CHAPTER 3

3. Adulteration and drug evaluation; significance of Pharmacopoeial standards.

Drug Adulteration: It is defined as admixture or substitution of original crude drug partially or wholly with other similar looking substances. The substance, which is mixed, is harmful or free from or inferior in chemical and therapeutic property. The reason –Enhancement of profit, Scarcity of crude drug and for costly drugs. It also occur accidentally, due to carelessness, ignorance.

ADULTERANTS: Adulterants are either sub-standard in verity or of the original crude drug or inferior drug or artificially prepared or other substance. That is present in the original drug, which decreases its quality. In general term **Adulteration** is regulation of any substance either with adding or taking off anything from original substance, which decreases the quality of that substance, maybe harming health, causes a variety of adverse effects from mild to moderate to severe life threatening responses. It studies that adverse drug reaction happens not due to the administration of a genuine drug, but due to the presence of adulterants in it. Therefore, understanding all the methods of adulteration and its evaluation technique is necessary to correct this illegal act and maximizing consumer's safety. This adulteration is done intentional or unintentional. Intentional adulteration is a criminal offence and punishable offense under the act, the motive behind intentional adulteration is normally commercial and originates mainly with the intention to make a profit.

DRUG ADULTERATION

a) **Spoilage**: Damaging quality or value of drugs with the attack of microorganisms. **E.g.,** Spoilage caused with fungi or bacteria with a result crude drug will be not suitable for human consumption.
b) **Deterioration:** Misdirection of quality of drug with removing constituents by distillation method or due to moisture, heat, insects, and rat. **E.g.,** removing the maximum amount of caffeine by over roasting the coffee beans.
c) **Admixture:** Addition of one or more substances to others due to ignorance or carelessness or by accident or collection of two similar species. **E.g.,** the Addition of earthy material like soil and stones to root rhizomes and stem part to leaf accidentally at the time of collection.
d) **Sophistication:** Intentional or deliberate addition of inferior material with the genuine drug. **E.g.,** Glucose powder is added to acacia gum powder. Addition of yellow colours starch powder in *Zingiber officinale* (Ginger) powder.
e) **Substitution:** The completely different substance is given in place of the original drug. For **E.g.,** Cottonseed oil is mixed or used in place of pure olive oil.
f) **Inferiority:** Any natural drug-containing chemical constituent less than the standard crude drug. **E.g.,** Seeds of *Strychnus nuxvomica* containing less than 1.15 % of the strychnine then it is considered as inferior.

TYPES OF ADULTERATION:

I. UN-INTENTIONAL

II. INTENTIONAL ADULTERATION

I. UN-INTENTIONAL OR INDIRECT ADULTERATION: It occurs without any bad intentions of manufacture or suppliers. Mainly occur due to the following reason.

a) Due to similarity in morphology or aroma.
b) Lack of knowledge about the authentic source.
c) Lack of or no availability of authentic plant drugs.
d) Absence of proper means of evaluation.
e) Name confusion in vernacular name.
f) Careless in collection or storage.

II. INTENTIONAL ADULTERATION OR DIRECT ADULTERATION: It occurs intentionally by manufacture or suppliers. Mainly occur due to following reason.

a) Due to the high price of the drug in the market.
b) Due to the Scarcity of drugs.
c) To earn more profit.

I. UNINTENTIONAL ADULTERATION

a) **CONFUSION IN VERNACULAR NAMES:** and due to similarity in morphology or aroma occurs due to the same name of different species and *vice versa* and due to which two herbs are interchanged or adulterated. **E.g.,** Ashoka is the vernacular name of medicinal plant *Saraca asoca* and ornamental plant *Polyalthia longifolia.*
b) **LACK OF KNOWLEDGE ABOUT AUTHENTIC SOURCE**: This is one of the reasons by which adulteration takes place in which the supplier is unaware of authentic source. **E.g.,** *Mesua ferrea* (Nagakesara), the market sample is adulterated with flowers of *Calophyllum inophyllum* (Punnaga).
c) **SIMILARITY IN MORPHOLOGY:** The reason for adulteration is due to similarity in appearance of the adulterant with the genuine drug. **E.g.,** *Mucuna pruriens* adulterated with other similar Papilionaceae seeds like *Mucuna utilis* (White variety) & *Mucuna deeringiana* (Bigger variety).
d) **UNSCIENTIFIC COLLECTIONS AND STORAGE OF DRUG:** Carelessness at the time of collection of herbs. **E.g.,** Saileyam or Shilapushpam *(Parmelia perlata);* lichen usually admixed with *Parmelia perforata & Parmelia cirrhata.*
e) **LACK OF AUTHENTIC PLANT:** Due to limited availability of certain species. **E.g.,** limited availability *Hypericum perforatum*, *Hypericum patulum* sold in the name of it.
f) **SIMILARITY IN COLOURS**: in course of time drug material changed to or substituted due to similarity in colour **E.g.,** Ratanjot original only source in past is *Ventilago madraspatana* but the present source is *Arnebia euchroma.*

