Historical background and development of profession of pharmacy

Definition: Pharmacy Greek word of Pharmacy is called **(PHARMAKON)** Pharmakon means drug or medicine. Pharmacy is defined as the profession which is concerned with the art and science of **Identification**, **Selection, Preparation, Preservation** & **Standardization** of suitable drug substances from natural and synthetic sources and their formulations which are meant for administration for Diagnosis, Prevention, and Treatment of diseases. Therefore, a pharmacist is a ***"medicine or drug man"***. While the classes of professionals legally permitted to prescribe medications are physicians, dentists, veterinary doctors and senior registered nurses, pharmacists are required by law to be experts in the preparation, preservation, distribution, and handling of drugs. A health profession that links the health sciences with the chemical sciences, and it is charged with responsibility which ensures the safe and effective use of medication. Hence forth a pharmacist is the right person to look all these aspects because he is educated and trained for this job. They are experts on medication.

Prehistoric Medicine links to Spirit World

The history of pharmacy is a recognized part of medical practice dating as far back as Sumer times, around 2,000 to 1,500 BC.(It mine BC Befour Christ) In which had list of animal, vegetable and mineral origin that were used in the management of diseases and prescriptions with details of the ingredients used in their compounding.

Chinese (2000 BC) – The Chinese believed that diseases resulted from the imbalance in forces acting on humans and animals, thus produced herbal drugs with "spiritual" effects. They were credited to be first users of podophyllum, rhubarb, ginseng, cinnamon etc. The text *Huangdi Neijing* listed the basic principles of pharmaceutical drugs in the third century BC.

Indian (800 BC) - the Indians art of healing is almost as old as the religion of hindiuism itself. Aurveda attained a state of reverence and is classified as one of the Upa-Vedas- a subsection-attached to the Atharva Veda, it also deals with the diseases, injuries, fertility, sanity and health. The main principle behind life or essence of all life forms was five elements of creation the pancha-maha-bhuta namely the earth, water, fire, air and ether form the basis. Out of these arise the three doshas namely Vata, pitta and kahpa. These three doshas unfortunately have been

PHARMACOPOEIA

Syllabus:

Pharmacopoeias: Introduction to IP, BP, USP and Extra Pharmacopoeia.
History and development of Indian Pharmacopoeia.

PHARMACOPOEIA / FORMULARIES / COMPENDIA

The books containing the standards for drugs and other related substances are known as pharmacopoeia and formularies - collectively these books are known as the drug compendia.

The pharmacopoeias or formularies contain a list of drugs and other related substances regarding their source, descriptions, standards, tests, formulae for preparing the same, action and uses, doses, storage conditions etc.

These books are prepared under the authority of the Government of the respective countries. The word "pharmacopoeia" is derived from the Greek words '*pharmacon'* meaning 'drug' and '*poieo'* means 'make'. Literally it means that it is a list of medicinal substances, crude drugs and formulae for making preparations from them.

These books are revised from time to time so as to introduce the latest information available as early as possible after they become established. In order to keep the size of book within reasonable limit it becomes necessary to omit certain less frequently used drugs and pharmaceutical adjuvants from each new edition of the book. Therefore, in each new edition of these books certain new monographs are added while the older ones are deleted.

For the preparation of these books the expert opinion of medical practitioners, teachers and pharmaceutical manufacturers are obtained.

CLASSIFICATION

The drug-compendia are classified as:

(i) Official compendia
(ii) Non-official compendia

A. OFFICIAL COMPENDIA

Official compendia are the compilations of drugs and other related substances which are recognized as legal standards of purity, quality and strength by a government agency of respective countries of their origin.

e.g. British Pharmacopoeia (BP)
British Pharmaceutical Codex (BPC)
Indian Pharmacopoeia (IP)
United States Pharmacopoeia (USP)
National Formulary (NF)
The State Pharmacopoeia of USSR and
Pharmacopoeias of other countries

B. NON-OFFICIAL COMPENDIA

The book other than official drug compendia which are used as secondary reference sources for drugs and other related substances are known as non-official drug compendia. e.g.

Merck Index
Extra Pharmacopoeia (Martindale)
United States Dispensatory etc.

INDIAN PHARMACOPOEIA

History

The historical developments of Pharmacopoeia in India traces back to 1563 and the credit goes to Garcia da Orta a Portugese physician-cum-teacher.

The idea of indigeneous Indian Pharmacopoeia was concieved in 1837 which bore fruits in 1841 in the shape of **Bengal Pharmacopoeia** and **Conspectus of Drugs**.

The hindustani version in Bengali and Hindi of **London Pharmacopoeia** was made available in India from 1901 onwards.

The **Indian Pharmacopoeial List**, published in 1946 formed the seeding for the true **Official Indian Pharmacopoeia** published in 1955.

The first edition of Indian Pharmacopoeia was published in 1955, but actually the process was started as early as 1944. In 1944 Government of India asked the Drugs Technical Advisory Board to prepare the list of drugs used, in India, having sufficient medicinal value to justify their inclusion in official pharmacopoeia.

The Indian Pharmacopoeial List, 1946.

The list of drugs both included and not included in the British Pharmacopoeia along with standards to secure their usefulness, tests for identity and purity was prepared by the committee and was published by the Government of India under the name '*The Indian Pharmacopoeial List 1946*'.

The committee constituted under the chairmanship of Col. Sir R.N.Chopra along with other nine members, prepared the list of drugs with the following details:

Substances included in the British Pharmacopoeia for crude drugs, chemicals and their preparations.

Substances not included in the British pharmacopoeia

a) Drugs of plant origin
b) Drugs of animal origin
c) Biological products
d) Insecticides
e) Colouring agents
f) Synthetics
g) Miscellaneous
h) Drugs for veterinary use.

The Indian Pharmacopoeial List 1946 was prepared by Department of Health, Govt. of India in 1946.

The history of development of Indian Pharmacopoeia:

Year	Events
1946	The Govt. of India published the *Indian Pharmacopoeial List*.
1948	The Govt. of India constituted a permanent Indian Pharmacopoeia Committee. This committee was assigned the task of preparing Indian Pharmacopoeia and to keep it up-to-date.
1955	The **first** edition of **Indian Pharmacopoeia** (IP) was published.
1960*	Supplement of IP 1955 was published. N.B. The work of revision of the Indian Pharmacopoeia as well as compilation of new edition was taken up simultaneously under the chairmanship of Dr. B.N.Ghosh, who died in 1958. After Dr. B.N.Ghosh, Dr. B.Mukherjee, the Director of Central Drug Research Institute was appointed as the chairman of Indian Pharmacopoeia committee.
1966*	The **second** edition of IP was published.

1975	A supplement of IP 1966 was published.
1978	The Indian Pharmacopoeia Committee was reconstituted by the Govt. of India, Ministry of Health and Family Welfare, under the chairmanship of Dr. Nitya Nand, Director, Central Drug Research Institute, Lucknow.
1985	The **third** edition of IP was published in two volumes, Volume-I and Volume-II by the Controller of Publications, on behalf of Govt. of India, Ministry of Health and Family Welfare. **Volume-I** contains: Legal Notices, Preface, Acknowledgments, Introduction, General Notices, and Monographs from A to P. **Volume-II** contains: Monographs from Q to Z, Appendices, Contents of Appendices and Index.
1989	Addendum (I) to IP 1985 was published.
1991	Addendum (II) to IP 1985 was published.
1996*	The **fourth** edition of IP was published.

For the preparation of Pharmacopoeia of India, the pharmacopoeias of other countries, like British, Europe, United States, USSR, Japan, the National Formulary (USA) and Merck Index were consulted. The persons working in pharmaceutical industry, drug control laboratories, research and teaching institutions also actively participated.

Under the Drugs and Cosmetics Act 1940, the Indian Pharmacopoeia is an official book which contains the standards for drugs and other related substances included in the pharmacopoeia. The drugs and other related substances prepared by pharmaceutical manufacturers must comply with these standards.

VARIOUS OFFICIAL PUBLICATIONS RELATED TO PHARMACY PROFESSION IN INDIA

1. NATIONAL FORMULARY OF INDIA

For the guidance of medical practitioners, medical students and pharmacists in hospitals and in sales departments National Formulary of India has been formulated.

1960 First edition was published by Govt. of India, Ministry of Health.
1966 Second edition was published.
1979 Third edition was published.

It contains information about drug interaction, resistance, cumulative effects, drug dependence, prescription writing etc.

2. THE INDIAN PHARMACOPOEIA

Under the Drugs and Cosmetics Act 1940, the Indian Pharmacopoeia is an official book which contains the standards for drugs and other related substances included in the Pharmacopoeia. The drugs and other related substances prepared by pharmaceutical manufacturers must comply with these standards.

1946 Indian Pharmacopoeial List was published by Govt. of India.
1955 First edition of Indian Pharmacopoeia was published.
1960 Supplement of IP 1955 was published.
1966 Second edition of IP was published.
1975 Supplement of IP 1966 was published.
1985 Third edition of IP was published.
1989 Addendum-I to IP 1985 was published.
1991 Addendum-II to IP 1985 was published.

1996 Fourth edition of IP was published.

Under each monograph chemical structures, molecular weight, physical description, solubility, identification tests, standards, assay method, storage etc. are given. Indian Pharmacopoeia is published by the Controller of Publications, Delhi on behalf of Govt. of India, Ministry of Health and Family Welfare.

3. THE BRITISH PHARMACOPOEIA (BP)

Under the Medical Act 1858 the General Council of Medical Education and Registration was empowered to alter, amend and republish the British Pharmacopoeia (BP) as often as necessary. The first BP was published in 1964.

1864 The **first** BP was published.

1926 Committee of Civil Research recommended that a Pharmacopoeia Commission be formed and it should be entrusted the work of new editions of BP and also recommended that BP be revised and reissued at an interval of ten years.

1932 New edition of BP was published according to the above recommendation.

1968 Medicines Act 1968 gave the responsibility of preparing the BP to the Medicines Commission. Medicines Commission reconstituted the British Pharmacopoeia Commission and gave the responsibility to British Pharmacopoeia Committee.

1980 The **thirteenth** edition of BP was [published.

1988 The 14th edition of BP was published.

1993 The 15th edition of BP was published.

BP 1988 contains two volumes with 2100 monographs:

Vol-I contains monographs on medicinal and pharmaceutical substances along with Infra-red (IR) reference spectra.

Vol-II contains formulated preparations, blood products, immunological products, radio-pharmaceutical preparations, surgical materials and appendices.

BP is the source of standards of drugs in United Kingdom and other parts of Common Wealth Countries.

4. BRITISH PHARMACEUTICAL CODEX (BPC)

It was in 1903 that the council of Pharmaceutical Society of Great Britain decided to prepare a reference book for the use of medical practitioners and dispensing pharmacists. The first edition of BPC was published in 1907.

On the request of British Pharmacopoeia Commission, the Council of the Pharmaceutical Society agreed in 1959 for the publication of Codex to coincide with that of the BP, so that BP and BPC should come into effect on the same date.

The BPC differs from BP in that :

a) It contains many more drugs and preparations some may be included in advance to the pharmacopoeia while other drugs may have been included in the former editions of pharmacopoeia but now they are retained in the Codex because they are still commonly used.
b) It provides information on the actions and uses of drugs, their undesirable effects, precautions and the treatment of poisoning.
c) It contains formulae, method of preparation, container and storage conditions of most of the preparations which are still extemporaneously prepared in the pharmacy.

5. THE UNITED STATES PHARMACOPOEIA (USP)

The USP was originally published in 1820 under the authority of United States Pharmacopoeial Convention. The National Formulary (NF) was published in 1888 under the guidance of American Pharmaceutical Association.

In 1974 the NF was purchased by the United States Pharmacopoeial Convention and from 1980 onwards only one official book of drug standards was published under the heading The United States Pharmacopoeia and The National Formulary (USP-NF).

6. EXTRA PHARMACOPOEIA

The Extra Pharmacopoeia was first produced in 1883 by William Martindale and is still known as '*Martindale*'. This is an authorized reference book on drugs and is used throughout the world. It provides all sorts of latest information on drugs and medicines. It is published by the direction of the Council of the Royal Pharmaceutical Society of Great Britain and prepared in the Society's Department of Pharmaceutical Sciences.

7. THE MERCK INDEX

It is an encyclopaedia of chemicals, drugs and biologicals. The first edition was published in 1989 and the eleventh edition was published in 1989 by Merck & Co., Inc. Rahway, New Jersy, USA.

8. THE INTERNATIONAL PHARMACOPOEIA

The International Pharmacopoeia is published by the World Health Organization and is particularly used in developing countries. The first edition was published in 1951 (Volume-I) and in 1955 (Volume-II).

The object of this was to provide a uniform list which would avoid the confusion caused by different national standards, strengths and names especially for the use of travelers who might need to use the same prescription in different countries.

Quality Control of Crude Drugs

➢ Adulteration

Adulterations are defined as admixture of genuine articles with spurious or harmful substances.

The action of making something poorer in quality by the addition of another substance is also known as adulteration.

Example:-

- Mixture of Papaya seed with black pepper.
- Mixture of power of brick into red chili powder.

Methods of adulterating the drugs.

- The extent of adulteration depends upon whether the drug is obtained from other countries.
- An adulteration of a drug may be accidental.
- Adulteration is very common with drugs which are sold illegally.

Following are the various methods used for drugs adulteration.

A. **Substitution with manufactured materials**
B. **Substitution with Inferior material**
C. **Substitution with Exhausted material.**
D. **Substitution with cheap natural substance.**
E. **Adulteration with non- plant material.**
F. **Excessive adventitious matter.**

A. Substitution with manufactured materials:-

This is done with artificially manufactured material which resembles various drugs in form and appearance.

Example: - Paraffin wax has been colored yellow to substitute bee wax.

B. Substitution with Inferior material:-

Drug are sometimes adulterated and substituted with standard commercial material. The common example of substitution is adulteration of cloves by mother cloves.

Saffron is adulterated with dried flowers of Carthamus tinctorius (Safflower).

C. Substitution with Exhausted material.

Exhausted material the vegetable residues which remain after the original material has been use for drug preparation.

Example

- The substitution of Alexandrian Senna with Arabian Senna.
- Used of exhausted Clove and ginger for adulteration.

D. Substitution with cheap natural substance.

Sometimes drugs are adulterated with cheaper natural substance which has no relation to the genuine article.

Example: - Japan wax for bees wax and sterculia gum for Tragacanth.

E. Adulteration with non- plant material.

Plant materials are sometime adulteration with worthless non-plant materials.

➢ Evaluation of Crude Drugs

Evaluation of drugs means identify of its quality and purity.

It is also includes the detection of the nature of adulteration in the crude drugs.

The morphological character may suffice the need of detection but in case of powdered drugs the microscopic characters, while in case of liquid drug chemical tests and one of the physical standards such as specific gravity, optical rotation solubility etc. May be helpful in detection of adulteration.

The methods are employed in detecting adulteration is genuine drugs.

The crude drugs can be identified on the basic of their morphological, histological and chemical studies.

The different techniques involved in standardization of crude drugs are as follow.

1. Physical Evaluation:- Physical standards are to be determined for drugs wherever possible.
They may help in evaluation, specifically with reference to specific gravity, density, optical rotation refractive index, melting point, viscosity and solubility in different solvents

2. Chemical Evaluation:- Chemical comprises of different chemical tests and chemical assays.
The isolation, purification and identification of active constituents are chemical methods of evaluation Quantitative chemical tests such as Acid value, Saponification value etc.

It also help in proper identification of various of the crude drugs.

3. Biological Evaluation:- The estimation of potency of crude drugs is done by means of the its effect on the living organism like bacterial, fungal growth or animal tissue or entities animal, it is called as bioassay

Bioassay is the measure of sample being tested capable of producing the biological effects as that of the standard preparation.

4. Morphological Evaluation (Organoleptic):- It is refers to evaluation of drugs by colour,
odor, teste, size, shape and special features like touch, texture and sound etc.

The study of form of crude drugs is morphology while description of the form is morphography.

The adulteration of seeds of strychnos nux-vomica with the seed of strychnos nux-blanda or Strychnos potatorum, caraway with Indian dill, Alexandrian Senna with dog Senna is identified by morphological techniques.

5. Microscopic Evaluation:- The microscopic evaluation also covers study of constituents by application of chemical tests to small quantities of drugs in powdered form or to histological sections of the drug (micro-chemistry)

This method allows more detailed examination of a drug and its can be used to identify organised drugs by their know histological characters.

Histological studies are made from very thin sections of the drugs.

Microscope by virtue of its property to magnify permits the minute structure under study to be enlarged and can be used to confirm the structural details of the drugs from plants origin.

Brief Outline of Important Plant Constituents

❖ Alkaloids

The term alkaloid (Alkali-like) is extremely useful in commonly applied to basic nitrogenous compounds (ergotamine contain 5
nitrogen) and it may be exist in primary amine, secondary amine, tertiary amine of plant origin, that are physiologically active about 21000 alkaloids have been identified.

- Alkaloids never occur alone, these are usually present as a mixture of a major or several minor alkaloids of a particular biosynthetic unit, which differ in functional groups. It contains at least one nitrogen atoms. Alkaloids are generally insoluble in water, but the salt formed on reaction with acids is usually freely soluble. Alkaloids are freely soluble in ether, chloroform or other organic solvents.

- The first complete synthesis of an alkaloid (coniine) was achieved in 1886 by German chemist Albert Ladenburg. The term alkaloid was coined by Meissner in 1819.
- Chemist Derosne in 1803 isolated the alkaloid norcotine. In the same year, morphine from opium was isolated by Serturner. Pettetier and Caventon isolated emetine in 1817 and colchicines in 1819.

➢ **On the basis of chemical nature of alkaloids it is divided in three parts-**

A. **True alkaloids—** True alkaloids derive from amino acid and they share a heterocyclic ring with nitrogen. These alkaloids are highly reactive substances with biological activity even in low doses. The primary precursors of true alkaloids are such amino acids as L-ornithine, L-lysine, L-tryptophan and L-histidine. Examples of true alkaloids include such biologically active alkaloids as cocaine, quinine, dopamine and morphine.

B. **Proto/Amino alkaloids—** Protoalkaloids are compounds, in which the N atom derived from an amino acid is not a part of the heterocyclic. Such kinds of alkaloid include compounds derived from L-tyrosine and L-tryptophan. Example- Hordenine, mescaline and yohimbine.

C. **Pseudo alkaloids—** Pseudoalkaloids are compounds, the basic carbon skeletons of which are not derived from amino acids. These alkaloids can also be derived from nonaminoacid precursors. Example- coniine, capsaicin, ephedrine, solanidine, caffeine and theobromine.

- **Occurrence and distribution of alkaloids-** Plant have been a rich source of alkaloids but some are found in animals (muscopyridine in muskdeer),

fungi (Ergot alkaloids in *Claviceps purpurea)*, insect (scopolamine in *Apis mellifera*), bacteria (pyocyamine in *Pseudomonas aeruginosa*), practically alkaloids are also obtained in the laboratory by chemical synthesis. In the plant kingdom, the alkaloids appear to have a restricted distribution in certain families and genera. Among the angiosperms the Leguminosae, Pavaraceae, Ranuculaceae, Rubiaceae, Solanaceae, and Barberidaceae are outstanding alkaloids yielding plants. The gymnosperm rarely contains the alkaloids.

- **Isolation of alkaloids-** Isolation of alkaloids is perform by different-different process-

✓ **Stas-otto process.**

- Initially powdered materials are defatted with non-polar solvents and moist with water and treated with NH_3 (free alkaloids).
- Then extract is obtain by the mixing of organic solvent (chloroform, ether) and concentrate it.
- Then dissolved the alkaloid salt and basified with ammonia or sodium bicarbonate.
- Finally obtained the organic phase free alkaloids and dry them.

✓ Manske's process.

- Initially powdered materials are defatted with non-polar solvents and convert the methanol extract by adding methanol and concentrate it.
- Then dissolve in water and acidified up to PH-2 and stand for several days in refrigerator or boiled water paraffin and filter it.
- Filtrate is shake with organic solvent and basified with ammonia.
- Finally obtained the organic phase free alkaloids and dry them.

➢ Identification Test for alkaloids-

1. **Mayer's reagent (Potassiomercuric iodide solution)—**Take the alkaloid materials → Mix with the Mayer's reagent → then obtained cream color ppt.

2. **Wagner's reagent (Solution of iodine in potassium iodide)—**Take the alkaloid materials → Mix with the Wagner's reagent → then obtained brown or reddish brown ppt.

3. **Hager's reagent (Saturated solution of picric acid)—**Take the alkaloid materials → Mix with the Hager's reagent → then obtained yellow color ppt.

4. **Dragendroff's reagent (Potassium bismuth Iodide)—**Take the alkaloid materials → Mix with the Dragendroff's reagent → then obtained reddish brown ppt.

5. **Murexide reagent (Ammonium purpurate)—** Take the alkaloid materials → Mix with the murexide reagent → then obtained purple color ppt.

➢ Therapeutic/Pharmaceutical applications-

In therapeutic efficiency alkaloids are used as broad level.

- **Acts on CNS—** Depressants (Morphine), stimulants (caffine),

- **Acts on ANS—** Sympathomimetic (ephedrine), Para sympathomimetic (pilocarpine), Anticholinergic (atropine, hyoscyamine).

- Local anaesthetic or analgesics (cocaine and morphine).
- Antitumor (Vinblastine).
- Antimalarial (Quinine).
- Antibacterial (Berberine).
- Antiseptic (Scopolamine).

❖ Glycosides

A glycoside is any molecule in which a sugar group/moiety is bonded through its anomeric carbon to another group via glycosidic linkage,chemically, the glycosides are acetal in which the hydroxyl of the sugar is condensed with a hydroxyl group of non sugar component.

The non sugar component is known as aglycone and sugar component is known as glycone. Both the portion can be chemically separated by hydrolysis in the presence of acid. There are also numerous enzymes that can form and break glycosides bond.

Genin or aglycones may be hydroxylic compounds like alcohols or phenols or even it may be an amine. Pharmacologically aglycone part of glycosides is the active constituents and helps in the growth, regulation, protection etc.

