

Drug Adulteration

Adulteration, in the broad and legal sense, is the debasement of any article. Drug adulteration is a practice of substituting original crude drug partially or wholly with other similar looking substances but the latter is either free from or inferior in chemical and therapeutic properties. It usually occurs when the drug is scarce or when its price is normally high, though there may not be any scarcity. And the adulterants must be some material which is both cheap and be available in large quantity. So, availability and price therefore limit the range of substitutes from which the adulterants are selected. Adulteration is done deliberately and the motives for it are commercial one and to get more profits. Although in some cases adulteration may be occur accidentally. Adulteration involves different conditions such as deterioration, admixture, sophistication, substitution, inferiority and spoilage.

- (1) **Inferiority**- It refers to any substandard condition of the drug. for example, the seeds of *Strychnos nux-vomica* containing less than 1.15% of Strychnine would be considered as inferior or substandard drug.
- (2) **Spoilage**- It is also a form of substandard drug where the quality or value or usefulness of the article is destroyed by the action of (fungi or bacteria) micro organisms to render the drug unfit for human consumption.
- (3) **Deterioration**- It is impairment of the quality or value of the drug by the abstraction or destruction of the important constituents by distillation, extraction, aging, moisture, heat, light or other means.
- (4) **Admixture**- Admixture- is addition of one article to another due to ignorance or carelessness or by accident. If, however, admixture exceeds the official standard of the drug, it legally becomes an adulteration.
- (5) **Sophistication**- It is the addition of a inferior spurious material to the drug with intention to defraud. When admixture is done intentionally to defraud, then it is the case of sophistication. It is also known as true adulteration.
- (6) **Substitution**- It occurs when totally different substance is used or sold in place of original drug. All types of substitution are considered legally as adulteration. Thus rapeseed oil sold as mustard oil, cotton seed oil sold as olive oil are all examples of substitution.

Generally, the drugs are adulterated by substitution with substandard commercial varieties, inferior drugs or artificially manufactured commodities. The different types of adulterants found in market are given below:-

(i) Substitution with substandard commercial varieties-

The adulterants. The examples are presence of *Strychnos nux-vomica* or *S. potatorum* in place of *Strychnos nux-vomica*; Indian senna substituted with Arabian senna; gentian by

Kutki, medicinal ginger replaced by its inferior varieties like African, Japanese and Cochin ginger.

(ii) Substitution with superficially similar inferior drugs-

These inferior drugs used may or may not be having any chemical or therapeutic value as that of original nature drug. Due to their morphological similarity to authentic drug, they are marketed as ado. *Belladonna* leaves are substituted with *Ailanthus* leaves; saffron is admixed with dried flowers of *Carthamus tinctorius*.

(iii) Substitution with artificially manufactured substances-

The substances artificially prepared to resemble original drug are used as substitutes. Generally this practice is followed for much costlier drugs. Compressed chicory in place of coffee; Paraffin wax made yellow colored and substituted for bee wax; clay material in place of clove.

(iv) Substitution with exhausted drugs-

The same drug is admixed but is devoid of any medicinally active constituents as they are already extracted out. This practice is more common in case of volatile oil containing drugs like fennel, clove, coriander, etc. Sometimes natural characters of exhausted drugs like colour and taste are manipulated by adding other additives and then it is substituted, e.g. exhausted gentian made bitter with aloes, artificial colouring of exhausted saffron, etc.

(v) Admixture with harmful adulterants-

Many times, the wastes from markets are collected and admixed with original drugs. This is particularly noticed for liquids or unorganized drugs. The examples are limestones in asafetida, lead shot in opium, white oil in coconut oils, cocoa butter mixed with stearin or cardamom seed is a very harmful adulterant.

(vi) Adulteration of powdered drugs-

Besides the entire drugs, the powdered forms are frequently found to be adulterated. The powdered liquorice or gentian admixed with powdered olive stones, red sander wood in capsicum, dextrin in ipecacunha, etc.