II. TYPES OF INTENTIONAL ADULTERATION USING ADULTERANTS

1) Substitution with inferior commercial varieties.
2) Adulteration by artificially manufactured substance.
3) Usage of vegetative part of the same plant
4) Substitution by superficially similar but cheaper/inferior natural drug substance
5) Addition worthless heavy material/toxic materials.
6) Addition of synthetic principles.
7) Substitution by the exhausted drug.
8) Adulteration of Powders.

II. TYPES OF ADULTERANTS.

1) SUBSTITUTION WITH INFERIOR (SUBSTANDARD) COMMERCIAL VARIETIES: Due to the morphological resemblance of inferior quality drugs adulterated to the Japanese ginger to adulterate medicinal ginger.
2) SUBSTITUTION BY SUPERFICIALLY SIMILAR (INFERIOR/ CHEAPER NATURAL SUBSTANCE): A drug which is used for adulteration physically very similar to the Indian dill with European dill or caraway Belladonna and Senna leave substituted by Ailanthus leaves.
3) SUBSTITUTION BY EXHAUSTED DRUG: In this method active constituent of the drug extracted out and is used again. Clove, Fennel after extracting volatile oil. Used tealeaves dried and mixed with genuine drugs.
4) ADULTERATION / SUBSTITUTION BY ARTIFICIALLY MANUFACTURED SUBSTANCE: are artificially made to look similar to adulterate the compressed chicory in place of coffee, artificial invert sugar for honey.
5) USAGE OR PRESENCE OF VEGETATIVE MATTER FROM THE SAME PLANT: Presence of excessive amount of vegetative part of the same plant Adulteration by faulty collection excessive amount of stem in Senna, Stramonium, lobelia. Mosses, liverworts, and lichens growing on the bark are mixed with the cinchona or cascara.
6) ADULTERATION BY THE ADDITION WORTHLESS HEAVY MATERIAL/TOXIC MATERIAL: Generally, stone and gravels are added to the drug to increase its weight a large number of stone with liquorice root Limestone pieces with Asafoetida.
7) ADDITION OF SYNTHETIC PRINCIPLES: Additions of synthetic substance to the Citral to lemon oil, Benzyl benzoate to balsam of Peru.
8) ADULTERATION OF POWDERS: Powdered drugs are found to be adulterated very frequently. Adulterants used are generally powdered waste products of a suitable colour and density.

1) **SUBSTITUTION WITH INFERIOR COMMERCIAL VARIETIES:** The adulterants used resembles the original crude drug by morphological, chemical, or therapeutic characters, but are substandard in nature/ inferior in quality and hence cheaper in cost. This is rather the most common practice of adulteration. **E.g.,** Hog gum for tragacanth gum, mangosteen fruits for bael fruits. Adulteration of *Strychnous Nuxvomica* with *Strychnous Potatorum,* Adulteration of *Zingiber officinalis* with *Japanese ginger.* Adulteration *Capsicum minimum* with *Capsicum annum* Indian Senna Arabian Senna.

2) **ADULTERATION WITH SUPERFICIALLY SIMILAR LOOKING BUT INFERIOR NATURAL SUBSTANCE:** Substitution of superficially similar cheaper natural substance. The substance, which is used for adulteration, is physically very much similar in appearance to and may or may not have any chemical or therapeutic value.

