

Herbs ⇒

Any plant which has leaf, stem, flowers, root and seeds used as flavoring, food, medicine, Perfume.

* Botanically herb seed bearing plant which does not have a woody stem.

* Medicinal aromatic plant constitute a major part of plant kingdom which provide raw material for used in the pharmaceutical, cosmetic and drug industries.

* As per WHO it estimated about 80% of the population of developing ~~can~~ country realize on plant based for their health requirement.

* India and china are the two major producing country having 40% of the global diversity and availability of rare plant species.

Herbal medicine ⇒

Isolated compound from herb are not consider as herbal drug required modern license medicine.

⇒ Natural product is wide term which includes the drug obtained from the various sources, such as plant, animal as well as minerals.

⇒ Herbal drug which are derived from plants are Herbal medicine

* Herbal medicinal Product consist of an active medicinal agent, one or more Herbal substance, one or more Herbal Preparation, one or more Herbal substance in combination with one or more Herbal Preparation.

↳ Herbal drug Preparation

They are prepared from Herbal material by different Processes which is extraction with various solvent, Purification, Concⁿ. and other Processes

It included such as Powders, extract, juices.

* Herbal medicine Preparation ^{should} ~~not~~ also contains vit. , minerals

* It also contains, chemically active substance, which are obtained by extraction and Purification on from Plant material

Finished Herbal Product:-

Finished Herbal Product consist of one or more herbal Preparation, one or more herbs.

* Product containing different Plant material called mixture herbal Product.

* Natural Product are an active agent isolated from Plant Sources.

All herbal drugs cannot be considered as ayurvedic medicine or regulatory authority has prescribed certain rules to avoid confusion related to herbal drugs.

* In India ----- Drug and Cosmetic Act 1940, there are 54 traditional books, which are called as classical books.

⇒ If drug or formula is mentioned in these books then only it is considered as ayurvedic medicine.

⇒ Herbal Drug Preparation ⇒

Herbal drug preparation are medicinally active product that are isolated from various plant sources these extract contains primary as well as secondary metabolites. Such as - Alkaloids, flavonoids, terpenoids, volatile oil etc.

Extract:-

These are preparation of liquid, semisolid (soft extract) or solid (dry extract) consistency obtained from herbal drug or animal matter.

Genuine Herbal Preparations ⇒

⇒ This is the preparation without excipient.
 ⇒ However soft and liquid preparation the genuine may contain variable amount of extract.

Herbal Substance :-

These are substance mainly, fragmented or cut plant parts usually from fresh.

* Herbal substances also contain certain -- Periolect -- which are not subjected to any specific treatment they are also used as flavoring agent in different type of food preparation.

* Preparation obtained by subjecting herbal substance to treatment such as extraction (Percolation, decoction, Infusion, digestion method), expression, fractionation, purification, concentration, Fermentation, are called

Herbal drug Preparation

eg:-
Powder H. Subs., Tincture, extract, essential oil, Express Juices, and Process organic substances.

Source of Herb :-

⇒ India is one of the biodiversity in world which contributed about 7% of total world bio-diversity

⇒ A/c to data base NMPB (National medicine Plant Board) of out of 1000-18000 flowering plant species in india more 4000 medicinal plant.

⇒ Herbs can be obtained from different sources, herbs can be collected from wild sources or cultivated sources.

⇒ Cultivation of herbs is becoming common practice all over world because it's give better quality of raw material as well as Phytochemicals.

S.No.	Source	Significant ⇐	Example ⇐
1)	Plant drug	most imp. source of drug widely available with low constituent.	→ Digitalis. B.M. - Digitalis Purpurea - Vinca. B.H. - Vincavosce.
2)	marine's source	Numerous novel medicinal agent derived from marine organism	- Algal, Fungi, sea horse, Antibiotics, Murotoxin
3)	mineral sources	Naturally occurring mineral salts, which are used as medicine from ancient time. They are stable and effective on various diseases	- Shilajit. - Zinc oxide, calcium - Bentonite. - Chalk
4)	Animal Sources	Provides many active agent, enzyme, hormone etc.	- Honey, Bees wax, wool, fat, cod liver oil, blood, Vaccines

S.No.	Source	Significant	Example.
5)	Micro-organism	Now days many of new drugs invented from microorganism.	Antibiotics Antimicrobial enzyme, vitamins
6)	Plant tissue culture as a source of drug	modern approach for the production of clone individuals in a limited period of time and limited space under aseptic condition	secondary metabolites terpene, glucanoid volatile oil