Drug adulteration is frequently done by substandard or inferior quality of drugs. The quality of the drugs may be inferior due to faulty collection, imperfect preparation and incorrect storage as describe below:

- A. **Faulty collection:** - in some cases the proportion of medicinally active constituent reaches a maximum at a particular season, stage of development, or age. But collection of correct part of genuine plant without regard to time factors causes the drug inferior. Examples are-

(i)Season-

<u>Drugs</u>	<u>Season of maximum activity</u>
Solanaceous leaves	Flowering stage of the drug (summer)
Colchicum corm	Early summer
Wild cherry bark	Autumn

(ii) **Stage of development & age-**

<u>Drugs</u>	<u>Stage and age of maximum activity</u>
Linseed	When fully ripe
Coriander	Fully grown & ripe
Wild cherry bark	Bark of young stems
Belladonna root	Root of 3-4 yrs. old

Ignorance or neglect on the part of the collectors may lead to unintentional collection of drug from the allied or foreign species. Such plants may bear a superficial resemblance to the genuine plant and they are frequently used as substituent for the gennine drug. Some examples are

<u>Drug</u>	<u>Official source</u>	<u>Source of adulteration</u>
(i) Aconite	<i>Aconitum napellus</i>	<i>A. Deinorrhizum</i>
(ii) Belladonna leaf	<i>Atropa belladonna</i>	<i>Phytolacca decandra</i> <i>Ailanthus glandulosa</i>
(iii) Indian Belladonna	<i>Atropa acuminata</i>	<i>Scopolia carniolica</i> Root of <i>Althea officinalis</i>
(iv) Digitalis	<i>Digitalis purpurea</i>	<i>Phytolacca acinosa</i> <i>Solanum nigrum</i> <i>Verbascum Thapsus</i>
(v) Chirata	<i>Swertia chirata</i>	<i>Primula vulgaris</i> <i>Digitalis thapsi</i>
(vi) Punarnava	<i>Boerhaavia diffusa</i>	<i>Swertia angustifolia</i> <i>S.alata</i> , <i>Andographis Paniculeta</i>
(vii) Rauwolfia	<i>Rauwolfia serpentin</i>	<i>Trianthema portulacastrum</i> <i>R. densiflora</i> , <i>R. nitida</i> , <i>R. tetraphylla</i> .

- B. **Imperfect preparation-** Collection of other and less valuable parts of the genuine plants may cause drug inferior that means adulteration. In most of cases stems are collected with leaves. The ad0 done by non-removal of inert or undesirable parts of the drugs. The examples are-

<u>Drug</u>	<u>Official composition</u>	<u>Inert and undesirable part</u>
Ginger	Rhizome freed from cork	Cork
Orange & lemon peels	Outer part of the pericarp	Inner white spongy part of pericarp
Ipecac	Roots and rhizomes	Aerial stem
Tamarind	Fruits freed from the brittle outer part	Outer part of the pericarp
Pyrethrum	Flower heads	Stem and leaf

Sometimes, neglect of proper conditions for drying make substandard and which ultimately leads to drug adulteration. The examples are as follows-

<u>Drug</u>	<u>Fault treatment</u>
Colchicum corm	Drying at a temperature above 65°C which accelerates the rate of hydrolysis of colchicine.
Digitalis	Leaving in a wilted condition for long time, thereby providing suitable conditions for the decomposition of the glycosides by the enzymes; or drying above 60°C thereby promoting hydrolysis of the glycoside.
Cod-liver oil	Excessive heat used in separating the oil from the livers affect the proportion of vitamins, odour and color.
Coffee	Caffeine is lost by over- heating.

- C. Incorrect storage- Incorrect storage spoils many drugs. The quality, value or usefulness of the drug has been impaired or destroyed by action of moisture, light, temperature and microorganisms and the article becomes unfit for human or animal consumption are legally considered as adulterated. A few examples are-

Drug

Storage condition

Digitails, Belladonna,
Hyoscyannus and stramonium

To be preserved in a dry place or a container which prevent enzymatic hydrolysis.

Volatile oil

Protected from light, and stored in well-closed containers in a cool place.

Ergot

Protected from molds.