this preparation.

Method of Preparation

- Place the clipped flowers into a mortar and pestle and grind them into a paste

- This paste is added to water in the ratio of 1:4 in a bottle
- Ensure storage in a cool place

The summary of preparations are described in Table 1.1.

Table 1.1: Summary of preparations

Prep	*Herb or material*	*Relationship to processes of*	*Planet*	*Planet to organ*	*Result*
502	Yarrow flower *Achillea millefolium*	Sulphur (S) Potassium (K) Trace Elements	Venus	Kidneys	Permits plants to attract trace elements in extremely dilute quantities for best nutrition
503	Chamomile flower *Matricuria chamomilla*	Calcium (Ca) Sulphur (S)	Mercury	Lung glands	Stabilizes nitrogen (N) within the compost and increases soil life to stimulate plant growth
504	Stinging Nettle *Urtica parviflora*	Sulfur (S) Potassium (K) Calcium (Ca) Iron (Fe)	Mars	Gall bladder	Stimulates soil health, by providing plants with the individual nutrition components needed, 'enlivens' the earth (soil).
505	Oak bark *Quercus glauca*	Calcium (Ca)	Moon	Reproductive	Provides healing forces (or qualities) to combat harmful plant diseases.
506	Dandelion flower *Taraxacum officinale*	Silicon (Si) or Silicic acid Potassium (K)	Jupiter	Liver	Stimulates relation between Si and K so that the Si can attract cosmic forces to the soil
507	Valerian flower *Valeriana officinalis*	Phosphorus (P)	Saturn	Spleen	Stimulates compost so that the phosphorus component is properly used by the soil

BD 508 (*Equisetum arvense*)

- It is very high in silica; it can be used as a tea to control fungus in the early season
- It should be sprayed at full moon (2–4 days before) and moon opposition Saturn, the same as BD 50.

Materials

- 1 kg *Equisetum arvense* (horsetail herb) or Casuarina
- 10 liters water

Preparation process: Make a strong tea/tincture by boiling the *Equisetum arvense* or Casuarina in hot water for 2 hr. Let it sit for 2 days.

Application process

- Dilute the tincture: 50 grams tincture to 10 liters of water
- Spray onto the soil or over the plants in the early growing stages
- For mild fungus problems, BD 508 is often sufficient, but for more severe problems BD 501 is more effective.

ORGANIC FARMING

Organic farming (OF) is defined as the production of crops, animals, and other products without the use of synthetic chemical fertilizers and pesticides, transgenic species, antibiotics, growthenhancing steroids, or other chemicals.

OF is a farming system that uses environmentally friendly methods of weed, pest, and disease control. The principles and practices of OF have been expressed in the standards of the International Federation of Organic Agriculture Movements (IFOAM) as the principle of health, ecology, fairness, and care. The organic movement began after 1920, as a reaction by individual agricultural scientists and farmers against industrialized agriculture. Three important movements have been received within the first half of the twentieth century: Biodynamic, organic, and biological agriculture. In 1998, IFOAM adopted the main standards for OF and recycling. Organic production means that more than 95% of agricultural raw materials are organic. If the organic content of the product is less than 70%, it cannot be attributed to organic production methods.

OF relies on the integration of the various components of the farm, the circulation of nutrients and other resources, and the sustainable use of soil and environment. OF is one of several innovative agricultural systems that could play an important role in the future of global food and ecosystem security.

Organic agriculture is characterized by two main features, which are the recycling of nutrients and natural means of pest and disease control according to both traditional and modern scientific knowledge. Nevertheless, OF is more than just a system of production that includes or excludes certain inputs, particularly agrochemicals and genetically modified organisms, because it builds on and enhances the ecological management skills of the farmers, fishermen, and pastoralists, and it includes soil standards. The organic principles and basic standards formulated by IFOAM are applied in both certified and noncertified organic agriculture and are adhered to and cherished.

Principles of Organic Agriculture

- Health
- Ecology
- Fairness
- Care

PEST MANAGEMENT (PM)

There is an urgent requirement for alternative tactics to help make crop protection more sustainable. Many experts promote PM as the best way forward, and the EU has placed it centrally within its sustainable use directive on pesticides. Integrated pest management IPM is a systems approach that combines different crop protection practices with careful monitoring of pests and their natural enemies. The idea behind PM is that combining different practices overcomes the shortcomings of individual practices. The aim is not to eradicate pest populations but rather to manage them below levels that cause economic damage. The main IPM tactics include:

- Synthetic chemical pesticides that have high levels of selectivity and are classed by regulators as low-risk compounds, such as synthetic insect growth regulators.
- Crop cultivars bred with total or partial pest resistance.
- Cultivation practices, such as crop rotation, intercropping or undersowing.
- Physical methods, such as mechanical weeders.
- Natural products, such as semiochemicals or biocidal plant extracts.

- Biological control with natural enemies, including predatory insects and mites, parasitoids, parasites, and microbial pathogens used against invertebrate pests; microbial antagonists of plant pathogens and microbial pathogens of weeds.
- Decision support tools to inform farmers when it is economically beneficial to apply pesticides and other controls. These include the calculation of economic action thresholds, phenological models that forecast the timing of pest activity, and basic pest scouting. These tools can be used to move pesticide use away from routine calendar spraying to a supervised or targeted program.

In contrast, biological control plays a central role in the production of many greenhouse crops. Pesticide resistance evolved in some key greenhouse pests as long ago as the 1960s, prompting the development of alternative methods of management. The pressure to reduce insecticide usage was reinforced by the adoption of bumblebees within greenhouses for pollination. Some highly effective IPM programs are now in place, based around the biocontrol of insect and mite pests using combinations of predators, parasitoids, parasitic nematodes, and entomopathogens. Short-persistence pesticides are used on an at-need basis, if they are compatible with biological control. Pest management strategies are also determined through a close interaction between growers, consultants, biocontrol companies and retailers. In Europe, IPM based around biological control is used on over 90 percent of greenhouse tomato, cucumber and sweet pepper production in the Netherlands and is standard practice for greenhouse crops in the UK. This use of biological control requires considerable grower knowledge, but it has clear benefits in terms of reliable pest control, lack of phytotoxicity, a short harvest interval, and better crop quality.

BIOPESTICIDES

Biopesticides are certain types of pesticides derived from such natural materials as animals, plants, bacteria, and certain minerals. For example, canola oil and baking soda have pesticidal applications and are considered biopesticides.