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Important Natural Product isolated from Plant Sources

Name of Natural Product	Name of Plant	Common use.
- Digitoxin	Digitalis purpurea	Cardiotonic
- Atropine	Atropa belladonna	Anticholinergic
- Morphine	Papaver somiferum	Narcotic opioid Analgesic
- Reserpine	Rauwolfia serpentina	Antihypertensive
- Vincristine & Vinorelbine	Vinca rosea	Anticancer

Name of M.O.P.	Name of Plant	Common use.
- Glycyrrhizin	Glycyrrhiza glabra	Expectorant
- Quinine	Cinchona officinalis	Antimalarial
- Quinidine	" "	Antiarrhythmic

⇐ Selection ⇒

Alculation thereof.

Plant based medicine for their Primary Health care needs. in almost all the traditional medicine, the medicinal plant play a major Role and constitute the back bone of the traditional medicinal.

Selection of plant can be done by various approaches like - random selection, ecological approach, chemosynthetic approach and ~~ethno~~ ethnobotanical approach.

(a) Random Selection ⇒

in this method's plant material is selected randomly from forest or nearby local area for main drug discovery.

⇒ Success Rate is low but this method offers wide range of variety of diversity and plant material is available readily.

(b) Ecological approach ⇒ (Zoo Pharmacognosy) ⇒

Zoo Pharmacognosy is observation of animal behavior for discovery and development of novel medicinal agent from plant sources.

→ This is also known as ecological approach.
→ ecological observations includes biosynthesis of certain secondary metabolites by Plant for insect repellence

C) Chemogenetic approach (Phyto-genetic method)

→ A plant belongs to certain taxa is therapeutically active than their higher classes of other plant from same taxa can be active
→ This approach is give's idea related behavioural diversity and possible activities of Plant.

D) Ethano Pharmacology (Ethano Botany)

Ethno botany is branch of science which observed the knowledge, ROP for their traditional and beliefs for dietary and development of drugs.
Ethano Pharmacology is also related with Pharmacological Significance of crude drugs.

→ Ethano medicine involves study of use of medicines by different indigenous region including traditional medicine.
This type of selection of plant material uses Success criteria like Plant is already known for activity, Saver, time

E) Identification and authentication of Herbal drugs

Control botanical identification of drug is very imp. for good quality of finished Product.
Substitution or adulteration with macrologically similar or chemically similar Plant is becoming common practice

in herbal drug industry.

There has been an increase in science based research in ASD (ayurvedic Siddha Unani) for the purpose of globalisation. one of the most critical issue in value in research study is the quality of test material.

⇒ A study can not be considered significantly valid if the material tested is not authenticated. is characterised by approved taxonomist.

⇒ correct identification and quality assurance of the starting material is therefore an essential component to insure quality and efficacy of herbal medicine.

⇒ Several method are employed for the authentication and corroboration of ASD herbal medicine

A) taxonomic method ⇒

The initial step is the identification and authentication of botanical material. and its source. the crude drug is identified by its botanical name, vernacular name, sight of collection, habit and habitat, season of collection, altitude and part collected.

B) Herbarium voucher Sample -

The sample of collected material should be kept as a voucher sample in the herbarium and submitted to approved research institute for future reference.

C) Microscopic method ⇒ microscopic identification of botanical materials is based on Parameters like shape, size colour

texture, odour, surface characteristics, fracture characteristics, taste and other organoleptic property.

D) Microscopic method

Microscopy is used to determine the structure, cell wall, histological and internal cell arrangement of botanicals.

E) Physicochemical methods

This includes total ash, water soluble ash, acid insoluble ash, extraction value, moisture content (loss on drying), solubility, pH, melting point, refractive index.

The value of the individual drug can be compared with the standard value of IP, for control identification and confirmation.

F) Chromatography methods

Chromatography method is a modern tool for the quality control analysis of Herbal mixture or extract.

• HPLC, HPTLC, column chromatography, gas chromatography and TLC are the most popular analytical method for the standardization of Herbal drugs.

* Marker Compound

Molecular marker generally refer to botanical compound including Pin and secondary metabolite and other macromolecule - nucleic acid (DNA, RNA)

G) Spectroscopic method

IR, spectroscopy, Electron spectroscopy

Chemical analysis, mass spectroscopy, UV. Spectrophotometry, Atomic absorption spectrometry, X-Ray diffraction analysis, X-Ray fluorescence analysis, are some analytical tool used for complete standardization of herbal drugs.