- **Classification of glycosides-**
  1. **On the basis of glycoside linkage.**
     a. **O-glycoside—** Sugar molecule is bond with phenol or OH group of aglycone. Example- Amygdaline, Salicin, Arbutin.
     b. **N-glycoside—** Sugar molecule is bond with N of the amine group (-NH-) of aglycone. Example-Nucleosides.
     c. **S-glycoside—** Sugar molecule is bond with S or SH (Thiol group) of aglycone. Example- Sinigrin.

d. **C-glycoside—** Sugar molecule is bond with C atom of aglycone. Example- Aloin, barbaloin.

2. **On the basis of aglycone nature.**
    a. Cardiac or sterol glycoside— Example- Digitalis, squill.
    b. Anthraquinone glycoside— Example- Senna, aloe, rubarb.
    c. Thiocynate or isothiocynate glycoside—Example- Black mustard.
    d. Saponinglycoside glycoside— Example- Liquorice, ginseng.
    e. Flavone glycoside— Example- Ginkgo.
    f. Aldehyde glycoside— Example- Vanilla.
    g. Phenol glycoside— Example- Cascara, bearberry.
    h. Steroidal glycoside— Example- Solanum.

- **Occurrence and distribution of glycosides-** Pharmaceutically important glycosides are obtained from the vegetable source. They occur in various

parts of plant like fruits, seeds, leaves, and barks. Most commonly occurring sugars as a product of hydrolysis of glycosides are glucose, mannose, and galactose.

Glycosides are colorless, crystalline, non-reducing, optically active compounds usually levo-rotatory molecule. These are class of compounds abundant in nature, some plants families containing important glycosides are- Liliacea, Leguminoceae, Scrophulareaceae, Rosaceae, cruciferae, gentianaceae, Umblliferae, Rutaceae, and mytaceae etc.

- **Isolation of glycoside-**

✓ **Stas-otto method.**

- Take the finely divided glycoside containg powder drugs.
- Obtain the extract by continuous hot percolation (thermolabile substance below 45^0C using soxhlet apparatus with alcoholic solvent (enzyme part deactivated by heat).
- Then extract treated with lead acetate for removing the tannins and non-glycosidal impurities.
- Excess lead acetate is precipitated as lead sulphide by passing the hydrogen sulphide gas.

- Finally obtain the crude glycoside and purify them by fractional solubility, fractional crystallization and chromatographic technique.

- **Identification Test for glycosides-**

1. **Borntrager's test (Anthraquinone glycoside).**
   - Take 1gm of crude drugs
   - Then add 5-10ml of HCl and boil on water bath for 10 minutes and filter.
   - Filtrate was extracted with CCl_4/Benzene and add equal amount of ammonia solution and shake well.
   - Formation of pink or red color in ammonia layer due to presence of anthraquinone glycoside.
2. **Saponin glycoside.**
   - Take the crude drug on slide.
   - Then add some drops of blood and mixed well.
   - RBC's becomes ruptured due presence of saponin glycosides.
3. **Steroid glycoside.**
   - Take alcoholic crude drugs and mixed with $CHCl_3$.
   - Slowly add concentrate H_2SO_4 from side walls of test tube.
   - Yellow color ring appear at the junction of two liquid. Which turns red after 2 minutes, indicates the presence of steroids.
4. **Vanillin HCl test for flavonoid glycoside.**
   - Take alcoholic crude drugs and mixed with vanillin HCl.
   - Formation of pink color due to presence of flavonoids.
5. **Killer-Killani test for cardiac glycoside.**
   - Take alcoholic drug + equal amount of water and add 0.5ml of strong lead acetate solution, shake well and filtered.
   - Equal amount of chloroform add in filtrate and evaporate to dryness.
   - Then residue is dissolve in 3ml of glacial acetic acid followed by addition of few drops of FeCl3 salt.
   - Finally solution transferred into 2ml of concentrate H2SO4 test tube.
   - Reddish brown layer is formed, which turns bluish green after standing due to presence of digitoxose.

- **Therapeutic/Pharmaceutical applications of glycosides—**
  - **Senna leaves—** Senna leaves are used as laxative. It causes irritation of large intestine and have some griping effect. Senna is stimulant cathartic and exerts its action by increasing the tone of the smooth muscles in large intestine.
  - **Aloe—** The drug Aloes is one of the safest and stimulating purgatives, in higher doses may act as abortifacient. Its action is exerted mainly on the large intestine; also it is useful as a vermifuge.
  - **Digitalis leaves—** It is also used in allopathic medicine in the treatment of heart complaints. It has a profound tonic effect upon a diseased heart, enabling the heart to beat more slowly, powerfully and regularly without requiring more oxygen
  - **Bitter almond—** it is used as sedative.

❖ Volatile oils and Terpenoids

Volatile oils are the odorous chemical substances which are easily evaporate when exposed to air at ordinary temperature. These represent
essence of active constituents of the plants and hence also known as essential oil. They differ entirely in both chemical and physical properties from fixed oils.

Volatile oils are freely soluble in ether and in chloroform and fairly soluble in alcohol and insoluble in water. Their density is lower than water with the exception(clove and cinnamon) heavier than water. They possess characteristics odor, have high refractive index and most of them are optically active. Volatile oils are colorless liquid, but when exposed to air and direct sunlight these become darker due to oxidation.

- **Classification of the volatile oils-** On the basis of chemical nature it is divided into many parts-

i. Hydrocarbons— Example- Turpentine oil.
ii. Alcohols— Example- Sandal wood oil, Peppermint oil.
iii. Ketone— Example- Caraway, dill, fennel, camphor.

iv. Aldehyde— Example- Lemon grass oil, Cinnamon oil, Saffron.
v. Phenols— Example- Clove, Ajowan, Tulsi.
vi. Phenolic ethers— Example- Nutmeg, calamus.
vii. Oxides— Example- Cardamom, Eucalyptus, Chenopodium oil.
viii. Esters— Example- Rosemary oil, Garlic, Gaultheria oil.

Volatile are chemically derived from terpenes (mainly mono and sesqui terpenes) and their oxygenated derivatives.

➢ Terpenoids—

Terpenoids are the hydrocarbons of plant origin of the general formula $(C_5H_8)_n$ as well as their oxygenated, hydrogenated, and dehydrogenated derivatives. It is a group of naturally occurring chemical compound, majority of which occur in plants (widely in the leaves and fruits of higher plants, conifers, citrus, and eucalyptus etc.), a few of them have also been obtained from other sources.

The term 'terpene' was given to the compound isolated from turpentine, a volatile liquid isolated from pine trees. The simpler mono and sesqui terpenes is the chief constituents of the essential oils obtained from sap and tissues of certain plants and trees. The di and tri Terpenoids are not steam volatile.

Terpenes are easily dividedinto their isoprene unit or (Isoprene unit is the monomer of any terpenes). On the basis of hydrocarbon (carbon number) it is divided into many parts.

i. **C_{10}-monoterpene—** Example- Essential oil, oleoresins, pyrethrins.
ii. **C_{15}-Seqsuiterpene—** Example- Essential oil, sesquiterpenoid lactones.
iii. **C_{20}-Diterpene—** Example- Retinol.
iv. **C_{30}-triterpene and steroids—** Example- Saponins, Cardiac glycosides.
v. **C_{40}-tetraterpene—** Example- β-carotene.

➢ Occurrence and distribution of volatile oils/terpenoids—

Majority of volatile are preexist in the plants and is usually contained in some special secretory tissues, for example- the oil ducts of umbelliferous fruits, the oil cells or oil glands occurring in the sub- epidermal tissue of the lemon and orange,

Mesophyll of Eucalyptus leaves, trichomes of several plants etc. In few cases it does not preexist but is formed by the decomposition of glycosides (example- Bitter almond oil and mustard oil).

Volatile oils are generally mixtures of hydrocarbons and oxygenated compound derived from these hydrocarbons. In some oils (example-oil of turpentine) the hydrocarbons predominate and only limited amounts of oxygenated constituents are present, in other (example-Clove oil) the bulk of oil consists of oxygenated compounds.

- **Volatile oils are extracted by the many plants-**
  - Leaves— (Eucalyptus oil, lemon grass oil).
  - Flowering tops— (Peppermint oil, rosemary oil, Cintronella oil).
  - Stem barks or woods— (Chinnamon, Taxus, camphor oil, sandal oil).
  - Fruiting body— (Chenopodium oil, coriander, caraway, fennel).
  - Rhizome— (Calamus).
  - Seeds— (Annatto).

Now days India and China produce large quantities of oil for export.

➢ Isolation methods for volatile oils-

i. **Isolation by distillation—** The distillation is carried out by water or steam. On the basis of melting properties of the volatile oil, hydro distillation, and steam distillation is widely used.

ii. **Isolation by scarification—** This method is used for the preparation of oil of lemon, oil of orange, and oil of bergamot etc. These oils are found in large oil glands just below the surface in the peel of the fruit. Scarification works on the two principle-

a. Sponge process—

- Removed the fruit content by cutting and emerged in water for a short period of time.

- Then fruit contents are pressed on the sponge operator. Oil glands are burst open and the sponge absorbs the exuded oil.
- Sponge liquid contain both water and oil so it allowed to stand for a short time, where upon the oil separates from water and is collected.

b. **Ecuelle process—** In this process, the rinds are ruptured mechanically using numerous pointed projections with a rotary movement and the oil is collected.

➢ Identification Test for volatile oils-

1. Take the naturally containing volatile oils and treat with alcoholic solution of Sudan-III develops red color in the presence of volatile oil.
2. Take the naturally containing volatile oils and treated with tincture of alkane, which produced red color that indicates the presence of volatile oils.
3. Take 0.5ml of eugenol containing drug and add 2 drops of 1% $FeCl_3$ solution. Then green color produced to indicate the Eugenol chemical.

Some common identification criteria—

Take the 0.5ml of unknown volatile oil sample and add 2 drops of 1% $FeCl_3$ solution

- Yellow color → Menthol.
- Green color → Thymol or Eugenol.
- Violet color → Methyl salicylate.
- Dark blue color → Vanillin.

➢ Therapeutic/Pharmaceutical applications of volatile oil/Terpenoids-

- In the pharmaceutical formulation it is used as an flavoring agent and perfuming agent for masking the unpleasant odor of the drugs.
- It is also used in the foods, beverages, and in cosmetic industries.

- It shows more therapeutic values— Carminative (Umbelliferous fruits), Irritant (Turpentine and oil of wintergreen), Local anaesthetics (Clove), Sedative (Jatamansi), Anthelmintics (Chenopodium oil).

❖ Tannins

The name 'tannin' is derived from the French and is used for a range of natural polyphenols. Tannins are secondary metabolites complex organic, non-nitrogenous, phenolic, plant products, which generally have astringent properties.

The term tannin was first used by Seguin in 1796 to denote substance which has the ability to combine with animal hides to convert them into leather which is known as tanning of the hide.

According to this, tannins are substance which is detected by a tanning test due to its absorption on standard hide power. The test is known as Goldbeater's skin test.

- **Classification of tannin compounds-** On the basis of Goldbeater's skin test it is divided into two major groups.

I. **Pseudo tannins—** Those tannins which are partly retained by the hide power and fails to give the test, are called as pseudo tannins.

II. **True tannins—** Those tannins which shows the maximum hide power and give the positive test are called as true tannins. On the basis of hydrolytic reaction it is further divided into two groups: -

   a. **Hydrolysable/Pyrogallol tannins—** These tannins are easily hydrolysable by mineral acid or enzymes. Their structure involves several molecule of polyphenolic acids are bounded through ester linkage to a central glucose molecule. On the basis of hydrolysis product it is divided into two part.
      - Gallotannins composed of gallic acid.
      - Ellagitannins composed of hexahydrodiphenic acid.

b. **Non hydrolysable or condensed/Proanthocyanidins tannins—** These tannins are not readily hydrolysable to simpler molecule with mineral acids and enzyme. These compounds contain condensed tannin only phenolic nuclei which are bio-synthetically related to flavonoids.

- **Occurrence and distribution of tannins-** Tannin compounds comprise a large group of compounds thet are widely distributed in the plant kingdom. The

families of the plants rich in both (Hydrolysable and Non- hydrolysable) groups of tannins, include: - Rosaceae, Leguminosae, Combretaceae, Polygonaceae, Rubiaceae, Geraniaceae etc.

The members of families Cruciferae and Papeveraceae on the other hand are totally devoid of tannin. In the plants in which tannins are present, they exert an inhibitory effect on many enzymes due to their nature of protein precipitation and therefore contribute a protective function in bark and heart wood.

- **Isolation of tannins-** Tannin compounds can be easily extracted by water r alcohol because both tannins (hydrolysable and non-hydrolysable) are highly soluble in water and alcohol but insoluble in organic solvents (chloroform, ether, and benzene).

The general method for the extraction of tannic acid from various gall is either with water-saturated ether, or with mixture of water, alcohol and ether. After extraction, the aqueous and ethereal layers are separately concentrated, dried, and subjected to further isolation and purification using various separation techniques of chromatography.

- **Identification Test for tannins-**

1. **Gold beater's skin test.**
2. **Phenazone test.**
3. **Gelatin test.**
4. **Test of catechin (Match stick test).**
5. **Test for chlorogenic acid.**
6. **Vanillin hydrochloric acid test.**

1. **Gold beater's skin test—**

- Take gold beaters skin piece and initially soaked in 2% hydrochloric acid and washed with distilled water.
- Then placed in a solution of tannin for 5 minutes then washed with distilled water and transferred to 1% ferrous sulphate solution.
- Finally brown or black color membrane is appearing which are indicating the presence of tannin.

2. **Phenazone test—**

- Take 5ml of aqueous solution of tannin and add 0.5 g of sodium acid phosphate.
- Then warm the solution and cool and filter, and add 2% phenazone solution to filtrate.
- Finally all tannins are precipitated as bulky, colored perceptible.

3. **Gelatin test—**

- Prepare the gelatinous solution by adding 1% of gelatin solution and little amount of 10% sodium chloride.
- Then add 1% solution of tannin.
- Finally tannin causes precipitation of gelatin solution.

➢ Therapeutic/Pharmaceutical applications of tannins-

- Medically tannins show astringents properties and promote rapid healing and the formation of new tissue.
- Tannins are also used for treating wounds and inflamed mucosa.
- Tannins are used in the treatment of various ulcers, hemorrhoids, minor burns frostbite etc.
- Recently tannins should antiviral activities and used for treatment of viral diseases including AIDS.

❖ Resins

Resin can be defined as the complex amorphous chemical of more or less solid characteristics. Which on heating, initially they soften and finally melt.

They are insoluble in water and petroleum spirit but dissolve in more or less completely in alcohol, chloroform, and ether.

Classification of Resin:- It is divided into two parts.

On the basis of their chemical natural (Functional group)

1. Resin acids : Resinous substances which contains the carboxylic acid groups. Being acidic compounds they are soluble in aqueous solution of alkalies producing frothy solution. Resin acids can be derivatized to their metallic salts known as resonates. Which finds their use in soaps, paints, varnish industries.

2**. Resin Esters :** Resin Esters are the esters of the resin acids or the other aromatic acids like benzoic, cinnamic acid, salicylic acids etc.

3**. Resin alcohols:** Resin alcohols or resinols are the complex alcoholic compound of high molecular weight like resin acids they are found as free alcohols or as esters of benzoic, salicylic and cinnamic acid.

4. **Resin phenols :** Resin phenols or resinotannols are also high molecular weight compounds which occurs in free state or as esters.

- **On the basis of their association with other chemicals-**

1. **Glucoresins :-** Glucoresins are the combined chemical of sugar and Resin by glycosylation.

2**. Oleoresins :-** these resins are the homogeneous mixture of resin with volatile oils.

3**. Gem resins :-** Gum Resin are the naturally occurring mixture of resins with gum.

4. **Oleogum Resin :-** Oleogum Resin are the naturally occurring mixture of resin, volatile oil and gum.

5**. Balsams :-** balsams are the naturally occurring resinous mixture which contain a high proportion of aromatic balsamic acids such as benzoic acid, cinnamic acids and their esters.

- **Occurrence and distribution of resins-** Resins are produced and stored in the schizogenous or schizolysigenous glands or cavities of the plants. Glands are present at the different-different location. Example—In the resin cell of blood root,in the elements of the heart wood of guaiacum, in the external glands of Indian hamp, in the internal glands male fern or in the gland on the surface of the lac insect.

They are often performed in the plant but the yield is usually increased by injury (pinus), and may products (benzoin and balsam) are not formed by the plant until it has been injured.

Isolated resin products which come as unorganized crude drug in the market are more or less solid, hard, transparent, or translucent materials.

- **Isolation of resins-** Isolation of resinous chemical is the difficult tasks due to presence of various combinations.
  - General mechanism of isolation technique can be the extraction of the drug with alcoholic solvents and then subsequent precipitation of resin by adding concentrated alcoholic extract to a large proportion of water.
  - The method of distillation or hydro-distillation can be used for the separation of volatile oils from resin. This process is used largely for the separation of resin from turpentine.

- **Identification Test for resins-**

1. Dissolve about 0.1gm of powdered resin in 10ml of acetic anhydride.
   - Then add one drop of cold and concentrated sulphuric acid on glass rod.
   - After adding the acid a purple color, rapidly changing to violet is produced.

2. Take the resinous drug (0.5g) is boiled with hydrochloric acid (5ml) and filtered.
    - Then add ammonia with filtrate.
    - Finally a blue fluorescence is obtained.
3. Take the crude resinous drug and add 50% of nitric acid. Finally green color is produced.
4. Take the crude resinous drug and add 1drop of sulphuric acid. Finally red color is obtained which changes to violet on washing with water.
5. Alcoholic solution of balsam reacts with potassium permanganate to yield benzaldehyde.
6. Alcoholic solution of balsam is acidic to litmus paper.

- **Therapeutic/Pharmaceutical applications of resins-** The pharmaceutical applications of resins are local irritant, local cathartic (e.g. Jalap,

Ipomoea), as anticancer (podophyllum), in bronchial asthma (Cannabis), used externally as mild antiseptic in the form of tinctures (Benzoin), ointment and plasters (Turpentine and Colophony) and used in the preparation of emulsion and sustained release formulations.

Laxatives Crude Drugs

The drugs are loose the bowels (Intestine) or the drugs producing increasing and hosting intestinal evacuation.

Laxatives are indicated in constipation and in evacuation of the bowel, prior to diagnostic procedure or surgery.

◆ *Aloe*

- Synonyms: Aloe, Aloevera

- Family: Liliaceace

- Biological Sources: It is the dried juice of the leaves of Aloe barbadensis Miller. (Curacao aloes)

- Physical Characteristics:

Colour	Bright yellow-ish or rich reddish brown to black.
Odour	Penetrating
Taste	Nauseous and bitter
Size	Various Size

- **Chemical Constituents:-**

- Aloes contain a yellow coloured crystalline substance known as barbaloin(C-glycoside) resin and aloe-emodin.
- Aloe emodin
- Barbaloin

➢ **Therapeutic efficacy :-**

- Improves digestive health.
- Promotes oral health.
- Clears acne.
- Relieves anal fissures
- It used as irritant purgative
- It use for cosmetic and protective
- It also used for treatment of radiation burns.

◆ *Castor oil*

➢ **Synonyms:-**

Oleum Ricini

➢ **Family:-**Euphorbiaceae

➢ **Biological Source:-**

It is the fixed oil obtained by the cold expression of the kernels of seeds of *Ricinus communis*.

➢ **Physical Characteristics**

Colour	Pale yellow or almost colourless liquid

Odour	Nauseating
Taste	Slightly acrid

- **Chemical Constituents:-**

Triglyceride of ricinoleic acid, fatty acids.

Isoricinoleic, linoleic, stearic and isostearic acids.

- **Therapeuticefficacy :-**

  - Costor oil is used as a cathartic.
  - It also used for lubrication commercially.
  - Castor oil can be used as an irritant/simulative laxative.
  - Castor oil is a natural emollient and a few drops may also be used to remedy dry skin, as a massage oil, and may benefit hair as a treatment. Castor oil contains ricinoleic acid, a fatty acid that comprises about 90% of the oil.

◆ *Ispaghula*

- **Synonyms:-** Isapgol, Isabgol
- **Family:- Plantaginaceae**

- **Biological source:-**

It consists of dried seeds of the plant known as *Plantago ovata* Forskal.

- **Chemical Constituent :-**

  - Isapgol seed contain mucilage
  - It consists of **pentosan** and **aldobionic acid.**

- **Physical Characteristics**

Colour	Pinkish-grey or brown
Odour	None
Taste	Mucilaginous, bland
Size	**Length :** 10 to 35 mm
	Width: 1 to 1.75 mm

- **Therapeutic efficacy :-**
  - It is also useful in dysentery, chronic diarrhoea, in cases of duodenal ulcers and piles.
  - It works effectively as a soothing agent.
  - The husk are used as demulcent, laxatives and emollient.
  - It used as the treatment of chronic construction amoebic and bacillary dysentery.
  - Ispaghula is used in the treatment of constipation.

◆ *Senna Leaves*

- **Synonyms:-**Tinnevelly Senna, Indian Senna
- **Family:-**Leguminosae
- **Biological source:-** It consist of dried leaflets of *Cassia angustifolia.*
- **Physical Characteristics**

Colour	Light Green

Odour	Faint
Taste	Bitter mucilagenous.
Size	3–5 cm long, 2 cm wide and about 0.5 mm thick

- **Chemical Constituents:-**
  - It consists not less than 2.0% of hydroxyanthracene derivatives calculated as sennoside B.
  - It contains anthraquinone derivatives.
  - The active constituents of the drug. They are sennosideA, sennoside B,sennoside C, and Sennoside D.
  - Senna Leaves also contains rhein, kaempferol, Aloe-emodin and isorhamnetin etc.
- **Therapeutic efficacy :-**
  - Senna Leaves are used as laxatives.
  - It is an irritant purgative due to presence of anthraquinone derivatives.
  - It causes irritation of large intestine and have some griping effect.
  - They are prescribed along with carminatives.
  - Senna is stimulant cathartic and exerts its action by increasing the tone of the smooth muscles in large intestine.

❖ Cardiotonic Crude Drugs

- The drugs which gives Strength or energy to the activity of the heart.
- Cardiotonic drugs increase the force of the contraction of the muscle(myocardium) of the heart.