Classes of Biopesticides

Biopesticides fall into three major classes:

1. Biochemical pesticides are naturally occurring substances that control pests by non-toxic mechanisms. Conventional pesticides, by contrast, are generally synthetic materials that directly kill or inactivate the pest. Biochemical pesticides include substances that interfere with mating, such as insect sex pheromones, as well as various scented plant extracts that attract insect pests to traps. Because it is sometimes difficult to determine whether a substance meets the criteria for classification as a biochemical pesticide, EPA has established a special committee to make such decisions.
2. Microbial pesticides consist of a microorganism (e.g., a bacterium, fungus, virus, or protozoan) as the active ingredient. Microbial pesticides can control many different kinds of pests, although each separate active ingredient is relatively specific for its target pest[s]. For example, some fungi control certain weeds and other fungi that kill specific insects. The most widely used microbial pesticides are subspecies and strains of *Bacillus thuringiensis*, or Bt. Each strain of this bacterium produces a different mix of proteins and specifically kills one or a few related species of insect larvae. While some Bt ingredients control moth larvae found on plants, other Bt

ingredients are specific for larvae of flies and mosquitoes. The target insect species are determined by whether the particular Bt produces a protein that can bind to a larval gut receptor, thereby causing the insect larvae to starve.

3. Plant-incorporated-protectants (PIPs) are pesticide substances that plants produce from genetic material that has been added to the plant. For example, scientists can take the gene for the Bt pesticidal protein and introduce the gene into the plant's genetic material. Then the plant, instead of the Bt bacterium, manufactures the substance that destroys the pest. The protein and its genetic material, but not the plant itself, are regulated by EPA.

Advantages of Biopesticides

- Biopesticides are usually inherently less toxic than conventional pesticides.
- Biopesticides generally affect only the target pest and closely related organisms, in contrast to broad-spectrum, conventional pesticides that may affect organisms as different as birds, insects, and mammals.
- Biopesticides often are effective in very small quantities and often decompose quickly, resulting in lower exposures and largely avoiding the pollution problems caused by conventional pesticides.
- When used as a component of integrated pest management (IPM) programs, biopesticides can greatly reduce the use of conventional pesticides, while crop yields remain high.

To use biopesticides effectively (and safely), however, users need to know a great deal about managing pests and must carefully follow all label directions. Biopesticides are a particular group of crop protection tools used in IPM. There is no formally agreed definition of a biopesticide. We define a biopesticide as a mass-produced agent manufactured from a living micro-organism or a natural product and sold for the control of plant pests (this definition encompasses most entities classed as biopesticides within the organisation for economic cooperation and development (OECD) countries. Examples of some biopesticides are given in Table 1.2.

Table 1.2: Examples of some commercially available biopesticides.

Category	***Type***	***Active ingredient***	***Product name***	***Targets***	***Crop***
Micro-organism					
Bacteria	Insecticide	*Bacillus thuringiensis* var *kurstaki*	Dipel DF	Caterpillars	Vegetables, soft fruit, ornamentals, and amenity vegetation
	Fungicide	*Bacillus subtilis* QST713	Serenade ASO	*Botrytis* spp.	Vegetables, soft fruit, herbs, and ornamentals
	Nematicide	*Pasteuria usgae*	*Pasteuria usgae BL1*	Sting nematode	Turf
Fungi	Insecticide	*Beauveria bassiana*	Naturalis-L	Whitefly	Protected edible and ornamental plant production

Contd.

Table 1.2: Examples of some commercially available biopesticides *(Contd.)*

Category	*Type*	*Active ingredient*	*Product name*	*Targets*	*Crop*
	Fungicide	*Coniothyrium minitans*	Contans WG	*Sclerotinia* spp	Outdoor edible and non-edible crops and protected crops
	Herbicide	*Chondrostereum purpureum*	Chontrol	Cut stumps of hardwood trees and shrubs	Forestry
	Nematicide	*Paecilomyces lilacinus*	MeloCon WG	Plant-parasitic nematodes in soil	Vegetables, soft fruit, citrus, ornamentals, tobacco, and turf
Viruses	Insecticide	*Cydia pomonella* GV	Cyd-X	Codling moth	Apples and pears
	Anti-viral	Zucchini yellow mosaic virus, weak strain	Curbit	Zucchini yellow mosaic virus	Transplanted zucchini and cantaloupes, water-melons, squash
Oomycetes	Herbicide	*Phytophthora palmivora*	DeVine	*Morenia orderata*	Citrus crops
Biochemical	Insecticide	Azadirachtin	Azatin XL	Aphids, scale, thrips, whitefly, leafhoppers, weevils	Vegetables, fruits, herbs and ornamental crops
	Fungicide	*Reynoutria sachalinensis* extract	Regalia	Powdery mildew, downy mildew, *Botrytis*, late blight, citrus canker	Protected ornamental and edible crops
	Herbicide	Citronella oil	Barrier H	Ragwort	Grassland
	Nematicide	*Quillaja saponaria*	Nema-Q	Plant-parasitic nematodes	Vineyards, orchards, field crops, orname

Biopesticides fall into three different types according to the active substance:

- Microorganisms;
- Biochemicals; and
- Semiochemicals.

Microbial Biopesticides

Bacteria, fungi, oomycetes, viruses, and protozoa are all being used for the biological control of pestiferous insects, plant pathogens, and weeds. The most widely used microbial biopesticide is the insect pathogenic bacterium *Bacillus thuringiensis* (Bt),

which produces a protein crystal (the Bt δ-endotoxin) during bacterial spore formation that is capable of causing lysis of gut cells when consumed by susceptible insects. The δ-endotoxin is host specific and can cause host death within 48 h. It does not harm vertebrates and is safe for people, beneficial organisms, and the environment. Microbial Bt biopesticides consist of bacterial spores and δ-endotoxin crystals mass-produced in fermentation tanks and formulated as a sprayable product. Bt sprays are a growing tactic for pest management on fruit and vegetable crops where their high level of selectivity and safety are considered desirable, and where resistance to synthetic chemical insecticides is a problem. Bt sprays have also been used on broad-acre crops such as maize, soya bean, and cotton, but in recent years there have been superseded by Bt transgenic crop varieties.

Other microbial insecticides include products based on entomopathogenic baculoviruses and fungi. In the USA and Europe, the *Cydia pomonella* granulovirus (CpGV) is used as an inundative biopesticide against codling moths on apples. In Washington State, the USA's biggest apple producer, it is used on 13 percent of the apple crop . The majority of products are based on the ascomycetes *Beauveria bassiana* or *Metarhizium anisopliae*. The largest single country of use in Brazil, where commercial biopesticides based on *M. anisopliae* are used against spittlebugs on around 750 000 ha of sugarcane and 250 000 ha of grassland annually. Microbial biopesticides used against plant pathogens include *Trichoderma harzianum*, which is an antagonist of *Rhizoctonia*, *Pythium*, *Fusarium* , and other soil-borne pathogens . *Coniothyrium minitans* is a mycoparasite applied against *Sclerotinia sclerotiorum*, an important disease of many agricultural and horticultural crops. The K84 strain of *Agrobacterium radiobacter* is used to control crown gall (*Agrobacterium tumefaciens*), while specific strains of *Bacillus subtilis*, *Pseudomonas fluorescens* and *Pseudomonas aureofaciens* are being used against a range of plant pathogens including damping-off and soft rots. Microbial antagonists, including yeasts, filamentous fungi, and bacteria, are also used as control agents of post-harvest diseases, mainly against *Botrytis* and *Penicillium* in fruits and vegetables.