1) Immuno assay \Rightarrow

~~ELISA~~ ELISA (Enzyme linked immune sorbent assay)
Polyacrylamide gel electrophoresis (PAGE),

Processing of Herbal Drug material \Rightarrow

\Rightarrow Processing is the entire process of raw material from field into finished product.

\Rightarrow Processing includes various steps etc to the nature of crude drug

\Rightarrow Raw drug's collection is carried out from cultivated plants.

\Rightarrow A fresh herb is not supposed to be use immediately. It should be dried to prevent deterioration.

\Rightarrow Again drying is selected depending upon the nature of herb. After drying it can be cleaned for certain impurities.

\Rightarrow Drying or garbling is done in order to make herb more reasonable before sending to market.

\Rightarrow Storage of crude drug also need special

Precaution. before storage herbal material should be packed in suitable container.

\Rightarrow It can undergoes Extraction procedure as per

requirement.

Extraction method can be selected q/c to nature of herb.

⇒ Extract can be characterised by chromatographic technique, analytical technique followed by bioassay.

⇒ Now after determination of one or more active constituent, these extract can be recognised as standardised extract.

⇒ Std. extract shall uniformly in Pharmacological action and don't have much variation.

These extract can be converted into suitable Herbal dosage form or can undergoes further selection, Purify purification Process.

② Collection of crude drug ⇒

Collection of crude drug is very imp. step to determine the quality and purity of crude drug.

⇒ After correct botanical identification, collection can be done.

⇒ Time, Place, and method of collection are determine the quality of the drug.

⇒ Chemical constituent in any plant are subjected to change q/c to time of collection, Season, geography, stage of maturity, sex, age of plant.

Harvesting of Cereals dry \Rightarrow

Harvesting is an operation which

is actual collection of cereals dry from field.

\Rightarrow Harvesting also includes processing of dryers 1:1:20 - removal of seed coat, cover etc.

\Rightarrow Thus agri Harvesting is carried out by machine as compared to conventional method.

Types of Harvesting \Rightarrow

* Manual or skilled worker

* Mechanical machines

* Mechanical Shaker

* Seed stripper-separator

Dressing or gauding of cereals dry \Rightarrow

Dressing need's preparation

of dry for market by removing sand, dirt, insect, mould and impurities, adulterant or unwanted matter.

Drying \Rightarrow

Drying is simple procedure and consists of removal

of moisture.

\Rightarrow drying of cereals dry generally follows immediately after collection, in general Herbs, flowers, are dry at 30-40°C and bark, root, stem, seed's can be dried at 30-50°C

Advantages of drying \Rightarrow

* It is self life and storage of dry.

* It help size reduction and packaging of cereals during

* drying is recommended before transport of dry as it reduces weight and save space before Peking.

* Drying prevent growth of microbes and maintain uniform quality of cereals dry.

Types of dryings

(A) dryng under sun ⇒ low cost but time consuming and possibility of contamination with dust.
⇒ fading of colour due to sun light.

(B) Under shade

Avoid photodegradation of heat, light sensitive drugs but it takes long for drying

(C) Tray dryer / Hot air oven

Quick method for large scale

dryng.

Tray dryer ⇒ Suitable for heat sensitive material, liquid or ~~at~~ slurry.

(E) Vacuum dryer / Freeze dryer ⇒ Suitable for heat and moisture sensitive drugs

(E) Packaging

After packing then ~~enclose~~ drying the goods

drugs are packed in suitable container.
⇒ Packaging is imp. for storage and transport of the goods drug. Proper Packing helps in long self life of goods drugs.

⇒ Types of Packaging ⇒

⇒ Drumny bags ⇒

It allows enough handling, supply air to ~~the~~ keep material ~~on~~ fresh.

⇒ Tin/metal container -

It prevent oxidation and photodegradation and its self life.

Exp = Volatile Resin

⇒ Plastic container -

Drug sensitive to oxidation packed in air tight plastic containers

⇒ Polythene bag ⇒

Suitable for hygroscopic material, specially for

Powder drug.

⇒ Wooden box / cardboard ⇒

Soft fruit are kept wooden boxes.

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(E) Storage of crude drug ⇒

Storage of crude drug is very impo step to maintain quality of drug and increases self life.

⇒ Different drug b/c of their different physicochemical nature needs separate storage conditions.

