

## Introduction to Adulteration of Crude Drug and its Evaluation Methods: Concise Review

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**ABSTRACT** –Food Plays A Major Role in Our Life and For Our Body. We Have A Variety of Cuisines as Per the Spices and Taste. Adulteration Is Done So as To Change the Actual Quality, Composition of Spices, Decrease Purity & Alter the Property of Natural Drug. Adulteration Has Led to Many Mild, Moderate, Severe Adverse Reactions in Our Body. They Can Be Life Threatening as Well. Adulteration Is Done with The Use of Other Crude Drugs Which Consists of Similar Properties to That of The Natural and Pure Crude Drug. Adulteration Has Led to Problems Like Anaemia, Brain Damage, Cancer and Other Toxic Diseases. So, To Understand the Term Adulteration and Evaluate the Methods of Adulteration We Should Be Having Right Knowledge on Adulteration.

**KEYWORDS** – Adulteration, Composition, Crude Drugs, Evaluate

### I. INTRODUCTION -

Adulteration Caused A Variety of Adverse Effects from Mild (Allergic Reactions, Pain, Mood Disturbances Etc), To Moderate (Seizures, Vomiting Etc) To Severe (Coma, Poisoning, Renal or Liver Damage) Serious Complications. Adulteration Is Similar to The Term Substitution Which Means Substituting the Original Crude Drug to Other Substances Which Are Inferior. Adulteration Is Done Intentionally and Unintentionally as Well. Sometimes Adulteration Is Done by Adding A Foreign Substance to Increase the Weight or Potency of The Materials or To Decrease the Price of The Product. Herbal Medicine Has Shown A Promising Result in

Healthcare. But, Because Of Adulteration Faith in Herbal Medicine Has Declined. The Substance Which Are Replaced by The Original Crude Drugs Are Called as Adulterants. Basically, Adulteration Is A Process Which Decreases the Quality of Any Food Because Of Addition or Substitution of Foreign Substance. Researchers Have Studied That the Problems Caused in Life of People Are Mostly Because Of The Presence of Adulterants. We Need to Know All the Basics of Adulterants to Minimize the Rate of Adverse Reactions and Learn How the Adulteration Is Been Done to Rectify This Illegal Act.

### Factors That Create Adulteration:

1. Deterioration
2. Spoilage
3. Admixture
4. Sophistication
5. Substitution
6. Inferiority

Let's See What These Factors Mean:

1. **Deterioration**– It Is A Process Which Decreases the Quality of Crude Drug with Actual Process of Distillation or Due to Moisture, Heat Etc. It Basically Means Decreasing the Quality of Drug by Any Physical Process. E.g.-
  - a. Manly Volatile Oil Containing Drugs Like Fennel, Clove, Coriander Etc Are Adulterated by This Process.



b. Removing Maximum Amount of Caffeine by Over Roasting the Coffee Beans.

2. **Spoilage**– Decreasing or Change in Quality of Crude Drug by The Attack of Microbes. The Crude Drug Gets Deteriorated. The Food Which Is Spoiled by The Microbial Contamination Leads to Food Poisoning and Other Related Problems.

E.g.-Sometimes Crude Drugs Are Not Dried Completely & Not Stored Properly Which Increases Their Chances of Microbial Contamination.

3. **Admixture**– Addition of Similar Looking Substance to Other Original Crude Drugs by The Means of Carelessness, Lack of Knowledge, Or Ignorance. This Factor Can Come Under Unintentional Adulteration. E.g.-

- a. Clove Is Added Along with Leaves and Petioles
- b. Adding of Soil and Stone Pieces to The Roots and Rhizomes Unintentionally.

4. **Sophistication**– This Method Can Come Under Intentional Adulteration.

It Means Adding an Inferior Substance with Less Therapeutic Activity in Place of Original Crude Drug. The Crude Drugs with Same Look A Like Powder Form Are Adulterated by This Method.

E.g.-

- a. Adding Glucose Powder in Place of Acacia Gum Powder.

b. Adding A Yellow Powder of Starch or Wheat Instead of Ginger.

5. **Substitution**– Substituting A Different Drug in Place of The Original Crude Drug. This Can Be A Type of Intentional Adulteration. In This Factor the Substance Added Is Not Even Related to The Original Crude Drug. It Can Be Done with Lack of The Original Crude Drug. It Means When One Does Have the Original Crude Drug, He Substitutes It with The Other Substance. E.g.- Cotton Seed Oil Is Often Used Instead of Pure Olive Oil.

6. **Inferiority**– The Original Crude Drug Is Replaced by A Substandard Drug Which Is Cheaper in Cost. The Substandard Drug Resembles the Original Crude Drug by Its Morphological, Chemical and Therapeutic Properties. In This Factor the Substandard Substance Contains Less Percentage of Chemical Constituents Than the Original Crude Drug Which Was to Be Used. Thus, The Substandard Substance Is Called as Inferior. E.g.- Indian Senna Is Replaced with Arabian Senna.