Biochemicals

Plants produce a wide variety of secondary metabolites that deter herbivores from feeding on them. Some of these can be used as biopesticides. They include, for example, pyrethrins, which are fast-acting insecticidal compounds produced by *Chrysanthemum cinerariaefolium*. They have low mammalian toxicity but degrade rapidly after application. This short persistence prompted the development of synthetic pyrethrins (pyrethroids). The most widely used botanical compound is neem oil, an insecticidal chemical extracted from seeds of *Azadirachta indica*.

Two highly active pesticides are available based on secondary metabolites synthesized by soil actinomycetes. They fall within our definition of a biopesticide but they have been evaluated by regulatory authorities as if they were synthetic chemical pesticides. Spinosad is a mixture of two macrolide compounds from *Saccharopolyspora spinosa*. It has a very low mammalian toxicity and residues degrade rapidly in the field.

Semiochemicals

A semiochemical is a chemical signal produced by one organism that causes a behavioral change in an individual of the same or a different species. The most widely

used semiochemicals for crop protection are insect sex pheromones, some of which can now be synthesized and are used for monitoring or pest control by mass trapping, lure-and-kill systems, and mating disruption. Worldwide, mating disruption is used on over 660 000 ha and has been particularly useful in orchard crops. Biopesticides have a range of attractive properties that make them good components of IPM. Most are selective, produce little or no toxic residue, and development costs are significantly lower than those of conventional synthetic chemical pesticides. Microbial biopesticides can reproduce on or in close vicinity to the target pest, giving an element of self-perpetuating control. Biopesticides can be applied with farmers' existing spray equipment and many are suitable for local scale production.

The disadvantages of biopesticides include a slower rate of kill compared with conventional chemical pesticides, shorter persistence in the environment, and susceptibility to unfavorable environmental conditions. Because most biopesticides are not as efficacious as conventional chemical pesticides, they are not suited for use as stand-alone treatments. However, their selectivity and safety mean that they can contribute meaningfully to incremental improvements in pest control. A good example is the entomopathogenic fungus *B. bassiana*, which is being used in combination with invertebrate predators against two-spotted spider mites on greenhouse crops. Spider mites are routinely managed using regular releases of predators, but there are often periods in the season when control breaks down. In the past, growers relied on conventional pesticides as a supplementary treatment but this has become ineffective because of pesticide resistance and it can have knock-on effects on other insect natural enemies. *Beauveria bassiana* is effective against spider mites, has a short harvest interval, and is compatible with the use of predators. So it works well as an IPM component and is now the recommended supplementary treatment for spider mites on greenhouse crops across Europe.

Essential Oils as Pesticides

Today there are several insecticides in production that contain rosemary, peppermint, cinnamon, clove, eucalyptus, and thyme oils (and others), either singly or in combination as their active ingredients. Some products contain mixtures of oils while others utilize a single essential oil or even a single terpenoid constituent. For some other essential oils, insecticidal activity can be attributed to the dominant constituent, for example, thymol in thyme oil or citral in lemongrass oil.

Table 1.3: Common essential oils used in pesticide formulations

Plant essential oil	***Botanical source (species, family)***	***Major constituent(s)***
Cinnamon oil	*Cinnamomum verum* (Lauraceae)	Cinnamaldehyde, eugenol
Citronella oil	*Cymbopogon winterianus* (Poaceae)	Citronellal, citronellol, geraniol
Clove oil	*Syzygium aromaticum* (Myrtaceae)	Eugenol
Eucalyptus oil	*Eucalyptus globulus* (Myrtaceae)	1,8-Cineole
Lemongrass oil	*Cymbopogon citratus* (Poaceae)	Geranial, neral, myrcene
Mint oil	*Mentha* spp (Lamiaceae)	Menthol, menthone
Orange oil	*Citrus sinensis* (Rutaceae)	*d*-Limonene
Peppermint oil	*Mentha piperita* (Lamiaceae)	Menthol, menthone

Contd.

Table 1.3: Common essential oils used in pesticide formulations *(Contd.)*

Plant essential oil	***Botanical source (species, family)***	***Major constituent(s)***
Rosemary oil	*Rosmarinus officinalis* (Lamiaceae)	1,8-Cineole, α-pinene, camphor, α-pinene
Tea tree oil	*Melaleuca alternifolia* (Myrtaceae)	Terpinen-4-ol, α-terpinene
Thyme oil	*Thymus vulgaris* (Lamiaceae)	Thymol, *p*-cymene

INDIAN SYSTEMS OF MEDICINE

INTRODUCTION

Medicinal plants based traditional systems of medicines are playing important role in providing health care to a large section of the population, especially in developing countries. Interest in them and utilization of herbal products produced based on them is increasing in developed countries also. It is a well-known fact that traditional systems of medicines always played important role in meeting global health care needs. They are continuing to do so at present and shall play a major role in the future also. The system of medicines which are considered to be Indian in origin or the systems of medicine, which have come to India from outside and got assimilated into Indian culture are known as Indian Systems of Medicine. India has the unique distinction of having six recognized systems of medicine in this category. They are Ayurveda, Siddha, Unani and Yoga, Naturopathy, and Homoeopathy. Though Homoeopathy came to India in the 18th century, it completely assimilated into the Indian culture and got enriched like any other traditional system hence it is considered as part of Indian systems of medicine. Apart from these systems—there are a large number of healers in the folklore stream who have not been organized under any category.

OFFICIALLY RECOGNIZED SYSTEMS

There are following traditional systems of medicine in India which are:

- Ayurveda
- Yoga
- Naturopathy
- Unani
- Siddha
- Homeopathy
- Yoga and Naturopathy are drugless therapies.

Ayurveda

Ayurveda means the science of life. Ayurveda is a very well-documented system of health care practiced in the Indian sub-continent. It is believed that Lord *Brahma* created Ayurveda along with the creation of mankind and the universe. *Vedas* (5000 BC) describes 100 plants and treatment of various diseases. Since 1000–500 BC, *Ashtang* Ayurveda (eight specialties of Ayurveda) are in practice in one or the other way. It is officially recognized by government. In India, Ayurveda is considered not just as an ethnomedicine but also as a complete medical system that takes into consideration the physical, psychological, philosophical, ethical, and spiritual well-being of mankind. It lays great importance on living in harmony with the universe and harmony of nature and science.

