Adulteration of crude drugs

➢ The adulteration and substitution of herbal drugs is the burning problem in herbal industry and it has caused a major effect in the commercial use of natural products.

➢ Adulteration in market samples is one of the greatest drawbacks in promotion of herbal products.

➢ The term 'adulteration' or debasement of an article covers a number of conditions, which may be deliberate or accidental.

➢ Adulteration is a practice of substituting the original crude drug partially or fully with other similar looking substances which is either free from or inferior in therapeutic and chemical properties.

➢ Or adulteration may be defined as mixing or substituting the original drug material with other spurious, inferior, defective, spoiled, useless other parts of same or different plant or harmful substances or drug which do not confirm with the official standards.

➢ Main intention is to enhancement of profits

Reasons for Adulteration of crude drugs

➢ unavailability or scarcity of particular crude drug

➢ High price prevailing in market

➢ Unwanted adverse effects of desired crude drug are there and have a choice of other drug with similar pharmacological effect and less unwanted after effects.

➢ Deforestation and extinction of many species

➢ Incorrect identification of many plants

➢ Most common in contraband drugs

Conditions of adulteration

➢ Inferiority is a natural substandard condition (e.g. where a crop is taken whose natural constituent is below the minimum standard for that particular drug) which can be avoided by more careful selection of the plant material.

➢ Spoilage is a substandard condition produced by microbial or other pest infestation, which makes a product unfit for consumption, which can be avoided by careful attention to the drying, and storage conditions.

➢ Deterioration is an impairment of the quality or value of an article due to destruction or abstraction of valuable constituents by bad treatment or aging or to the deliberate extraction of the constituents and the sale of the residue as the original drugs.

➢ Admixture is the addition of one article to another through accident, ignorance or carelessness e.g. inclusion of soil on an underground organ or the co-collection of two similar species.

➢ Sophistication is the deliberate addition of spurious or inferior material with intent to defraud; such materials are carefully produced and may appear at first sight to be genuine e.g. powder ginger may be diluted with starch with addition of little coloring material to give the correct shade of yellow colour.

➢ Substitution is the addition of an entirely different article in place of that which is required e.g. supply of cheap cottonseed oil in place of olive oil

Direct or intentional adulteration

➢ Direct or intentional adulteration is done intentionally which usually includes practices in which a herbal drug is substituted partially or fully with other inferior products.

➢ Due to morphological resemblance to the authentic herb, many different inferior commercial varieties are used as adulterants.

➢ These may or may not have any chemical or therapeutic potential.

➢ Substitution by "exhausted" drugs entails adulteration of the plant material with the same plant material devoid of the active constituents. This practice is most common in the case of volatile oil-containing materials, where the dried exhausted material resembles the original drug but is free of the essential oils.

➢ Foreign matter such as other parts of the same plant with no active ingredients, sand and stones, manufactured artifacts, and synthetic inferior principles are used as substitutes.

Types of adulterants

Substitution with Inferior Commercial Varieties

Due to morphological resemblance to the authentic drugs, different inferior commercial varieties are used as adulterant which may or may not have any chemical or therapeutic potential as that original natural drug.

Eg. Arabian Senna (Cassia angustifolia), dog Senna (Cassia obovata) and avaram senna (Cassia auriculata) have been used to adulterate Senna (Cassia senna); Japanese ginger (Zingiber mioga) to adulterate medicinal ginger (Zingiber officinale).



Cassia obovata



Cassia acutifolia

Adulteration using Artificially Manufactured Substances

- To provide the general form and appearance of various drugs, some materials are artificially manufactured and are used as substitute of the original one.
- Eg. artificial invert sugar for honey; paraffin wax after yellow coloration substituted for bees wax, bass wood in place of Nutmeg, compressed chicory in case of coffee berries.