E.g., Adulteration of Black Pepper *(Piper nigrum)* with Papaya seed (*Carica papaya*), Adulteration of Saffron (*Crocus sativus*) with *Safflower* (*Carthamus tinctorius*). Adulteration of Indian Dill with Caraway, Adulteration of *Belladona leaves* with *Ailanthus leaves,* Adulteration of Almond with Peach Kernel/ Apricot kernel Adulteration of Fresh Cloves Clove with Clove Stalk.

3) **SUBSTITUTION WITH EXHAUSTED DRUG:** The same drug is used again after removing / extraction out the medicinally active constituents. The practice is most common in the case of the costly drugs such as case volatile oil containing drugs (clove and fennel). Examples are Balsam of tolu devoid of cinnamic acid. After extraction, saffron and red rose petals are re-coloured with artificial dyes. **E.g.,** Adulteration of Clove Exhausted clove, Adulteration of Fennel with Exhausted fennel.

4) **SUBSTITUTION WITH ARTIFICIALLY MANUFACTURED SUBSTANCE**: Substance is prepared / manufactured in such a way so that it looks similar in appearance to the and this artificially manufactured substance is then used for adulteration. Examples are ergot adulterated with flour dough moulded incorrect size and colours with red and writing ink. **E.g.,** Adulteration of Beeswax after Yellow coloration of Paraffin Wax, Adulteration of Honey with Artificial invert sugar. Adulteration of Coffee Beans with Compressed Chicory Root, Adulteration of Nutmeg with properly cut shaved Basswood.

5) **ADULTERATION WITH VEGETATIVE MATTER:** Adulteration due to the presence of vegetative matter from the same plant due to the faulty collection or intentionally adding excessive vegetative matter from the same plant. A part of same plant, which is devoid of therapeutic action, is mixed with the same drug. Examples Clove is mixed along with leaves and petioles, an excessive amount of stem in lobelia, and Stramonium Leaves. **E.g.,** Adulteration of Senna leaves with Excessive amount of Stems in Senna leaves, Adulteration of Cinchona Bark with Moss liverworts and lichen growing on the bark is mixed with the cinchona bark.

6) **ADULTERATION WITH SYNTHETIC PRINCIPLES**: Using synthetic drugs/chemicals are used to enhance natural character, market and therapeutic value. Examples, Citral are added to citrus oils (like lemon oil and orange oil), Benzyl benzoate to Balsam of Peru. Apart from this, the herbal product labelled to improve sexual performance in men when analyzed contain Sildenafil, Sleeping Buddha contain Estamazole, Diabetes Angel containing Glyburide and Phenformin **E.g.,** Adulteration of Lemon oil with Citral, Adulteration of Balsam of Peru with Benzyl Benzoate..

7) **ADULTERATION WITH WORTHLESS HEAVY MATERIAL OR TOXIC SUBSTANCE**: Drugs are also adulterated WITH the addition of worthless heavy material or the material that would be toxic in nature. Generally, stone and gravels are added to the drug to increase its weight in order to gain more profit. Piece of limestone in Asafoetida, Mentanil Yellow in Turmeric powder, Lead shot in Opium, rodent faecal matters in Cardamom seed, Argemone seed in Mustard seed, White oil in coconut oil. **E.g.,** Adulteration of Asafoetida with Piece of Lime Stone, Adulteration of Liquorice Root with Other hardwoods (Toxic).

8) **ADULTERATION OF POWDERS**: Powdered drugs are found to be adulterated very frequently. Adulterants used are generally powdered waste products of a suitable colour and density. Examples: Olive stones in powdered Gentian, Liquorice or Pepper, Brick powder in barks, Red Sander wood into chillies, Dextrin in powdered Ipecacuanha, exhausted powder ginger in ginger. Adulteration **E.g.,** Adulteration of Powdered Gentian with Olive stones, Adulteration of Red chillies with Powder Brick Powder + Colour.

a) Drug evaluation: means confirmation of its identity + determination of its quality + purity, also includes detection of nature of adulterants in the crude drugs. → (2) marks

Different methods of Evaluation are: → (3) marks

1. Organoleptic (morphological evaluation)
2. Microscopic Evaluation
3. Physical Evaluation
4. Chemical Evaluation
5. Biological Evaluation

EVALUATION OF CRUDE DRUGS: It means a determination of IDENTITY, determination of QUALITY, and PURITY of crude drug. There are different evaluation methods available WITH which we can detect any type of adulteration in the original drug.