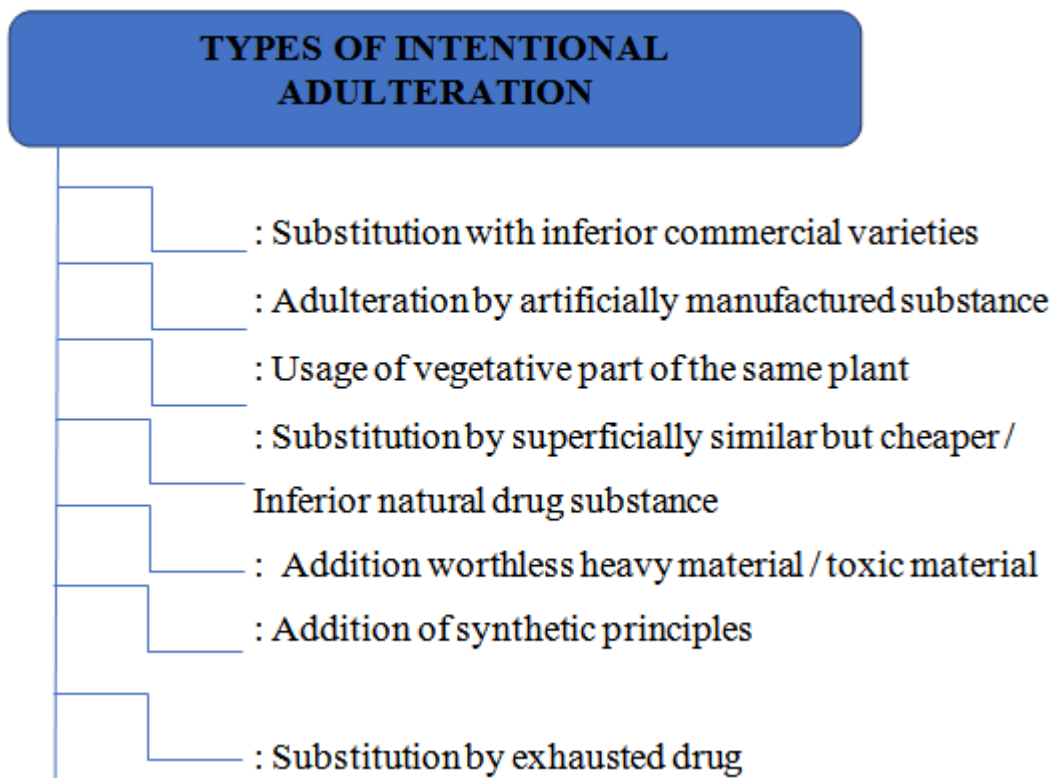
#### Types of Adulteration: -

1. Intentional Adulteration or Direct Adulteration
2. Unintentional or Indirect Adulteration

**I. Intentional Adulteration or Direct Adulteration** – In This Type of Adulteration the Inferior Substance Is Added in Place of

The Original Crude Drug Intentionally. The Inferior Substance Means A Substance Which Resembles the Original Crude Drug Morphologically Are Used as An Adulterant. They Have Less Content of Constituent Which Is Responsible for The Therapeutic Activity.

This Type of Adulterants Leads to Fraud and Can Cause Greater Adverse Reactions Which Can Lead to Life Threatening Diseases Like Cancer, Respiratory Problems Etc. Many Problems in India, Mostly Occur Due to This Type of Adulteration.



**1. Substitution with Inferior Commercial Varieties**

- In This Type of Intentional Adulteration, The Original Crude Drugs Are Replaced by An Inferior Drug / Substance That Resembles the Morphological Property, Chemical Constituents (But Not Much), Therapeutic

Activity of Original Crude Drug. This Is Done as The Substances Are Cheaply Available, And Non-Toxic in Nature.

- E.g.- Indian Senna Is Adulterated with Dog Senna
- Tragacanth with Hog Tragacanth



**ORIGINAL DRUG(CAPSICUM MINIMUM) ADULTERATION (CAPSICUM ANNUM)**



**ORIGINAL DRUG (INDIAN SENNA)**



**ADULTERATION ( ARABIAN SENNA)**

**2. Adulteration by Artificially Manufactured Substance**

- Artificial Substances Are Produced or Made in Such A Type That They Look Similar to That of The Original Crude Drug.

- Few Examples Are Cargo of Ergot Adulterated with Small Masses of Flour Dough Moulded to The Correct Size, Shape and Colour.
- CoffeeBerries Are Adulterated with Compressed Chicory.