Bees Wax



Paraffin wax



Bass Wood



Nutmeg

Substitution by Exhausted Drugs

- Here the same plant material is mixed which is having no active medicinal components as they have already been extracted out.
- This practice is most common in case of volatile oil containing materials like clove, fennel etc., where the dried exhausted material resembles the same like original drug (similarly with drugs like Cascara sagrada and ginger).
- Sometimes when coloring matters have been extracted or removed during exhaustion, the residue is re-colored with artificial dyes as is done with saffron and red rose petals.



Exhausted Cloves



Cloves



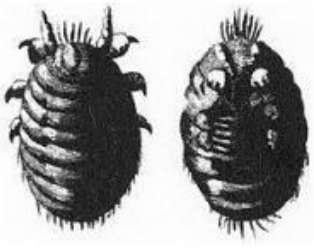
Saffron



Safflower

Adulteration of toxic materials

- In this type of adulteration the materials used for adulteration would be toxic in nature.
- Eg. A big mass of stone was found in the centre of a bale of liquorice root.
- Limestone pieces with asafetida, lead shot in opium, amber coloured glass pieces in colophony, barium sulphate to silvergain cochineal and manganese dioxide to blackgrain cochineal, are few examples in this adulteration.



Black grain - Cochineal



Silver grain - Cochineal



Colophony

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.
- Eg. Powdered olive stones for powdered gentain, liquorice or pepper, brick powder for barks, red sanders wood to chillies; dextrin for powdered ipecacuanha, are few adulterants.



OLIVE STONES



GENTIAN ROOTS



RED SANDERS WOOD

Simple methods for detecting adulterants

Sl	Food	Adulterant	Method of detection
1	Milk, milk product, powdered spices	Starch	Mix sample in a test tube with water, add a few drops of iodine solution. A blue colour indicates the presence of starch.
2	Milk	Water	Measure the specific gravity with a lactometer by immersing it in milk kept in a deep vessel. The normal values lie between 1.028-1.032. But this is not a foolproof method, as, in addition to water, sugar or urea may have been added to the milk to increase its specific gravity.
3	Milk	Developed acidity	Place a test tube containing 5 ml of the milk sample in a boiling water bath and hold for about 5 minutes. Remove the tube and rotate in an almost horizontal position. The film of milk on the side of the test tube is examined for any precipitated particles. Formation of clots is indicative of developed acidity in the milk due to microbial spoilage. Such milk is unsuitable for consumption.
4	Milk, milk powder	Neutralizers like carbonates	To about 5 ml of milk in a test tube add 5 ml of alcohol and a few drops of rosalic acid solution and mix the contents of the test tube. A rose red colour is obtained in the presence of a carbonate, whereas, pure milk shows only a brownish colouration.
5	*Ghee*, butter	Margarine or *vanaspati*	In one tea spoonful of completely melted sample, add 5 ml concentrated hydrochloric acid. Shake for 5 minutes, add a pinch of sugar or furfural. Appearance of pink colour in the acid layer indicates added *vanaspati*.
6	Oils and fats, black pepper	Mineral oil	To 2 ml of oil sample taken in a flask, add 20 ml of 0.5 ml normal alcoholic potash. Heat for 30 minutes and add 20 ml hot water. If turbidity appears, mineral oil is present.
7	Sweetmeats, ice cream and beverages, *sella* rice, pulses, spices	Metanil yellow	Extract colour with lukewarm water from food samples and add a few drops of concentrated hydrochloric acid. A magenta colour indicates the presence of metanil yellow.

8	Pulses, whole and split, *besan*	Kesari dal	*Kesari dal* is wedge shaped, with a slant on one side and a square face on the other side. Physical examination can detect the adulterant
		Metanil yellow	Put the sample in dilute hydrochloric acid. Pink colour develops indicating the presence of the adulterant.
9	Mustard seeds	Argemone seeds	Argemone seeds have a rough surface and mustard seeds are smooth. Upon pressing, mustard seeds are yellow inside while argemone seeds are white.
10	Black pepper	Papaya seed	Papaya seeds are comparatively shrunken, oval and greenish brown to brownish black in colour.
11	Tea leaves, sugar	Iron filings	Easily separated using a magnet.

