BHARATHIDASAN UNIVERSITY

TIRUCHIRAPPALI-620 024

TAMIL NADU,INDIA

Programme : M.Sc., Biochemistry

# COURSE TITLE : DETECTION METHODS OF FOOD ADULTERATION

COUSE CODE :BC002VAC

## UNIT-V

## TESTING ADULTERATION IN SEEDS

DR . T.PRABHASH

DEPARTMENT OF BIOCHEMISTRY

# POPPY SEEDS: TEST FOR AMARANTHUS

**WHAT IS POPPY SEEDS:**

- A poppy seeds is an oil seeds obtained from the poppy plant (papaver somniferum).
- The tiny,kidney seeds, dried seed of the opium poppy used as food .
- It is still widely used in many countries ,especially south asia .the seeds are used in whole grains or ground into meal as an ingredient in many foods especially in pastry and bread and t, hey are pressed to yield poppy seeds oil
- Opium poppy narural opiods,such as codeine,heroin, morphine, and opium.

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UNIT V

# What are adulterant in poppy seeds

**Common adulterant**

other plant seeds (eg. Seasome seeds,sunflower,or pumpkin ,amaranthus)

mineral matter (eg , sand, dust, stone particles)

**visual examination**

color : check for unusal colours, discoloration,blue black seed

shape and size : identify , seed shape and size for uniformity

texture : check seed texture for roughness , and smoothness,slightly crunch

**HAND PICKING**

sort seeds manually to remove any visible contaminants.

- **sieving** use sieves of different mesh sizes to separate seeds from contaminants .
- **density separation** use water or other liquids to separate seeds based on density

# What is amaranthus

- amranthus is called rajgira .
- Its edible starchy seeds from amaranth plant

amaranthus is a traditional food in many countries ,

including india, Mexico, and peru

good source of protein and fiber and are gluten free.

## WHAT IS SAJEERA:

- IT is also known as black cumin seeds or royal cumin seeds or caraway seeds.
- is a spice with a pungent aroma and slightly sweet taste that’s commonly used in Indian and middle eastern cooking.
- sajeeraa seeds ia a good source of vitmins mineralsand antioxidants and including aiding digestion, relieving flatulence and improving blood sugar and cholesterol levels.

# Common adulterants

Other seeds mixing other seeds like cumin seeds , coriander se

or fennel.

Mineral matter  addition of sand , dust, or stone particles.