➢ Classification of Cardiotonic

Digoxin:

- Digoxin is used to treat heart failure, usually along with other medications. It is also used to treat a certain type of irregular heartbeat (chronic atrial fibrillation).
- Digoxin is one of the oldest medications used in the field of cardiology.
- Treating heart failure may help maintain your ability to walk and exercise and may improve the strength of your heart. Treating an irregular heartbeat can decrease the risk for blood clots, an effect that may reduce your risk for a heart attack.

Milrinone:

- This medication is used for the short-term treatment of heart failure. It works by making your heart beat stronger and by relaxing certain blood vessels so that the amount of blood that is pumped from the heart is increased.

Dexazoxane:

- The heart from damage of continued treatment with chemotherapy agents known as anthracyclines in women with breast cancer.

Phenyephrine:

Phenylephrine is a decongestant that is used to treat stuffy nose and sinus congestion caused by the common cold, hay fever, or other allergies.

Lisinopril :

- Lisinopril is used to treat high blood pressure (hypertension) in adults and children who are at least 6 years old.

Dopamine:

- Dopamine is a medication form of a substance that occurs naturally in the body. It works by improving the pumping strength of the heart and improves blood flow to the kidneys.

Dobutamine:

- Dobutamine is used short-term to treat cardiac decompensation due to weakened heart muscle.
- Dobutamine is usually given after other heart medicines have been tried without success.

◆ *Digitalis*

➢ **Synonyms:-**

Digitalis leaves, Foxglove leaves

➢ **Chemical Constituents:-**
➢ **Family:-**Scrophulariaceae.
➢ **Biological Source:-** It consists of dried leaves of ***Digitalis purpurea*** at 60°c below temperature after collecting the leaves.

- Cardiacglycosides (Cardenolideas) 0.2 to 0.45 %
  Purpurea glycosides.
- They also contains few other glycosides like oderoside H
  , glucogitaloxin,gitaloxin, verodocin and
  glucoverodoxin.

➢ **Therapeutic Uses**

- It is effective in congestive cordiac failure to increase cardiac output and relieve venous congestion.
- The drug is also used to slow the rate of ventricular contraction in patients with atrial fibrillation or flutter.
- Digitalis directly increases the contractile power of the heart muscle, enabling a disease-weakened heart to keep up with the body's demand for heart action
- It increases excitability to cardiac muscles.

◆ *Arjuna*

Synonyms:-

Arjun bark, Arjun, Terminalia Arjuna rab

Family:- Combretaceae

Biological source:- Arjuna consists of dried stem bark of the plant known as *Terminalia arjuna* Rob.

➢ **Chemical Constituents:-**

- It contains triterpenoid saponins, arjunolic acid, arjunic acid arjungenin.
- It also contains β-sintoerol, ellagic acid and arjunic acid.

➢ **Therapeutic Uses:-**

- The bark of Arjun is astringent, sweet, acrid, cooling,aphrodisiac, urinary astringent, and expectorant, but,chiefly used as cardio tonic as it improves blood supply to
  heart.

- It is also useful in ulcer treatment, fractures, cirrhosis of liver, ischaemic heart disease, and hypertension.
- Arjuna bark is used as a diuretic and astringent.

Carminatives and G.I Regulators Crude Drugs

◆ *Carminative*

- The word carminative is derived from Latin word:-

(Carminare : To cleanse)

- The drugs which used relieving pain in the stomach and intestine is Known as carminative.
- The carminatives are prescribed in indigestion, gastric discomfort and loss of appetite.

Examples of carminatives are fennel, coriander, cardamom, clove, cinnamon, caraway etc.

G.I regulators/ Gastric intestinal regulators.

- The gastrointestinal regulators are the agents which regularise the activity of G.I tract and include bitter stomach, anti-emetics and appetizers.

◆ *Coriander*

Synonyms:- Coriander fruits

Family:-Umbelliferae

Biological Source:-

- These are fully dried ripe fruits of the plant known as ***Coriandrum sativum*** **Linn**.

Physical characteristics / Oganoleptic characters:-

Colour: Yellowish-brown to brown

Odour :- Aromatic

Taste :- spicy and characteristic

Size:- 2 to 4 mm in diameter and 4.8 mm in length (Fruit)

Chemical Constituents:

- Coriander seed contain coriandrol (D-linalool)
- It yield from 0.3 to 1% and proteins (20%) are other contents of the drug.
- Coriander leaves are rich in vitamin A content.
- Fruit contains protein, fat, carbohydrates, fiber, calcium, phosphorus and iron. Leaves are reported to be a good source of vitamin C and carotene.
- The odor of the fruit is due to an essential oil present in it.
- This oil possesses linalool and pinene.

Therapeutic efficacy:-

- It used as flavouring agents
- Coriander oil is used along with purgative to prevent gripping.

- It also used as volatile oil as an aromatic, carminative stimulant.
- Treat Osteoporosis
- Prevents Anemia
- Coriander contains both Cineole and linoleic acid. These elements pose antirheumatic and antiarthritic properties which help reduce skin inflammations.
- Coriander prevents flatulence and controls spasmodic pain

◆ *Fennel*

Synonyms:

- Fennel fruits,
- FructusFoeniculumsaunf
- AnethumpanmoriumRoxb.
- Fleming,
- AnethumrupestreSalisb.
- Foeniculumazoricum Mill.
- FoeniculumdivaricatumGriseb.
- Foeniculumofficinale

Family: Umbelliferae

Biological Source:

- It consists of dried ripe fruits of the plant known as ***Foeniculum vulgare.***
- It should contain less than 1.4% of volatile oil.

Physical characteristics / Oganoleptic characters:-

Colour: Green to Yellowish-brown

Odour: Sweet aromatic

Taste: Strongly aromatic and

mucilaginous **Size:** 5 to 10 × 2 to 4

mm

- **Chemical Constituents:**

  - It consists of 3 to 7% of volatile oil.
  - The chief active constituent of votatile oil is a ketone, Fenchone and Aenthole.
  - It also contained protein, fat, minerals, fibre and carbohydrates.
  - Total phenolic content in organic fennel oil was 262.59 ± 15.5 mg Gallic Acid Equivalents/l(44) . The phenolics identified in the fruit of this plant were neochlorogenic acid (1.40%), chlorogenic acid(2.98%), gallic acid (0.169 %) etc.

- **Therapeutic efficacy:-**

  - It is used as a carminative, aromatic and stimulant.
  - It also used as flavouring agents.
  - Fennel is an herbal supplement which can be used as treatment of
    infants and nursing children suffering
    from colic and dyspeptic disease.
  - It also be used for its anti-inflammatory, analgesic and antioxidant.

- It Use to treat menstrual disorders, dyspepsia, flatulence and cough.
- It Roots were employed as purgative.
- Fennel was used by the ancient Egyptians as a food and medicine.

◆ *Cardamom.*

Synonyms:

Cardamom fruit, Cardamom seeds.

Family:-Zingiberaceae

Biological source:-

- It consists of the dried ripe fruits of ***Elettaria cardamomum*** **Maton**

Organoleptic characters:-

Colour: Green to pale buff

Odour: Aromatic, agreeable and pleasant

Taste: Strongly aromatic

Size: Capsule (Fruits) 2 cm in length.

- **Chemical Constituents:-**

Terpineol

Borneol

- **Therapeutic efficacy:**

It is used as a flavouring agents

Cardamom is used as a aromatic carminative and stimulant.

It is used in the treatment of respiratory disorders like asthma,bronchitis, cough, nausea, vomiting, indigestion, headache, diarrhea,colds, for flatulence, also used as a spice in cooking.

◆ *Ginger*

Synonyms: Zingiber, Zingiberis, sonth

Family:-Zingiberaceae

Biological Source:

- Ginger consists of rhizomes of ***Zingiber officinale***

Organoleptic characters:

Colour: Buff Coloured

Odour: Agreeable and aromatic

Taste: Agreeable and pungent

Size: Rhizomes of ginger

Chemical Constituents:-

- Ginger contain about 1 to 2% of volatile oil, an acrid resinous matter (5-8%) and starch.
- The pungent principal of ginger is gingerol which is Yellowish oily substance.

Therapeutic efficacy:

Ginger is used as a stomach an aromatic a carminative

stimulant.

It is used as a flavouring agents.

Ginger oil is used in mouth washes, ginger beverage and liquors.

◆ *Clove.*

Synonyms:-Caryophyllum, clove flower, clove bud, Laung

Family: Myrtaceae

Biological source:

It consists of dried flower buds of ***Eugenia caryophyllus***.

Organoleptic characters:-

Colour- Crimson to dark brown

Odour: Slightly aromatic

Taste: Pungent and Aromatic

- **Chemical Constituents:**

  - It contains not less than 15% (V/W) of clove oil.
  - The clove oil contains eugenol (70 to 90%) eugenal acetate,methylamylketone, caryophylleness and small quantities of esters,alcohols.

- **Therapeutic efficacy:**

Clove is used as a dental analysis, Carminative stimulant flavouring agents aromatic and antiseptic.

It also used in preparation of cigarettes.

The clove oil is used in perfumery and also in manufacture of uanillin.

◆ *Black Pepper.*

Synonyms: Kalimirch, Madagascar pepper, Piper nigrum.

Family: Piparaceae

Biological Source:

It consists of dried unripes fruits of ***Piper nigrum*** Linn.

Organoleptic characters:

Colour:-Blakish - Brown or greyish black.

Odour:- Aromatic and pungent

Teste :- Bitter

- **Size :-** 3.5 to 6 mm in diameter.

Chemical Constituents:-

It should contain not less than 2.5% of piperine on dried basis.

Pepper contain an alkoloidpiperine (5-9%) Volatile oil (1.25%) pungent resin (6.0%) piperidineand starch (about 30%)

- **Therapeutic efficacy.**

The fruits are used as aromatic, stimulant.

◆ *Asafoetida.*

Synonyms:-Asafoetida, Gum Asafoetida, Devil's dung,Hing

Family:-Umbelliferae

Biological source:-

It obtained by making incision from living Rhizomes and roots of Ferula, Foetida, Regal. ***Ferula Rubricaulis*** and other species of Ferula.

Organoleptic characters

Colour: Yellowish-white changing to reddish brown

Odour: Penetrating and alliaceous

Taste: Bitter

Size: Tears are 0.5 to 3 cm in diameter.

- **Chemical Constituents:**
  - Asafoetida contain resin (40 to 65 %) and volatile oil (4 to 20%).
  - The resin of the drug consists chiefly asaresinotannol in the free or combined from with ferulic acid.
  - Umbelliferone is absent in drug (Distinction from galbanum).
- **Therapeutic efficacy:-**
  - It is used as carminative, nervine tonic, flavouring agent, intestinal antiseptic.
  - It also used in ueterinary medicine and for culinary purposes.

◆ *Cinnamon.*

Synonyms:cinnomom bark, kalmi - Dalchini, Ceylon cinnamon

Family: Lauraceae

Biological source:- It consists of dried inner bark of shoots of coppiced trees of ***Cinnamomum zealanica.***

Organoleptic characters:

Colour: Dull yellowish brown

Odour: Aromatic

Taste: Quills compound

- **Chemical Constituents:**

1. **Cinnamon bark :-**

- It consists about 0.5 to 1.0% of volatile oils and 1.2% of tanins.
- It also contain calcium oxalate, starch and mannitol.

2. **Cinnamon oil :-**

- 60-70% cinnamaldehyde
- 5 - 10% evgenol
- It also contain benzaldehyde cuminaldehyde and terpenes(Phellondrene, pinene, cymene, caryophyllane)

- **Therapeutic efficacy:-**

- It used as flavouring agents and antiseptic.
- Bark is used as a carminative, stomachic and mild astringents.
- It is also used as a spice and condiment.
- It also used as the preparation of candy, perfumes.

◆ *Nutmeg.*

Synonyms: Myristica, Nux Moschata, jaiphal

Family: Myristicaceae.

Biological Source:

It dried from kernels of seeds of ***Myristica fragrans*** **Houtten**

Organoleptic characters:-

Colour: -Greenish- brown or brown (Kernels)

Odour: - Strongly aromatic

Taste: -Pungent and aromatic

Size: -*Length* - 20 to 30mm (Kernels)

***Broad* -** 20mm (Kernels)

➢ Chemical Constituents:-

- It containElemicin, myristicin and saffrole.
- It other constituents is contain geraniol, terpineol.
- Nutmeg principally contains volatile oil (5 to 15 percent)and fat (30 to 40 percent). It also contains phytosterin,starch, amylodextrin, colouring matters and a saponin.

➢ Therapeutic efficacy:

- Cancer.
- Diarrhea.
- Intestinal gas.
- Kidney disease.
- Nausea.
- Nutmeg and its oil are used as stimulants,flavouring agents and carminatives.
- The expressed fatty oil and the volatile oil have been used externally in chronic rheumatism.

❖ Astringents Crude Drugs

- The substance that cause the contraction or shrinkage of tissue and that dryup secretions.
- They are capable of arresting haemorrhages and reducing secretions of mucous membrane of stomach or intestine by precipitating proteins.

◆ *Black Catechu*

Synonyms: Cutch, kattha, khadir, khair

Family: Leguminosae

Biological source: It consists of dried aqueous extract of the heartwood of the plant ***Acacia Catechu*.**

Organoleptic characters:

Colour - Light brown to black

Odour- None

Taste - Very astringents

Size - 2-5 to 5 cm

Chemical Constituents:-

- It contains about 10% of acacatechin.
- The oth black Catechu are Catechu red ,quercetin, and gum.

- Acacatechin is also known as Acacatechin.

Therapeutic efficacy:

- It is used as styptic and antidiarrheal agent.
- It used for relaxed condition of throat, mouth and gums.
- Kattha is used as a astringents and for cooling and digestive purposes.
- It also used for printer inks.

◆ *Myrobalan*

Synonyms:- Chebulic myrobalan, harde, haritaki.

Family: Combretaceae.

Biological Sources

Myrobalan is the mature dried fruits of ***Terminalia chebula*****,**

Chemical Constituents

- Myrobalan contains about 30% of the hydrolysable tannins,which consists of chebulinic acid, chebulagic acid and D-galloyl glucose.
- It contains free tannic acid, gallic acid, ellagic acid, and resin myrobalanin. Anthraquinone glycosides, sennosides have been reported in myrobalan.

➢ Therapeutic efficacy

- Myrobalan is reputed in Indian system of medicine as a drug for various types of diseases.
- It is used externally in chronic ulcers, wounds,piles, and as stomachic.
- It is one of the drugs of the well-known preparation ‘Triphala’.
- powder of myrobalan is used in dental preparations
- It is used in dyeing and tanning industry and also in treatment of waterused for locomotives.

❖ Drugs acting on Nervous system Crude Drugs

Nervous system of human being is classified into two type.

1. Central Nervous System
2. Peripheral Nervous System

1. Central Nervous System:-

- The CNS consists of the brain and spinal cord.
- The brain plays a central role in the control of most bodily functions, including awareness, movements, sensations, thoughts, speech and memory.
- There are many different types of drugs that work on the CNS, including anaesthetic,Anticonvulsant, anti-emetics, antiparkinson agents, muscle relaxants etc.

2. **Drug Acting on autonomic nervous system:-**

- It is considered as automatic nervous system and controls the functions like respiration,circulation, digestion and maintenance of body temperature.

◆ *Hyoscyamus*

Synonyms:- Henbane, Hyoscyamus leaves

Family:- Solanaceae

Biological source:- It consists of dried leaves and flowering tops of the plant known as ***Hyoscymus niger*** **Linn.**

➢ **Chemical Constituents:-** It constituent of Henbane leaves is the alkoloid hyoscyamine, together with smaller quantities of atropine and hyoscine also known as scoplamine.

➢ **Therapeutic efficacy:-**

- It is used as antispasmodic hypnotic and mild diuretic.
- It is used for relieve pain in cystitis.
- It is used to relieve the gripping caused by drastic purgatives and is a common ingredient of aperient pills.
- It also used to relieve the spasms urinary tract.
- It is used sedative and anti-asthmatic.

◆ *Belladonna*

Synonyms:- Belladonna leaf, Belladonna herb

Family:- Solanaceae

Biological source:- It consists of dried leaves and other aerial part of ***Atropa belladonna*** **Linn**.

➢ **Chemical Constituents:-**

It contain alkaloids (l-h nine and other components are atropine,apoatropine as choline belladonnine, cuscohygrine, chrysa-tropic acid and other components.

➢ **Therapeutic efficacy:-**

- It used to reduce secretion of sweat salivary and gastric glands.
- It used in parasympathetic depressant.
- Narrow-angle glaucoma
- A bladder obstruction, enlarged prostate, or other urination problems
- A stomach or bowel obstruction (including paralytic ileus) severe ulcerative colitis or toxic megacolon;

◆ *Ephedra*

Synonyms:- Ma-haung

Family:- Ephedraceae

Biological source:- Ephedra consists of dried young stem of ***Ephedra***

gerardiana Wall

➢ **Chemical Constituents:-**

Ephedra contains about 1 to 1.5% of total alkaloids of ephedrine.

The different alkaloids of ephedra:

- Ephedrine or ephedrine
- L-methyl ephedrine
- D- methyl iso-ephedrine
- Ephedrine,
- Pseudoephedrine,

➢ **Therapeutic efficacy:-**

- Athletic performance. Taking ephedra by mouth with caffeine is no more effective than taking caffeine alone for improving athletic performance.
- It is used for early relief of asthama.
- It use for whooping cough.
- It use fornasal congestion, cough, fever, and chills.

Opium

Synonyms:- Raw opium

Family:- Papaveraceae

Biological source:-

Opium consists of dried latex obtained from the unripe capsules of the plants,
Papaver somniferum.

- **Chemical Constituents:-**

- It contain alkaloids which occurs naturally in the largest amounts are morphine,narcotine, codeine, etc.

- **Therapeutic efficacy:-**

- It used to reduces atherosclerosis
- It used to relief of pain
- It also used in antidiarrheal for common cold and cough and insomnia.
- It works by slowing the movement of the intestines.

◆ *Tea leaves*

Synonyms:- fig leaf, chaipatti, augur, crystal ball gazer

Family:- Theaceae

Biological source:- The biological source of tea is prepared

leaves and leaf buds ***Thea sinensis*** **Chemical Constituents:-**

- The leaves are a rich source of caffeine (1–5%). It also contains theobromine and theophylline in minor quantities.
- The colour of tea leaves is due to tannin (10–20% gallotannic acid).
- The agreeable odour is due to presence of a yellow volatile oil.
- Tea leaves also contain protein, wax, resin and ash.

- **Therapeutic efficacy:-**

- It is used as stimulant, astringent and also as diuretic.
- It used treatment cancer, heart disease, and diabetes; encourage weight loss; lower cholesterol; and bring about mental alertness.
- Tea also appears ties.

◆ *Coffee seeds*

Synonyms

Coffee bean, coffee seed, Arabica coffee, Arabian coffee, Abyssinian coffee, Brazilian coffee.

Family:- Rubiaceae

Biological Source

• The biological source of coffee is its dried ripe seed ***Coffea arabica*** **Linn**

Chemical constituents:

• Caffeine is the main chemical constituent of coffee present in coffee bean.
• Other chemical constituents are tannins, fixed oils and proteins are also present in coffee bean.
• The amount of caffeine present in coffee bean is 2-3 % .
• Amount of tannin is 3-5%.
• 13% proteins and 10-15% fixed oils are present in coffee bean.
• The coffee contain sugars in the form of dextrin, glucose and chlorogenic or caffeotannic acid.
• The seed contain caffeine as the salt of chlorogenic acid and combined with potassium.
• Also contain nicotinic acid.

Therapeutic efficacy:-

- It has cardiotonic action.
- It work as counterirritant, hypnotic and lactagogue.
- Coffee is used in the folk remedy for fever, gout, diarrhea, cough and headache.
- It is also a folk remedy for asthma, atropine-poisoning, jaundice, malaria, migraine, nacrosis, opium- poisoning, sores and vertigo.
- It is used to stimulate diuretic action due to presence of caffeine.
- It also have toxic effect due to CNS depressant drugs.
- It is used as flavoring agent as in ice cream, pastries, candies.

◆ COCA

Synonyms

Coca, Cuca, Cocaine, Folium cocae, Peruvian coca, Truxillo coca, Java coca, Bolivian coca.

Family:- Erythroxylaceae

Biological source:

- The biological source of coca is its dried leaves *Erythrox*

➢ Chemical constituents:

- The major chemical constituent of coca is alkaloids and it is about 0.7-1.5% of total alkaloids.
- It is consist of cocaine, cinnamyl cocaine and alpha-truxilline or cocamine.
- In java coca, tropacocaine and 4 crystalline glucosides are present in addition with other chemical constituents.
- Cinnamylcocaine is the chief chemical constituent of coca.
- Hygrine, hygroline, cuscohygrine , dihydrocuscohygrine and tropacocaine also isolated from the leaves of coca.
- They also contain cocatannica acid.

➢ Therapeutic efficacy:-

- The major chemical constituent of coca, cocaine has stimulant action on CNS.
- Leaves are used to relieve from hunger and fatigue.
- Coca leaves are used as stimulant of cerebral area and muscle stimulant.
- It is especially used during convalescence, to get rid from nausea, vomiting and pains of stomach without upsetting the digestion.
- It also has local anesthetic action on skin and mucous membrane.
- It is used as dental anesthesia and in minor local surgery of eye, ear, nose and throat.
- The chemical structure of cocaine lead many synthetic anesthetics like anesthesia, Novocain and stovain.

❖ Anti-Hypertensives Crude Drugs

- The drugs which are used to treat of high blood pressure are called Antihypertensive.
- Antihypertensive therapy seeks to prevent the complication of hypertension such as strokes and myocardial infarction.
- The word hypertension is derived from hyper above tendere to stretch due to narrowing of peripheral blood vessel.

◆ *Rouwolfia*

Synonyms:- Rouwolfia root, snake-root, chhotachand

Family:- Apocynaceae

Biological source:- It consists of dried roots of the plant known as ***Rouwolfia serpentina***

➢ Chemical Constituents:-

The chemical constituents of rauwolfia are alkaloids. Also it contain phytosterol, fatty acids, Reserpine and rescinnamine are alkaloids which have main therapeutical effect in rauwolfia.
Also it contain indole alkaloids and iridoid glycoside,7-epiloganin, which is a new sucrose derivative.It also contain ajmaline and ajmalicine.