Rejuvenating Herbs

The following ayurvedic herbs are very famous and effective for many years. Here we will describe herbs with their benefits –

1: <u>Ashwagandha</u>

- Ashwagandha is a traditional ayurvedic medicine used for multiple uses. It is found in India, Africa, and some parts of the Mediterranean continent.
- Ashwagandha's name is taken from a Sanskrit word where Ashva means horse, and Gandha means smell. As per the traditional description, it can bring the strength and stamina of a horse while nourishing the female and male reproductive and nervous systems.
- It is also called 'Winter Cherry' or 'Indian ginseng'. Generally, Ashwagandha roots are used for preparing ayurvedic remedies. The benefits of Ashwagandha are as follows –

- Boosts immune system
- Decreases stress and calm your body
- Enhance your memory and cognition
- Improve sleep patterns
- Helps to manage weight
- Helps to maintain normal testosterone levels in males
- Increase fertility
- Improve heart health
- Helps to manage weight
- Promote thyroid health

Ashwagandha is versatile and can be consumed as a powder, a tablet, or a liquid extract form. You can also take it with or without food and at any time.

2: Brahmi

- Brahmi is also called a Bacopa Monnieri is a traditional ayurvedic herb that has been used specifically to treat neurological disorders.
- It has anti-inflammatory and antioxidant properties.
- The leaves of this plant are considered very pure and effective. The benefits of Brahmi are as follows –

- Works as a brain tonic
- Enhance memory, concentration, and intelligence
- Improve nervous system function
- Reduces stress and depression
- Calm your mind
- Reduce the symptoms of attention deficit hyperactivity disorder (ADHD) like hyperactivity, impulsiveness
- It is used as a great antioxidant that helps to remove cancer-producing cells
- Acts as a natural blood purifier give healthy skin and hair

3: Shatavari

- Shatavari is a medicinal herb with excellent health benefits.
- Shatavari is also called as 'queen of herbs'.
- It has antioxidant properties due to the presence of Saponins in it.
- It is very beneficial to boost your immunity and for the female reproductive system.

Here are some benefits of Shatavari

- Enhance immunity power
- Reduces inflammations
- Improve female reproductive system activity
- Effective in alleviating respiratory symptoms
- Works excellent to relieve acidity symptoms
- Helps to cure esophagus, stomach, and intestinal ulcers
- Maintain blood sugar levels
- controls anti-aging changes of skin

4: Licorice

- Licorice has been used since the old days not only in Indian but in Greek and Egyptian medicine preparations.
- Due to its sweet flavor, it is been used in various preparations such as herbal teas, candies, capsules, and liquid extracts. Benefits of Licorice are as follows –

- Provides relief from acidity, stomach ulcers, and food poisoning
- Treats cold and cough
- Reduces stress
- Works as an anti-inflammatory, anti-spasmodic, anti-microbial, and anti-aging
- Excellent for hair fall and to prevent dandruff
- Beneficial in prostate gland problems

5: <u>Neem</u>

- Neem is a well-known herb due to its bitter taste.
- The word ”Neem”• is derived from the Sanskrit Nimba – which means the bestower of good health. Neem has miraculous healing powers used in various disorders.
- It is used in almost 75% of formulations in Ayurveda.
- The benefits of neem are as follows –
- Neem has antiseptic, anti-microbial, and antifungal properties.
- Potent blood purifier and detoxifier
- Treat acne, eczema, and skin diseases.
- Helps to reduce fever, especially malarial fever
- Maintain oral hygiene and prevent dental caries, infections
- Neem paste is great for hair and helps to control dandruff.