⇒ Temp, light, oxygen and moisture are the imp. factors to maintain the quality and self life of crude drug.

⇒ Proper care should be taken while storing volatile oil containing drugs which may lose aroma by using temp.

generally the oil is kept in an amber coloured glass bottle or stainless steel containers for storage.

⇒ Crude drug should be stored in optimum storage condition

⇒ Crude drug should be protected from direct sunlight and excessive temp. variation.

⇒ Properly shield containers which are ~~impractical~~ impermeable for insect and mildew can be employed to ~~also~~ the storage life.

Common factor to affect storage condition =

a) Temperature

High temp. \uparrow degradation of drug such as protein, enzyme, A.A., they are highly sensitive to heat.

b) Light

\uparrow \rightarrow Photodegradation, decomposition and bleaching of drug.

c) Oxygen

Responsible for oxidation of drug, rancidity of oil and resinification of volatile oil.

d) Moisture

Responsible to \uparrow in weight of crude drug, encourage growth of fungus, mold and bacteria.

Biodynamic Agriculture

Biodynamic agriculture is a practice of agriculture. Includes avoiding chemical soil fertilizers and chemical pesticides to enhance the productivity of herbal drug without affecting ecosystem.

"This practice is started by a German philosopher and scientist Dr. Rudolf Steiner in 1924."

⇒ Biodynamic agriculture includes ~~manure~~ manure and compost which are prepared ecologically.

⇒ Biodynamic agriculture means Keep in existence long term support.

⇒ B.D.A. is environment friendly, resource conserving, economical, socially supportive and commercially competitive.

⇒ The method does not use any synthetic chemical fertilizer and pesticide. Biodynamic farming involves greater earthworm population and less energy used for production as compared with other conventional farming methods.

Biodynamic agriculture involves -

⇒ use of natural method for soil improvement.

⇒ use of natural manures and composted fertilizers.

⇒ Soil rotation to increase yield and soil health.

⇒ Prohibition of any synthetic fertilizer and pesticide.

⇒ management of ~~pest~~ "Pest" by natural way, involve certification of product to ensure quality of plant.

⇒ The concept of biodynamic agriculture Rudolf Steiner introduced in 1924

⇒ To check the Idea of biodynamic agriculture a group of more than 800 farmer was formed in Europe and America named as "agricultural experimental Circle of ~~ant~~ Anthroposophical farmer and gardeners of the general society."

⇒ The term Bio indicates as living entity while term dynamic indicate energy.

↳ Organic Farming

It is defined as Production of crop, animal and other product without application of harmful chemical like synthetic chemical fertilizer, pesticide, genetically modified or transgenic species or antibiotic and growth enhancing phytohormone.

⇒ Organic farming is also known as ecological farming

Objective of organic farming

- * Production of food and herbal medicine of high quality and in sufficient quantity
- * Controlling of all form of pollution.
- * Production of biodegradable organic product.
- * Consideration of wider social and ecological impact of the organic production.
- * Maintenance of long term fertility of soil.

- * maintenance of genetic diversity of the plant.
- * Promotion of the healthy use and proper care of water & water resources.
- * Processing of Product by using renewable resources.

⇐ Effect of organic farming ⇒

- * Improve the biodiversity.
- * Improve soil quality and microbial biomass.
- * Biofertilizer contains microbial inoculant of living cell of microorganism like - bacterial, algae, fungi, alone or combination which ↑ crop productivity.
- * Nitrogen fixing bacteria - like - Azotobacter, Spermogonium species are Nitrogen fixing organism, capable of forming and symbiotic relation with the root of several crop.
- * Organic farming can act on plant growth directly through the production of phytohormone or indirectly through nitrogen fixation or production of bio-control agent against soil born pathogen for better yield.
- * Organic agriculture is a production system that maintain the health of soil, ecosystem and people.
- * Organic agriculture combines traditional innovation and science to better benefit the environment and promote fair relationship and good quality of life for all involved.

⇒ Good Agricultural Practices ⇒ (GAP)

In India about 22% of the Production of medicinal Plant are cultivated through Scientific way for the Production of best quality of Raw material

⇒ Domestic demand of medicinal Plant has been estimated as one lakh five thousand mt for the year of 2014-15. Total Consumption of herbal raw material in the Country for the year 2014-15 has been estimated five lakh to twelve ^{thousand} mt.