**ORIGINAL DRUG (BEES WAX)**  
**ADULTERATION ( YELLOW COLOURED PARAFFINWAX)**

**3. Usage of Vegetative Part of The Same Plant**

- Presence of Vegetative Part of The Same Original Crude Drug Comes Under Adulteration Due to Faulty Collection.
- Basically, The Parts of The Plant Attached with The Original Crude Drug Also Is Collected.



They Look A Like with The Crude Drug So They Aren't Properly Differentiated and Used.

- The Vegetative Part Collected Doesn't Contain Much of Therapeutic Activity or The Therapeutic Activity Is Negligible.
- E.g.- The Stem Portions of a Certain Leaf Drugs Are Mixed Together.



Senna leaves excess amount of vegetative part in senna leaves

**4. Substitution by Superficially Similar but Cheaper / Inferior Natural Drug Substances**

- In This Type of Adulteration, The Adulterant's Morphological Character Is Similar to The Original Crude Drug.



- They May or May Not Be Similar with Their Chemical or Therapeutic Property.
- E.g.- Caraway Is Used as An Adulterant for Indian Dill.



**5. Addition Worthless Heavy Material / Toxic Material**

- In This Type of Adulteration, The Substance Used in Place of Original Crude Drug Are Toxic in Nature or Else Heavy.



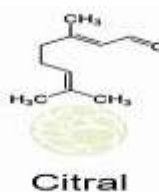
- To Increase Weight Heave Substances Are Used in Place of Original Crude Drugs
- E.g.- Hard Woods Are Used as Adulterants for Licorice Root.

**6. Addition of Synthetic Principles**

- Synthetic Substances Are Used in Place of Original Crude Drugs



- They Are Prepared Based on Their Therapeutics Properties.
- E.g.- Citral In Place of Lemon Oil



**7. Substitution by Exhausted Drug**

- In This Type of Adulteration, The Exhausted Constituents Are Used Again After Extraction.
- This Is Done for The Substances Whose Taste or Appearance Are Not Purely Destroyed and

- They Are Adulterated by Using Flavouring & Colouring Agents.
- E.g.- Exhausted Clove



## II. Unintentional Or Indirect Adulteration

- This Type of Adulteration Is Often Done Because Of Lack of Knowledge, Carelessness, Non- Availability of The Original Crude Drug, Confusion Etc.
- It Doesn't Mean That the Person Who Is the Manufacturer or The Supplier Is Doing It with Bad Intention or To Harm Others.
- Confusion Occurs Due to Same Morphological Property, Same Look A Like Shape. E.g.- Indian Dill and Caraway.
- Lack of Knowledge Is Due to Not Having Information About the Original Crude Drug.
- Sometimes During Collection Excess Vegetative Part Is Also Collected Without Knowing. So, This Carelessness Also Leads to Unintentional Adulteration.
- Similarity in Colour of The Crude Drugs Also Leads to This Type of Adulteration.

## EVALUATION METHODS OF ADULTERATION

- Testing the Food Before Eating Is A Safe Way to Be Prevented from Any Adverse Reactions.
- But Here, We Are Talking About Evaluating the Crude Drugs.
- We Have Seen the Types and Reasons of Adulterations and Now, We Need to Test the Purity, Quality, And Also Identify the Crude Drug.
- These Evaluation Method Will Help Us Identify the Type of Adulteration.
- The Evaluation Techniques Help Us to Know Whether There Is Any Presence of Foreign Substance or The Drug Is Full on Its Therapeutic Activity.

## THERE ARE DIFFERENT METHODS OF EVALUATION:

- MORPHOLOGICAL AND ORGANOLEPTIC EVALUATION

- MICROSCOPIC EVALUATION
- PHYSICAL EVALUATION
- CHEMICAL EVALUATION
- BIOLOGICAL EVALUATION
- CHROMATOGRAPHY AND SPECTROPHOTOMETRY

## 1. MORPHOLOGICAL AND ORGANOLEPTIC EVALUATION

- In This Type of Evaluation, We Detect the Adulterants with the Help Of
  - Colour
  - Shape
  - Odour
  - Taste
  - Size
  - Texture Etc.
- It Is the Kind of Evaluation Which Includes Physical Examination.
- Some Drugs Can't Be Evaluated Much with This Due to Same Look A Like or Similar Physical Properties.
- E.g.- Drugs Such as Nux - vomica Are Disc Shaped, Fennel Are Small in Size.
- Sweet Taste Like Honey
- Aromatic Odour Like Umbelliferous Fruits
- Basically, For This Kind of Evaluation We Need to Have Knowledge About Their Physical Characters Which Includes Macroscopic Properties.
- Organoleptic Properties Include Colour, Odour Etc.
- Thus, With This Evaluation It Will Be Easy to Identify Drugs.
- This Is the First Step of Evaluation of Any Drug.