6: Manjistha

- Manjistha is great blood and lymph purifier helps to improve and regulate your immune system.
- Manjistha is effective to cleanse the liver, kidneys, and skin. The benefits of Manjistha are as follows –
- Boost your immunity
- Helps to improve complexion and clears acne
- Memory enhancer and increase learning ability
- Treats allergic conditions

7: Amala

- Amala is a powerful rejuvenating herb in Ayurveda.
- It mainly uses to boost the immune system.
- It has great antioxidant properties.
- The benefits of amala are as follows –
- Enhance body immunity
- Strengthen heart muscles
- Great for hair, skin, eyes, and nails
- Reduces high blood sugar levels
- Relieve from acidity

8: Haritaki

- Haritaki is known as a ‘king of herbs’ in the ayurvedic system of medicine.
- It is useful to strengthen energy, awareness, and intelligence.
- The benefits of Haritaki are as follows –

- Strengthens the vital functions of the body, such as strong digestion, nutrient absorption, elimination, etc.
- Reduce cholesterol levels
- Prevent lung infections
- Great for eyes

Uses of Non-Flowering Plants

- Non- Flowering plants are used in many ways.
- Gymnosperms are a healthy food supply.
- These non-flowering plant seeds are a popular edible species used to make various food items.
- These plant types include cycas, ginko, and pinus.

- Some gymnosperm species are useful sources of starch and are also employed in the manufacture of sago. It is a significant staple food for indigenous or lowland populations.
- The leaves of these plant species are soaked and consumed as green leafy vegetables in some sections of America and other lowland areas.
- Wine and other food products are produced using a variety of non-flowering plant types. In addition to being used to make food, gymnosperms are frequently used in the pharmaceutical business to make a variety of medications that are successfully used to treat allergies and other diseases like colds, coughs, asthma, and bronchitis.
- . The coniferous tree species Taxus is best known for the drug taxol. This anticancer medication, made from the Taxus tree's bark, is used to treat various tumours.
- Various Cycas plant species are used to cure various diseases and make various hair care products, such as oil, lotion, shampoo, etc.
- A few non-flowering plant types are frequently used as ornaments for home décor. Fern is an illustration.
- The cosmetics industry uses oil from plant materials such as bark, wood, and other parts to make perfumes, air fresheners, and other scent sprays.
- Some of these non-flowering plants are cultivated extensively in gardens, parks, and other locations in addition to their uses in food and medicine because they have lovely ornamental leaves.

In addition to these implications, gymnosperms have additional economic relevance.

- Specific medications for treating malignant ulcers are produced using many of these species.
- The mounting medium is used in labs for microscopic inspection.

- The antidote for snake bites is gum extracted from cycas plants.
- These plants' timber is a common resource in the paper industry.
- Handbaskets, brooms, hats, door and floor coverings, and other eco-friendly products are made from cycad leaves. Like teak and rosewood, pine tree bark, stems, and branches can be used to make beams, doors, flooring, poles, train waggons, and other structures out of wood.

CRUDE DRUGS

- Crude drugs are plants or animals, or their parts which after collection are subjected only to drying or making them into transverse or longitudinal slices or peeling them in some cases.
- Most of the crude drugs used in medicine are obtained from plants, and only a small number comes from animal and mineral kingdoms.
- Drugs obtained from plants consist of entire plants, whereas senna leaves and pods, nux vomica seeds, ginger rhizome and cinchona bark are parts of plants.
- Though in a few cases, as in lemon and orange peels and in colchicum corm, drugs are used in fresh condition, and most of the drugs are dried after collections.
- Crude drugs may also be obtained by simple physical processes like drying or extraction with water.
- Therefore, aloe is the dried juice of leaves of Aloe species, opium is the dried latex from poppy capsules and black catechu is the dried aqueous extract from the wood of Acacia catechu.
- Plant exudates such as gums, resins and balsams, volatile oils and fixed oils are also considered as crude drugs.

CHRYSOPOGON ZIZANIOIDES

- Chrysopogon zizanioides (L.)Roberty
- Family: Poaceae
- Common names: Vetiver grass, Khus
- Part used: Whole plant



Domain	- Eukaryota
Kingdom	- Plantae
Phylum	- Spermatophyta
Subphylum	- Angiospermae
Class	- Monocotyledonae
Order	- Cyperales
Family	- Poaceae
Genus	- *Chrysopogon*
Species	- *zizanioides*

- Perennial; roots stout, aromatic.