It has been conceptualized that the universe is composed of five basic elements named

- *Prithvi* (earth),
- *Jala* (water),
- *Teja* (fire),
- *Vayu* (air), and
- *Akash* (space/ether).

The human body is derived from them in which these basic elements join together to form what is known as 'Tridoshas' (humor) named

- *Vata,*
- *Pitta,* and
- *Kapha*.

This humor governs and controls the basic psychobiological functions in the body. In addition to these three senses of humor, there exist seven basic tissues (*saptha dhatus*)—*Rasa, Rakta, Mamsa, Meda, Asthi, Majja,* and *Shukra*—and three waste products of the body *(mala)* such as feces, urine, and sweat.

Vata governs all movement in the mind and body. It controls blood flow, elimination of wastes, breathing, and the movement of thoughts across the mind. Since Pitta and Kapha cannot move without it, Vata is considered the leader of the three ayurvedic principles in the body.

Ayurvedic compound formulations are mainly divided into two groups viz. (1) *kasthausadhi* (predominantly plant drugs) and (2) *rasausadhi* (predominantly metals and minerals). There are several categories of *kasthausadhi* formulations such as asavaristra, avleha, grafa churena, taila, etc., and *rasausadhis* such as bhasma, pisti, lauha, kapibadkva, rasayana, etc. The ayurvedic drugs are derived from vegetable sources from the various parts of the plant like root, leaf, flower, fruit extrude, or plant as a whole.

Ayurvedic medicines are available in the form of powder, tablets, pills, liquid, and semi-solid which are classified into the following different categories:

- Arishta and asavsa
- Rasa rasayan
- Lauha
- Bati
- Churna
- Avaleha
- Ghrita
- Parpati
- Taila
- Guggulu
- Swarasa
- Arka

Ayurveda lays great emphasis on diet regulation. According to aurvedic concepts food has great influence over the physical, temperamental, and mental development of an individual. Food is the basic material for the production of the body and life-supporting vital matter known as *rasa.* The *rasa* is converted to body components and supports all types of life activities.

Different Disciplines of Ayurveda

Ayurveda is known as *Astanga Ayurveda*- means that which is made up of eight parts. The eight major divisions of Ayurveda are as follow:

1. *Kayachikitsa* (internal medicine)
2. *Kaumar bhritya* (pediatrics)
3. *Bhootavidya* (psychiatry)

4. *Shalakya* (otorhinolaryngology and ophthalmology)
5. *Shalya* (surgery)
6. *Agada tantra* (toxicology)
7. *Rasayana* (geriatrics), and
8. *Vajikarana* (aphrodisiacs and eugenics).

Unani System of Medicine

The Unani system of medicine (unanipathy) originated in Greece, was enriched by Arabic experts, and arrived in India during the medieval period. The Unani theory is based on the tenet that balance among humor (blood, phlegm, yellow bile, and black bile) is required for the maintenance of health.

Disease prevention and health promotion are achieved through an emphasis on the "6 essentials":

1. Pure air
2. Food and water
3. Physical movements and rest
4. Psychic movement and rest
5. Sleep and wakefulness, and
6. Retention of useful materials and evacuation of waste materials from the bod

Unani treatments include medicines of herbal, animal, marine, and mineral origin, as well as pharmacotherapy, diet therapy, and surgery. There are over 42,000 registered Unani *hakims* practicing in India, and there are more than 250 Unani hospitals with over 5,000 beds. Unani medicine has been used for centuries all over the world. It is obtained from herbal sources is in great demand all over the world. They are famous due to their efficacy and fewer side effects as compared to allopathic medicine. The Unani system of medicine is matchless in treating chronic diseases like arthritis, asthma, mental, cardiac, and digestive disorders, urinary infections, and sexual diseases. The medicines administered go well with the temperament of the patient, thus speeding up the process of recovery and also reducing the risk of drug reaction.

The human body is considered to be made up of six components, which have a direct bearing on the health status of a person. They are:

1. Elements *(arkan)*
2. Temperament (*mijaz).*
3. Humor (*aklat*)
4. Organs (*aaza)*
5. Faculties (*quwa*)
6. Spirits (*arwah*).

These components are taken into consideration by the physician for diagnosis and also for deciding the line of treatment.

Unani medicines are available in the form of powder, tablets, pills, liquid, and semi-solid which are classified into the following different categories:

- Safoof (powder)
- Qurse (tablet/ pill)
- Majoon
- Jawarishi
- Arq

Siddha System of Medicine

Siddha system of medicine is practiced in some parts of South India, especially in the state of Tamil Nadu. It has a close affinity to Ayurveda yet it maintains a distinctive

identity of its own. This system has come to be closely identified with Tamil civilization. The term '*Siddha*' has come from '*Siddhi*', which means achievement.

Similar to Ayurveda, the Siddha system also follows the ashtanga concept concerning treatment procedures. However, the main emphasis is on the three branches:

- *Bala vahatam* (pediatrics),
- *Nanjunool* (toxicology) and
- *Nayana vidhi* (ophthalmology).

The other branches have not developed to the extent seen in Ayurveda. The surgical procedures, which have been explained in great detail in ayurvedic classics, do not find mention in Siddha classics. The mineral and metal-based drugs in Siddha system are categorized under the following categories:

1. *Uppu (Lavanam)*: Drugs that are dissolved in water and get decrepitated when put into the fire giving rise to vapor.
2. *Pashanam*: Drugs that are water-insoluble but give off vapors when put into the fire
3. *Uparasam*: Similar to pashanam chemically but have different actions.
4. *Ratnas and uparatnas*, which include drugs based on precious and semiprecious stones
5. *Loham:* Metals and metal alloys that do not dissolve in water but melt when put into the fire and solidify on cooling.
6. *Rasam*: Drugs that are soft, sublime when put into fire changing into small crystals or amorphous powders.
7. *Gandhakam:* Sulfur is insoluble in water and burns off when put into the fire.

It is much similar to preparations used in Ayurveda. Numbers of plant-based preparations are also used in the Siddha system of medicine they are quite similar in profile to those mentioned in Ayurveda.

Homeopathy

Homeopathy is a system of medicine that believes in a specialized method of the treatment system of curing natural diseases by administration of potentized drugs that have been experimentally proved to possess the power of producing similar artificial symptoms on healthy human beings. Physicians from the time of Hippocrates (around 400 BC) have observed that some substances produce a few of the symptoms that they were used to treat. However, it was not until the late 17th Century that a German Physician, Dr Christian Friederic Samuel Hahnemann examined this observation more thoroughly, discovering the fundamental principles of what was to become homoeopathy.

