Different methods of adulteration of crude drugs

Introduction of the adulteration of crude drugs

Overview

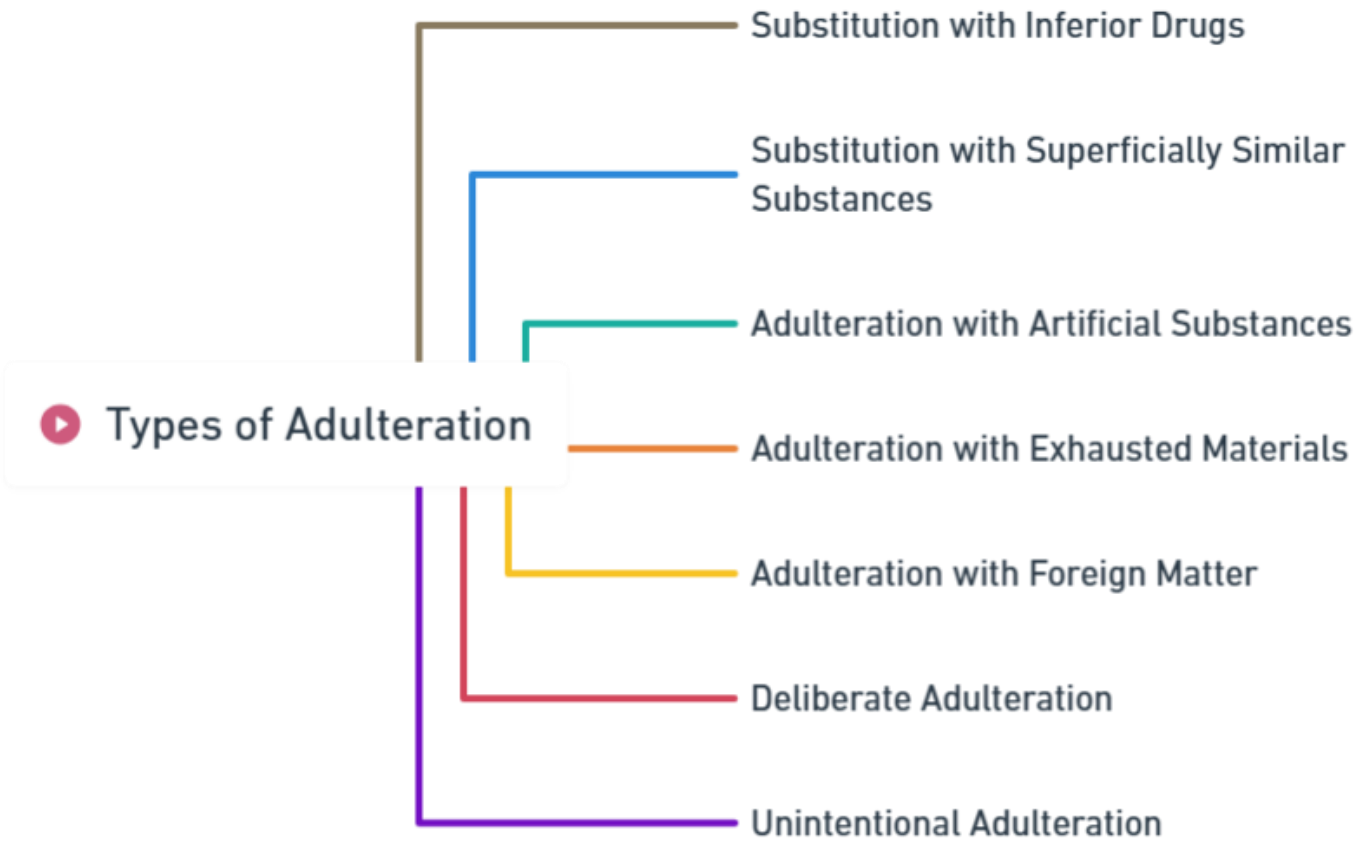
- Crude drugs are naturally occurring substances that are derived from plants, animals, or minerals and used in their raw or minimally processed forms for therapeutic purposes.
- These substances are the foundation for many traditional and modern medicinal preparations.
- Adulteration refers to the practice of intentionally or unintentionally lowering the quality and purity of crude drugs by adding inferior, substandard, harmful, or even entirely different substances.