- Culms robust, 1 -2.5 m tall, ca. 5 mm in diam. Leaf sheaths glabrous, lower sharply keeled and imbricate in fanlike clusters;
- leaf blades linear, pale green, stiff, 30 -90 × 0.5 -1 cm, pilose on adaxial surface toward base, otherwise glabrous; ligule a scarious rim.
- Panicle oblong in outline, 20 -30 cm, usually contracted, purplish; branches numerous, lowermost 5 -20 cm, bare at base, smooth or slightly scaberulous; racemes slender, with 5 -13 spikelet pairs and a terminal triad; internodes and pedicels slightly scabrid.
- Sessile spikelet linear-lanceolate to almost linear, 4 -5 mm; callus rounded, subglabrous; lower glume muricate, 3 -5-veined, veins spinulosely aculeate, apex acute; upper glume spinulosely aculeate on keel, not awned; upper lemma slightly 2-toothed, awnless or mucronate; mucro 0 -2 mm, not exserted. Pedicelled spikelet staminate, sparingly aculeolate or almost smooth.

ZINGIBER OFFICINALE

Description, Cultivation and Uses

Contents:

- Botanical Name of Ginger
- Family of Ginger
- Description of Ginger
- Distribution of Ginger
- Parts Used in Ginger

1. Botanical Name of Ginger: ZINGIBER OFFICINALE Roscoe

2. Family of Ginger: ZINGIBERACEAE

3. Description of Ginger:

- Ginger are aromatic herb with an underground rhizome and an erect stem, up to 75 cm. in height.
- Leaves of ginger are simple, alternate, linear-lanceolate, sheathing at the base, sessile, acuminate at apex, glabrosus, up to 15 cm.long.
- Inflorescence a spike on a distinct scape; flowers densely arranged, bisexual, irregular, each subtended by a persistent scarious bract.
- Calyx tubular shortly 3-lobed.
- Corolla bilabiate, tubular below, yellow with purplish spots.

- Stamens 3 in one whorl, one of which is perfect the other 2 united to form a labellum; filament of perfect stamen short, anther cells contiguous, connective produced into a beak.
- Ovary of 3 carpels, syncarpous, 3-celled, inferior; ovules many on axile placentas; style filiform, lying in a groove of the anther; stigma subglobose.
- Fruit an oblong capsule, many seeded; seeds arillate, globose, with a small embryo and copious endosperm.

4. Distribution of Ginger:

- Ginger is indigenous to Indo-Malayan region and has been in cultivation in India since prehistoric times.
- It is now cultivated over a greater part of the tropical and temperate regions.
- The chief ginger growing countries of the world are India, China, Australia, East Indies, West Indies, Mexico, Jamaica, North Africa and West Africa.

5. Parts Used in Ginger: Rhizome.

- The ginger rhizome is much branched, somewhat resembling the palm of a hand with fingers.
- It has circular scars representing the nodes with small scales.
- Fibrous roots are emitted from these nodes.
- Buds developing in the axil of these scales come up as aerial scoots with normal leaves.
- The rhizome continues to grow underground while the aerial shoots die out annually and the tail end of the rhizome also perishes when old.

BARK DRUGS Vs WOOD DRUGS

Type # 1. Cinnamon:

Cinnamomum zeylanicum B1., of family Lauraceae; Eng. Cinnamon; Hindi—Dalchini.

This is native of Sri Lanka but grown in the Nllgirls, South Kanara, Malabar, Assam and Kumaon.

Uses:

The bark is aromatic, cordial, astringent, carminative and stimulant; it is given in diarrhoea, nausea, gastric irritation, flatulence, vomiting, spasmodic affections of the bowels, toothache, paralysis of the tongue and labour caused by defective uterine contractions. It is administered in the form of a powder, infusion or decoction.

A paste made of the bark is applied to the temples to get relief from neuralgic pains and severe headaches. The oil obtained from the stem bark is used as a carminative, antiseptic and astringent.