Homeopathy is based on the following cardinal principles:-

1. The law of similar
2. The law of direction of cure
3. The principle of a single remedy
4. The theory of minimum doses
5. The theory of chronic diseases

The law of similar states that medicine that can produce artificial symptoms on healthy human beings can cure a similar set of symptoms of natural diseases. Homeopathy attaches significance to the nomenclature of disease to the extent of choosing the auxiliary mode of treatment, prevention, clinical management, prognosis, etc. not in the selection of the remedy. The concept is that the physical, mental and spiritual expression

of the sick form the totality of the disease. Homeopathy has effective treatment for individuals with chronic diseases such as diabetes arthritis, bronchial asthma, skin, allergic and immunological disorders, behavioral disorders, mental diseases and for several other diseases.

Homeopathy is the system of medicine that works on the principle of ***'like cures like'*** (*similia Similibus curantur*). This system of holistic healing was founded by Dr Samuel Hahnemann, a German physician. Hahnemann, who was translating the book on the medicinal properties of drugs, was reading the properties of the medicine Cinchona, when he read that Cinchona cures malaria, because of its bitter taste. Hahnemann was surprised by this statement and when he read on, he found a footnote that said that cinchona poisoning leads to malaria-like symptoms. This set him thinking and he decided to test the medicine of himself. He experienced the symptoms of malaria, by repeatedly taking the Cinchona medicine and after continuing his experiments found that those medicines which cause disease-like symptoms in healthy individuals are capable of curing the diseased individuals. So, homeopathy relies on the *Materia Medica,* a book containing the properties of medicines, properties which have been proved on healthy individuals. Homeopathic doctors rely on the materia medica as the authority for it contains not empty theories, but details of symptoms that were experienced by hundreds of provers. It is thus a system based on sound principles and as a result of solid experiments.

The Basic Principle of Homeopathy

The theory behind the working of homeopathy is that the body of every human being contains a vital force within the body that regulates the functioning of the body. Due to reasons such as heredity, environmental conditions, stress, etc. this vital force weakens causing disease. So, the disease is nothing but a complex of certain symptoms observed in the human body. The homeopathic physician makes a study of not only the symptoms the patient is complaining of but of the entire patient himself. This leads to a picture of the patient. The physician then prescribes homeopathic medicine, which matches this picture. Now, the medicine so prescribed would have caused the same symptoms in a healthy person during 'drug provings'. This medicine is given in a highly diluted dose, to prevent side effects. This minute dose creates a similar disorder in the vital force and provokes the vital force to react to the symptoms and overcome. (The same system is used in vaccines, where vaccination against smallpox is done by injecting the smallpox disease-causing organism so that the body can build up its natural immunity.)

Medicines Used in Homeopathy

Homeopathy uses an array of medicines whose source ranges from animals to plants and chemicals. Plants like onion (allium), capsicum, belladonna, cactus, etc. are used for preparation of homeopathic medicines. A large number of chemicals like nitric acid, arsenious acid, iron, phosphorus is popular homeopathic remedies. There are also a large number of animal-sourced medicines like Naja and Lachesis which are snake poisons. Medicines are also prepared from a substance like milk (Lac def) and sand (silica). The products of diseases are used to prepare homeopathic medicines called nosodes. These nosodes include carcinosin (prepared from the cancer cells), tuberculinum (prepared from the cells of the lungs of a cow infected by tuberculosis), etc. While there may be a few people who are apprehensive of taking

such medicines, they need not fear, because the process of preparing homeopathic medicines ensures that they are diluted such that they lose their original form and are rendered harmless.

PREPARATION AND STANDARDIZATION OF AYURVEDIC FORMULATIONS

- Arishtas and asavas
- Churna
- Lehya
- Bhasma
- Ghutika

Preparation and Standardization of Arishtas and Asavas

Asava and arishta are very important dosage forms of Ayurveda. These are fermented liquid preparation They contain naturally generated alcohol. This alcohol acts as the medium for active ingredients of the herbs to dissolve in it. In general, all asava and arishta have 5–10% of alcohol. Though these ayurvedic medicines contain alcohol, they are quite safe to prescribe and consume. The differences between arishta and asava are shown in Table 1.4.

Table 1.4: Differences between arishta and asava

Asava	***Arishta***
Asava is prepared from fresh dried herbs	Arishta is prepared from the decoction of dried medicinal herbs
It is less stable than arista	It is more stable
It has less life span than arista	It prolongs life span
It may be contaminated easily	It does not contamination easily

General Method of Preparation of Arishta

Usually in arishta manufacturing, (like Ashwagandharishtam),

- First Kashaya is prepared by boiling herbs in water and filtered.
- To this Kashayam, specified amounts of jaggery (guda)/sugar candy/honey is added. Mixed well and then filtered again.
- To this, fermenting agent—Dhataki flower (Woodfordia fruticosa) or Madhuka flower (*Madhuca indica*) is added.
- To this, Prakshepa Dravya—certain spices like pepper, long pepper, clove, cinnamon, etc. are added.
- This is taken in a vessel, kept closed under a heap of husk/hay/ any place where the temperature is around 35° C.
- It is kept for fermentation for 15–45 days, as per the specific formula.
- During this time, the sucrose in jaggery/sugar candy gets converted into alcohol with the help of fermenting agents.
- While the natural alcohol production takes place, the water-soluble active principles in the Kashaya and the spices get dissolved in the alcohol medium.
- After the said period, it is taken out of the vessel and stored in bottles for dispensing.
- In many cases, a remnant portion of the previous arista is used as the seed to induce fermentation (called Sura Beeja—mother yeast).

Examples of Arishta

- *Dasamoolarishtam:* Used in treating cold, cough, anemia, after delivery care of the mother, female infertility, etc.
- *Draksharishtam:* Used in cold, cough, asthma, throat infection, intestinal disorders.
- *Saraswatarishtam:* Used to improve memory, concentration, and immunity. Also acts as a cardiac tonic.
- *Amritarista:* Used in treating fever
- *Arjunarishta:* Used in cardiac disorders, cold, cough, etc.
- *Ashokarishta:* Used in heavy periods, fever, bleeding disorders, bleeding hemorrhoids, etc.

Preparation of Asava

- Usually, herbs are mixed with the required amount of water. This is taken in place of Kashayam (here, kashayam is not prepared, but there are a few exceptions).
- To this Kashayam, specified amounts of jaggery (guda)/sugar candy/honey is added. Mixed well and then filtered again.
- To this, fermenting agent—Dhataki flower (Woodfordia fruticosa) or Madhuka flower (*Madhuca indica*) is added.
- To this, Prakshepa dravya—certain spices like pepper, long pepper, clove, cinnamon, etc. are added.
- This is taken in a vessel, kept closed under a heap of husk/hay/any place where the temperature is around 35°C.
- It is kept for fermentation for 15–45 days, as per the specific formula.
- During this time, the sucrose in jaggery/sugar candy gets converted into alcohol with the help of fermenting agents.
- While the natural alcohol production takes place, the water-soluble active principles in the Kashaya and the spices get dissolved in the alcohol medium.
- After the said period, it is taken out of the vessel and stored in bottles for dispensing.
- In many cases, a remnant portion of the previous asava is used as the seed to induce fermentation (called Sura Beeja—mother yeast).