➢ Therapeutic efficacy:

- Rauwolfia has been studied for the treatment of mental diseases,
- Rauwolfia treated migraine headaches effectively

- Rauwolfia has been studied as a treatment for autistic children between the ages of 3.5 and 9 years.
- It leads to generalized vasodilatation and lowering of blood pressure by action on the vasomotor centre.
- It soothes the general nervous system by depressant action on the cerebral canters

❖ Anti rheumatics Crude Drugs

- The drug used to the treatment of rheumatism and known as antirheumatics.
- It can reduce joint damage associated with inflammatory disorders of the joints.

◆ *Colchicum seed*

Synonyms:- Indian Colchicum

Family: Liliaceae

- **Biological source:-** Colchicum consists of dried seeds of the plant ***Colchi-cum autumnale*** **Linn.**

- **Chemical Constituents:-**

Colchicum seeds contain alkaloids, colchicine and demecolcine.

- **Therapeutic efficacy:**

  - Colchicum seed are used in gout and rheumatism.
  - It can control the malignant tumor but are highly toxic.
  - It also in horticulture.

❖ Antidiabetics Crude Drugs

The drug that works to lower abnormally high glucose levels in the blood which are characteristic of the endocrine system disorder known as diabetes mellitus

Or

- The agent used in treatment of diabetes (Diabetes Millitus are known as antibiotics.
- The inability of the body to utilise glucose due to failure of pancreas to secret insulin in sufficient quantity.

◆ *Gymnema*

Synonyms: Gudmar, Madhu nashini

Family: Asclepiadaceae

Biological source: It consist of the leaves of the plant known as ***Gymnema syluestre***

➢ Chemical Constituents:

They contain hentriacontane, pentriacontane, phytin alpha (α)and β(beta)-chlorophyllis, resin, tartaric acid etc.

➢ **Therapeutic efficacy :**

- It used as antidiabetics, stomachia, stimulant laxatives and diuretic.
- It used to treat eye diseases, allergies, constipation, cough,dental caries etc.

◆ *Pterocarpus*

Synonyms: Bijasal, Indian kino tree, Metaborkino Asana, Rakta-chandan

Family: Leguminosae

Biological source: It consists of the juice of the plant
Petrocarpus marsupium

➢ **Chemical Constituents:**

- Pterocarpus contains about 70–80% of kinotannic acid,kino-red, k-pyrocatechin (catechol), resin and gallic acid.
- Kinotannic acid is glucosidal tannin, whereas kino-red is anhydride of kinoin.
- Kinoin is an insoluble phlobaphene and is produced by the action of oxydase enzyme.
- It is darker in colour than kinotannic acid.

➢ **Therapeutic efficacy:**

- It used as astringent.
- It also used as the treatment of diarrhoea.
- It used in dyeing, tanning and printing.

❖ Anti-tumour Crude Drugs

- The drugs are used in the treatment of cancer.
- The cancer or carcinogenic growth is an abnormal mass of new tissue growing of the body.

◆ *Vinca*

Synonyms:- Periwinkle, Vinca rosea, Catharanthus.

Family: Apocynaceae

Biological source:- It is the dried whole plant of

Catharanthus roseus

➢ Chemical constituents :

- Vinca contain indole alkaloids in large amount, mainly vincristine and vinblastine.
- Vinca also contain other alkaloids such as ajmalicine,serpentine and lochnerine as a chemical compound.
- When coupling of indole alkaloids such as catharanthine and vindoline occur, they produce vinca alkaloids.

➢ Therapeutic efficacy:

- It is used to treat lymphomas.
- The Hodgkin's disease is treated by vinca because it contains vinblastin as a chemical constituent.
- Also it helps to treat non-Hodgkin's lymphomas .

❖ Anti Dysenteric Crude Drugs

- The dysentery is usually the bacteria from genus shigella.
- The inflammation occurs because of the exotoxins produced by certain protozoal animals like Amauba shigella and certain ciliate protozoans etc.

◆ *Ipecacuanha*

Synonyms: Ipecac

Family:- Rubiaceae

Biological source :

➢ It consists of dried roots or the rhizomes of ***Cephaelis ipecacuanha***

Chemical Constituents:

- It contain cephalis acuminata and cephalis ipecacuanha,alkaloids, cephalis psychotrine and ematamine.
- The root also contain ipecacuanhic acid, glycoside ipecacuanhin,starch and calcium oxalate.

➢ **Therapeutic efficacy:**

- Ipecac is emetic and used as an expectorant and diaphoretic and in the treatment of amoebic dysentery.
- It is used to treat amoebic dysentery.

- It have local irritant action.
- Ipecac has the property of emetic.

❖ Antiseptics and Disinfectants Crude Drugs

Antiseptics:

- They are chemical agents used to reduce the risk of infection from germs and help stop the spread of disease.
- Antiseptic are applied to living tissues often to the skin in the form of hand rubs or washes.
- Sometimes antiseptics are called skin disinfectants.

One line Definition:-

Antiseptic are chemical agent which are used to kill pathogenic microbes and stop there growth.

Disinfectants :

- Disinfectants are also chemical substance but they are used to kill bacteria and their Spores.
- They are primarily applied to non-living surface such as for cleaning your countertops or tubes and sterilization of instruments are apparatus.

◆ *Benzoin:*

Synonyms: Sumatra Benzoin, Gum Benzoin, Laban

Family: Styraceae

Biological Source: Benzoin is a balsamic resin obtained from *Styrax benzoin.*

Organoleptic Characters:

Colour Greyish to Brown or grey

Odour Aromatic and Characteristic

Taste Sweetish and slightly acrid

- **Chemical Constituents :**

- Sumatra benzoin contains of free balsamic acid and their esters.
- It also contains triterpenic acids like siaresinolic acid and sumaresinolic acid.

- **Therapeutic Uses:**

- It is used as expectorant carminative and diuretic.
- It is also used externally as an antiseptic and protective.
- It is used in the preparation of compound tincture of benzoin.
- It used in cosmetics industry for making soaps, perfumes.
- It is used in flavour agent in pharmaceutical preparations.

◆ *Myrrh*

Synonyms: Gum myrrh, Bol myrrha

Family : Burseraceae

Biological Source: Myrrh is an obtained from *Commiphora molmol.*

Organoleptic Character:

Colour Raddish to Brown

Odour Aromatic

Taste Agreeable

➢ **Chemical Constituents:**

- It contains yellowish thick volatile oil, gum of resin.
- Resin contains ether- soluble resin acid, α, β and γ commiphoric acids.
- **They volatile oil contain terpenes cuminic aldehyde eugenol etc.**

➢ **Therapeutic Uses:**

- It is used as stimulant and an antiseptic. It is also protective.
- Myrrh is astringent to the mucosous membrane
- It used in mouth washes and gargles.

◆ *Neem*

Synonyms: Margosa, Nim

Family: Meliaceae

Biological Source: It consists of leaves and other aerial parts of *Azadirachta indica.*

➢ **Chemical Constituents**: The active ingredients azadirachtin, Salannin and meliantriol.

Neem tree contain different constituents in different part

Seed	Azadirachtin, Salanin, Meliantrol and meliacin
Leaves	Nimbosteral and Quercetin
Bark	Nimbin, Nimbinin, Nimbidin
Neem Oil	nimbosteral Chiefly glycerides of oleic (50%) and stearic 20% acids.

➢ Therapeutic Uses:

- The neem is used in antiseptic and insecticides.
- Neem oil used in fungi.

- They are used in Anti-insect Product.

◆ *Turmeric*

Synonyms: Haldi, Haridra, Indan Saffron

Family: Zingiberaceae

Biological source : Turmeric consist of dride as well as fresh rhizomes of plant known as *Curcuma longa* Linn

➢ Chemical Constituents:

Turmeric contains volatile oil, resin, abundant zingiberaceous starch grains and yellow colouring substance known as curcuminoids.

Turmerone, zingiberene, borneal, cuprylic acid are the other constituents of turmeric oil.

➢ Therapeutic Uses:-

- It is used as antiseptic expentorant.
- It used in colouring agent.

❖ Anti malarials Crude Drugs

Anti malarials drug is used to prevent or treatment of malaria.

Malaria is occurs due to infection by the four species of a

1. Plasmodium Malariae
2. Plasmodium vivax
3. Plasmodium ouale

4. Plasmodium falciparum

The Disease are infected into human body due to bite of female **Anapheles mosquitos.**

◆ *Cinchona :-*

Synonyms : Jesuit's bark, Peruvian bark.

Family: Rubiaceae

Biological source:- It is dried bark of cultivated trees of cinchona *Calisaya wedd.*

- **Organoleptic characters:**

Colour Brownish grey to white

Odour Slight and characteristic

Taste Bitter and astringent

- **Chemical Constituents:-**

Cinchona contains alkaloids. It consists of approximately 30 types of alkaloids like:- Quinidine, Quinine, cinchonine,cinchotannic acids etc.

- **Therapeutic Uses:-**

- It is used in stomachic and tonic.
- It used in treatment of antimalaria
- It is used as antiseptic
- It is used to treatment dyspepsia and gastric catarrh.

◆ *Artemisia*

It is also known as mugworts.

Synonyms:- Mugworts, wormwood and sagebrush.

Family:- Asteraceae.

Biological Source:

Artemisia annua is an annual herbaceous plant of the Asteraceae. *Artemisia annua* (L.)

Chemical constituents:

The main constituent of the plant is artemisinin, It is a promising anti-malarial drug effective against Plasmodium vivax and P. Falciparum. The distillation of aerial parts of the plant also yield essential oil (0.2 - 0.4%) which comprised of many chemical constituents with the major compounds including myrcene (3.8%), 1,8-cineole (5.5%), artemisia ketone (66.7%), linalool (3.4%), camphor (0.6%), alpha-pinene (0.032%), camphene (0.047%), ß-pinene (0.882%), borneol (0.2%) and ß caryophyllene (1.2%).

Uses:

- Thick, raised scars (hypertrophic scars). Developing research suggests that applying a lotion containing mugwort and menthol directly to the skin relieves itching in severe burn victims.
- Stomach problems (colic, diarrhea, cramps, constipation, slow digestion, vomiting).
- Epilepsy.
- Irregular menstrual periods.
- Low energy.
- Anxiety.
- Diarrhea.
- Constipation.

8.17 OXYTOCICS

These are the drugs which have stimulant effects on the motility of the uterus. The uterus is composed of smooth muscles which have all the specialised properties of the same. It shows spontaneous and rhythmic contractions even in the pre-puberty age. But such contractions become more pronounced after full maturity. The variations in the activity are exhibited alongwith menstrual cycle. The contractions of the uterus have the most vital role to play during pregnancy and ultimate expulsion of foetus during parturition.

The uterus is supplied with cholinergic and adrenergic nerves. The cholinergic nerves are represented by pelvic nerves, while adrenergic nerves come through post ganglionic fibres from inferior mesenteric and hypogastric ganglia. The effect of these nerves varies in pregnant and non-pregnant uterus.

Oxytocics have a marked effect on the motility of uterus. The most typical among them are the ergometrine from ergot and oxytocin, an oxytocic principle from posterior pituitary lobe. These are called as clinical oxytocics, owing to their use in therapeutics. Other plant drugs with oxytocic effect are vasaka (vasicine) and cinchona (quinine).

ERGOT

Synonyms: Ergot of Rye; Ergota.

Biological Source:

Ergot is the dried sclerotium of a fungus *Claviceps purpurea* Tulasne, (Family: Hypocreaceae), developed on the rye plant, known as *Secale cereale* Linn. (Graminae). It contains not less than 0.19 % of total alkaloids of ergot calculated as ergotoxine, of which not less than 15 % consists of water-soluble alkaloids of ergot, calculated as ergometrine.

History:

The obstetric use of ergot was known in sixteenth century, but the drug was not widely employed until the nineteenth century. It was first introduced into London Pharmacopoeia of 1836.

Geographical Source:

Ergot is produced in Russia, Portugal, Spain, Germany, Hungary, Yugoslavia and India.

Cultivation and Collection:

Ergot is a fungal growth and infestation of the cereal rye. Due to the infestation, the yield of the food grain rye may even reduce to the extent of 20 %. The ascospores are developed into various colonies in a nutrient medium, diluted with water and sprayed over crops of rye. A good number of sclerotia are produced on each spike of rye which fall on the ground and are collected.

Preparation for Market:

The sclerotia are either collected by hand or separated by putting them in 30 % solution of sodium chloride, wherein ergot floats. The floatation method is very effective and labour saving as compared to other methods adopted commercially. After collection, the sclerotia are dried thoroughly and stored properly in suitable containers.

Life Cycle of Ergot (Fig. 8.65):

Ergot is a fungal growth. Its life cycle is required to be studied so as to produce the drug commercially by artificial means. Ergot completes its life-cycle in three stages of which one is in its host. These stages of life cycle can be described as:

(i) over wintering stage

(ii) stage of sexual reproduction, and

(iii) stage of asexual reproduction.

Fig. 8.65: Life Cycle of Ergot

The sclerotia are produced in the late summer. They fall on the ground in autumn. When the favourable conditions for the germination are available, these sclerotia germinate in the spring to produce small purple coloured stalks which on further growth form a flattened spherical stromatic head at the top. The head of the stroma contains several flask shaped cavities which are known as perithecia. Each perithecium contains several elongated asci. Each ascus contains eight thread-like ascospores. The ascospores come out of the perithecium and get dispersed by the air current. The dispersal of ascospores takes place at the time of flowering of rye plant (the host). The ascospores become entangled with the feathery stigmas of host and produce mycelia which penetrate through the ovary. The mycelia give rise to conidia, produced from the surface of the ovary. The honey-dew is sweet in taste and attracts the insects. Alongwith honey-dew, conidia are carried from one place to another by insects. The stage is either known as the honey-dew stage or sphacelia stage.

In the second stage, hyphae penetrate deeply into the ovary and develop into a mass covering the entire ovary which results in the formation of elongated sclerotium. The stage is known as the sclerotium stage. Sclerotium developes further, attains the maximum size and falls on the ground alongwith the seeds of the host.

Organoleptic Characters (8.66):

Colour : Externally, it is dark violet to black. Internally, it is whitish or pinkish-white.
Odour : Disaggreable and faint.
Taste : Unpleasant.
Size : The sclerotia are 1 to 3 cm in length and 1 to 5 mm in width.
Shape : Sclerotia are fusiform, triangular and usually tapering on the ends.
Fracture : It is brittle with short fracture.

Ear of Rye Sclerotia of Ergot

Fig. 8.66: Characteristics of Rye

Extra Features:

Longitudinal furrows and transverse cracks are present on each surface.

Microscopic Characters: (Fig. 8.67)

The outermost layer of the sclerotium is made up of few thin, flattened, polygonal cells of purple to dark brown colour, while inner part is made up of dense pseudo-parenchymatous cells composed of chitin. The mycelial cells (central region) are round or oval, thick and with high refractive walls. They also contain cells with fixed oil. Sclerotium does not contain starch, calcium oxalate or any of the lignified tissue.

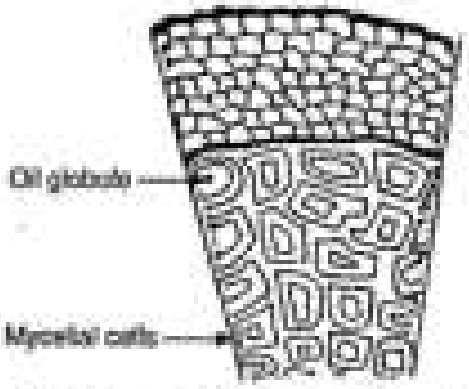


Fig. 8.67: T.S. of Sclerotium of Ergot

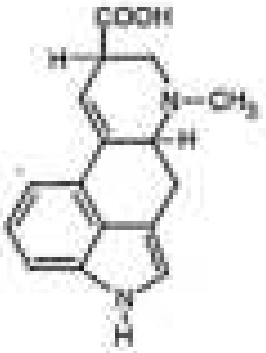
Chemical Constituents:

Ergot contains large number of highly potent indole alkaloids (0.1 to 0.25 %). Six isomeric pairs of alkaloids are known for therapeutic effect. A good quality of ergot should contain not less than 0.19 % of total alkaloids. The alkaloids of ergot are classified in two groups i.e. water-soluble and water-insoluble. The water-soluble group is known as ergometrine group and should constitute not less than 15 % of the total alkaloids of ergot. Rest of the alkaloids of ergot are water-insoluble (ether-soluble). The active alkaloids are laevorotatory, while dextrorotatory alkaloids are therapeutically inactive.

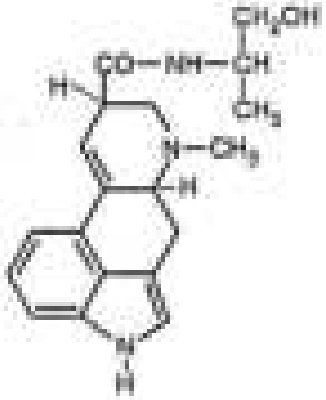
Table 8.9: Properties of Ergot alkaloids

(–) Laevorotatory alkaloids			(+) Dextrorotatory alkaloids
Ergometrine group	Ergometrine	Water-Soluble	Ergometrinine
Ergotamine group	Ergotamine	Water-Insoluble	Ergotaminine
	Ergocine		Ergocinine
Ergotoxine group	Ergocristine		Ergocristinine
	Ergocryptine		Ergocryptinine
	Ergocornine		Ergocorninine

The alkaloids of ergot are the derivatives of lysergic acid or isolysergic acid in combination with amino alcohol or amino acids. The water-insoluble alkaloids of ergot are represented by ergotamine and ergotoxine groups. Ergotamine group consists of ergotamine itself and ergosine, while ergotoxine group consists of ergocristine, ergocryptine and ergocornine alkaloids. In addition to the alkaloids, ergot contains histamine, tyrosamine, isoamylamine, acetylcholine, two colouring substances viz., sclererythrin (red colouring substance) and socalonic acid (yellow colouring substance) and about 30 % of fat. The unsaponifiable matter of the fat contains about 1 % ergosterol and fungisterol. The cell walls of the ergot are made up of chitin.



d-lysergic acid



Ergometrine

Identification:

1. To defatted ergot powder, add 50 % potassium hydroxide solution and heat at 170°C for one hour, cool, wash thoroughly with alcohol and to it add first iodine solution and then 20 % sulphuric acid: violet colour is produced.
2. Extract about 1 g of powdered ergot with 10 ml of solvent ether alongwith 0.5 ml of dilute sulphuric acid. Filter the extract and to the filtrate add approximately 1 ml of cold saturated solution of sodium bicarbonate. The aqueous layer becomes red or violet (due to sclererythrin).
3. In ultra-violet light, ergot powder shows red fluorescence.
4. Extract ergot with chloroform and sodium carbonate and to extract add paradimethylaminobenzaldehyde, 35 % sulphuric acid and 0.5 % ferric chloride solution. A blue colour is produced (ergotoxine test).

Uses:

Ergot is used in labour to assist delivery and to reduce post-partum haemorrhage. Ergotamine is used in the treatment of migraine. Ergometrine is also known as ergonovine in U.S.A. It is oxytocic and produces much faster uterine stimulation than other alkaloids. The

8.18 VITAMINS

These are the substances which are considered to be essential for the maintenance of normal metabolic functions, but are not synthesized by human body on its own, and hence to be supplied from outside sources. It must be noted that the vitamins received through the normal, well balanced diet are not treated as drugs for a healthy person. But, certain conditions like inadequate intake, increased tissue requirements, disturbances in absorption or utilization of vitamins reduce their concentration in the body. This leads to certain deficiency symptoms and in such situation vitamins need to be supplied in chemically pure form or their active concentrates. In such conditions, they are treated as drugs of therapeutic nature. Sometimes, they are also given in prophylactic forms.

The excessive use of many vitamins, especially vitamin D, causes toxic effects.

The vitamins are normally not associated with energy formation. They have an important role in several energy transformation reactions in the body. Sometimes, they resemble hormones in their functions and are required in small quantities. The adults, infants, children, pregnant and lactating mothers require a certain minimum level of vitamins in the food called as Recommended Daily Allowances. Chemically, the vitamins largely differ from each other and are grouped as water soluble and fat-soluble vitamins. The water-soluble vitamins are easily absorbed, highly excreted through urine and not stored in body except vitamin B_{12}. On the other hand, fat-soluble vitamins need bile salts and fats for their absorption, normally not excreted in urine and are generally stored in liver.

Cod liver oil, Halibut liver oil are the sources of vitamin A and D, **shark liver oil** and **carrots**, in the form of carotene are richest source of vitamin A, while **amla** contains vitamin C and **yeast** contains vitamin B complex.

COD LIVER OIL

Synonyms: Oleum morrhi.

Biological Source:

It is processed from fresh liver of cod fish, *Gadus morrhua* and other species of *Gadus* (family - Gadidae).

Geographical Source:

Large quantities of oil consignments are prepared in coastal regions of Norway, Scotland, Iceland, Germany, Denmark and Britain.

Method of Preparation:

The fishes are caught by nets, opened, and livers are separated. The healthy livers free from gall bladders are washed, minced, steamed in steam jacketed vessels or 'kors' at a temperature not exceeding 85°C for half an hour, cooled and buried in snow for several days. Special barrels are used for this cooling process, which results in separation of stearin. The steaming of oil destroys enzyme lipase. The medicinal oil after filtration is kept in well-closed air tight containers in a cool place protected from light.

Description:

Cod liver oil is a pale yellow thin liquid with slightly fishy taste and odour, disagreeable on exposure to air and light.

Solubility:

It is freely soluble in chloroform, ether, carbon disulphide, petroleum ether, and slightly soluble in alcohol.

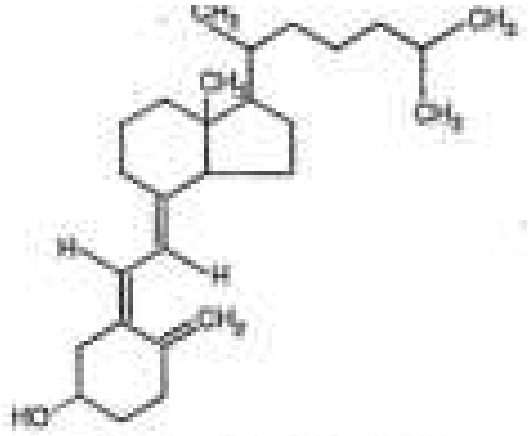
Five major steps involved in refining of medicinal cod-liver oil are (a) removal of impurities, (b) drying, (c) winterization, (d) deodorisation, (e) standardisation for vitamin content. The vitamin A content of the oil is determined spectrophotometrically.

