

ADULTERATION OF DRUGS OF NATURAL ORIGIN

INTRODUCTION- Medicinal plants constitute an effective source of traditional and homeopathy medicine. Herbal medicine has been shown to have genuine utility. In India, about 80% of the rural population depends on medicinal herbs and/or indigenous systems of medicine. In fact today, approximately 70% of synthetic medicines are derived from plants. Herbal adulteration is one of the common malpractices in herbal raw-material trade.

Adulteration is described as intentional substitution with another plant species or intentional addition of a foreign substance to increase the weight or potency of the product or to decrease its cost.

In general, adulteration is considered as an intentional practice. However, unintentional adulteration also exists in herbal raw-material trade due to various reasons, and many of them are unknown even to the scientific community.

Adulteration-

Definition- The term adulteration is defined as substituting original crude drug partially or wholly with other similar looking substances. The substance, which is mixed, is free from or inferior in chemical and therapeutic property.

Types of adulterant- 1.INTENTIONAL ADULTERATION

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 here.

1) Adulteration using manufactured substances-

In this type of adulteration the original substances are adulterated by material that are artificially manufactured. The materials are prepared in a way that their general form and appearance resemble with various drugs.

Eg. Cargo of ergot from Portugal was adulterated with small masses of flour dough moulded to the correct size and shape and coloured, first using red ink, and then into writing ink.

Artificial invert sugar is used in place of honey.

Paraffin wax coloured yellow and is been substituted for beeswax.

Compressed chicory is used in place of coffee berries.

Bass-wood is cut exactly the required shape of nutmeg and used to adulterate nutmeg.

2)substitution using inferior commercial varieties-

In this type, the original drugs are substituted using inferior quality drugs that may be similar in morphological characters, chemical constituents or therapeutic activity.

Eg. Hog gum or hog tragacanth for tragacanth gum,

Mangosteen fruits for bael fruits,

arabian senna, obovate senna and provence senna are used to adulterate senna, ginger being adulterated with cochin,African and Japanese ginger.

3)substitution using exhausted drugs-

In this type of substitution, the active medicaments of the main drugs are extracted out and are used again. this could be done for the commodities that would retain its shape and appearance even after extraction, or the appearance and taste could be made to the required state by adding colouring or flavouringagents. This technique is frequently adopted for the drugs containing volatile oil, such as clove, Fennel, etc.

Eg. After extraction, Saffron and red rose petals are recoloured by artificial dyes.

The bitterness of exhausted gentian is restored by adding aloes.

4)substitution of superficially similar inferior natural substance-

The substituents used may be morphologically similar but will not be having any relation to the genuine article in their constituents or therapeutic activity.

Eg. Ailanthus leaves are substituted for belladonna, senna leaves,

Saffron admixed with saff flower

Peach kernels and apricot kernel for almonds

5) Adulteration using the vegetative part of the same plant-

The presence of vegetative parts of the same plant with the drug in excessive amount is also an adulteration.

Eg. Epiphytes, such as mosses, liverworts and lichens that grow over the barks also may occur in unusual amounts with the drugs,

Excessive amount of stems in drugs like lobelia, stramonium, hamamelis leaves, etc.

6) Addition of toxic materials-

In this type of adulteration, the materials used for adulteration would be toxic in nature. A big mass of stone was found in the centre of a bale of liquorice root. lime stone pieces with asafoetida, lead shot in opium, amber coloured glass pieces in colophony.

7) 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. Powdered olive stones for powdered gentian, liquorice or pepper, brick powder for barks.

8) Addition of synthetic principles-

Synthetic pharmaceutical principles are used for market and therapeutic value.

Eg. Citral is added to lemon oil, diabetes angel containing glyburide and phenformin, sleeping buddha containing estazolam.