EVALUATION:

IDENTITY: Identity means to determine the authenticity or exact biological source of the drug. Whether the drug we are using are from the same biological source or from different sources.

PURITY: Purity evaluation means to check the presence of foreign material, either organic or inorganic that may be present in the drug accidentally or intentionally added to the drug to earn more money.

QUALITY: Quality means to determine the concentration of therapeutically active constituent present in the drug and comparison with the standard value so that the drug produces desirable therapeutic effect.

METHODS OF EVALUATION:

1) Morphological / Organoleptic evaluation/ Macroscopic.
2) Microscopic evaluation.
3) Chemical evaluation.
4) Physical evaluation.
5) Biological evaluation.
6) Chromatography and spectrophotometer.

1) MORPHOLOGICAL / ORGANOLEPTIC / MACROSCOPIC EVALUATION: In this type of evaluation, drugs is evaluated with the help of sense organs.
2) MICROSCOPIC EVALUATION: In this type of evaluation drug or its powder is examined under the microscope to study the arrangement of tissue and characteristics of powder.
3) PHYSICAL EVALUATION: In this type of evaluation physical constant of the drug is determined wherever possible.
4) CHEMICAL EVALUATION: This method is used to determine the active constituent in a drug WITH the chemical test or chemical process.
5) BIOLOGICAL EVALUATION: In this type of evaluation biological activity of the drug is determined.
6) CHROMATOGRAPHY AND SPECTRO PHOTOMETRY: Different chromatographic and spectroscopic techniques were used to check the quality and purity of the drug.

1. **MORPHOLOGICAL/ORGANOLEPTIC EVALUATION:** Morphological and organoleptic evaluation includes Examination of the drug WITH colour, odour, shape size, special features like touch, texture, etc of the crude drug. In organoleptic evaluation, drugs are evaluated with the help of sense organs like colour, odour, taste and texture. Morphological and organoleptic features of various parts of plants are

very useful in the identification of crude drugs and give an idea about the presence of adulterants in crude drugs.

a) Wavy shape- Rauwolfia, Disc shape – Nuxvomica, Conical shape Aconite, Quills of cinnamon.
b) Strength of odour like musty, mouldy, rancid, fruity.
c) Aromatic odour of umbelliferous fruit.
d) Sweet taste Honey and liquorice.
e) Bitter taste Gentian and chirata.
f) Brown colour of cinnamon.
g) Pungent taste Capsicum and ginger.
h) Mucilaginous taste Ispaghula.
i) Fractured Surface- Cinchona, cascara bark, quassia wood.

2. **MICROSCOPIC EVALUATION**: Medicinal plant dealers have discovered the scientific method in creating adulteration of such a high quality that is very difficult to trace out the adulteration without microscopic and chemical analysis. In this type of evaluation, the drug or its powder is examined under the microscope to study the arrangement of tissue and characteristics of powder. This can be performed WITH powdering crude drug or cutting a thin section or preparing a macerate of the crude drug. The characteristic feature of cell wall, cell content, starch grains, calcium oxalate crystal, Trichome, fibres, vessel etc.

E.g., Powder of clove stalk contains sclereids and calcium oxalate crystal but cloves do not contain these two. , Sclerenchyma absent in *Rauwolfia Serpentina* root but present in *Rauwolfia micratha*, *Rauwolfia densiflora*. Glandular Trichome of Mint and warty Trichome of Senna., Stone cell present in frangula bark and absent in cascara bark., Lignified Trichome and plasmodesmeta in nuxvomica.