Standards of Quality:

Specific gravity	:	0.918 - 0.927
Refractive index	:	1.4705 – 1.4745
Acid value	:	Less than 2
Saponification value	:	180 - 190
Iodine value	:	145 – 160

Chemical Constituents:

The medicinal value of oil is due to vitamin A and vitamin D. About 1 g of oil contains not less than 255 mcg of vitamin A and 2.125 mcg of vitamin D. The oil contains glyceryl esters of oleic, linoleic, gadoleic, myristic, palmitic and other acids. Cod liver oil also contains 7 % eicosapentaenoic acid and 7 % docosahexanoic acid. (Both of them are omega-3 fatty acids).



Vitamin D3 (Cholecalciferol)

Uses:

The oil is used as source of vitamins, as a nutritive and in treatment of rickets and TB.

As a result of competition from vitamin concentrates, the consumption of medicinal oil has substantially decreased in developed countries of Europe and the USA. The renewed interest in fish liver oils, particularly cod liver oil resulting from nutritional requirements for polyunsaturates in diet, coupled with blood cholesterol reducing property the vistas of trade seem to open ahead for commerce and industry of fish liver oil.

Non-destearinated cod liver oil is the entire oil that has not been chilled to separate stearin. The oil contains not more than 0.5 % by volume of water and liver tissues and it deposits stearin upon chilling.

Storage:

In order to avoid loss of vitamins during storage, the oil should be kept in well-filled airtight containers, protected from light and in a cool place. The addition of small quantities of certain antioxidants (e.g. dodecyl gallate) is permitted. It may be bottled in containers from which air has been expelled by production of vacuum or by an inert gas like nitrogen.

SHARK LIVER OIL

Synonyms: Oleum Selachoids.

Biological Source:

Shark liver oil is the fixed oil obtained from the fresh and carefully preserved livers of various species of the shark, mainly *Hypoprion brevirostris*. In India, Scoliodon, Carcharias and Sphyrna are abundant among the species, and are generally utilised for the extraction purpose. According to I.P., one gram of oil should not contain less than 6000 International Units of vitamin A activity.

Geographical Source:

In India, the sharks (Fig. 8.68) are processed and oil is obtained on commercial scale in Tamil Nadu, Maharashtra and Kerala. Most of the European countries are also producing shark liver oil on large scale.

Method of Preparation:

With a little variation, the principle involved in extraction of the oil from the livers is uniform in almost all cases. Government factories in Tamil Nadu and Maharashtra process livers for extracting the oil. The livers are cleaned and minced. The minced mass is taken to a boiling pot, where the temperature of 80°C is maintained. The oil extracted is treated with dehydrating agent to remove traces of water.

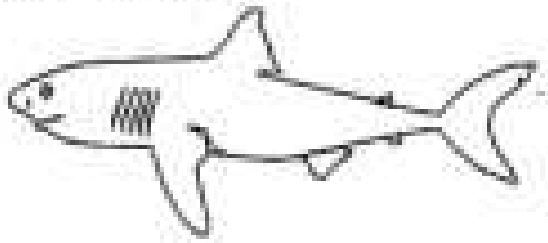


Fig. 8.68: Shark Fish (Carcharias Species)

The oil is then taken to a vacuum still for dehydration and chilled to separate stearin. Centrifuges are used to separate the suspended materials in oil. The clear oil is manipulated to adjust the desired strength. The oil being sensitive to light and air, all the while, care is taken to minimize its exposure to sunlight and air. Many a times, the livers are stored at very low temperature, until they are taken for processing.

Description:

Colour : Pale yellow to brownish-yellow.

Odour : Characteristic fishy, but not rancid.

Taste : Bland or fishy.

Solubility:

Shark liver oil is soluble in solvent ether, chloroform and light petroleum. However, it is insoluble in water and slightly soluble in ethyl alcohol.

Standards of Quality:

The pharmaceutical grade of shark liver oil should comply with the following standards.

Specific gravity : 0.912 to 0.916

Refractive index : 1.459 to 1.477 at 40°C

Acid value : Not more than 2

Iodine value : Not less than 90

Chemical Constituents:

Shark liver oil contains vitamin A. The concentration of vitamin A in the oil varies from 15000 to 30000 International Units of vitamin A activity per gram. Other constituents of the oil are the glycerides of saturated and unsaturated fatty acids.

Vitamin A

Identification:

1. Dissolve one gram of shark liver oil in 1 ml of chloroform and treat with 0.5 ml of sulphuric acid. It acquires light violet colour, changing to purple and finally to brown (due to vitamin A).
2. Dissolve 1.0 ml of shark liver oil in 10 ml of chloroform and treat with saturated solution of antimony trichloride in chloroform. Shake it well. A blue colour is developed (due to vitamin A).

Uses:

It is used in the deficiency of vitamin A. It is also known as antixeropthalmic factor. (However, it should be noted that shark liver oil is free of vitamin D and is required to be fortified when necessary. Due to the absence of vitamin D, shark liver oil is not a vitamin substitute for cod liver oil). It is also nutritive. Pharmaceutically, it is used [illegible]tion of dilute shark liver oil, shark liver oil emulsion (Indian N.F.) and shark li[illegible] D. It is used in burn and sunburn ointments.

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Storage:

Shark liver oil is preserved in well-filled and well-closed containers protected from light and in cool place.

9.19 ENZYMES

Enzymes are the protein substances, which serve a role of catalysing the biochemical reactions.

Although, they are an essential constituent of living cell, they can act independently. They are colloidal in nature, heat-labile, and highly specific in action. Enzymes are sensitive to pH and to particular substances which act as activators. They are classified according to the type of reaction they catalyse. Normally they are named by adding the suffix -ase to a specific substrate upon which they act.

The enzymes are classified into following categories:

1. **Hydr[illegible]ases** for catalysis of hydrolytic reactions.
2. **Transferases** for the transfer of chemical group from one molecule to another.

❖ Enzymes Crude Drugs

Enzymes are the protein substance which server a role of catalysing the biochemical reactions.

They are colloidal in nature, heat-labile and Highly specific in action.

◆ *Papaya:-*

Synonyms:

Family: Caricaceae

Biological source:- it is a cultivated fruiting tree known as *Carica papaya* Linne.

- **Chemical Constituents:-**

It different proteolytic enzymes present in papaya latex are the mixture of papair And chymopapain the proteolytic enzymes acting on polypeptides and amides.

- **Therapeutic Uses:-**

  - It is used for treating Gastro Intestinal tract (GIT) disorders,intestinal parasite infections and as a sedative and Diuretic.
  - It also used for nerve pains.
  - Papaya leaves are used to make medicine.
  - It is used in clarification of beverages and as a meat tenderiser.

◆ *Diastase :-*

Synonyms: Amylose, salivary diastase, malt diastase.

Biological source:

It is one of the amylolytic enzymes present in saliva.

Salivary diastase or ptyalin and pancreatic diastase or amylopsin found in the digestive tract of the animals.

- **Chemical Constituents:**

It Contains dextrin, maltose, traces of glucose and amolytic enzyme diastase.

- **Therapeutic Uses:-**

Diastase from various sources is used as digestant.

It is used in the production of predigested starchy foods and also for the conversion of starch to fermentable sugars in fermentation and brewing industries.

◆ *Yeast :-*

Synonyms:-

Fungus, catalyst, foam, froth, leavening, fermenter.

Family:- Saccharomycetaceae

Biological Source:- Yeasts are very common in the environment, and are often isolated from sugar-rich materials.

- **Chemical Constituents:**

They contains about 65 to 85% of moisture, members of Vitamin B group nitrogenous compounds glycogen, fat and Vitamins.

- **Therapeutic Uses:**

The yeast is used in manufacture of alcohol, beer etc.

It also yeast in bread industry.

◆ *Pancreatin*

Biological Source:-

Pancreatin is a digestive enzyme extracted from the pancreas of certain animals like hog, *Sus scrofa* (Suidae).

Chemical contains:

It is composed of **amylase, lipase and protease**.

Uses:

This medication contains digestive enzymes, which are natural substances needed by the body to help break down and digest food. It is used when the pancreas cannot make or does not release enough digestive enzymes into the gut to digest the food.

Depending on the amount of enzymes in your product, it may be used for indigestion, as a supplement, or as replacement therapy (such as in chronic pancreatitis, cystic fibrosis, cancer of the pancreas, after surgery on the pancreas or gut).

Pharmaceutical Aids Crude Drugs

The drugs and substance which have no or little pharmacological effect but they are essentially used in the preparation of pharmaceutical dosage form like tablet, injection ,emulsion etc.

◆ *Kaolin:-*

Synonyms:- China clay, kaolin umproderesum, porcelain clay.

Source:- kaolin is a purified native hydrated aluminium silicate free from gritty particles.

It obtained by powdering the native kaolin, elutriation and collecting the fraction which complies with the requirements of particle size.

- **Chemical Constituents:-**

  - Kaolin is anhydrous aluminium silicate with a chemical formula $Al_2O_2 2SiO_2 2H_2O$
  - The % composition are as follow.
  - Silicon dioxide, Iron oxide, titanium dioxide aluminium oxide etc.

- **Therapeutic Uses:-**

  - It is treatment for enteritis

- Dysentery and food poisoning
- Used as dusting powder
- Used in pharmaceutical preparation.

◆ *Lonolin*

Synonyms:- wool fat

Family:- Bouidae

Biological source:-

Hydrous wool fat is the purified fat like substance obtained from the wool of *Ovies aries* Linn.

➢ **Chemical Constituents:-**

It contains mainly esters of cholesterol and isocholesterol with caranubic, oleoc myristic, polmitic, lanoceric and lanopalmitic acids.

It also contain 50% water.

➢ **Therapeutic Uses:-**

It is used as water absorbable ointment base.

It used as a common ingredient and base for water soluble creams and cosmetics.

◆ *Bee wax*

Family: Apidae

Biological source:

It is obtained from the honey comb of the bees *Apis mellifeca*.

- **Chemical Constituents:**

  - It contains straight chain monohydric alcohols with straight chain acids.
  - The chief constituents is Myrcin.
  - It also contains free cerotic acid, melissic acid and cerolein.

- **Therapeutic Uses:**

It is also used in the manufacturing of candles, moulds and in dental and electronic industries.

◆ *Acacia:-*

Synonyms: Indian Gum, Gum acacia, Gumarabic.

Family: Leguminosae

Biological source:-

- It is dried for gummy exudation obtained from the stem and branches Acacia arabica.

- **Chemical Constituents:**

  - It is contains of calcium, magnesium and potassium salts of arabic acid.

- **Therapeutic Uses:**

  - Acacia is a demulcent.
  - It is also administered intravenously in haemolysis.

- It is used as a suspending agent specifically in mixtures with resinous.

◆ *Tragacanth:-*

Synonyms:- Gum Tragacanth, Tragacanth

Family: Leguminosae

Biological source:

It is dried obtained by making incisions on stems and branches of *Astragalus gummifer.*

➢ **Chemical Constituents:**

- It consists of tragacanthic acid, xylose fructose, galactose, galacturonic, Rhamnose in small quantities.
- It is also contain starch and cellulose.

➢ **Therapeutic Uses:**

- It is used as a demulcent and an emollient in cosmetics and also in the confectionery.
- It is used as thickening, suspending and emulsifying agent.
- It is used as binding agent in tablet and capsule.

Sodium alginate:-

Synonyms: Algin, Sodium Polymannuronate.

Family: Phaeophyceae

Biological source:

The common species are *mocrocystis pyrifera, laminaria hyperborea,lami-naria digitata, Ascophyllum nodosum and Durvillaea tessonia.*

- **Chemical Constituents:**

It consists the sodium salt of alginic acid a linear polymer of L-guluronic acid and D-mannuronic acid.

Mannuronic acid is the major components.

- **Therapeutic Uses:**

  - It is used in food industry.
  - It is used as thickening agent, gelling agent emulsifier stabilizer, texture improve.
  - It is used in ice cream, jelly, beer, etc.

◆ *Agar*

Synonyms: Agar-agar, Japanese-Isinglass.

Family: Rhodophyceae

Biological source:

It is the dried gelatinous substance obtained from *Gelidium amansie*.

- **Chemical Constituents:**

Agar consists of two different polysaccharides named as agarose and agaropectin.

It contain cellulose and nitrogen and other chemicals.

- **Therapeutic Uses:**

  - Agar is used as an emulsifying agent and bulk laxative.
  - It is used in preparation of jellies.
  - It is used in preparation of bacteriological culture medium.

◆ *Guar gum :-*

Synonyms: Guar flour, jaguar gum.

Family: Leguminosae

Biological source: It is the powder of endosperm of seeds of *Cyamopsis tetragonolobus* Linn.

- **Chemical Constituents:**

i. Carbohydrate

ii. Gum- Guaran, the water soluble portion of the gum and yields on hydrolysis galactose 35% and mannose 60-65%.

iii. Small quantity of protein.

- **Therapeutic Uses:**

  - It is also reduces blood glucose concentration in diabetic patients and serum concentration in hyper lipidaemia.
  - Protective colloids.

- Used as binding agent and disintegrating agent in tablet formulations.
- In bulk laxatives.
- As appetite depressant.

◆ *Gelatin:-*

Biological source: It is a product obtained by partial hydrolysis of collagenous materials.

➢ **Chemical Constituents:**

Gelatin contains protein know as glutin.

➢ **Therapeutic Uses:**

- Gelatin is used as a valuable dietary supplement.
- It is used as the preparation of candies, jellies, meat extracts, and as a thickener in jams etc.
- It is used as an antidote foor halogen poisoning.

Miscellaneous Crude Drugs

◆ *Squill*

Synonyms: Sea onion, sqring squill, sea squill, scilla.

Biological source:

Squill consists of the dried slices of the bulb of white varity of *Urginea maritima* Linn.

➢ Chemical Constituents:

Squill contains cardiac glycosides of buffadienolides types scillaren A and B and enzymes scillatenase.

The other chemicals present in proscillaridin, flavonoid, mucilage, volatile substance and sinistrin.

➢ Therapeutic Uses:

- It is used in asthama.
- It is a potential substitute for foxglove in aiding a failing heart.
- It is used in pest control as rat poison.
- It is longely used for its stimulating, Expectorant and diuretic properties and is also a cardiac tonic.
- It is used to relieve edema, thin mucusa, and vomiting.

◆ Galls

Synonyms: Acimony, animosity, arrogance, bitterness, brass.

Family: Anacardiaceae

Biological source:

Galls are vegetable outgrowths formed on the twigs of dyer's oak *Quercus infectoria*.

Chemical Constituents:

It contains tanins known as gallotannic acid, gallic acid, ellagic acid, sitosterol methyl betulate starch, calcium oxalate and other chemical syringic acid.

Uses:

- It is used as astringent.
- It is used for tanning and dyeing.
- It is also used in the manufacturing of ink and tannic acid.

◆ Pale catechu

Synonyms: Gambier, Catechu

Family: Rubiaceae

Biological source:

It is an aqueous extract prepared from the leaves and young shoots of *Uncaria gambier* Roxburgh.

Chemical Constituents:

It contain catechin, catechu, tannic acid and catechu red, Quercetin and Gambier fluorescein.

Uses:

It is used as astringent.

It is used in leather and fabric industry.

◆ *Ashwagandha:*

Synonyms: Balya, Vajikari, vajigandha varahakarni, hayagandha, kushthagandhi.

Family:- Solanaceae

Biological source:

It consists of the dried roots and stem bases of *Withinia somnifera* Dunal.

➢ **Chemical Constituents:**

Ashwagandha contain the alkaloid withanine as the main constituent and somniferine, pseudo with anine, tropine, hygrine and steroid lactones.

➢ **Therapeutic Uses:**

- They are used in treatment of nervous disorders.
- It used to treat intestinal infection and leprosy.
- It is also used to treat nervous exhaustion, dedility, insomnia wasting diseases, failure to thrive in children etc.
- It is used in treatment of infertility.

◆ *Vasaka*

Synonyms: vass, vasaka sinhasya, adulasa.

Family: Acanthaceae

Biological source:

Vasaka consists of dried as well as fresh leaves of the plant *Adhatoda vasica* Nees.

➢ **Chemical Constituents:**

They contain very small amount of essential oil and quinazoline alkaloids.

➢ **Therapeutic Uses:**

- It used as bronchodilator
- It used to preparation of syrup act an Expectorant.
- Vasicine shows oxytocic property like oxytocin and methyl ergotamine.

◆ *Tulsi*

Synonyms: Sacred basil, Holy basil

Family: Lamiaceae

Biological source:

It consists of fresh and dried leaves of *Ocimum sanctum* Linn.

➢ Chemical Constituents:

It contains isothymusin, Ursolic acid, eugenol, and sinapic acid, rosmarinic acid etc.

➢ Therapeutic Uses:

- It is use to treat heart disease and fever.
- It is used to treat respiratory problems.
- It is used to treat insect bites.
- Tulsi leaves are used to Treatment of skin problems like acne blackheads.

Plants Fibres Used As Surgical Dressings

Surgical dressing- The word surgical dressing is used to include all the materials either used alone or in combination to cover the wound.

The purpose of application of dressing is to protects the wound and favour its proper healing.

Dressings Are Meant For Following Functions.

- To reduce the microbial contacts and protects the infections.
- To provide the mechanical support and healing the tissue.

Classification Of Surgical Dressing

A- Fibres

1- Non medicated fibres.

Ex- absorbent cotton, wool, silk etc.

2- Medicated fibres.

Ex- Capsicum wool

B- Fabric

C- Bandages

D- Rubber and oil impregnated materials.

❖ COTTON-

Synonyms- Cotton wool, surgical cotton, absorbent cotton, purified cotton.

Biological source- Cotton consists of the epidermal trichomes or hairs of the seed of cultivated plant *Gossypium herbaceum* and other Gossypium species.

Family- Malvaceae

Geographical source- Cotton is produced commercially in U.S.A , Egypt, and India. It is also cultivated in various part of Africa and South America.

- **Cultivation and collection -**
  - The plant after flowering bears fruits known as capsule. The fruit are 3 to 5 celled and each capsule contain numerous seeds. The seed covered with hairs are known as bolls.
  - The bolls are collected dried and taking to the ginning press, where in the trichomes are seperated from the seed and contains long and short hairs.
  - Short length hairs are known as linters and are used in the manufacturing of absorbent cotton, and long hair are used in cloth preparation.
- **Chemical Constituents-** Raw cotton contains about 90% of Cellulose 7 to 8
  % of moisture, wax, fat and remains of protoplasm. Purified cotton is entirely cellulose,with 6 to 7 % of moisture.
- **Chemical Tests-**
  A. Cotton is insoluble in dilute NaOH solution and HCl, it is soluble in 66% of H_2SO_4.
  B. With iodinated ZnCl solution, it becomes violet coloured.
  C. 0.1g of sample add 10ml of ZnCl solution and heat to 40°c fibres do not dissolve.
- **Uses/Applications**
  - Cotton is used as a filtering medium in surgical dressing.
  - Absorbent cotton absorbs blood, mucus, pus, and prevent wounds from infections of microbes.
  - It is also used as an insulating materials.

❖ SILK-

Synonyms - fabric, sarsenet, textile.

Biological source- These are the fibres obtained from the cocoons of ***Bombyx mori*** and other species of Bombex and also from Antheraea species.

Family- Bombycidae.

Order- Lepidoptera.

Geographical source- Fine quality of silk is manufactured in Japan, Italy, China,and France. Now a days large quantity of silk is also prepared in India.

➢ Preparation Of Silk-

- The larva of silkworm produce silk fibroin fibres from the gland in their mouth
- This fibroin gets United with a gum like secretion known as sericin and forms cocoon.
- These cocoons are not allowed to grow further into an insect, but are heated to 60 - 80° C by exposing them to stem.
- The exposed cocoons are put into hot water to dissolve the gum and to seperate the fibres.

➢ Chemical Constituents -

Silk contains a protein is known as fibroin. Fibroin on hydrolysis yields amino acids glycine and alanine.

➢ Uses/Applications-

- It is soft smooth lustrous and holds a prestigious place among textile fibres and known as 'Queen of textile'.
- Raw silk is used for clothing such as shirts, suits, ties, blouses, pajamas etc.

Storage Conditions- It needs to be stored in cool place. Exposure to light causes its darkening and bleaching reduces its tensile strength.

❖ WOOL

Synonyms- fleece, coat, woollen hair.

Biological source- Wool fibres are obtained from the fleece of sheep ***Ovis aries***.

Family- Bovodae

Order- Ungulata.

Geographical source- Large quantities of wool are manufactured in Australia, Russia, Argentina, USA and also in India.

➢ Preparation of Wool Fibres-

The hairs forming the fleece of the sheep are removed at shearing time. They are then processed to remove the wool fat and dirt. The clean and defatted wool is subjected to bleaching, washed again and dried.

➢ Chemical Constituents-

Chemically wool contains sulphur containing protein is known as keratin. Keratin is rich in amino acid cystine

➢ Chemical Tests

Take 0.5g sample in chloroform and add 1ml acetic anhydride and 2 to 3 drops of sulphuric acid then deep green colour indicate the cholesterol presence.

➢ Uses/Applications-

It is used as water absorbable ointment base. It is the common ingredients in the water soluble cream and cosmetics.

It is widely used in the winter clothes preparation like sweaters, winter coat, cap etc.

❖ Regenerated Fibres-

Regenerated fibres are made from the cellulosic parts of the plants by dissolving in chemicals.

They are partially natural and partially synthetic, as a chemical is needed to extract these fibres.

Rayon

Synonyms- Regenerated cellulose, viscose rayon.

Source, Preparation And Chemical Constituents-

- It is an artificial fibre composed of regenerated cellulose in which substituents have replaced not more than 15% of hydrogen of hydroxyl groups. Now it is produced exclusively by the viscose process
- The cellulose of coniferous wood in the form of pulp is processed to give viscose rayon. The pulp contain about 80- 90 % of cellulose and hemicellulose. The cellulose is treated with sodium cellulosate. It is further treated with carbon disulphide and sodium hydroxide to produce viscous solution of sodium cellulose xanthate.
- After ripening, this solution is forced through the fines nozzles into the both of sodium sulphate and sulphuric acid to give continuous filaments.The filaments are drawn together to form the yarn.
- The yarn is desulphurized bleached, washed, twisted and then dried. Rayon contains about 10% moisture and does not loose the absorbency on storage like cotton.