Examples of Asava

- *Lohasavam:* Used in anemia, malabsorption syndrome, IBS, anorexia, etc.
- *Ushirasav:* Used in bleeding disorders, anemia, urinary tract disorders, intestinal worms, etc.

Standardization of Arishta and Asava

Standardization of Arishta (AFI, Part-I, 1:20)

Draksarista: It is a fermented liquid preparation. It contains not more than 10 percent, and not less than 5 percent of alcohol that is self-generated in the preparation over some time.

Parameters for Standardization

1. **Description:** Clear brown liquid without frothing and significant sedimentation; with aromatic odor and sweet taste.

2. **Identification**
   - **Thin layer chromatography:** Dry 50 ml of the formulation in a vacuum to remove the self-generated alcohol. Add 50 ml water to dissolve the extract and partition successively with *n*-hexane (50 ml × 3), chloroform (50 ml × 3), and ethyl acetate (50 ml × 3). Filter and concentrate the ethyl acetate extract under vacuum and weigh. Dissolve 10 mg of residue in 1 ml of methanol and carry out thin layer chromatography. Apply separately 5 ml of test solution prepared as above and 3 ml of marker solution prepared by dissolving 1 mg of gallic acid in 1 ml of methanol, on TLC plate and develop the plate to a distance of 8 cm using toluene: ethyl acetate: acetic acid (5: 4: 1) as mobile phase. After development, allow the plate to dry in the air and derivatize with a natural product reagent and examine under ultraviolet light (366 nm). It shows spots at Rf 0.19 (light blue), 0.37 (blue, corresponding to gallic acid), 0.44 (yellow) and Rf 0.64 (light green).
3. **Physico-chemical parameters**
   - Total phenolic content: 0.028 to 0.082 per cent w/v equivalent to tannic acid
   - Total solids: Not less than 28.00 percent w/v,
   - Specific gravity (at 250): 1.08 to 1.20
   - pH: 3.5 to 4.5
   - Reducing sugars: Not less than 14.0 percent w/v
   - Non-reducing sugars: Not more than 0.80 percent w/v
   - Alcohol content: 5 to 10 percent v/v
   - Methanol: Absent
4. **Other requirements**
   - Microbial limit
   - Aflatoxins

Standardization of Asava

Draksasava: It is a fermented liquid preparation. It contains not more than 10 percent, and not less than 5 percent of alcohol that is self-generated in the preparation over some time.

Parameters for Standardization

1. **Description:** Clear brown liquid without frothing and significant sedimentation; with aromatic odor and sweet taste.
2. **Identification**

Thin Layer Chromatography

Dry 50 ml of the formulation in a vacuum to remove the self-generated alcohol. Add 50 ml water to dissolve the extract and partition successively with n-hexane (50 ml × 3), chloroform (50 ml × 3), and ethyl acetate (50 ml × 3). Filter and concentrate the ethyl acetate extract under vacuum and weigh. Dissolve 10 mg of residue in 1 ml of methanol and carry out thin layer chromatography. Apply separately 5 ml of test solution prepared as above and 3 ml of marker solution prepared by dissolving 1 mg of gallic acid in 1 ml of methanol, on TLC plate and develop the plate to a distance of 8 cm using toluene: ethyl acetate: acetic acid (5: 4: 1) as mobile phase. After development, allow the plate to dry in the air and derivatize with a a natural product reagent and

examine under ultraviolet light (366 nm). It shows spots at Rf 0.01 (light blue), 0.44 (blue, corresponding to gallic acid), 0.65 (light green) and at Rf 0.80 (green).

1. **Physico-chemical parameters**
   - Total phenolic content: 0.049 to 0.085 percent w/v equivalent to tannic acid
   - Total solids: Not less than 25.00 percent w/v,
   - Specific gravity (at 250): 1.08 to 1.20
   - pH: 4.0 to 4.5
   - Reducing sugars: Not less than 16.0 percent w/v
   - Non-reducing sugars: Not more than 0.80 percent w/v
   - Alcohol content: 5 to 10 percent v/v
   - Methanol: Absent
2. **Other requirements**
   - Microbial limit
   - Aflatoxins

Preparation and Standardization of Churna

Churna is a solid dosage form of medicament meant for internal use. These are two types:

1. Simple churan: It contains only one medicament.
2. Compound churan: It contains two or more two medicaments.

Method of Preparation

- The drugs are cleaned and dried properly.
- They are finely powdered and sieved.
- If more than one drug is present then each one is separately powdered, sieved, accurately weighed, and then all mixed.
- The powder is fine to the extent of at least 80 mesh sieves. It should not adhere together or become moist. The finer powder has better therapeutic value.

Preservation

- It should be stored in air-tight containers.

Precaution

- Thoroughly cleaned and dried drugs should be used for the preparation of churans.
- They should be finely sifted.
- Each substance should be powdered separately and then mixed.
- Pestle and mortar used for reducing the particle size and mixing the substances should be clean and dry.
- They must be stored in a dry container.
- They should not be prepared in the rainy season.
- They should dissolve in the stomach contents.

Marketed Preparation

- Triphala churna.
- Sudarshan churna.
- Drakshadi churna.

Standardization of Churna

Jataphaladi churna is a powder preparation.

Standardization Parameters for Jataphaladi Churna (AFI, Part-1, 7:12))

Description: Greenish brown, smooth powder, odor characteristic of camphor, tastes sweet and faintly pungent. The powder completely passes through sieve number 44 and not less than 50 percent through sieve number 85.

Identification

Thin Layer Chromatography

Extract 4 g of formulation with 25 ml alcohol under reflux on a water bath for 30 min, filter and concentrate the extract to 10 ml and carry out the thin layer chromatography. Apply 10 ml on TLC plate and develop the plate to a distance of 8 cm using toluene: ethyl acetate (5 : 1.5) as mobile phase. After development, allow the plate to dry in the air. Spray the plate with vanillin-sulphuric acid reagent followed by heating at 1050 for about 10 min. It shows major spots at Rf 0.27 (light yellow), 0.41 (light pink), 0.49 (light violet), 0.54, 0.64 (both bluish grey), 0.81 (light violet) and 0.95 (violet) in visible light.