## 2. MICROSCOPIC EVALUATION

- Every Drug Has Its Own Microscopic Characters.

- But These Evaluation Methods Are Divided Into 2 Parts Which Are,
  - Quantitative
  - Qualitative
- Quantitative Evaluation Includes – Palisade Ratio, Stomatal Index, Vein - Islet Number Etc.
- Qualitative Characters Include:
  - Calcium Oxalate Crystals
  - Starch Grains
  - Trichomes
  - Stomata Etc
- This Evaluation Method Gives You Almost A Complete Information of the Drug with Respect to The Microscopic Characters of That Drug.
- This Evaluation Can Be Done in Laboratories of Colleges Which Is Also Called as Small Scale. So, Detecting the Microscopic Characters We Need to Know Which Drug Has Which Microscopic Characters Present in It.
- E.g.- Lignified Trichomes Are Present in Nux – Vomica, Glandular Trichome In Vasaka, Anomocytic Stomata in Digitalis Etc.

### 3. PHYSICAL EVALUATION

- To Identify the Drug on The Basis of Its Quality and Purity of Drug.
- Physical Parameters Such As,
  - Solubility
  - Melting Point
  - Refractive Index
  - Optical Rotation
  - Viscosity
  - Specific Gravity
  - Total Ash Value Etc.
- These Parameters Are Evaluated to Identify the Drug.
- Parameters Such as Melting Point Is Useful in Determining the Purity of The Crude Drug. Because if Any Impurity Is Added the Melting Point Won't Be Similar to The Original Crude Drug.
- Refractometer Is Used to Measure the Refractive Index of Certain Drug to Know the Percentage of Volatile Oils and Fixed Oils.
- Viscosity Is Measure by Viscometers, Specific Gravity Is Measured My Specific Gravity Bottle.
- E.g. - Clove Oil Has Refractive Index Of 1.52 – 1.53

### 4. CHEMICAL EVALUATION

- Determining the Chemical Constituents Is Known as Chemical Evaluation. The Chemical Constituents Relates to The Drug's Pharmacological Properties. The Isolation, Purification, Identification of These Chemical Constituents Refers to The Chemical Evaluation. The Chemical Tests Done Is Based on This Chemical Evaluation.
- Identification Tests, Test for determining The Acid Value – Saponification Values Etc, Assays of Certain Phytoconstituents Comes Under Chemical Evaluation Method
- E.g.- Van Urk's Test for Ergot.

### 5. BIOLOGICAL EVALUATION

- This Method of Evaluation Is Done When the Other Evaluation Doesn't Give Appropriate Results or When the Drug Doesn't Get Confirmed by Those Evaluation Methods. Sometimes, The Quantity of The Crude Drug Is Less and They Couldn't Be Used in Other Evaluation Methods, Like When the Quantity Is Less, We Won't Be Able to Perform All the Chemical Test or Physical Tests. So, This Method Comes in For That. This Method Is Performed on Living Organisms Like Animals or Birds Such as Cats, Pigeons Etc.
- When the Living Organisms Like Bacteria Are Used to Determine the Antibiotics Activity, Such Methods Are Called A Microbiological Evaluation / Assay.
- E.g.- Cardiac Glycosides Are Evaluated by This Method.

### 6. Chromatography And Spectrophotometry

- This Method Can Be Used as Both Qualitative and Quantitative. There Are Various Spectroscopic Methods Used in This Evaluation Such As, UV– VISIBLE, NMR, IR. There Are Various Chromatography Techniques Used Such As TLC, GLC Etc.
- In the Spectroscopic Technique Measurement and Interpretation of EMR Absorbed or Emitted When the Molecules Move to The Excited State from The Ground State. They Are Also Used to Check the Purity and Quality of The Drug.

## II. CONCLUSION -

We Understand from This Article That Problems Occur Is Because We Have Lack of Knowledge About the Drug's Properties. People Intentionally or Unintentionally Adulterate the Food and We Have to Suffer Lot of Problems Like

Food Poisoning, Respiratory Problems Etc. So, We Need to Understand How This Adulteration Is Done with Crude Drugs and How Can We Minimize It. This Article Is Purely Based Upon the Introduction of Adulterants and It Gives A Brief About All the Basic Adulterants Evaluation Methods. We Need to Be Aware of This Fraud Technique and Should Gain Enough Knowledge on This Topic. We Need to Recognize the Drugs Based on Their Morphology, Microscopic Characters Etc, And Also Provide Information to Others Based on It. We Should Be Reporting Such Cases of Adulterations and Also Should Spread Awareness to Minimize Future Health Related Problems.

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