



Hit-Mix: The Food Authenticity Methods Charts

Dr. Bert Popping
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May 24, 2022

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We have choices

Oregano – Olive and Sumac leaf adulteration

**Expensive – limited skill & experience
required**

- PCR: need to know the specific species you are looking for. Primers specific to adulterant species
 - Price: \$\$

2

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 - Price : \$\$\$\$

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Inexpensive – skills & experience required

- Microscopy: requires a person with experience in recognising different plants. Can also identify other visible fillers that do not contain DNA, e.g. cellulose or similar
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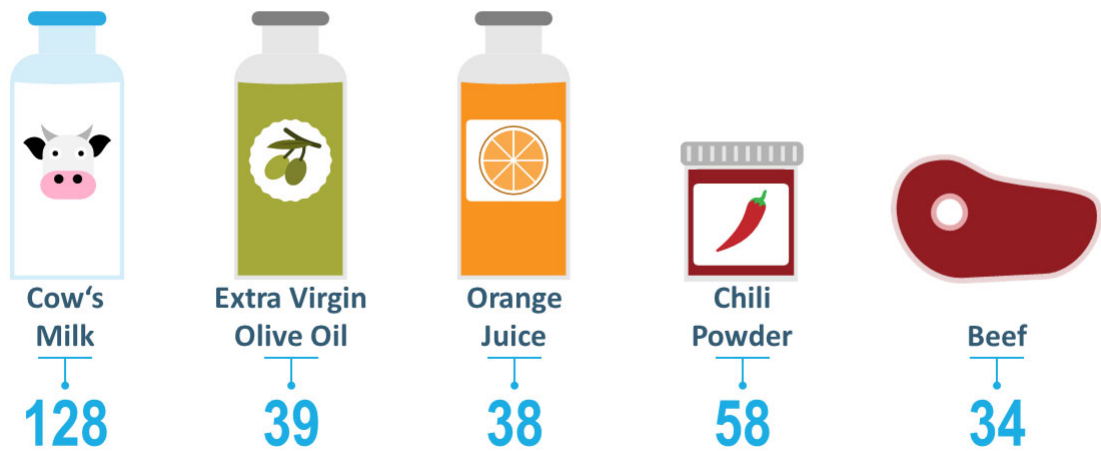
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Number of Adulterants and Detection Method Categories

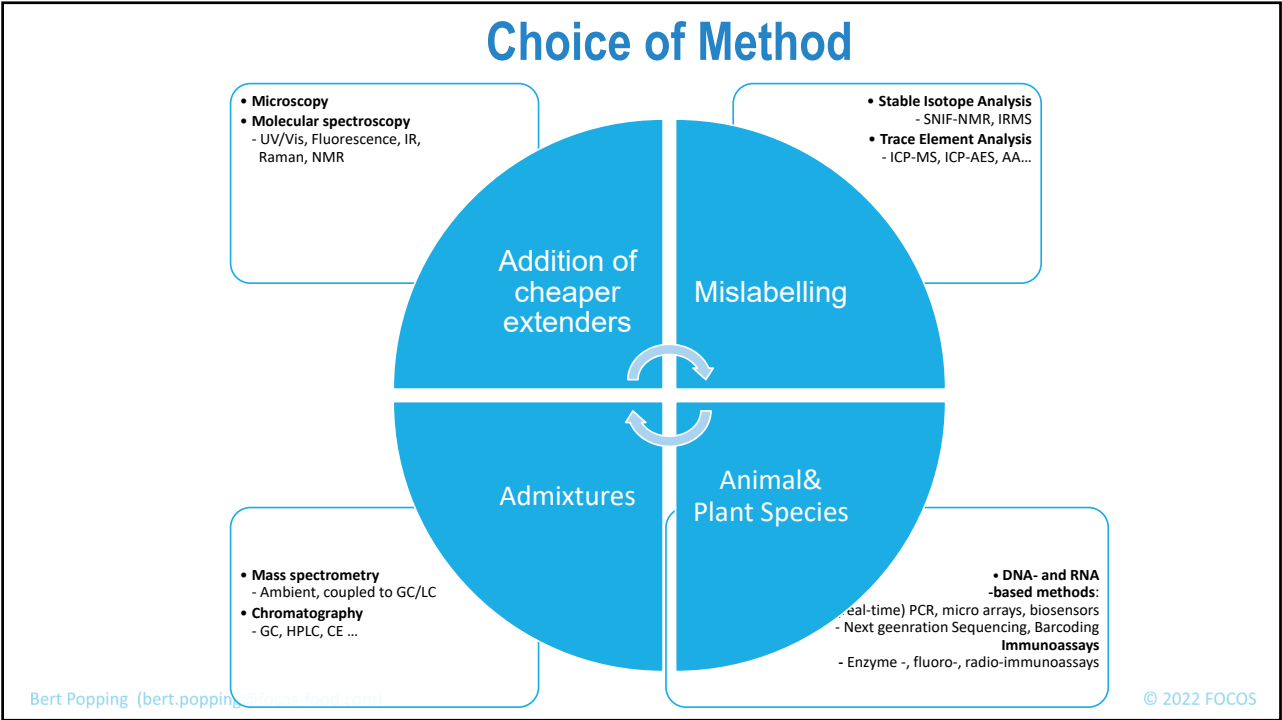
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Number of Adulterants in USP* Food Fraud Database 2