Physico-chemical Parameters

- Loss on drying at 105°C: Not more than 6.0 percent
- Total ash: Not more than 7.5 percent
- Acid-insoluble ash: Not more than 2.8 percent
- Alcohol-soluble extractive: Not less than 16.0 percent
- Water-soluble extractive: Not less than 41.0 percent
- pH (10% aqueous solution): 6.0 to 7.0
- Total sugar: Not less than 36.0 percent

Other Requirements

- Microbial limits
- Aflatoxin

Preparation and Standardization of Lehya

Avaleha or Lehyam is one of the forms of ayurvedic medicine which is semi-solid inconsistency. It is prepared from mentioned drugs or herbs with the addition of Gur (jaggery), Sharkara (sugar or sugar candy), and boiled with prescribed Swarasa (drug juice) or Kwatha/ Kashayam (decoction). Avaleha is also termed as Modaka, Guda, Khanda, Rasayana, Leha, Lehyam, etc.

Method of Preparation of Avaleha

In all types of Avaleha preparations, there generally have following ingredients–

- Kashaya (decoctions or other liquids)
- Gur/Guda/Sharkara (Jaggery, sugar, or sugar candy)
- Churna (Powders or pulps of certain drugs)
- Ghrita (Ghee) or Tailam (oil)
- Madhu (honey).

Methods

- First, Gur/ Guda/ Sharkara (Jaggery, sugar, or sugar candy) is dissolved well in the decoction or liquid and strained to remove the foreign particles.
- This solution is then boiled over a moderate fire.
- When the Paka (Phanita) is tantuvat (thread-like) when pressed between thumb and index finger or when it sinks in a glass of water without getting easily dissolved, it should be removed from the fire.
- Churna (fine powders) of herbs are then added in small quantities and stirred continuously and vigorously to form a homogenous mixture.
- Ghita (Ghee) or Taila (oil), if mentioned, is added while the preparation is somewhat hot and mixed well.
- Madhu (honey), if mentioned is added at the last when the mixture or preparation is cool and mixed well.

Characteristics

- The Avaleha or Lehyam should neither be hard nor be a thick fluid.
- When the pulp of the raw herbs is added and ghee or oil is present in the preparation, this can be rolled between the fingers.
- The growth of fungus over it or fermentation is sign of deterioration.
- When metals are mentioned in the formula, the bhasmas of the metals are used.
- In the case of specific drugs like Bhallataka, Vatsanabha, etc. purified drugs alone are included in the preparation.
- The color and smell of the prepared Avaleha depend on the drugs or herbs used as ingredients.

Preservation and Storage

The Avaleha or Lehyam should be kept in glass or porcelain jars. It can also be kept in a metal container or pet bottles which do not react with it.

Expiry or Best Before Date

Normally, Avalehas should be used within one year for best efficacy. Afterward, its potency gets reduced.

Examples

- Chyavanprash
- Dashmoola rasayan
- Agastya haritaki
- Manibhadra gudam
- Madnanda modaka
- Ashwagandhadi lehyam
- Drakshavaleha

Standardization of Draksavaleha (AFI, Part-I, 3:15)

Draksavaleha is a semisolid preparation.

Standardization Parameters

Description: Semi-solid, malleable, dark brown, sticky preparation, with a spicy odor, sour and pungent, sweet taste

Identification

Microscopy

Weigh 5 g of the sample, and mix with 50 ml of water in a beaker with gentle warming, till the sample gets completely dispersed in water. Centrifuge the mixture and decant the supernatant. Wash the sediment with distilled water and centrifuge again. Decant the supernatant and mount the sediment in glycerine. Take another small quantity of sediment and mount it in iodine water. Observe the following characters. Broad xylem vessels with spiral thickening, septate fibers, wide lumen with oblique tips, sac shaped simple large starch grains with hilum at the narrow end and showing eccentric striations, parenchymatous cells filled with yellowish-brown droplets of oleoresin, perisperm cells packed with minute starch grains; elongated, spindle-shaped, wide lumened lignified cells associated with spirally thickened narrow vessels; cells from pericarp filled with pink color pigment, acicular needles of calcium oxalate; crystal fibers, group of tracheids with bordered pits and slit-like openings, fragments of xylem vessels with bordered pits; angular fragments, glass-like, visible in the microscope, but becoming invisible between crossed polars in a polarizing.

Thin-layer Chromatography

Extract 5 g of formulation with 25 ml methanol under reflux on a water bath for 30 min, filter, and concentrate the extract to 10 ml and carry out the thin layer chromatography. Apply 20 ml of the extract on the TLC plate and develop the plate to a distance of 8 cm using toluene: ethyl acetate: formic acid: methanol (3: 3: 0.8: 0.2) as mobile phase. After development, allow the plate to dry in the air and examine under ultraviolet light (254 nm). It shows major fluorescent spots at Rf 0.10, 0.21, 0.48, 0.60, 0.74, 0.80 and 0.84 (all blue).

Physicochemical Parameters

- Total ash: Not more than 2.5 percent
- Acid-insoluble ash: Not more than 0.8 percent
- Alcohol-soluble extractive: Not less than 55.0 percent
- Water-soluble extractive: Not less than 65.0 percent
- Reducing sugar: 37 to 40 percent
- Non-reducing sugar: 4.7 to 6.3 percent
- pH (5% aqueous solution): 3.35 to 3.75

Assay

Draksavaleha contains 5.0 to 5.75 percent gallic acid when assayed by the following method:

Estimation of gallic acid: Dissolve 10 mg of gallic acid in 100 ml of methanol in a volumetric flask. From this stock solution, prepare standard solutions of 15 to 75 mg/ml by transferring aliquots (1.5 to 7.5 ml) of stock solution to 10 ml-volumetric flasks and adjusting the volume 10 ml with methanol. Apply 10 ml of each standard solution corresponding to 150 ng to 750 ng of gallic acid on a TLC plate. Develop the plate to a distance of 8 cm using toluene: ethyl acetate: formic acid: methanol (3: 3: 0.8: 0.2) as mobile phase. After development, dry the plate and scan in TLC scanner at a wavelength of 280 nm. Note the area under the curve for peak corresponding to gallic acid and prepare the calibration curve by plotting peak area vs the amount of gallic acid.

Hydrolyze about 5 g, accurately weighed azalea by refluxing with 50 ml of 2N hydrochloric acid on water-bath. Filter, add an equal amount of water, transfer to a separating funnel and extract with diethyl ether (20 ml x 4). Collect the diethyl ether layers and dry over an anhydrous sodium soleplate to remove the solvent. Dissolve the residue in 25 ml of methanol. Apply 10 ml on a TLC plate and develop, dry and scan the plate as described in the preceding paragraph for the calibration curve of gallic acid. Note area under the curve for a peak corresponding to gallic acid. Calculate the amount of gallic acid in the test solution from the calibration curve of gallic acid.

Other requirements

- Microbial limits
- Aflatoxins

Preparation and Standardization of Bhasma

Bhasma is a very fine ayurvedic medicinal powder prepared by the process of calcination of metals, minerals, and natural stones or gems. Calcination is a process of heating metals, minerals, etc. at a high temperature to convert them into their oxides. Bhasma is manufactured with a series of preparation methods involving detoxification of raw materials, grinding them with herbal juices, making small pieces, drying, and heating. The gradual process of preparation may continue for a week to 3 years. The end-product of these long-term preparation methods are residues of metals and minerals. Bhasma is also called ashes or calcined preparations.

