

ADULTERATION OF CRUDE DRUGS

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- 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.

CONDITIONS OF ADULTERATION

- **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

TYPES OF ADULTERANTS

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

TYPES OF ADULTERATION

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

TYPES OF ADULTERANTS

Substitution by Superficially Similar Inferior Natural Substances

Usually here the adulterated product has no relation with the genuine article, may or may not have any therapeutic or chemical component desired.

Eg. leaves of species - *Ailanthus* are substituted for belladonna, senna, mint etc.; saffron admixed with saff flower, peach kernel oil with olive oil, etc.



Atropa belladonna



Ailanthus glandulosa

TYPES OF ADULTERATION

Addition of Synthetic Principles

Sometimes to fortify inferior natural products, synthetic principles are added

Eg. adding citral to oil of lemon; benzyl benzoate to balsam of Peru etc.

Adulteration using the Vegetative Matter of the Same Plant

The presence of vegetative parts of the same plant with the drug is also one type of adulteration.

Eg. liver warts and epiphytes growing in bark portion are mixed with Cascara or Cinchona; *excessive amount of stems in drugs like lobelia, stramonium, etc.*



Lichens



Liver warts



Mosses



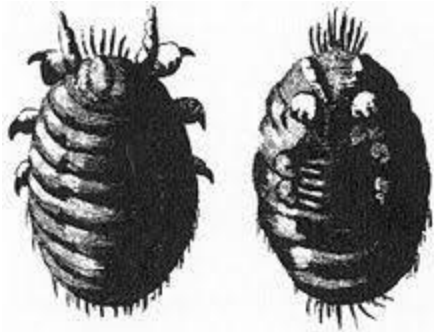
Epiphytes

TYPES OF ADULTERANTS

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 silvergrain cochineal and manganese dioxide to blackgrain cochineal, are few examples in this adulteration.



Black grain - Cochineal



Silver grain - Cochineal



Colophony

TYPES OF ADULTERANTS

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

INDIRECT OR UNINTENTIONAL ADULTERATION

- Confusion in vernacular names between indigenous system of medicine and local dialects
- Lack of knowledge about authentic plant
- Non availability of authentic plant
- Similarity in morphology and or aroma
- Careless collection
- Other unknown reasons

INDIRECT OR UNINTENTIONAL ADULTERATION

- Confusion in vernacular names between indigenous system of medicine and local dialects:
 - In Ayurveda - Parpatha – *Fumaria parviflora*
 - In Siddha – Parpadagam – *Mollugo pentaphyla*
- Lack of knowledge about authentic plant
 - Nagakesar – *Mesua ferra* – Two celled ovary
 - *Callophyllum inophyllum* – single celled ovary
- Non availability of authentic plant
 - *Hypericum perforatum* – European countries – compressed thin phloem, hollow pith, absence of calcium oxalate crystals
 - *Hypericum patulum* – India – broader phloem, partially hollow pith, presence of calcium oxalate crystals

INDIRECT OR UNINTENTIONAL ADULTERATION

- Similarity in morphology and or aroma
 - Ratanjot – Ventilago madraspatana – Western Ghats
 - Arnebia euchroma – present drug
 - Both yields Red dye
- Careless collection
- Other unknown reasons