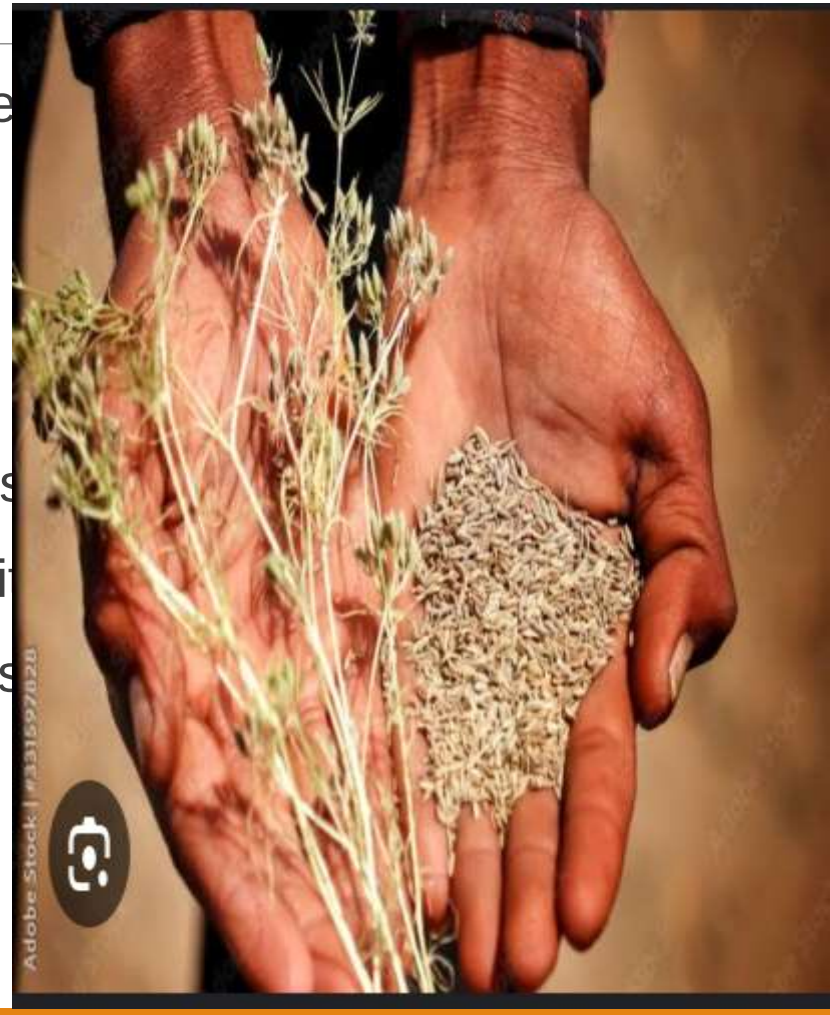
**visual examination**

color : check for unusal colours, discoloration,brown black s

shape and size : identify , seed shape and size for uniformi

texture : check seed texture for roughness , and smoothnes

crunch



**sieving**
use sieves of different mesh sizes of to separate seeds from contaminants like sand, stones.

HAND PICKING
sort seeds manually to remove any visible contaminants

Flotation test

Separate seeds based on their ability to float in water

## Hand method

rub a small amount of the seeds on your palms.
PURE SEEDS : if your palms do not turn black
the sajeera seeds are pure.
ADULTERATED SAJEERA SEEDS :if your palms turn black
the sajeera seeds are adulterated , sajeera seeds are often
adulterated with grass seeds that are covered with

# VISUAL EXAMINATION FOR MUSTARD AND PAPAYA SEEDS

One of the most common edible adulterants in mustard seed is argemone seeds

The unadulterated mustard seeds will have a smooth outer surface.

While, the adulterated mustard seeds having argument seeds have a grainy rough surface and a blackened colour.

Argemone seeds are non-edible but resemble mustard seeds.

PAPAYA SEEDS

# SIGNIFICANCE OF FOOD ADULTERATIONS

Food adulteration and contaminants were an important concern in food industry as they were possess serious health risk to consumers

Rapid detection of food adulterants is crucial to ensure food safety and quality

Various detection methods are available including chromatography, spectroscopy and immunoligical techniques


## PRINCIPLES OF FOOD ADULTERATION

Food adulterarion involves the intentional adulteration addition of unwanted substances of food products such as melamyde, formaldehyde or other heavy metals.

The food adulteration were includes Substitution ie.,Replacing a valuable constituent with another substance  Addition :Adding substances to increase bulk or weight, reduce quality, or make food appear larger or more valuable Concealment : Hiding damage or inferiority toxic substances

Mixing food with toxic substances : Such as dyes, color additives, or harmful preservatives

# Mustard Seeds :Visual Examination

**INTRODUCTION OF MUSTARD SEED:**

The mustard seed belongs to the Cruciferae (Brassicaceae) family.Mustards are functional foods having beneficial physiological effects of foods.Sinapis alba can be used as a wide range of active components including isiothiocyanates, phenolics, diothiolthiones and dietary fibres

Mustard consumption in different countries varies according to local food habits.

Mustard is principally grown as a source for condiment for the spindle fibre.

## TYPES OF MUSTARD SEEDS

1) BLACK MUSTARD SEEDS :- Which is typically black or brown in color with a more matte appearance. They are usually smaller in size around 1- 2 mm in diameter

2) BROWN MUSTARD SEEDS :- These seeds are typically brown or reddish brown in color with a small, glossy.

3)WHITE MUSTARD SEEDS:- These seeds are milder than brown mustard seeds but with a light color and odor when compared with other.


## APPEARANCE OF MUSTARD SEEDS:-

Mustard seeds are usually about 1-2mm in diameter and may coloured from yellowish white to black

Mustard seeds are the small round seeds of 3different plants : Black mustard, brown Indian and white mustard. Its shape were spherical or oval. Mustard seeds have a dull, mature text.

SURFACE : The surface of mustard seeds csn be smooth or sightly rough, depending on the type. It have a glossary or matte appearance, depending on the type

# VISUAL EXAMINATION OF ADULTERATION OF MUSTARD SEED

COLOR:-Mustard seeds are typically brown or black in colour.SHAPE AND SIZE :-Mustard seeds are commonly small and round. Adulterated seeds may be large or irregular in shape.

SURFACE TEXTURE:-Mustard seeds have smooth surface while the adulterated seeda have rough or pitted surface. OIL CONTENT :- Mustard seed are typically high oil content which can be visible as shiny or oily appearance. Adulterated seeds may have a lower oil content resulting in a dull appeaeance. FOREIGN MATTER :- Adulterated seeds may have a foreign substances such as dust, stones or other debris

## CHEMICAL. TECHNIQUES TO DETECT THE ADULTERATION

ACID VALUE TEST:-This technique is used to detect the presence of argemone oil in mustard seeds. The acid value of argemone oil is higher than that of mustaed oil.

SAPONIFICATION TEST :-This technique is used to detect the presence of argemone oil in mustard seeds.The saponification value of argemone oil is lower than that of mustard oil.

REFRACTIVE INDEX TEST:-This technique is used to detect the presence that argemone oil is differ from mustard oil

DENSITY TEST:-The density of argemone oil is differ from that of mustard oil

# ANALYTICAL TECHNIQUE USED FOR DETECTION.

THIN LAYER CHROMATOGRAPHY :- Thin layer chromatography were applied in detection of adulteration. TLC is an analytical technique used to seperate and identify the mixture of a components.

MASS SPECTROMETRY :-Mass spectrometry is an analytical tool useful for measuring the mass-to-charge ratio of one or more molecules present in a sample. These measurements can often be used to calculate the exact molecular weight of the sample components as well.