➢ Uses/Applications-

It is mainly used for making fabrics preparation of surgical dressing and viscose rayon absorbent wool.

❖ Sutures

These are the sterile threads, strings or strands specially prepared for use in surgery meant for sewing tissue together. SUTURES must possess the following properties.

A. A-They must be sterile and should cause no irritation.
B. B- They are intended to be used for one occasion only.
C. C- If absorbable, their time of absorbation must be known.

➢ Preparation-

Sutures may be prepared from intestinal tissues and tendons of animals and birds,Vegetable fibres, camel hair, human hair, synthetic threads or metallic wires.
Depending of absorbation character it is divided into two parts-

1- Absorbable

2- Non absorbable

3- Haemostatics.

❖ Surgical Catgut

Catgut is a type of string or cord that is prepared by the natural fibers, present in the cattle intestine. First time it is prepared by the sheep intestine fibres. It is also prepared by the many cattles intestine like goat, horses, donkey, etc.

Catgut sutures finally treated with the chromium salt solutions to resists body enzymes and slow down their absorbation process, this sutures are widely used in surgical procedure and it is known as chromic catgut sutures.

Nowdays catgut are also prepared by synthetic absorbable polymers such as vicryl and polydioxanone.

➢ Ideal Characteristics of Sutures-

- Easily degraded by the proteolytic enzyme.
- Easily absorbable by the body.
- Do not cause any irritation and allergic reaction.
- Not shows any chemical reactions to the body chemicals.
- Maintain the tensile strength upto tissue healing.

➢ **Uses/Applications**

- Catgut sutures are used in the surgical process at any accidental/trauma condition for blocking the excessive bleeding.
- Also used in other surgical process like- tissue replacement, during delivery of baby, Cancer surgery, for wound healing.

❖ **LIGATURES**

Ligatures are specially prepared and sterilized threads which is used without a needle for tie the blood vessels and other tissue together.

Stainless steel ligatures- these are used for the tooth aligning and leveling.

Traditional System of Medicine

- It is a well-known fact that Traditional Systems of medicines always played important role in meeting the global health care needs.
- They are Ayurveda, Siddha, Unani and Homoeopathy. Though Homoeopathy came to India in 18th Century, it completely assimilated in to the Indian culture and got enriched like any other traditional system hence it is considered as part of Indian Systems of Medicine (Prasad, 2002).

1. Ayurveda -indian system of medicine

- Ayurveda, a natural system of medicine, originated in India more **than 3, 000 years ago.**
- The term Ayurveda is derived from the Sanskrit words ayur (life) and veda (science or knowledge). Thus, Ayurveda translates to knowledge of life. Based on the idea that disease is due to an imbalance or stress in a person's consciousness, Ayurveda encourages certain lifestyle interventions and natural therapies to regain a balance between the body, mind, spirit, and the environment.
- Ayurveda is based on the hypothesis that everything in the universe is composed of five basic elements viz. Space, air, energy, liquid and solid .
- They exist in human body in combined forms like VATA (space and air), PITTA (energy and liquid)
- and KAPHA (liquid and solid) .
- Vitta,pitta and kapha together are called Tridosha (three pillers of life).
- It believed that they are harmony with each other , but in every human being one of them is dominating which ,in turn is called saptadhatu viz. Rasa(lymph) ,Rakhta (blood) ,meda (adipose tissue) , mamsa (flesh) , majja (nervine tissue) , shukra (reproductive tissue) and asti (bones) .

Authentic information on ayurveda has been complied by ancient indian

- Some important herbs in Ayurveda are RAUWALFIA SEPENTINA ,CASSIA ANGUSTIFOLIA, PIPER LONGUM, etc.

2. Unani system of medicine -

- The roots of this system go deep to the times of the well known ***greek philosopher Hippocrates*** who is credited with it .
- **Aristotle Golen - philosopher " father of natural history "** made valuable contributions to it .this system of Greek origin was further carried to **Persia(Iran),** where it has been improved by **Arabian physicians** .
- The history of Unani medicine can be characterized by the work of its practitioners, or hakims, who relied on natural healing based on principles of harmony and balance, uniting the physical, mental, and spiritual realms.
- They believed that these principles are responsible for the body constitution and its health , as well as , the diseased conditions.
- The Unani system of medicine aims at treating the cause of disease and not its symptoms. For this purpose , thorough history of the patient is recorded in addition to his pulse , urine and stool examination .
- **Unani medicine : Madar, fuful, kabab chibi , sana Zeera.**

3. Siddha system of medicine -

- The term "siddha" means achievement and 'siddhars' were saintly personalities, who attend proficiency in medicine through practice of bhakti and yoga . according to traditional belief Lord Shiva unfolded the knowledge of medicine to his wife parvati which was then passed to Siddhars.
- Siddha practitioners believe that five basic elements– earth, water, fire, air, sky – are in food, "humours" of the human body, and herbal, animal or inorganic chemical compounds, such as sulfur and mercury, used as therapies for treating diseases.

- The identification of causative factors of disease is done through pulse reading , colour of body, study of voice ,urine examination, status of digestive system and examination of tounge.
- Few natural drugs used in siddha system of medicine are :
  - **Abini (papaver somniferum)**
  - **Ethi(Strychnos Nux-vomica)**

4. Homoeopathic system of indian medicine -

- It was developed in the late 1700s in Germany. It's common in many European countries, but it's not quite as popular in the United States.
- In comparison to other traditional system of medicine , homoepathy is a newer one and has been developed in the eighteenth century by Samuel Hahnemann - he proposed that the cause of disease itself can be used for its treatment .
- Homoepathy is a medical system based on the belief that the body can cure itself. Those who practice it use tiny amounts of natural substances, like plants and minerals. They believe these stimulate the healing process.
- In the homoepathy system ,the drug treatment is not specified , but the choice of drug depends on symptoms and the clinical condition of the patients .this is based on the concept of proving and prover.
- The drug are extracted in the form of mother tincture , which is further diluted in terms of decimal or centesimal potencies .

Various medicinal plants used in homeopathy are :

Vegetable drugs - Arnica, Belladonna, Opium , Nux-vomica

Animals drug - Honey -bees, Calcium carbonate, Cantharis

Minerals and metals - Kalashisa, sulfur, Copper, platinum.

Role of medicinal and Aromatic plants in national economy-

- The wealth of India is stored in the enormous natural flora which has been gifted to her, Endowed with a wide diversity of agro-climatic conditions, India is virtually herbarium of the world,
- Medicinal and Aromatic Plants (MAPs) contribute to the local and national economy and become the source of the cash for the rural livelihood at the hard time. The financial contribution made by Non-Timber Forest Products (NTFPs), especially medicinal plants, is significantly higher as compared to the timber products
- because of vast areas and variety of agro-climates in India, a large number of medicinal and aromatic plants are found growing wildly. India, with her varied climatic conditions and topography has been considered as " Botanical Garden of the World" and this botanical wealth constitutes more than 2200 species of medicinal and essential oil containing plants, regularly.
- The importance of medicinal and aromatic crops in the national economy and their potential for the rapid growth of phytopharmaceuticals, perfumery and allied industries in India has been emphasised from time to time. It is felt by experts that the drugs of natural origin with their wide range of action shall play an important role in health care particularly, in the rural areas of India
- Indian senna (Cassia angustifolia) is commercially cultivated in Tirunelveli, Madurai and Ramanathapuram districts of Tamil Nadu. The cultivation is also reported on small scale in Cudappa district of Andhra Pradesh. When grown for leaves alone under irrigated conditions, the yield obtained is 300 kg of dry leaves and 50 kg of dry pods per hectare.
    - The annual indigeneous production of Neem and Mahua oils is 3 lakh tonnes and 50 thousand tonnes respectively.
    - India is one of the few countries in the world where the essential oil industry was developed at a very early stage. The essential oils, perfumes and flavours have been associated with the Indian civilization for several thousand years. Because of availability of vast area and a variety of soil and

climate, essential oil bearing plants of all types can be grown in one or the other areas of the country.

- As a result of agrotechnology developed by the Central Institute of Medicinal and Aromatic Plants, Lucknow and Regional the Research Laboratory, Jorhat, Cymbopogon winterianus (Java citronella) is now being commercially cultivated in the states of Assam, Uttar Pradesh, West Bengal,Karnataka, Tamil Nadu and Maharashtran.

Their export potential-

- The export of medicinal plants and herbs from India has been quite substantial in the last few years. India has been the major supplier of medicinal plants in the world market till 1976 when it was relegated to the second position by South Korea. With exports worth only Rs. 15 crores during 1978-79, the quantum of export has dropped to almost half of what it was in 1976-77, when India exported medicinal plants worth of Rs. 29 crores.
- With development of phytochemical industry in India, domestic requirements for various medicinal plants grew considerably. Consequently,the Government of India has adopted restrictive export policy in respect of those crude drugs which were indiscriminately exploited in the forests.) In accordance with the policy, the exports of rauwolfia, podophyllum, Indian rhubarb, dioscorea, saussurea, etc. from India were restricted. The exports of these drugs are, however, permitted by firms obtaining certificates from the Chief Conservator of Forests or officer authorized by him that the material is of plantation or nursery origin.

Method of Preparation of Ayurvedic Formulations

- Ayurveda medicine is a system of healing that originated in ancient India.

Ayu: Life or Living

Veda: Knowledge

- So, Ayurveda has been defined as the knowledge of living or the "Science of Longevity".

Ayurvedic formulations:

- Different solvent (Menstrum) used in preparation of Ayurvedic formulation are water, oils, milk,Ghee, Cow's urine etc.
- The use of sweetening agent, binding agent, colorant, flavoring agent and other adjuvant is also very common in ayurvedic preparation.
- With an objective of obtaining maximum therapeutic benefit & making the formulation palatable different Pharmaceutical process are prescribed in Ayurveda.
- According to drugs & cosmetic Act 1940, Ayurvedic medicine includes all medicines intended for internal or external use, in the diagnosis, treatment and prevention of disease or disorder in human beings or animals.

Types of Ayurvedic formulation:

It is divided into 2 parts.

1. **Classical Ayurvedic medicines:** These medicines are present in traditional Ayurvedic text books such as-
    - Charaka Samhita, Sushruta Samhita the manufacturing company follows the same formula and prepare medicines.
      Example: Bhasma, Aswas, Arishtas, & Taila etc.
2. **Proprietary Ayurvedic medicines:** It is also called as patient medicine or modern Ayurvedic medicines. Their formula, Dosage form are decided by the manufacturing company &ingredients used in these preparation are not found in traditional Ayurvedic text books.

- Every company has its own formula and conducts clinical trial, research on the medicine about its efficacy.
  Example: Capsules, Syrups etc.

Types & Forms of Ayurvedic Formulations:

1. Solid Dosage Form- Gutika, Churna
2. Semi Solid forms- Avaleha & ghrita
3. Liquid dosage forms- Asava, Arista & Taila

Aristas & Asavas:

- They are also known as preparations contain self-generated alcohol (alcoholic preparations).
- They are prepared by adding powdered drug or its decoction into solution of sugar/
  Jaggery which facilitates the extraction of active principles present in the drugs.

Preparation of Aristas:

Crude drugs are coarsely powdered

Decoction is prepared

Filtered

Mix other ingredient

Contents are added to solution of sugar honey or jaggery

Boiled cooled and transferred to wooden vessels

Covered with an earthen lid

Fermentation

Filtered

Preparation of Asava:

Drugs is fine powdered

Mix with other ingredients

Added solution of sugar, jaggery or honey

Mix Well

Boiled cooled and transferred to wooden vessels

Covered with an earthen lid

Fermentation

Filtered

Stored

Standardization for Aristas & Asavas:

1. It should be clear without any froth or foam at the top.
2. It should not become sour upon standing.
3. It should have a characteristic aromatic and alcoholic odour.
4. These should be no effervescence produced.

Example:

Aristas: Ashokarishta, Dasmularishta,Ashwgandharista, arjunarista,

Asavas: Arvindaswa, kumaryaswa, Vasakasava, Punarnavasa etc.

Gutika

- These are medicines in the form of tablets (Vati) & Pills (Gutika). They contain single or combinations of herbal mineral or animals' drugs.

Preparation of Gutika:

Take the drugs and make the fine powdered

Mineral drugs are converted into calcined products (Bhasmas)

Drug & Other ingredients are mixed

Made into soft paste with specified liquids

Properly ground & made into vati (Tablets) or gutika (Pills)

Standardization for Gutika:

1. It should be stable upto 2 years after preparation.
2. It they contain only mineral ingredients. They can be used indefinitely.
3. They should not lose their original colour, odour, taste & form upon storage.
4. If they contain sugar/ salt they should be protected from moisture.

For Example: Pranda Gutika, Khadiradi, Lasunadi gutika.

Taila

- Taila is the liquid or semisolid dosage form of medicament which is meant for internal &External use.

Preparation of Taila:

Take drugs and make fine powdered

Sneha Kalpa/ Paka paste of drugs and cooking oil is added

Mix with other ingredients

Boiled 1/4th part of the oil and liquid (drava) should be 4 time of oil.

Cooked, Stirred constantly to the paste at the bottom & prevented for getting charred

Boil it on moderate heat till the oil became free from water

Oil properly cooked, large amount of foam appear at the surface of the oil.

Filtered & Stored

Standardization for Taila:

- It can be used internally & topically.
- They retain potency for about 16 months.
- They are taken internally with warm water or warm milk.
  For Example: Bhringaraj tail, Maha Narayantaila, Lagnvisgarbha taila.

Churna

- They contain single or combination of drugs along with other ingredients in a powder's forms.

Preparation of Churna:

Finely powder raw materials are cleaned

Dried & Crushed

Sieved to get uniform size particles

Mixed to get a uniform powder

Churna must be packed in an air tight glass container

Standardization of Churna:

1. Churna should be free flowing powder and should not adhere or moist.
2. Churna are stable upto one years if they are stored properly.
3. Finer the powder, better is its potency and therapeutic value.

Example: Triphala churna, trikatu churna, Drakshadi churna etc.

Lehya/ LEHA

- They are semisolid preparations made by boiling the powdered drug. Extract with a solution of sugar or jaggery.

Preparation of Leha:

Sugar/jaggery is dissolved in a liquid

Boiled & Filtered

Powdered drugs/ Extract along with other ingredients are added

Continuous stirring to form a homogeneous semisolid

Ghee or oil is also added

While the preparation is hot

Standardization of lehya/leha :

1. It should neither become hard or liquefy
2. There should be no growth of fungus over it.
3. It should not be change its colour odour and taste.
4. They can be used upto one year if properly stored.

Example: Chyavanaprasa, etc.

Bhasma

These are the powdered form of drugs prepared by calcination (heating the solid in air) to changes its original form of metals, minerals or animal products known as bhasma.

Preparation of Bhasma:

These are prepared into two stages.

1. **Sodhana**
2. **Marana**

1. **Sodhana:** it is a process of purification of metals, minerals by heating them and immersing in a specific liquid this is done for remove its toxicity.
2. **Marana:** Second stage of preparing Bhasma is which the purified drugs obtained from sodhana process are grounds and mixed with plants Extract.
    - After specified time, small cakes are made (Dried in sunlight)
    - Dried cake is kept in earthen vessels sealed with clay smeared cloth.
    - Pit covered with cow dung and the fire is put on all the sides.
    - The contents are removed and ground into a fine powder and stored.

Standardization of Bhasma:

- Bhasma are grey, whitish, yellowish or black coloured powders.
- They are highly stable for long periods.
- They should not their potency.

Example: Suvarna bhasma, shankha bhasma, taura bhasma.

Role of Medicinal and Aromatic Plants in National Economy

Introduction:

- The term medicinal plant include various types of plant used in herbalism.
- It is the use of plant for medicinal purpose & the study of such uses.
- The word herb has been derived from the Latin word herbs and an old French word herbs now a days herb refers to any part of plants like fruits, seed, stem, bark, flower, leaf, stigma or a root as well as a non woody plant. Earlier the term herb was only applied to non woody plants including those that come from trees and herbs.
- Among ancient civilization India has been known to be rich repository of medicinal plants. The forest in India is the principle repository of large no of medicinal and aromatic plants which are largely collected as raw materials for manufacturing of drugs and perfumery products.
- Recently WHO, estimated that 80% of people worldwide sly on herbal medicines for some aspect according to WHO, around 21000 plant species have the potential for being used as medicinal plants.
- Medicinal plants such as Aloe, Tulsi, Neem, turmeric and ginger cure several common ailments.
  These are considered as home remedies in many parts of the country. It is known fact that lots of consumers are using bark tulsi, for making medicines, black tea.
- Over the past two decades these has been a tremendous there has been a tremendous increase in the use of herbal medicine however these is still a significant lack of research data in the field.
- Therefore since 1999, WHO has published there volumes of the WHO monograph on selected medicinal plants.

Importance of some herbs with their medicinal values:

- Herbs such as black paper, cinnamon, myrrh, aloe, sandal wood, ginseng, are used to heal wounds sores and boils.
- Basil fennel, cilantro apple mint thyme, oregano, lemon, rosemary, are some important medicinal herbs can be planted important medicinal herbs and can be planted un kitchen garden.
- Many herbs are used as blood purifiers to alter or change a long standing condition by eliminating the metabolic toxin these are also known as blood cleaners certain herbs improve the immunity of the person there by reducing condition such as fever.
- Turmeric is useful in inhibiting the growth of germs harmful microbes and bacteria turmeric is widely used and a home remedies to heal out and wounds.

- To reduce fever & the production of heat caused by condition certain antipyretic herbs such as chiraula, black paper, sandalwood is especially used in arresting is especially used in arresting the discharge of blood mucus etc.
- Herbs such as marshmallow root and leaf they serve as antacids the healthy gastric acid needed for proper digestion is retained for proper digestion is retained by such herbs.
- Indian sages were known to have remedies from animals and snakebites.
- Herbs like cardamom and coriander are renowned for their appetizing qualities other aromatic herbs such as peppermint, cloves and turmeric add a pleasant aroma to the food thereby increasing the taste of the meal.
- Ginger and cloves are used in certain cough syrup, they are known for their expectorant property which promotes the injection of mucus from the lungs trachea and bronchi eucalyptus, cardamom, wild cherry and cloves are also expectorants.
- Herbs such as chamomile, calamus, ajwain, basil, cardamom, coriander, fennel, peppermint & spearmint cinnamon ginger & turmeric are helpful in promoting good blood circulation therefore they are used as cardiac stimulants.
- Certain aromatic plants such as aloe chiryta are used as mild tonic. The bitter taste to such plant reduce toxins in blood they are helpful in destroying infection as well.
- Honey turmeric marshmallow and liquorice can effectively treat a fresh cut and wound they are turmed as vulnerary herbs.

Future economic growth:

- Worldwide approx. 35000 – 70000 species of plants have been used at one time as another for medicinal, nutraceuticals & cosmeceuticals purposes. In India, approx. 1000 plant species in Nepal about 700 species about 700 species in peninsular Malaysia and its neighboring Islands &in Chinese medicine about 9905plant materials are used.
- Thus these is lot of scope in future for new plant based drugs that are still to be introduced and the economic significance of these plant based pharmaceuticals is considered which is based on the cossets based plant pharmaceuticals. The value of potential plant based pharmaceuticals.

- The value of these drug are described both market and economic value.
  Market value is a subset of economic value which includes all benefits to society.

- Economic value represents all the social benefits of particular type of product including market value.

- Economic value can be viewed as an expression of the total benefit of product. The medicinal plants and their products have taken an increasing medical and product categories like health food, cosmetics and personal care products containing natural ingredients the demand for medicinal plants is growing exponentially. The fastest growing world market in herbal products is opening up new opportunities for the developing countries to benefits from the rising green consumerism trend to develop their export potential.

Herbs as Health Food

❖ Nutraceuticals:

Nutraceuticals is defined as a substance which can be considered a food or its part which in addition to its normal nutritional value provide health benefits including prevention of disease or promotion of health.

➢ Therapeutic applications:

They used to improve health, delay the aging process, prevent chronic diseases, increase life expectancy or support the structure or function of the body.

The major disease for the preparation and or treatment where of nutraceuticals have been associated are heart disease, cancer, hypertension and diabetics.

❖ Antioxidants:

- Antioxidant nutraceuticals are those which contain vitamin E, Vitamins C, Vitamin A, and beta carotene.
- They are present in some fixed oils, fruits, vegetables and fishes.
- Antioxidants present in such food are those compounds which either prevent the formation of oxygen free radicals or trap them (Scavenging effect).
- The body defence system against the oxidative damage consists of enzymes such as superoxide dismutases, glutathione peroxidase, catalase and the reducing agent such as glutathione ascorbate and iron.
- Anti-oxidants of oxidation are compounds which retard or prevent the oxidation and in general prolong the life of the oxidizable matter.

➢ Therapeutic applications:

- It is used in treatment of stroke.
- It is used in antioxidants therapy in cancer.
- They protect from heart disease, cancer, anxiety and depression etc.

❖ Pro-biotics:

- These are the living microorganisms which when taken with or without food improve the intestinal microbial balance and in turn functioning of the large intestine.
- These microorganisms exert their efforts by producing substances and conditions which inhibit the growth of harmful bacteria in the large intestine.
- Pro-biotics include bifidobacterium and Lactobacilli species such as L. acidophillus.

➢ Therapeutic Applications:

- It is used in diarrhoea, colon cancer, allergy and cardiovascular disease.

❖ Prebiotics:

- They are the nutraceuticals which promotes the flourishing of probiotics.
- The probiotics microorganism have to survive the digestive enzymes and acids in the upper gut.
- To overcome this problem nutraceuticals in the form of prebiotics are available.
- Prebiotics are the food substance which reach to colon in intact from without getting depleted by gastric pH and digestive acids.
- Prebiotic was described as “a non-digestible food ingredient that beneficially affects the host by selectively stimulating the growth and/or activity of one or a limited number of bacteria in the colon, and thus improves host health”.