a) STOMATA NUMBER: The average number of stomata per square mm of the epidermis is termed as Stomata Number.
b) STOMATA INDEX: Stomata index is defined as a portion of stomata against the total the number of cell in the epidermis (epidermal cell plus the stomata) reduced to percentage.
c) PALISADE RATIO: - Palisade ratio is defined as the average number of palisade cell beneath each epidermis cell of the leaf.
d) VEIN LET TERMINATION NUMBER- Number of vein-let termination per square mm of leaf surface midway between the midrib and margin.
e) VEIN-ISLET NUMBER- Number of vein islet per square mm of leaf surface midway between the midrib and margin.
f) QUANTITATIVE MICROSCOPY: an analytical technique to analyze the powder drug when a chemical method of evaluation of drug fails to measure the accurate quality of the drug. It includes Lycopodium spore method, Stomata number, Stomata index, Palisade ratio, Vein let termination number, Vein-islet number.
g) QUANTITATIVE MICROSCOPY: Stomata Index = S ×100 E+ S

3. **PHYSICAL EVALUATION:** This type of evaluation method is very essential for the determination of the quality and purity of the drug. In this type of evaluation, the physical constant of the drug is determined wherever possible. Different parameters to physically evaluate the drug are described below.

a) MOISTURE CONTENT: The presence of excessive moisture content in a drug will deteriorate its quality due to the activation of enzymes, which causes chemical changes, or due to the growth of microorganisms. It is determined by Karl Fischer's method or loss on drying method at 105° C in an oven to constant weight. Starch-Moisture content not more than 15% Digitalis not more than 5%.

b) MELTING POINT: It is useful parameter for determining the purity of solid, fixed oil and waxes. Pure phytochemical gives very sharp and constant melting point Beeswax- 62-65° C Wool fat -34-44° C Agar melts at 85°C.

c) REFRACTIVE INDEX: It is very useful for the evaluation of volatile oil and fixed oil. Physical constant changes the speed of light. A Refract meter Castor oil 1.4758 Clove oil 1.527-1.535 measures it.

d) OPTICAL ROTATION: Certain substance in the pure state or in the solution is optically active, having property to rotate the plane of polarized light. This property is known as optical rotation. Dextrorotatory (+) right side rotation and laevorotatory (-) left side Caraway oil + 75° to + 80° Clove oil 0° to – 1.5°.

e) FOREIGN ORGANIC MATTER: It is the part of the plant that presents other the main drug part. Weigh accurately 100 g of the drug is taken and spread in a thin layer on the paper. It is examined at 6X magnification and percentage recorded Garlic not contain more than 2%, Saffron 2%, Shatavari 1%.

f) VOLATILE OIL CONTENT: The Clevenger apparatus is used to determine the volatile oil content of Fennel not less than 1.4 % Dill not less than 2.5.

g) SOLUBILITY: In this parameter drugs solubility in a specific solvent is taken into consideration Colophony in light petroleum Balsam of Peru in chloral hydrate solution.

Define Extractive value. Mention different types with their significance.

Extraction is a process in which chemical constituents may be extracted with suitable solvent known as extractives.

Types: 1. Water soluble extractives: This method is used for the drug which contains Water soluble active constituents-Sugars mucilage etc. Plays an important role in evaluation of crude drugs. It gives an idea about the nature of chemical constituents present in them.

2. Alcohol soluble extractives: Alcohol is the ideal solvent for the extraction. Alkaloids, Glycosides, etc.

3. Ether soluble extractives: It is of two types-

a. Volatile ether soluble extractive-Ex: Volatile oil containing drug (Clove, Fennel)

b. Non-Volatile ether soluble extractive-Ex: Fixed oil, Resin (Nutmeg, Linseed)

h) SWELLING INDEX: Swelling index is the volume in millimetre taken up by the swelling of 1g of plant material in under the specific condition. A plant containing mucilage. Ispaghula not less than10.

i) SOLVENT EXTRACTIVE VALUE: This method determines the approximate amount of chemical constituents present in the given amount of medicinal plant material when extracted with a solvent. The solvent used for extraction dissolves appreciable quantities of the substance. Aloe Not less than 25% w/w Glycyrrhiza Not less than Water-soluble extractive value 20% w/w.

   a. WATER SOLUBLE EXTRACTIVE VALUE: it is used for the drug-containing water-soluble active a constituent of crude drugs such as tannin sugar, plant acid, mucilage, glycosides.
   b. ALCOHOL SOLUBLE EXTRACTIVE VALUE: Alcohol is an ideal solvent for extraction of various chemicals like tannin, glycoside, resins, etc. the solvent strength of alcohol varies from 20-95%. The solvent strength has to be chosen depending on the nature of the drug to be extracted. Aloe Not less than 10% w/w Glycyrrhiza Not less than 50% w/w.
   c. ETHER SOLUBLE EXTRACTIVE VALUE: Volatile ether soluble extractives which represent the volatile oil content of drug Linseed Not less than 25 % w/w Non-volatile ether soluble extractives represent resin, fixed oil, or colouring matter present in drug Capsicum Not less than 12 % w/w.