- It is a significant issue in the pharmaceutical and herbal drug industry, affecting drug efficacy, safety, and therapeutic value.
- Adulteration is a major concern due to:
    - Increased demand for herbal and natural products
    - Lack of stringent regulatory controls in some regions.
    - Economic motives, where adulterants are used to increase profit margins.
    - Difficulty in authentication of crude drugs by untrained professionals.

Types of Adulteration

Adulteration can be broadly classified into the following types:



1. Substitution with Inferior Drugs

- This involves replacing the original drug wholly or partially with another drug that has similar appearance but inferior medicinal properties.
- **Example:** Substituting *Atropa belladonna* leaves with leaves of *Alkanna tinctoria* (which do not have the same alkaloid content).

2. Substitution with Superficially Similar Substances

- Here, the adulterant resembles the genuine drug in appearance but is chemically and pharmacologically inactive or different.
- **Example:** *Digitalis purpurea* leaves may be substituted with *Plantago* leaves (non-medicinal look-alikes).

3. Adulteration with Artificial Substances

- Addition of artificially prepared substances that mimic the genuine crude drug.
- **Example:** Adding synthetic benzoin resin to natural benzoin to increase weight or quantity.

4. Adulteration with Exhausted Materials

- Crude drugs that have been previously extracted for their active constituents (via solvent extraction)

- **Example:** Exhausted ginger after volatile oil extraction sold as crude ginger.

5. Adulteration with Foreign Matter

- This involves mixing unwanted parts of the same plant or extraneous materials such as dirt, sand, stones, or other plant parts.
- **Example:** Mixing stem pieces with genuine rhubarb root.

6. Deliberate Adulteration

- Intentional replacement of the drug with worthless or low-cost materials, often for economic gain.
- **Example:** Adding brick powder to red chili powder to increase weight.

7. Unintentional Adulteration

- Occurs due to ignorance, carelessness, or lack of proper knowledge during collection, storage, or handling of drugs.
- **Example:** Harvesting *wrong species* of a medicinal plant due to misidentification.

Examples of Adulteration (Drugs and Adulterants)

Genuine Drug	Common Adulterant
Clove (*Syzygium aromaticum*)	Exhausted cloves (after oil extraction)
Ginger (*Zingiber officinale*)	Exhausted ginger
Black Pepper (*Piper nigrum*)	Dried fruits of *Papaya*
Turmeric (*Curcuma longa*)	Colored starch or lead chromate
Asafoetida (*Ferula species*)	Resin, gypsum powder
Nutmeg (*Myristica fragrans*)	Spurious seeds, artificial nutmeg
Senna (*Cassia angustifolia*)	Leaves of *Cassia auriculata*
Saffron (*Crocus sativus*)	Dyed petals of marigold or safflower

- These adulterants may not only reduce therapeutic efficacy but could also introduce toxic or allergenic components.

Methods of Adulteration of Crude Drugs

- Adulteration may occur during different stages such as collection, storage, processing, or marketing.

Some of the common methods include:

A. Physical Adulteration

- Mixing of foreign matter like stones, sand, wood, shells, or stems.
- Intentional addition of exhausted materials (already extracted).
- Replacing valuable parts with inferior parts of the same plant.

B. Chemical Adulteration

- Use of artificial coloring agents, preservatives, or synthetic chemicals to mimic color or odor of genuine drugs.
- Adding metallic salts to enhance color.
- Adulteration with synthetic active ingredients or compounds.

C. Biological Adulteration

- Use of different plant species that are morphologically similar but pharmacologically inactive or toxic.
- Includes substitution of closely related or unrelated species.

D. Morphological Adulteration

- Substitution with drugs that are morphologically similar in appearance but differ in chemical composition.
- This method exploits lack of microscopic or anatomical inspection.

E. Economical Adulteration

- Using low-cost substitutes, fillers, or bulking agents to increase volume or weight of crude drugs.

F. Microbial Adulteration

- Poor storage or handling leading to contamination with bacteria, fungi, or insects.
- This not only degrades the drug but also poses health risks.

G. Accidental Adulteration

- Caused by lack of knowledge, improper identification, or harvesting from wrong species or habitat.
- Example: Collecting poisonous *Datura stramonium* instead of non-toxic *Hyoscyamus niger*.

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