➢ Therapeutic Applications:

- Probiotics have been shown to promote health benefits in many diseases related to an unbalanced GIT microbiota.
- Inflammatory bowel disease is a chronic, multifactorial disorder caused by inflammation of the GIT that may induce severe watery and bloody diarrhea accompanied by abdominal pain.
- Irritable Bowel Syndrome
- Helicobacter pylori Infection

❖ Dietary Fibers:

- Fibers are non-digestible polysaccharides found in the plant cell walls.
- They are present in food including fruits, vegetables, grains and legumes. Thus fibers which we eat are called dietary fibres.

Type of dietary Fibres:

They are two types.

1. Soluble dietary fibres: Soluble fibres are partially soluble in water and form gel.

2. Insoluble dietary fibres: Insoluble fibres are insoluble in water and pass through the digestive tract largely intact.

✓ Source of dietary fibres

S.No	**Soluble dietary fibres**	**Insoluble dietary fibres**
1.	Oat-meal	Whole-wheat
2.	Nuts	Carrots
3.	Seeds	Cucumbers
4.	Apples	Barley
5.	Pears	Brown rice

Requirment dose:

- Adult- 30gm/day
- Child - 5 gm/day

➢ Therapeutic applications:

- Fibre has important therapeutic effects on the gastrointestinal tract, and several common disorders that affect North Americans are associated with a low intake of dietary fibre (as well as with the amount of fat in the diet and the extent of exercise taken).

❖ Omega-3 fatty acids:

➢ Biological Source:

- These are found in cold water fishes like cod, salmon, tuna, sardines blue fish, marc kevel and herring.
- These are also reported in cold weather bean-oil plants like flax seed, canola, walnuts, soyabean and freshly ground wheat germ.

➢ Therapeutic applications:

- Omega 3 fatty acids have been found to be useful due to their following activities:
- Suppression of smooth muscle cell proliferation and migration.
- Reduction of LDL and VLDL levels. Decrease in hypercholesteremia and triglyceridaemia.
- Increase in HDL levels.

❖ Spirulina

- It is a Microscopic plant which grows in fresh water (planktonic form)
- Spirulina is a concentrated source of food containing nutraceuticals and contains anti-oxidants, probiotics and phytonutrients.

➢ Biological Source:

- Spirulina is a blue green algae *Spirulina platensis* or *Spirulina maxima*

Family: Oscillatoriaceae

➢ Biological role :

- Spirulina has immuno-stimaulant activities.
- It stimulants the production and activity of bone marrow stem cells, macrophages and T-cells. Spleen and thymus gland shows enhanced function.
- In-vitro studies on spirulina indicate that it enhances cell nucleus enzyme activity and and DNA repair and hence it has possible role in cancer treatment.

➢ Therapeutic applications:

- Spirulina is simple and has fast growth rate since cultivation of spirulina can be undertaken even in waste water, this helps to solve the problem of water pollution.
- Spirulina grows well in sewage water which is best material for bio-degradations.

❖ Soya (Soya bean)

Biological Source:

- These are the fully matured dried seeds of the plant *Glycene-soja* and *Glycine max*.

Family: Leguminosae

➢ Biological role:

- Soya contains low proportion of saturated fat, but is a rare source amongst plants containing omega-3 fatty acids.

- It contains no cholesteral but helps to lower blood cholesteral levels.

➢ Therapeutic applications:

- Dietary fiber is present in soybean in high quantities. Dietary fiber is essential for total body functioning and plays a vital role in the digestive system.
- Soybean contains isoflavones in abundance, which is a vital component of the female reproductive system. When women reach menopause, they experience a drastic drop in estrogen levels.
- Soybeans are a good source of healthy unsaturated fats (with 2 grams MUFA and 5.06 grams PUFA) that can help you lower your cholesterol in the body.

❖ Garlic (Allium sativum)

Family: Liliaceae

- It has been associated with humans and their food since ancient times.
- It is grown and used as food and medicine in all temperate climatic region of the world.
- It contains carbohydrates, protein, high amount of phosphorus, potassium and calcium.

➢ Therapeutic applications:

- It reduces serum lipids levels because it causes

A. Reduction or inhibition of lipogenesis
B. Enhancing break down and excretion of lipids.

- Garlic show antibiotics activity against mycobacterium tuberculosis, Staphylococcus aureus and S. faecalis.
- Garlic is useful in the treatment of amoebic dysentery and parasites like tapeworm and hook worm.

INTRODUCTION TO HERBAL FORMULATIONS

14.1 HISTORY AND CURRENT STATUS

Herbal remedies have been used throughout history, dating back to ancient times. Herbs were utilized in ancient Chinese, Greek, Egyptian, and Indian medicine for a variety of treatments, and Native Americans and Africans use them in their healing rituals as part of their culture. Herbs are one of the most effective therapeutic elements in the Indian Ayurvedic system, as documented in literature such as the Vedas and Samhitas.

Traditional practitioners and herbal remedies are still used by large segments of the public in underdeveloped and developing nations for primary care. Herbal medicines are used by up to 90% of the people in Africa and 70% of the population in India to meet their health care needs. Traditional medicine accounts for about 40% of all healthcare given in China, and traditional medicine clinics may be found in more than 90% of general hospitals. Traditional medicine is not restricted to underdeveloped nations; in fact, with the growing use of traditional medicine, public interest in natural treatments has grown substantially in developed countries during the last two decades. In the United States, in 2007, about 38% of adults and 12% of children were using some form of herbal medicine. Similarly, a survey conducted in Hong Kong in 2003 reported that 40% of the subjects surveyed showed marked faith in Traditional Chinese Medicine compared with Western medicine.

Due to the availability of chemical analysis methods in the early 19th century, scientists started to extract and isolate the phytochemicals and modify active compounds from the herbals. It is estimated that about 25% of the drugs prescribed worldwide are derived from plants, and 121 such active compounds are in use. Between 2005 and 2007, 13 drugs derived from natural products were approved in the United States. More than 100 natural product-based drugs are in clinical studies, and of the total 252 drugs in the World Health Organization's (WHO) essential medicine list, 11% are exclusively of plant origin.

Despite the wide use of synthetic pharmaceuticals globally, they produce numerous undesirable side-effects and relatively more expensive. Nowadays, people are shifting back to herbal drugs, which are originate from nature and claim to be safer.

In India, herbal medicine is a common practice, and about 960 plant species are used by the Indian herbal industry, of which 178 are of a high volume, exceeding 100 metric tons per year. In China, the total value of herbal medicine manufactured in 1995 reached 17.6 billion Chinese Yuan (approximately US$2.5 billion). This trend has continued, and annual revenues in Western Europe reached US$5 billion in 2003–2004. In China, sales of herbal products totaled US$14 billion in 2005, and revenue from herbal medicines in Brazil was US$160 million in 2007. It is estimated that the annual worldwide market for these products approaches US$60 billion.

14.2 HERBAL MEDICINE AND ITS FORMULATIONS

Herbal formulations are a **dosage form consisting of one or more herbs or processed herbs in specified quantities** to provide specific nutritional, cosmetic benefits meant for use to diagnose, treat, mitigate diseases of human beings or animals, and alter the structure or physiology of human beings or animals.

Advantages:

1. Culturally accepted and easily available.
2. Economical compared to modern synthetic medicine.
3. It has fewer side effects because it works through a polypharmacy mechanism.

Disadvantages:

1. Non-stringent regulations allow most of the herbal products to enter the market without being tested for their safety and efficacy.
2. Unavailability of active chemical markers for quality control of herbal formulations.
3. Differences in active chemical constituents of plants collected in different geographical locations, wild sources, and from cultivated forms.
4. The presence of other constituents in an herbal formula affects therapeutic response in many ways.
5. Very few herbal formulas and plants are standardized for their active constituents.
6. Poor practical yields of extracts make them difficult to process.

14.3 CHALLENGES IN HERBAL FORMULATION

1. Plant authentication and geographical variation are always quality concerns.
2. It has fewer side effects because it works through a polypharmacy mechanism.
3. The available toxicological, epidemiological, and other data on herbal formulations is perplexing.
4. It is difficult to follow pharmacovigilance guidelines in case of herbal formulations.
5. Unavailability of herb–drug interaction data.

6. Standardization, safety and efficacy measurement of herbal formulations are a big challenge.

Fig. 14.1 - Types of herbal formulations practiced in India

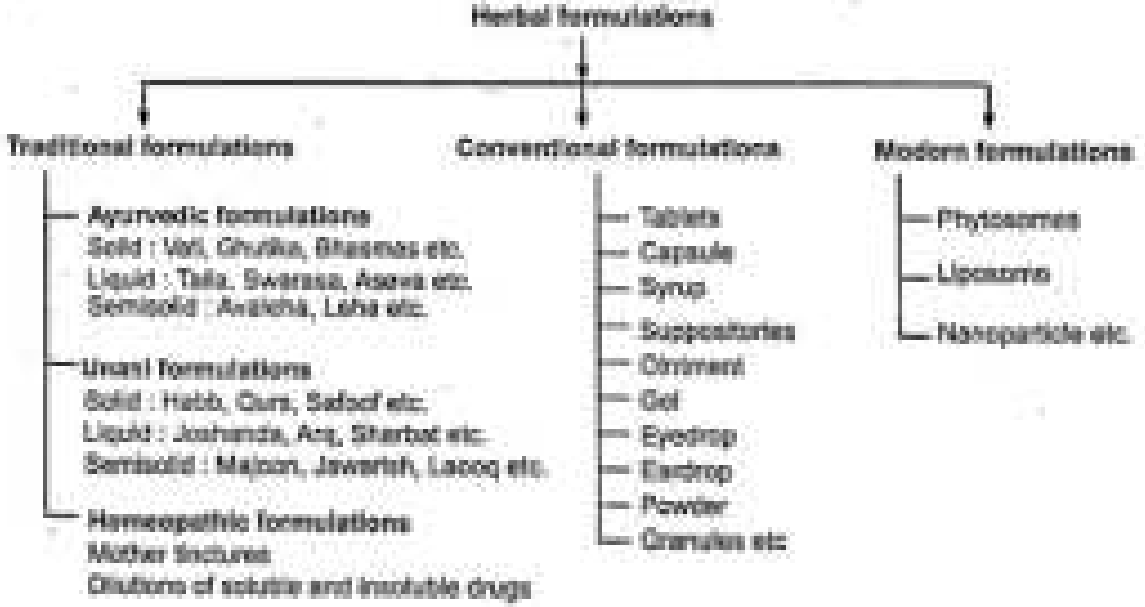

Fig. 14.1: Types of herbal formulations

Preparation of herbal formulations begins with the following processes:

- **Herb selection:** The herb is selected based on its traditional use or phytochemistry, depending on the desired therapeutic effect of the herbal formulation.
- **Collection:** The herbs are collected either from cultivated farms or authenticated herb suppliers.
- **Drying:** It is an important step in the preparation of the herbal formulation. The excess of moisture may cause, deterioration of phytochemicals or promote the growth of microorganisms. Sun, shade, or artificial drying are used to dry the plant material.
- **Grinding:** Plant material is pulverised to various degrees depending on the type of formulation.
- **Extraction:** extraction of herbs is carried out using cold / hot maceration, percolation, etc. Most traditional and conventional formulae are made by mixing the plant material directly, so this step is optional. Plant extracts are employed in modern herbal formulations.
- **Preparation of herbal formulation:** The resultant dried powdered material (plant material or extract) is processed into the suitable dosage forms [illegible] tablets, pills, or ointments etc.

The schematic representation of the various stages involved in the herbal formulation process is shown in Fig. 14.2.

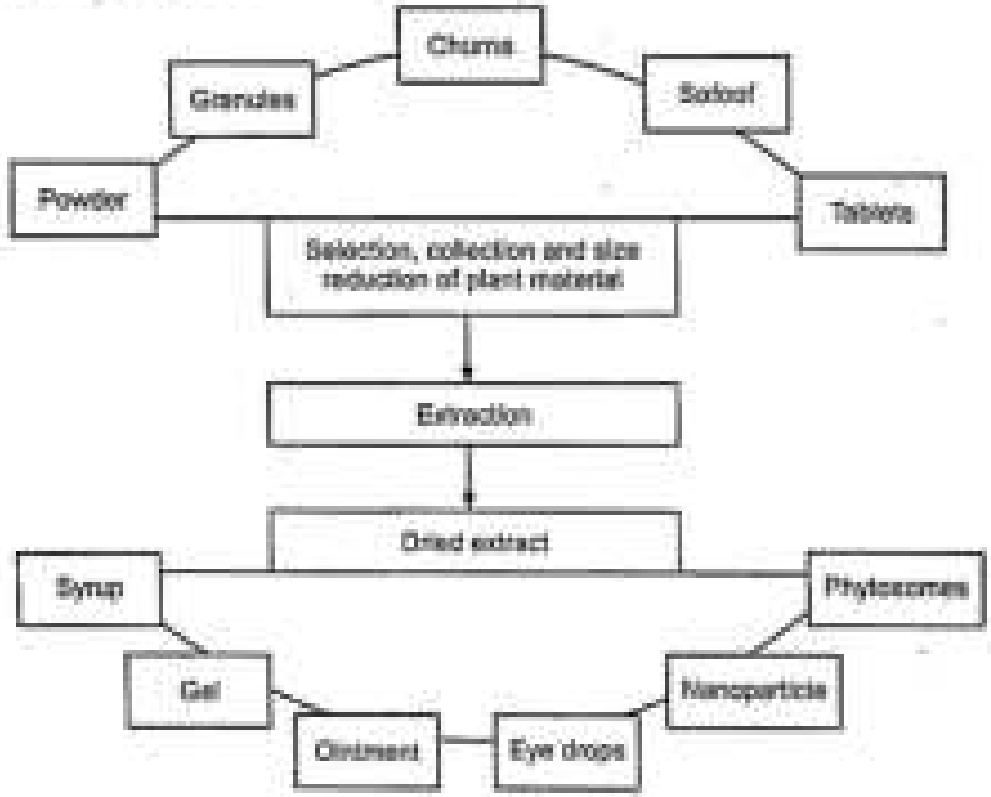

Fig. 14.2

A. Conventional Herbal Formulations:

A large number of conventional herbal formulations are in commercial use. Here a few of them are discussed along with their method of preparation.

Infusion

The dilute aqueous preparation prepared from herbal material is known as infusions.

Infusions are prepared by steeping the herbs along with water for a sufficient period of time. There are two types of infusions, cold infusion and hot infusion. Cold infusions are prepared when herbal active chemicals are volatile in nature or heat sensitive. These are prepared by soaking the herb or herbs in cold water for several hours followed by straining. Hot infusions are prepared by pouring boiling water over the herb or herbs and keeping them covered with a lid for 10-15 minutes. Infusions are ready to use preparations. Their shelf life is not more than 24 hours.

Decoction

Decoction is prepared by boiling the crude drug in water. This formulation is preferred when plant phytochemicals are insoluble in cold or hot water. In the decoction preparation,

crude drug material is boiled in water for a set period of time, which facilitates the solubilisation of phytochemicals in water. The hard tissue drugs, like roots, rhizomes, bark, wood, etc., are used in decoction preparation.

Method of preparation:

1. Approx. 20-40 gm of fresh or dried herb is taken in a closed vessel. 750 ml of cold water is added and subjected to boiling. The process of boiling is given for 20-30 minutes or until the volume is reduced to 500 ml. The resultant preparation is filtered to obtain the decoction.
2. Decoctions are normally prepared for immediate use or used within 24 to 72 hrs.

   Example: Sijunzi Decoction (Traditional Chinese products).

Tinctures:

These are hydroalcoholic preparations made by soaking the herbs in a different strength of alcohol. The alcohol in this preparation facilitates the solubilization of active phytochemicals when compared with infusions and decoctions. They are relatively stronger than these preparations.

Method of preparation:

1. Approximately 200 to 400 gm of herbs in the powdered form are taken in a clean glass vessel and steeped in alcohol (35–55%). Close the vessel and set it aside for 7 to 14 days with intermittent shaking. After a specified period of time, this solution was filtered and the marc was pressed to obtain herbal tincture.
2. The tinctures can be used and last up to 2 years.

   Example: Compound benzoin tincture.

Syrups:

Herbal syrup is a viscous liquid made by mixing a concentrated decoction, infusion, extracts, or expressed juices with a large amount of honey or sugar. The syrup may be flavoured or non-flavoured. The flavour is added to cover up the herb's disagreeable smell and taste. Syrups are sensitive to microbial contamination due to their high sugar content, thus typically contain preservatives.

Method of preparation:

1. Pour the mentioned quantity of decoction, infusion, or extract into a vessel and mix with the desired quantity of sugar. Boil with constant stirring until all the sugar is dissolved and the mixture has a syrupy consistency. Stop the heating and cool the mixture. If honey is mentioned in the formulation, it should be added after the boiling.

2. Preservatives, colourants and flavouring agents may be added.

Examples – Tolu syrup, Adhulsa syrup, etc.

Herbal teas:

This is powdered herbs containing a single or mixture of herbs which are free of contamination. It is usually preferred for soft tissue herbs. These are preparations meant for infusion or preparation to be taken as tea. Prepared infusions should be taken immediately after preparation. Teas stored in airtight containers may last for up to a year, while those stored in tea bags may last for a shorter period.

Examples: Ginger tea, Peppermint Tea etc.

Herbal powder:

These are preparations that come as powdered herbal materials meant for direct use or by incorporation into foods, beverages for drinking, insufflations, and wounds. They could be finely sifted herbal materials derived from various parts of plants and intended to have a specific therapeutic effect. It can be available in sachet form.

Example: Kayam churna, Ashwagandha powder etc.

Herbal Granules:

Granules are agglomerations of small spherical particles made from herbal extracts. The herbal granules are prepared by wet granulation techniques. It is prepared by mixing the concentrated extract with an acceptable excipient to form a lump mass, followed by the addition of flavouring agents and preservatives. Granules are produced after passing this material through shifter. Herbal granules have advantages such as faster disintegration and dissolution as compared to tablets and capsules, and are palatable as compared to syrups and decoctions.

Example: Shatavari granules.

Capsules:

Capsules are solid dosage forms in which herbs or extracts are enclosed in a small shell of gelatine. There are two types of capsule, i.e. hard gelatine capsules and soft gelatine capsules. Hard gelatine capsules are preferred for dried drug substances, while herbal oils or oil soluble herbal ingredients are available as soft gelatine capsules.

For the filling of the capsule with drug ingredients, various capacity automatic and semiautomatic filling machines are available. The general method is given below.

1. Pour into a saucer and scoop up the powder by sliding the capsule halves toward one another (or use a capsule-making tray).
2. When the halves of the capsule are full of powder, slide them together without spilling the powder and store.

Examples: Evacare capsule, Lesuna 60 capsule.

Tablets:

Tablets are unit solid dosage form containing a single dose of one or more herbs, extracts of herbs with or without excipients, prepared by the moulding or compression method.

Tablets are prepared by two different methods.

1. Dry compression method
2. Wet granulation method

Direct compression:

This compression technique is preferred for drug materials which require large doses of good bulk density, flowability, and compressibility. In some cases, along with herbal material, disintegrating agents are added. It involves the following steps:

1. **Milling or size reduction:** In this step, the size of the drug is reduced and passed through a sifter to get the desired particle size of the drug.
2. **Blending:** The desired particle size material is then blended with excipients like disintegrating agents, lubricants, and glidants for a sufficient period of time using a double cone blender.
3. **Compression:** The lubricated herbal material is finally compressed into tablets of the desired weight, hardness, and thickness using a tablet compression machine.

Wet granulation method:

The various process steps involved in this method are as follows:

1. **Sifting/milling:** Weighed herbal ingredients (extract/powder) and excipients are passed through the desired sieve number to obtain a uniform size.
2. **Dry mixing:** After milling of the drug-excipient, it is mixed with other additives like colour lakes and subjected to dry mixing in a suitable mixer for a predetermined time.
3. **Granulation:** The powder mixture is mixed with the binder solution and mixed for a suitable time period to produce a dump mass. This wet mass passes through a specified sieve to get the desired wet granules.
4. **Drying:** The wet granules are dried at a specific temperature for a specified period of time to obtain dry granules.
5. **Blending:** The dried granules are again passed through the desired sieve to obtain uniform granules and are blended with additives in suitable blenders (Double cone blender, etc.).

6. **Compression:** The lubricated herbal granules are finally compressed into tablets of the desired weight, hardness, and thickness using a tablet compression machine.

   Coating is done to mask undesirable odours and tastes of herbal ingredients.

   Examples: Septilin tablet, Himalaya brahmi tablet, etc.

Lozenges:

These are small, medicated tablets intended to be dissolved slowly and release medication slowly into the mouth. It is prepared by boiling the decoction or extracts with sucrose and water. The colourants and flavouring agents are added during the cooling. It produces a thick, molten mass of medicament. This mixture is added into moulds to get lozenges of the desired size and shape. It can have local and systemic effects and is generally used to treat throat infections. They are also known as cough drops.

Example – Vicks lozenges, Koflet lozenges.

Ointments:

Ointments are soft semisolid preparations meant for external application to the skin or mucous membrane. They usually contain medicament that is dissolved, suspended or emulsified in an ointment base.

Method of preparation:

The following are the various methods of manufacturing ointments:

1. **Fusion method:** This method is used when extracts or oils are soluble in ointment base. It is prepared by melting the all oily phase followed by addition of extracts/ oils slowly with intense stirring until mass cools down to homogenous ointment
2. **Trituration method:** This method of preparation when extracts used are insoluble in ointment base. Finely powdered solids are passed through sieve #85. The medicament is taken on an ointment slab and triturated lightly with a small amount of the base with long broad steel spatula.
3. **Chemical reaction method:** Chemical substances are used to dissolve the medicament in ointment base (iodine ointment).
4. **Emulsification method:** Ointment is prepared as emulsion of oil base and water base with the help of emulsifying agent.

   Examples: Relaxyl ointment, Himalaya antiseptic herbal ointment.

Herbal Paste:

It is a semisolid dosage form mainly meant only for external application to the skin. They are usually stiffer in nature but are less greasy than ointments. They do not melt at ordinary temperatures and hence act as a protective layer over the skin surface.

Herbal pastes may contain the herbal ingredient dissolved or dispersed in a base (fatty base) if it is meant for topical use. Pastes are prepared either by trituration or by fusion method.