j) TOTAL ASH VALUE: The amount of residue/ash left after the incineration is known as ash value of the drug. The quality of the drug also determined by the quantity left after ignition. It simply represents the inorganic salt naturally occurring in Drugs, adhering to it, or deliberately added to it as a form of adulteration. Low-grade drug, exhausted drug and excess of sand or earthy matter are detected by ash value. Guduchi Total ash not more than 16%, Ginger 6%.

   a. ACID INSOLUBLE ASH: Ash insoluble in dilute HCl. By this, we can detect the presence of excessive earthy matter, which is likely to occur with roots and rhizomes. Guduchi Acid insoluble ash value not more than 3%.
   b. WATER SOLUBLE ASH: It is used to detect the presence of material exhausted by water 6000C Ginger 1.7%.
   c. SULPHATED ASH: Done by addition of sulphuric acid in order to get sulphate salts.

k) SPECIFIC GRAVITY: It is also known as relative density. The ration of the mass of a solid or liquid to the mass of an equal volume of distilled water Coconut oil 0.925 Castor oil 0.95

l) VISCOSITY: Viscosity is the resistance of a liquid to flow. The viscosity of a liquid is constant at a given temperature and hence used as an evaluation parameter Pyroxylin viscosity 1100-2450 centistokes.

4. **CHEMICAL EVALUATION**: Determination of active constituent in a drug is referred to as chemical evaluation. In this method different specific chemical test are subjected to check the purity of crude drug. These includes
    a) **QUALITATIVE AND QUANTITATIVE CHEMICAL TEST:** Chemical assay and instrumental analysis. Methods of chemical evaluation Description.
    b) **QUALITATIVE CHEMICAL TEST:** Identification test for various Phytoconstituents like glycoside, alkaloid, and tannin. Copper acetate test used to detect colophony as an adulterant for resin, balsam, and waxes Van Urk's test for ergot Vitali morin for tropane alkaloid.
    c) **QUANTITATIVE CHEMICAL TEST:** This test includes acid value, saponification value, ester value, acetyl value Esters value of balsam and volatile oil, Acetyl value of volatile oil, Acid value of resin and balsams
    d) **CHEMICAL ASSAY:** Assay of alkaloids, resin, volatile oil, glycosides, vitamin, or other constituent present in drug Assay of total alkaloid in belladonna herb Assay of the resin in jalap and vitamin in cod liver oil.
    e) **CHROMATOGRAPHY & INSTRUMENTAL ANALYSIS:** Used to analyze the Phytoconstituents using chromatographic and spectroscopic method PC, TLC, HPTLC, HPLC, GC, UV Visible, IR, MS, NMR.

5. **BIOLOGICAL EVALUATION**: When physical and chemical method of are not able to produce satisfactory result then the drug are evaluated by biological method of evaluation. This method of evaluation is also knows as bioassay or biological assay in which plants or extract are evaluated by the various biological method to determine pharmacological activity. These assays are conducted by determining the amount of drug of known quantity required to produce a definite effect on suitable test animal or organ under standard condition. These methods are performed on living animal, isolating living organ and tissue, animal preparation and microorganism. When the living bacteria, yeast and moulds are used for assaying vitamin and to determine the activity of antibiotics drugs then it is called microbiological assay.

6. CHROMATOGRAPHIC AND SPECTROSCOPIC TECHNIQUES FOR EVALUATION:

Different types of chromatographic techniques are use for separation and to analyze component present in the drug and to check the purity and quality of drug by using different types of spectroscopic techniques. In the spectroscopic techniques measurement and interpretation of electromagnetic radiation absorbed or emitted when the molecules, atom, or ion of a molecule of sample move one energy state to other. These methods are used for qualitative and quantitative evaluation of drugs. **E.g.,** TLC, HPTLC, HPLC, GLC, UV-Visible spectroscopy, IR, Mass, NMR.