2. UNINTENTIONAL ADULTERATION-

Unintentional adulteration may be due to the following reasons:

- 1) confusion in vernacular names between indigenous systems of medicine and local dialects
- 2) lack of knowledge about the authentic plant
- 3) non availability of the authentic plant
- 4) similarity in morphology and or aroma
- 5) careless collection
- 6) other unknown reasons

Name confusion-

In Ayurveda , 'Parpatta' refer to *Fumaria parviflora*. In siddha, 'Parpadagam' refer to *Mollugo Pentaphylla*. Owing to the similarity in the names in traditional system of medicine , these two herbs are often interchanged or adulterated or substituted. Because of the popularity of siddha medicine in some parts of south India, traders in these regions supply *M.Pentaphylla* as Parpatta/Parpadagam and the north Indian suppliers supply *F.Parviflora*. These two can be easily identified by the presence of pale yellow to mild brown coloured, thin wiry stems and small simple leaves of *M.Pentaphylla* and black to dark brown -coloured, digitate leaves with narrow segments of *F.Parviflora*.

Lack of knowledge about authentic source-

Nagakesar is one of the important drugs in Ayurveda. The authentic source is *Mesua ferrea*. However, market sample are adulterated with flowers of *calophyllum inophyllum*. Though the authentic plant is available in plenty throughout the western ghats and parts of the Himalayas, suppliers are unaware of it. There may also be some restrictions in forest collection. Due to these reasons, *C. inophyllum* is sold as Nagkesar. Authentic flowers can be easily identified by the presence of two- celled ovary, whereas in case of spurious flowers they are single celled.

Similarity in morphology-

Mucuna pruriens is the best example for unknown authentic plant and similarity in morphology. It is adulterated with similar papilionaceae seeds. *M.utilis*(sold as

white variety) and *M.deeringiana* (sold as bigger variety) are popular adulterants. Apart from this, *M.cochinchinensis*, *Canavalia variso* and *C.ensifomis* are also sold in Indian markets. Authentic seeds are upto 1cm in length with shining mosaic pattern of black and brown colour on their surface. *M.deeringiana* and *M.utilis* are bigger (1.5-2cm) in size. *M.deeringiana* is dull black, whereas *M.utilis* is white or buff coloured.

Lack of authentic plant-

Hypericum perforatum cultivated and sold in European markets. In India, availability of this species is very limited. However, the abundant Indo-Nepal species *H.patulum* sold in the name of *H.perforatum*. Market sample is a whole plant with flowers, and it is easy to identify them taxonomically. Anatomically, stem transverse section of *H.perforatum* has compressed thin phloem, hollow pith and absence of calcium oxalate crystals. On the other hand, *H.patulum* has broader phloem, partially hollow pith and presence of calcium oxalate crystals.

Similarity in colour-

It is well known that in course of time, drug materials get changed to or substituted with other plant species.

Eg. Ratanjot – On discussion with supplier and non-timer forest product (NTFP) contractors, it came to be known that in the past, roots of *ventilago madraspatana* were collected from western Ghats, as the only source of Ratanjot. However, that is not the practice now. It is clearly known that *Arnebia euchroma var euchroma* is the present source. Similarity in yielding a red dye, *A. euchroma* substitutes *V. madraspatana*. The description to identify these two is unnecessary because of the absence of *V. madraspatana* in market. Whatever is available in the market, in the name of Ratanjot, was originated from *A.euchroma*.

Careless collections-

some of the herbal adulterations are due to the carelessness of herbal collectors and suppliers. *Parmelia perlata* is used in ayurveda, unani, and siddha. It is also used as grocery. Market samples showed it to be admixed with other species (*P.perforata* and *P.cirrhata*). Sometimes, *Usnea* sp. is also mixed with them. Authentic plants can be identified by their thallus nature.

Unknown reasons-

Vidari is another example of unknown authentic plant. It is an important ayurvedic plant used extensively. Its authentic source is *Pueraria tuberosa*, and its substitute is *Ipomoea digitata*. However, market samples are not derived from these two. It is interesting to know that an endangered gymnosperm *cycas circinalis* is sold in plenty as vidari. The adulterated materials originated from Kerala, India. Although both the authentic plant and its substitute are available in plenty throughout India, how *C.circinalis* became a major source for this drug is unknown. *P.tuberosa* can be easily identified by the presence of papery flake-like tubers, *I.digitata* by the presence of its concentric rings of vascular bundles and their adulterant *C.circinalis* by its leaf scars and absence of vessel elements.