Type # 2. Quinine:

Cinchona calisaya Wedd., C. ledgerina Moens. ex Trimen; C. officinalis Linn; C. robusta How., C. succirubra Pavon ex Klotzsch. of family Rubiaceae; Eng. Quinine; Hindi—Kunain.

The quinine tree is native to the Andes of South America. In India it is found in West Bengal, the Khasia hills, Nilgiris, South India, Sikkim and Madhya Pradesh.

Uses:

Quinine is one of the most important drugs known and it is the only adequate cure for malaria. Quinine is obtained from the hard thick bark of above mentioned species of Cinchona. The most important constituent of Cinchona bark is quinine, a very bitter, white, granular substance.

In addition to its use in the treatment of Malaria, it is a valuable tonic and antiseptic. It is also used in the treatment of other fevers. Some 29 other alkaloids have been isolated from the bark, including cinchonidine, cinchonine, and quinidine, all of which are useful in medicine.

Type # 3. Asoka Tree:

Saraca indica Linn, of family Caesalpiniaceae; Eng. Asoka tree; Hindi—Ashot, Sanskrit, Hindi and Bengali—Asok; ashoka; Marathi—Ashoka; Gujarati—Ashopalava; Telugu—Asoka; Tamil—Asogam; Kannada—Asokadamara; Malayalam—Asokam; Oriya—Oshoko; Khasi Hills— Dieng-sohkyrkha.

This is a spreading evergreen tree; native of India; commonly found in Central and East Himalayas, Bengal and West Peninsula.

Uses:

The bark is astringent. Its decoction is given in uterine disorders, especially in menorrhagia and leucorrhoea. The decoction is also an efficacious remedy for piles and dysentery. The dried flowers are given in diabetes. The dried flowers of it are fried and used even by common people in Kerala.

Type # 4. Arjun Tree:

Terminalia arjuna (Roxb. ex DC.) Wight and Am., of family Combretaceae; Eng. Arjun tree; Hindi—Arjuna.

A tree, commonly found in Madhya Pradesh, Bihar and the Western Peninsula.

Uses:

The bark is astringent, febrifuge, cooling, cardiac stimulant, cholagogal, lithontriptic and vulnerary. It is an excellent remedy for heart diseases. The decoction with milk is given every morning on an empty stomach. The decoction is also used for cleaning sores and ulcers.

Type # 1. White Sandal Wood:

Santalum album Linn., of family Santalaceae; Eng. White sandalwood; Hindi—Safed chandan.

ADVERTISEMENTS:

A tree, found in the Western Peninsula, Kamataka, Tamil Nadu, and forests of Kerala.

Uses:

The wood is cooling, astringent, bitter, sedative, cardiac, tonic and diuretic. It is given in fevers and thirst. The powder of wood is given in gonorrhoea, fevers and bilious disorders. A paste of wood is a cooling dressing in inflammatory eruptive skin diseases.

The paste is also applied to the temple in headache and fever. The essential oil of wood is stimulant, antiseptic demulcent and diuretic. It is used in gonorrhoea, chronic catarrh of the bladder, urethral haemorrhage, chronic bronchitis and intermittent fevers. The oil is applied over scabies and other skin diseases.

Type # 2. Catechu:

Acacia catechu Wild., of family Mimosaceae; Eng.. Catechu tree; Verna. Kattha, Khair.

Uses:

It is a valuable astringent. It is generally used for disorders in which a mild, non- irritating and powerful astringent is required, such as chronic diarrhoea, dysentery, bleeding piles, uterine haemorrhage, leucorrhoea, etc.

It is very efficacious for mercurial salivation bleeding or ulcerated or spongy gums, hypertrophy of the tonsils, enlarged uvula, aphthous ulceration of the mouth etc., It may be used as lozenge made with the addition of gum arable and sugar.

A powder of catechu is used for plugging the cavity of an aching tooth to relieve pain. A tincture of catechu is useful for bed sores and painful mammary glands. A mixture of catechu and myrh, known as Kathbol is used as a tonic, as a galactagogue for nursing mothers.