Herbal balms:

These are similar to herbal ointments meant for massage into the skin for relief of body aches and pains. They normally contain herbal materials which provide a rubefacient effect on the skin and by so doing, cause relief of pain.

Examples: Amrutanjan, penil balm etc.

Other herbal formulations include herbal liniments, herbal creams, herbal oils, herbal soaps, herbal inhalers, herbal glycerites, herbal wines, herbal suppositories, herbal plasters, herbal pessaries, etc.

B. Novel Drug delivery of herbal formulation:

Advancement in knowledge of phytochemistry and analytical chemistry enables the pharmacognosist to isolate and identify therapeutically active phytochemicals. In the last few decades, an increasing number of phytochemicals have been isolated and their pharmacological efficacy validated in in-vitro assays. These phytochemicals showed excellent results in in-vitro studies but failed to produce the effects in animal and human studies. This occurs due to their complex chemical nature and diverse physicochemical properties. The novel drug delivery system has emerged in the last few decades exponentially, which enables the preparation of formulations of such complex and diverse chemicals.

Advantages:

1. Bioavailability, distribution and pharmacological effect of phytoconstituents can be enhanced.
2. Release of drugs can be modulated and targeted at specific affected site.
3. Targeted drug delivery avoids the accumulation of drug in all tissues and this toxicity can be avoided.

Disadvantages:

1. Industrial scale production needs modernization, which is costly affair.
2. Unaffordability of medicine.
3. The formulation trials of herbal phytochemicals are at lab scale.

Liposome:

Liposomes are relatively small (approx. 50 nm in diameter) aqueous compartments surrounded by a phospholipid bilayer membrane. The ability of liposomes to encapsulate hydrophilic or lipophilic drugs has allowed these vesicles to become useful drug delivery systems.

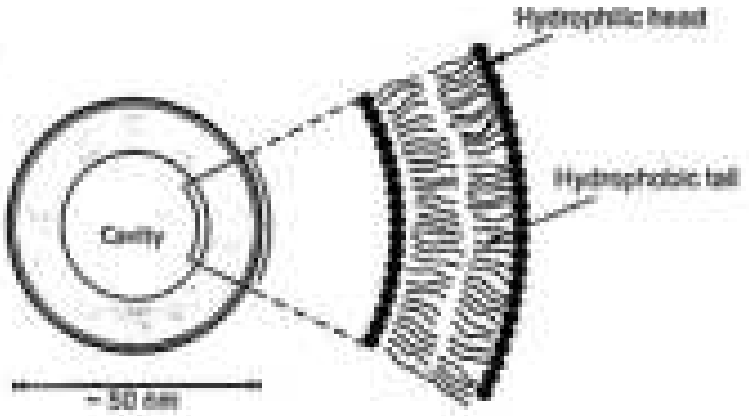

Fig. 14.3: Liposomes – A typical phospholipid bilayer membrane

Method of preparation:

A lipid vesicle can be formed by mixing a lipid solution into an aqueous solution and then sonicating the solution. Sonication involves the bombarding of sound waves into solution. The energy carried by sound waves disperses the lipids, allowing them to spontaneously aggregate into bilayer membranes (liposomes). The herbal liposomes can be made to entrap the phytochemicals within vesicles of a lipidic bilayer.

In brief, the phytochemicals dissolved in water are mixed with a phospholipid solution. The resultant mixture is subjected to sonication at the desired frequency. Results in the spontaneous formation of nano-sized liposomes. The liposomes can be separated from the entrapped solution via dialysis.

Examples:

1. Vinorelbine liposome (Alocrest®) is plant an alkaloid intra-venous anticancer formulation under clinical trials.
2. Vincristine liposome (Marqibo®) is plant an alkaloid intra-venous anticancer formulation in clinical use from 2012.

Herbal cosmetics Crude Drugs

❖ Aloe vera gel

Family: Liliaceae

Source:- Mucilaginous tissue located in the leaf ***parenchyma*** of Aloe species.

Chemical Constituents:

Barbaloin, Aloesin, Anthraquinone glycosides, aloe-emodin- anthrone, chrysophanic acid, choline salicylate, Saponins, etc.

➢ **Therapeutic Uses:**

- Aloe is used as purgative.
- Improves digestive health.
- Promotes oral health.
- Clears acne.
- Relieves anal fissures
- It used as irritant purgative
- It use for cosmetic and protective
- It also used for treatment of radiation burns.

➢ **Cosmetic Uses:**

- It is used to treatment of pains and itchings.
- Aloevera gel is used in skin cosmetics as a protective.
- It is anti-wrinkle properties.
- It used in the form of ointments cream, to assist healing of woulds burns, eczema and also in psoriasis.

➢ **Commercial Preparation:**

1. Compound benzoin tincture (Friar's balsam):-

It consists of benzoin, prepared storax, balsam of tolu, aloes and 90% alcohol.

2. The separation method, the bottom of the leaf is cut off and the leaves are left to "bleed". This leads to the aloin leaking out of the leaves.

- This is the part of the plant known for its bitter taste and its laxative effect. For a quality product, it is important that the aloin is kept out of the final gel.
- After you remove the gel from the plants, you need to filter it. And finally, homogenize, pasteurize and stabilize it. The last step is then to concentrate the gel. The process from – cutting the leaves and the final
- Aloe extract – you need to complete it within a maximum of 2 days. however, the quality loss in the process can occur in a number of ways.
- The most important reasons are the poor quality of leaves and poor or slow processing.
- Now you can sell the concentrated aloe vera gel to the end consumers or to the industries who produce herbal products with aloe vera gel.

❖ Almond oil

Source: Almond oil is a fixed oil obtained by expression from the seeds of ***Prunus amygdalus***.

➢ **Chemical Constituents:-**

Bitter almond contains fixed oil (40-50 percent), Protein (20 percent), enzyme emulsin and bitter glycoside amygdalin (1-3 percent). It also contains volatile oil (0.5 percent). Amygdalin gives benzaldehyde and hydrocyanic acid upon hydrolysis. Bitter almond oil contains 80 percent benzaldehyde and 2-6 percent hydrocyanic acid.

➢ **Therapeutics Use:-**

- Inflammation
- Immune changes
- Impaired wound healing

➢ **Cosmetics Uses:-**

- Acne can be frustrating and difficult to treat.
- Moisturizing Properties
- It is uses of preparations of lipstick and skin cleansing products include almond oil to help moisturize your skin.
- Earwax plays a vital role in protecting your ears and keeping them clean.

- **Commercial Preparation:**

1. The almond oil obtaining process is very similar to the processes for obtaining other nut oils. The nut is harvested before the autumn rains start (August-September).
2. After harvesting, the next step is de-hulling, consisting of the removal of the mesocarp that appears adhered to the nut and has not been lost by falling from the tree.
3. After de-hulling, the nuts are normally exposed to the sun for two or three days (drying), as a general rule, or they are subjected to hot air ventilation, with the aim of finishing their drying. By using drying, the humidity content is considerably reduced by up to 5–8%.
4. After that, cracking takes place, which consists of the separation of the shell and the seed (Harris, 2013). Finally, oil extraction takes place, generating also a solid edible by-product. Some extraction systems will require a previous grinding of the seeds.
5. The most important operations in almond oil extraction, which would need to be optimized with the aim of obtaining a better quality final product, are drying and extraction.

❖ Lavender Oil

Source: It is an essential oil obtained by distillation from the flower spikes of certain species of lavender.

- **Chemical Constituents:**

- It contains of linolool, Linalyl acetate, Lauandulyl acetate, Eucalyptol, terpineol, ocimene, Terpinen-4-ol, etc.

Commercial Preparation (preparation of Lavender Oil)

1. Harvest. Cut and dry enough lavender to make at least 1 oz. of dried lavender. (To dry, hang cut flowers upside down in a dry, dark place for 2 to 4 weeks.) Add dried lavender to a clean glass jar.

2. Infuse. Pour coconut oil over the lavender in the glass jar until lavender is covered completely. Secure lid tightly and shake well. Store the jar near a window (but not in direct sunlight) to infuse for 7 to 10 days. Shake every day or so.

3. Strain. Strain using a strainer or cheesecloth. Pour the mixture through a funnel into a clean glass jar. Store in a cool, dark place; the oil will keep for up to 1 year.

- **Therapeutic Uses:**

  - It is uses to promotes relaxation and believed to treat anxiety, fungal infections, allergies, depression, insomnia, eczema, nausea, and menstrual cramps.

- **Cosmetic Uses:**

  - Lavender oil works to kill bacteria, and this can prevent and heal acne breakouts.
  - Lavender oil can also be used to treat psoriasis.
  - The lavender oil helps cleanse your skin and lessen redness and irritation.

❖ Olive oil

Family: Oleaceae

Source:

- It is the fixed oil expressed from the ripe fruit of ***Olea europaea*** Linne.

- **Chemical Constituents:**

  - The olive oil contains the triglycerides mainly in the from of Olein, palmitin and linolein.

- **Commercial Preparation:**

  - It is prepared by crushing and pressing the ripe fruits called "Olives"
  - The entire olive consists of 20-30% oil and the fruit pulp has 60-80% oil.

- **Therapeutic Uses:**

  - It is used as nutrient, demulcent and as mild Laxative.

- **Cosmetic Uses:**

  - It is used to soften the skin and crusts in eczema and psoriasis.
  - It also used as an ingredient of ear wax.

❖ Rosemary Oil

Source: Rosemary oil is distilled from the flowering tops of leafy twigs of ***Rosmarinus officinalis***

Family: Lamiaceae

Chemical Constituents:

- The main constituents of the oils were p-cymene, linalool, gamma-terpinene, thymol, beta-pinene, alpha-pinene and eucalyptol.
- The oil consisted of monoterpenic hydrocarbons, oxygenated monoterpenes and sesquiterpene hydrocarbons.

➢ **Therapeutic Uses:**

- Memory. Taking rosemary by mouth might somewhat improve memory in young adults. It's not clear if rosemary aromatherapy helps.
- May Help Relieve Pain.
- Reduce Joint Inflammation.

➢ **Cosmetics Uses:**

- Stimulates Hair Growth.
- It deeply hydrates skin and can be used instead of moisturiser.
- Its anti-bacterial and anti-inflammatory properties help battle acne.
- It helps reduce the appearance of blemishes and can be used to lighten stretch marks.

❖ Sandal Wood oil

Source: Sandalwood oil is obtained by distillation of sandalwood, ***Santalum album*** Linn.,

Family: Santalaceae.

Chemical Constituents

- The main odorous and medicinal constituent of Sandal-wood is santalol.
- This primary sesquiterpene alcohol forms more than 90% of the oil and is present as a mixture of two isomers, α-santalol and β-santalol, the former predominating.
- The other constituents reported are hydrocarbons santene, nor-tricycloekasantalene, α-, and β- santalenes.

- **Therapeutic Uses:**

  - A chemo-protective action on liver carcinogenesis in mice has been demonstrated.
  - Used for symptomatic treatment of DYSURIA(medical term for pain or discomfort when urinating)

- **Cosmetics Uses:**

  - Sandalwood oil is highly used in perfumery creations and finds an important place in soaps, face creams, and toilet powders.

- **Commercial Preparation:**

1. Producing commercially valuable sandalwood with high levels of fragrance oils requires Santalum trees to be a minimum of 15 years old (S. album) the age at which they will be harvested.
2. The sandalwood tree's precious sandalwood oil is located within the tree's heartwood, and the older the tree, the high proportion of heartwood it contains. Because the oil is held tightly within the wood, a distillation process is required, in which the wood is first ground to a powder form.
3. Steam distillation is a process in which steam heated at extremely high temperatures (usually around 140- 212˚ F) is passed through the powdered wood.
4. The steam releases the sandalwood essential oil that is locked within the cellular structure of the wood.
5. The mixture of steam and oil then flows through a condenser and cools, yielding a layer of oil and a layer of water.
6. The sandalwood essential oil separates from the hydrosol (floral water) rises to the top so it can then be collected.

Phytochemical Evaluation of Drugs

- Phytochemicals are substance produced mainly by plants, and these substances have biological activity. In the pharmaceutical industry plants represent the main source to obtain various active ingredients.
- They includes phenolic compound, terpenoids , alkaloids, flavonoids, glycosides, lignins, saponins, sterols, tannins, anthraquinone, and reducing agents
- More than 500 individual dietary phytochemicals have been identified in plant foods (ie- fruits ,vegetables,whole grains, legumes and nuts) with varying content and composition .
- Phytochemical investigation may be defined as phytochemical screening confirmed the presence of a large array of phytoconstituents .
- Process involved in phytochemical investigation
- In this method , aqueous and organic extracts are prepared from those plant sample that are the reservoirs of secondary metabolites such as leaves ,stem, roots , or bark .
- It is not suitable method for efficient separation.

Process :

Four different stages of phytochemical behaviour of plant material -

1. The procurement of row material and quality control.
2. Extraction, purification and characterisation of the constituents of pharmaceutical interest and in process quality control .
3. Investigation of biosynthetic pathway to particular compounds and
4. Quantitative evaluation.

Types of phytochemical test

Two types -

1. Quantitative chemical test-

- Determine the purity or concentration of the constituent.

2. Qualitative chemical test-

- They are used for determination of different types of adulterents.
- Mainly used qualitative chemical tests

1. For alkaloids -

- Drageandorff's test
- Meyer's test
- Wagner's test
- Hager's test

2. For glycosides-

a. Cardiac glycosides

- killer kiliani test
- Baljet test
- Legal test
- Raymond's test

b. Anthraquinone glycosides

- Brontragers test
- Modified brontragers test

c. Saponin glycosides

- Foam test
- Hemolysis test

d. Flavonoids test

- Shinoda test
- Amonia test

3. For carbohydrates

- Molish test
- Fehling test
- Benedict test
- Tollan's reagent

4. For protein -

- Biuret test
- Millions test
- Xanthoproteic test

5. For Amino acids-

- Nin-hydrin test.

crudely translated as air, bile and phlegm. The Ayurveda incorporates all forms of lifestyle in therapy. Thus yoga, aroma, mediation, gems, amulets, herbs, diets, astrology, color and surgery etc are used in a comprehensive manner in treating patients. The important contribution was by was Charaka Samhita, Sushruta Samhita, Vaghbata.

Separation of pharmacy and medicine:

Pharmacy always existed, but not so for pharmacist. A person uses to made diagnosis also provide medicines and he hired assistants to collect herbs for him and make preparation under his supervision known as pharmacopolae but they are not pharmacists.

Arabs were of thought that those who prepare medicines could do as independent profession. The first pharmacy scope was opened in a Baghad in 770 under Calip Al- Mansoer. Pharmacists don't have much that time knowledge of drug this situation was changed by Al Mamoen who ruled Baghad from 813 to 833 and pharmacist started acquiring professional education.

The profession of pharmacy was honourable called as Sayadilah (Arabic) and Sandaliin (Latin). They also pharmacy as pharmaceutical terms' (the collection of equipment and methods used in the practice of medicine), for the exchange of ideas as well as of goods between people from India, China and Spain that introduced many new drugs in the field of medicine. Arabs develop number of new drug delivery forms such as syrups, pellets, preserves, confections, marmalades.

History of pharmacy profession in India:

Pharmacy practice includes traditional practice of compounding and dispensing of medications. History of pharmacy profession in India can be divided in to three parts

1. Ancient history
2. Pre-independence
3. Post –independence

Ancient Pharmacy Profession:

In India the source of drugs were of vegetables, animal and mineral origin. They were prepared empirically by few experienced persons. Knowledge of that medical system was usually kept secret within a family. There were no scientific metods of standardization of drugs. The Ayurveda work on internal medicine whereas Sushrute-Samhita deals with surgical medicine. Charaka and Sushruta were physicians and pharmacists who studied more than 1000 herbs.

In Tamil Nadu during 900 AD (AD mins Anno Domini/ Common Era) discovered organized

practice of hospital activity for the treatment of patients with diseases. India, being rich in flora and fauna, wide variety of herb was mainly used to treat disease like jaundice, haemorrhage etc. British traders brought the practice of allopathic system to India in 15th century. The Indian system of medicine declined during the Muslim rule while the Arabic or the Unani-Tibbi system flourished.

Pre-independence Pharmacy Profession:

The first chemist shop was opened by Scotch Bathgate at Calcutta in 1811. The pharmacy activities were performed according to London Pharmacopoeia. This situation forced back traditional practice in Indis and compelled to import drugs from European countries.

- 1840- Goa medical college was started at Panjim
- 1841- Bengal Dispensatory and Pharmacopoeia was published
- 1870- The Madras Medical College were first to train the students to gain skills in pharmacy practice
- 1878- The Opium Act was implemented the dealt with cultivation of poppy and the manufacture, transport, export, import and sale of opium
- 1889- Indian Merchandise Act was implemented to avoid misbranding of goods in general
- 1894- Indian Traiff Act passed for levy of customs duty on goods including foods, drinks, drugs, chemicals and medicines import to India or export
- 1909- Bengal Excise Act was implemented

Pharmaceutical Education:

Pharmacy education in India traditionally has been industry and product oriented. In contrast to the situation in developed nations, graduate pharmacists prefer placements in the pharmaceutical industry. To practice as a pharmacist in India, one needs at least a diploma in pharmacy, which is awarded after only 2 years and 3 months of pharmacy studies. These diploma-trained pharmacists are the mainstay of pharmacy practice. The pharmacy practice curriculum has not received much attention. In India, there have been number of institutions offering pharmacy degrees at various levels and a practice-based doctor of pharmacy (Pharm D) degree program was started in some private institutions in 2008. However, relatively little information has been published describing the current status of complex pharmacy education of India.

D Pharm Program:

In India, higher secondary study is concluded by a terminal examination, the higher secondary examination, at the end of 12 years. Admission to the first year D Pharm program in any government college is based on performance on the higher secondary examination. However, private colleges have their own admission procedures that comply with the education regulations of the PCI. Students generally may choose to undertake the D Pharm program as their second or third choice, having been unable to obtain a place at the college in another degree program that was their first choice. The D Pharm curriculum is framed through the education regulations of the Pharmacy Act. The present education regulations framed way back in 1991 (ER91). The curriculum is the same throughout the country. In the 1990s, the efforts of the pharmacy council of India for upgrading the minimum qualification for registration from D Pharm to B Pharm failed due to lack of consensus.12

B Pharm Program:

Admission to the first-year B Pharm program is made directly from higher secondary school on the basis of marks obtained in the higher secondary examination or on the basis of a merit list rank prepared based on scores on an entrance examination administered by a state or individual institution. Administering an entrance examination as an admissions requirement is used mainly by public institutions. For example, admission to the first-year B Pharm of Banaras Hindu University (BHU) is made through the joint entrance examination (JEE) conducted by Indian Institutions of Technology (IITs), a group of 13 autonomous engineering and technology-oriented public institutes of higher education established and declared as institutes of national importance by the government of India.

M Pharm Program:

The criterion for entry to an M Pharm program is academic performance in the B Pharm or an entrance test or both. Currently, there is more demand for the M Pharm program than the availability of places in the country. An important criterion, a high Graduate Aptitude Test for Engineering (GATE) score, qualifies a student to receive government scholarship during the period of their M Pharm study. This criterion is optional for admission to the first-year M Pharm program. However, many public institutions require both past academic performance and GATE score for application to the M Pharm program.

Pharm D Program:

Admission to a Pharm D degree program is on the basis of successful completion of the higher secondary examination or the D Pharm program. Passing the higher secondary examination with physics, chemistry, and biology or mathematics entitles a student to enter the Pharm D program. B Pharm degree holders can join the Pharm D program in the fourth year.

Table 1: First 10 Pharmacy Colleges/Universities Offering Degree Programs in India

Year of Inception	College/Universities	Category	Current Degrees Offered
1917	Department of Pharmaceutical Engineering, Institute of Technology, Banaras Hindu University, Varanasi	Central University	BPharm, MPharm, PhD
1944	University Institute of Pharmaceutical Sciences, Panjab University, Chandigarh	State University	BPharm, MPharm, PhD
1947	L. M. College of Pharmacy, Ahmedabad	Private College	BPharm, MPharm, PhD
1956	Department of Pharmacy, Madras Medical College, Chennai	Medical College	BPharm, MPharm
1956	Birla Institute of Science and Technology, Pilani	Private University	BPharm, MPharm, PhD
1991	College of Pharmaceutical Sciences, Andhra University, Visakhapatnam	State University	BPharm, MPharm, PhD
1952	Department of Pharmaceutical Sciences, Dr. H.S. Gour University, Sagar	Central University	BPharm, MPharm, PhD
1956	Department of Pharmaceutical Sciences, Nagpur University, Nagpur	State University	BPharm, MPharm, PhD
1958	Pharmaceutical Department, University Institute of Chemical Technology, Mumbai University, Mumbai	State University	BPharmSci, MPharmSci, PhD (Tech)
1963	Department of Pharmaceutical Technology, Jadavpur University, Kolkata	State University	BPharm, MPharm, PhD

Pharmacy education in India is regulated by 2 organizations: the Pharmacy Council of India (PCI), under the Pharmacy Act of 1948, and the All India Council for Technical Education (AICTE), which was established under the AICTE Act of 1987. As mentioned previously, the PCI makes regulations regarding the minimum standard of education required for qualification as a pharmacist. It is responsible for registration of persons fulfilling the prescribed eligibility criteria (minimum D Pharm) and issuing a license permitting them to practice in an Indian state. Registration activity is decentralized and the state pharmacy councils are responsible for registering pharmacists in their respective states. Thus, the PCI regulates the D Pharm program and the recently introduced Pharm D program. The B Pharm program needs to be recognized by the PCI for the qualifications to be accepted for registration purpose only. The PCI has no jurisdiction over M Pharm and other higher-level degree programs.

Indian Pharmaceutical Industry:

In 1930, in Calcutta the first pharmaceutical company called Bengal Chemicals and Pharmaceutical Works, which still is today as one of 5 government-owned drug manufacturers was started The history of Indian pharmaceutical market in 1970s was almost non- existent. Today, India has gained immense importance and carved a niche for itself in the pharmaceutical domain. In fact, it has emerged as a big mart for the pharmaceutical industry. Formulations, bulk drugs, generics, Novel Drug Delivery Systems, New Chemical Entities, or Biotechnology, etc. Indian companies are dominating in the marketplace which was traditionally manned by MNC.