TEST FOR GENUINITY OF DRUGS:

a) **Kumkuma** (*Crocus sativus) Adulterants are Stamens of* Safflower, Stamens of Marigold. Test for Genuinely: When sprinkled with concentrated H2SO4, the stigmas turn blue immediately, gradually changing to purplish red.

b) **Haridra** (*Curcuma longa) on addition of Concentrated* H_2SO_4 or a mixture of concentrated H_2SO_4 and alcohol to the powdered drug: A deep crimson colour is produced, if the sample is genuine.

c) **Hingu** (*Ferula asafoetida)* freshly broken surface *when* touched with concentrated H_2SO_4: A bright red or reddish-brown colour is produced, changing to violet when acid washed off with water, if the sample is genuine.

d) **Guggulu** (*Commiphora mukul) Adulterants used are* sand, wood pieces, pieces of bark, and shallaki exudates. When small particles put on water, the particles become round. When put on fire, first liquefies then gives white fumes.

e) **Sarja** (*Vateria indica): Slightly soluble in Alcohol in* which it forms a jelly-like mass, insoluble in petroleum ether forming white precipitation.

f) **Kunduru** (*Boswellia serrata)* Triturating *with water* forms an emulsion. When immersed in alcohol (90%), a tear of Kunduru is not altered much in form but becomes almost opaque and white. When a drop of concentrated H_2SO_4 is added on a freshly fractured surface, it becomes cherry red which when washed with water changes to the white emulsion, then turns to a buff colour.

SIGNIFICANCE OF PHARMACOPOEIAL STANDARDS

It is an important that drugs should uniform in quality, origin and cleanliness and with respect to the content of therapeutically active constituents. Uniformity of quality is promoted by the use of standards which are numerical commodities by which the numerical quantities by which the quality of commodities may be assessed. There are three kinds of pharmacognostical standards.

1) Structural standards
2) Analytical standards
3) Physical standards

1) **STRUCTURAL STANDARDS:** The drug when they occur because of carelessness during the process of collection or preparation and foreign material added for substitution. These materials are called foreign organic matter. A standard commonly prescribed for this kind of impurity is 2%. It is difficult to assess the quantity of organic matter in the form of insects, their droppings fungus, and hairs of rodents.

2) **ANALYTICAL STANDARDS:** Require the presence of minimum amounts of useful constituents. Some of these are definite substances such as *Strychnine*, *Quinine*, and *Balsamic Esters*. While others are less definite and include such materials are water-soluble extract yield to alcohol total ash and acid-insoluble ash.

3) **PHYSICAL STANDARDS:** They are useful for Oils, fats, waxes and resins. Properties such as density, refractive index, and average mass.
   a) Standards are prescribed by pharmacopeia: The pharmacopeia prescribes standards for the quality and purity of drugs. The following important standards are mentioned in pharmacopoeias.
   b) Sampling: Before a consignment of a drug can be evaluated, a sample must be drawn for analysis considerable care must be taken to ensure that this sample is truly representative of the bulk. The methods of sampling used in the United States are fully described in the USP.
   c) Preliminary Examination: in the case of whole drugs, the macroscopical and sensory characters are usually sufficient to enable the drug to be identified. However, drugs may comply with the descriptions given in the pharmacopeia. In such cases, the trained pharmacist is able to examine of the history of the sample from its appearance.

d) Foreign matter: The difficulty of obtaining vegetable drugs in entirely pure conditions is fully recognized and pharmacopeia contains statements as to the percentage of other parts of the plant or other organic matter, which may be permitted.

e) Microbial contamination: For a few crude drugs (Digitalis, Tragacanth) limits are set in the B. P. for certain organisms such as E.Coli and salmonella. Investigation of crude drugs 246 samples was examined and 24 percent were contaminated at the level of 1000 organisms per gram.

f) Moisture content: Drugs like Aloe and Gelatine contains excess water. The presence of moisture uneconomical and it leads to the proliferation of living organisms. The moisture content was evaluated by loss on drying, separation and measurement of moisture. Other standards are Extractive values, Ash values, Determination volatile oil, Refractive index, RF values, and Optical rotation.