Importance of Bhasma

- Bhasma is potent in a small dose.
- Provides easily absorbed and usable calcium
- Maintains optimum alkalinity for optimum health
- Cleanse the kidneys, intestines, and liver
- Maintains healthier teeth and stronger bones
- Alleviate depression and insomnia.

Preparation of Bhasma

- Selection of raw materials
- Identification of purity
- Washing and cleaning
- Grinding and making fine powders
- Mixing with herbal juices or herbs
- Again grinding with herbal juices for 10 to 100 hours
- Making paste, then making small pieces
- Keeping the small pieces to dry up
- When small pieces are dehydrated, then put them in earthen pots
- The materials are then heated up under high temperatures to make bhasma.
- Again, steps 5 to 10 are repeated until the metal or mineral gains the properties of bhasma.

Uses of Bhasma

There are different kinds of bhasma prepared and used in Ayurveda. Each has its specific indications, properties, and healing characteristics. Generally, most of them

are used in the treatment of chronic diseases such as osteoarthritis, infertility, erectile dysfunction, chronic gastritis, ulcer, ulcerative colitis, inflammatory diseases, psoriasis, eczema, depression, bipolar disorder, cancer, tuberculosis, hormonal problems, etc.

Standardization of Bhasma

Standardization Parameters for Bhasma

1. **Physicochemical methods**
   - Ash value
   - Total ash
   - Acid insoluble ash
   - Water-soluble ash
   - Sulfated ash
   - LOD
2. **Analytical methods**
   - SEM
   - TEM
   - FTIR
   - XRD
3. **Microbial evaluation**

Preparation and Standardization of Ghutika/Vati

Gutika (Tablets): Condense of a medicinal preparation is combined with binding agents like gum, etc. and rolled into pills. These can be stored for longer periods and are easy to swallow. They resist fungus and handling is easy. These are also known as *vaṭi.*

Preparation of Gutika

- Take all the ingredients of the pharmacopoeial quality.
- Wash, dry, and powder the ingredients of the formulation composition separately and pass through sieve number 40.
- Soak the coarse powder of ingredients 4 times of potable water for 12 h gently heat the mixture to boil and continue the boiling to reduce the volume of the mixture to one-fourth of its original volume.
- Stop the boiling and filter while still warm through a muslin cloth.
- Powder the Gandhaka áuddha and pass through sieve number 120.
- Add Taila to the filtrate (Kavatha) and gently heat to concentrate.
- Add Shuddha-Gandhaka and Shuddha-Guggulu with continuous stirring to obtain a semi-solid mass of suitable plasticity.
- Expel the mass through vati machine fitted with a suitable die and cut the vatis to the desired weight.
- Roll the vatis on a flat surface to round them by the circular motion of palm covered with a glove and smeared with Taila or use a suitable mechanical device.
- Dry the rounded vatis in a tray-dryer at a temperature not exceeding 600 for 12 to 15 hr.
- Pack it in tightly closed containers to protect it from light and moisture.

Standardization of Ghutika/vati

Simhanada guggulu vati is a preparation.

Standardization Parameters

Description: Spherical pills, brownish-black to black with an agreeable odor and bitter taste

Identification

Thin-layer Chromatography

Extract 5 g of formulation powder in 75 ml of *n*-hexane under reflux on a water bath for 30 min. Filter and concentrate the extract to 25 ml and carry out the thin layer chromatography. Apply 10 ml on TLC plate and develop the plate to a distance of 8 cm using toluene: acetone (9:1) as mobile phase. After development, allow the plate to dry in the air and examine under ultraviolet light. It shows major spots at Rf 0.19, 0.37, 0.44 and 0.59 (all fluorescent blue) under 366 nm and at Rf 0.35, 0.42 (both black) under 254 nm. Spray the plate with anisaldehyde-sulphuric acid reagent followed by heating at 1050 for about 10 min. It shows major spots at Rf 0.37, 0.44, and 0.59 (all pink changing to purple) in visible light.

Test for Sulphur

Burn 100 mg of tablet powder in flame. The evolution of sulphur dioxide is recognized by its characteristic suffocating odor. To about 500 mg of tablet powder, add 0.25 g of zinc and sodium carbonate reagent, mix and transfer into a small test tube. Carefully heat the test tube to a red heat, starting at the upper end and heating towards the bottom end. Drop the content quickly into about 20 ml of water. Filter and acidify the filtrate with hydrochloric acid. The fumes evolve, which turn the lead acetate paper brown or black.

Physicochemical Parameters

- *Loss on drying:* Not more than 12 percent
- *Total ash:* Not more than 7 percent
- *Acid-insoluble ash:* Not more than 3.5 percent
- *Alcohol-soluble extractive:* Not less than 31 percent
- *Water-soluble extractive:* Not less than 23 percent
- *pH (1% aqueous solution):* 4.87 to 5.33

Other Requirements

- Microbial limit
- Aflatoxins

QUESTIONS

Short Questions

1. Define herb
2. Write about the source of herbs.
3. Write on identification and authentication of herbal materials.
4. Define herbal materials.
5. What do you mean by herbal preparation?
6. Define biodynamic agriculture.
7. What is a finished herbal product?
8. Define decoction.
9. What do you mean by infusion?

10. What are the main objectives of biodynamic agriculture?
11. Define the terms arista.
12. Write a short note on asava.
13. What is bhasma?
14. Define the term lehyea.
15. Classify the traditional system of medicine in India.
16. Give a note on the preparation of asava.
17. Give the basic principle of the Unani system of Indian medicine.
18. Define the term standardization
19. Name the various methods for standardization
20. What do you mean by ash value?
21. What is tridosha theory?
22. Compare between arista and asava.
23. Describe the principle of the homeopathic system of Indian medicine.
24. Define biopesticide.
25. Give the classification of biopesticide.

Long Questions

1. Describe the good herbal processing practices for the production of herbal materials.
2. Explain the preparation of harvested/collected medicinal plant parts for processing.
3. Write historical development of biodynamic agriculture?
4. Describe the advantages of biodynamic agriculture.
5. Discuss on Ayurveda system of medicine.
6. Write about the method for preparation and standardization of arishta.
7. Discuss on homeopathic system of medicine.
8. Write in detail about the role of pharmacognosy in Ayurveda.
9. Define lehya. Give its method for preparation and standardization.
10. Explain the Siddha system of medicine.
11. Discuss on Unani system of Indian medicine.
12. Define vati. Discuss methods for preparation and standardization.
13. Discuss the advantages and disadvantages of biopesticide.
14. Discuss the management of pests in details.