Nuclear magnetic resonance (NMR) spectroscopy is a non-destructive analytical technique that uses the magnetic properties of atomic nuclei to determine the chemical composition and molecular structure of a sample:

How it works

NMR spectroscopy works by analyzing how nuclei in a molecule interact with a strong, stationary external magnetic field.

# ADULTERATION OF PAPAYA SEED IN PEPPER SEED

**PROCEDURE :- Papaya seeds can br separated out from pepper as they are less denser than pure back pepoer**

**TEST METHOD :-**

**Add some amount of black pepper to a glass of water**

**Pure black pepper settles at the bottom**

**In the adulterated black pepoer, papaya seeds float on the surface of water**

**In thr adulterated black pepper, papaya seeds float on the surface of water**

**From the above mentioned method we cam seperate the black peppper from thr adulterant papaya seed which has less density**

**Thenw water and hence floats whereas black pepper settles down due to it's high density than water**

**Papaya seeds can be separated out from pepper as they are shrunken, oval in shape and greenish brown brownish in color**

TEST METHOD 2:-

Spread spice ona white paper

Observe the appearanc of the sample using the magnifying the glass

Black pepper is brown in color. It has a wrinkled surface and uas a characteristic smell sjd pungent taste

The papaya seeds have shrunken smooth surface and oval shape. It is greenisj browm or blackish brown in colour and uas a repulsive flavour

Hence based on the above Mentione physical properties of black pepper we can seperate it from the adulterant papaya seeds

# Testing Adulteration In Seeds

## QUALITY ASSURANCE IN SPICES : SAFFRON,CUMIN ,AND CINNAMON

Saffron is scientifically called  crocus sativus.it can grow anywhere in the world .The kind of soil is more important than the climate of the region where one wants to grow it

Saffron is dry,glossy and greasy to the touch when freshly picked and dried ,turning dull and brittle with age

The quality of saffron can be determined based on its  crocin concentration  (coloring powder),odor(safranal) and taste( picrocrocin)

Saffrons are planting from June to mid September are flowering throughout October ,and vegetative development occurs in the winter then leaves dryout in may month

# DNA Barcoding:

- DNA barcoding is an advanced method for identifying the species of plant material in a mixture. By extracting DNA from saffron powder and amplifying specific genetic markers (e.g., rbcL, matK, ITS), it is possible to identify any foreign plant material, such as maize cob tendrils. In the case of maize, specific primers could be used to identify maize DNA

## Spectroscopic Techniques:

- **Near-Infrared Spectroscopy (NIR):** NIR spectroscopy can be employed to differentiate between saffron and adulterants based on their unique spectral signatures. Since maize tendrils and saffron have distinct chemical compositions, their absorption spectra will be different, which can be detected by this non-destructive method.
- **Raman Spectroscopy**: Similar to NIR, Raman spectroscopy can be used to analyze the molecular vibrations of saffron and its potential adulterants. The spectral differences can help identify maize cob tendrils among other substances

# DETECTION TECHNIQUES

•**Microscopic Examination:** The structure of cumin seeds is distinctive, and under a microscope,
•it is possible to differentiate cumin from other similar-looking seeds.
• For example, the presence of caraway or fennel seeds can be identified due to their unique cellular features.
•**THIN LAYER CHROMATOGRAPHY :**Solvent using for the separation of chemical components,adulterants like fennel seed can be detect

•**SPECTOSCOPIC TECHNIQUE :**
  •**Fourier Transform Infrared (FTIR) Spectroscopy:** FTIR can identify characteristic chemical bonds and functional groups found in cumin. The spectral patterns of cumin seeds can be compared to known adulterants to detect any foreign substances

Near-Infrared (NIR) Spectroscopy: NIR spectroscopy can be used for rapid, non-destructive analysis, providing a way to identify cumin adulteration in a fast and efficient manner without damaging the sample

DNA Barcoding: This molecular technique helps identify plant species based on their DNA sequences. In the case of cumin seed adulteration, DNA barcoding can differentiate cumin from other seeds like fennel or caraway, even in finely ground forms

## Chromatographic Methods (HPLC and TLC):

- **High-Performance Liquid Chromatography (HPLC):** HPLC can be used to detect the coumarin content in cinnamon. Cassia bark contains significantly higher levels of coumarin than true cinnamon. By analyzing the chemical profiles of the cinnamon sample, one can differentiate between true cinnamon and cassia.

- **Thin Layer Chromatography (TLC):** TLC can be used to separate and identify the chemical constituents of cinnamon. It can differentiate between true cinnamon and cassia based on the presence of specific compounds such as coumarin

- **Fourier Transform Infrared Spectroscopy (FTIR):** FTIR spectroscopy helps identify the molecular structure of cinnamon and its adulterants.
- The spectra of true cinnamon and cassia are distinct, making it possible to detect adulteration quickly and efficiently.
- **DNA Barcoding:** DNA barcoding is increasingly being used to detect adulteration in cinnamon. By comparing the DNA sequences of cinnamon and cassia, this method can confirm whether the product contains only true cinnamon or if it has been adulterated with cassia or other plant barks.