⇒ Needs of GAP ⇒

Use of medicinal plant is continuously rising world wide. Last few decades no. of people using herbal medicine there is a rise in concern about safety. On this background quality assurance and quality control of ~~herb~~ herbal medicine ~~shall~~ need attention.

Poor quality of herbal medicine is most of the time b/c of poor quality of starting material. In order to ensure quality, safety and efficacy of herbal medicine, WHO had identified importance of agricultural and collection practices.

WHO Guidelines provides detail description of GAP for Herbal medicine.

These are guideline which are supposed to be followed for the Crop Improvement

↳ GAP for medicinal Plant ⇒

(A) Selection of Plant material ⇒

Plant material should be selected as per specification of National Pharmacopoeia
 ⇒ In case of new Plant material, identity of the material selected for cultivation should be confirmed and documented.

(B) Botanical ~~identity~~

Correct botanical identity of medicinal plant -

including - genus, order, family and local name should be documented.

⇒ In case of doubt identification voucher specimen should be submitted to national or local Herbarium for identification.

(C) Good cultivation Practices (GCP) ⇒

(i) Environmental factors

* Climate ⇒

climatic condition like - length of the day, sunlight, Rainfall or irrigation (if any), Temp. and night variation and many more factor should be study.

* Soil ⇒

Soil & soil fertility, nutrient content of soil, soil type, PH (6.5), water retention should be considered before selecting Plant material.

* Use of Fertilizer ⇒

Needs of suitable type of fertilizer and its quantity needed to be consider.

⇒ Animal excreta should be completely decomposed before using.

Fertilizer should be approved by respective country.
 ⇒ Irrigation system should be select acc to plant need.
 ⇒ Chemical use should be as less as possible and is to be done when there is no other alternative.

* harvesting ⇒ medicinal plant should be harvested only during best optimal season to produce best possible product quality.

⇒ National Pharmacopoeia Published Standards or other Reference books should be consider the report deciding time of harvesting.

⇒ Best time of the season and day for harvest should be determined quality and quantity of biologically active constituent.

⇒ Care should be taken to ensure no foreign matter are available in authentic drug.

* Good collection Practices ⇒

Collection of any plant from wild resources should be done with prior permission from govt authority before initiation of collection. Proper study of geographical distribution and population of medicinal plant is needed.

* Post harvesting Processing ⇒

Primary Processing ⇒ Plant material should be extracted from rain, water, moisture, or other condition which can be harmful to plant.

⇒ Drying ⇒

⇒ Storage ⇒

Storage of Plant material is very impo. to improve shelf life, quality of finished product.

⇒ Building should have adequate space, Hygienic, term for controls, humidity controls, cleaning facility, building should prevent entry of pollutant, pest and animal.

⇒ Generally fresh plant material should be preserved b/w $2-8^{\circ}\text{C}$ while frozen material should be kept @ -20°C .

Quality assurance ⇒

QoA major measure should be taken through regular audits carried by expert professional as per Regulatory body requirements.

⇐ Pest and Pest management

Due to increase in population day by day consumption of crude drug ↑ but the production of drug is reduced or harvesting is reduced due to presence of various types of pest. that why the cost of the raw material is increases.

Pests ⇒

Pest is undesirable animal or plant species or insects which destroyed crop.

Pesticides ⇒

(A) Mechanical method ⇒

By using manual labour, or using

different devices.

- * Hand picking.
- * Pruning.
- * Burning.
- * Trapping.

(B) Agricultural method ⇒

It covers advanced plant breeding technique capable of producing genetic manipulation resulting in production of pest resistant varieties.

- * Crop rotation - obstruction in their life cycle
- * Deep Plugging -
- * Production of pest resistant species by genetic manipulation.

(C) Biological method ⇒

This method is practised by combating the pest mostly the insect with other living organisms.

eliciting = formation of som. ⇒

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* The chemical substances produced and released by some female insect are capable of eliciting a sexual response from the opposite sex. which could be properly exploited for biological control of pest. Such eliciting substances are called as sex-feromones.

⇒ This method is more effective, safe, economical for pest control.

D) Chemical control

Control of pest by chemical substances from synthetic as well as natural sources.

Ideal Properties of Pesticides

- * It should be non-toxic and non-injurious to medicinal plant and human being.
- * It should be selective in action and highly toxic to insect/pest in small concⁿ.
- * The pesticide should be stable under ordinary condition of storage, non-inflammable, non-corrosive and free from bad odour.
- * Inherently less harmful and less environmental load.
- # Designed to affect only one specific pest or a few target organisms.