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Selected Frequently Adulterated Commodities

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Milk



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Common adulterants

- Addition of water
- Addition of starch
- Addition of vegetable fats
- Addition of formaldehyde
- Addition of N-containing compounds (urea, melamine etc)
- Addition of bovine milk to sheep or goat milk

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Milk – Our Toolbox




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Common adulterants

- Addition of water - **cryoscopy**
- Addition of starch - **iodine**
- Addition of vegetable fats – **fatty acid profile analysis**
- Addition of formaldehyde: **Liquid Chromatography (LC)**
- Addition of N-containing compounds (urea, melamine etc) – **LC-MS/MS**
- Addition of bovine milk to sheep or goat milk – **PCR and ELISA**
-several other issues: **FT-IR or MIR screening**

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Rice


Common adulterants

- Non-Basmati in Basmati
- Colourants (fake black rice)
- Paraffins (translucency)

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Rice – Our Toolbox

Common adulterants


- Non-Basmati in Basmati – **PCR & NGS: variety identification**
- Colourants (fake black rice) – **LC-MS/MS: colour addition // place rice in water**
- Paraffins (translucency): **HPLC**

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Herbs &Spices



Common adulterants

- Colourants (azo dyes)
- Filler (sand, dirt, clay)
- Bran
- Safflower (safron)

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Herbs &Spices – Our Toolbox



Common adulterants


- Colourants (azo dyes): **LC-MS/MS**
- Filler (sand, dirt, clay): **microscopy, sieving**
- Safflower (safron): **PCR and microscopy**

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Herbs &Spices – Our Toolbox



Common adulterants

- Colourants (azo dyes): **LC-MS/MS**
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- Safflower (safron): **PCR and microscopy**



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What do you think when you read

DART

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FOOD SAFETY AND STANDARDS
AUTHORITY OF INDIA

Inspiring Trust, Assuring Safe & Nutritious Food



**DETECT ADULTERATION
WITH RAPID TEST**

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**COMMON
QUICK TESTS
FOR DETECTION OF
SOME FOOD ADULTERANTS
AT HOUSEHOLD**

Food is essential for sustenance of life. Adulteration of food deceive the consumer and can cause risk to their health. The purpose of this manual is to list out common methodologies available for food adulterants generally found in India.

The scope of this manual is meant for household, which can induce awareness among the consumer about food safety.

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ToC

QUICK TESTS FOR
SOME ADULTERANTS IN FOODS

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Spices and Condiments

TEST 19

Detection of papaya seeds in black pepper

Testing method:

1

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

2

Pure black pepper settles at the bottom.

3

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



Black pepper



Papaya seeds

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Spices and Condiments

TEST 20

Detection of artificial/water soluble synthetic colours in chilli powder

Testing method:

1


 Sprinkle chilli powder on the surface of water taken in a glass tumbler.

2

 The artificial colourants will immediately start descending in colour streaks.



Pure



Adulterated

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Spices and Condiments

TEST 22

Detection of grass seeds coloured with charcoal dust in cumin seeds

Testing method:

1

 Rub small amount of cumin seeds on palms.

2

 If palms turn black, adulteration is indicated.



Pure



Adulterated

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Milk

TEST 1

Detection of water in milk

Testing method:

1


Put a drop of milk on a polished slanting surface.

2

Pure milk either stays or flows slowly leaving a white trail behind.


3

Milk adulterated with water will flow immediately without leaving a mark.



✓

Pure milk



✗

Adulterated milk

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Milk

TEST 2

Detection of detergent in milk

Testing method:

1

Take 5 to 10ml of sample with an equal amount of water.

2


Shake the contents thoroughly.

3

If milk is adulterated with detergent, it forms dense lather.


4

Pure milk will form very thin foam layer due to agitation..



✓

Pure milk



✗

Adulterated milk

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Milk

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- 1 Take 5 to 10ml of sample with an equal amount of water.
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- 4 Pure milk will form very thin foam layer due to agitation..



✓
Pure milk



✗
Adulterated milk



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Honey

Common adulterants

- Sugars
- HFCS 55
- Water



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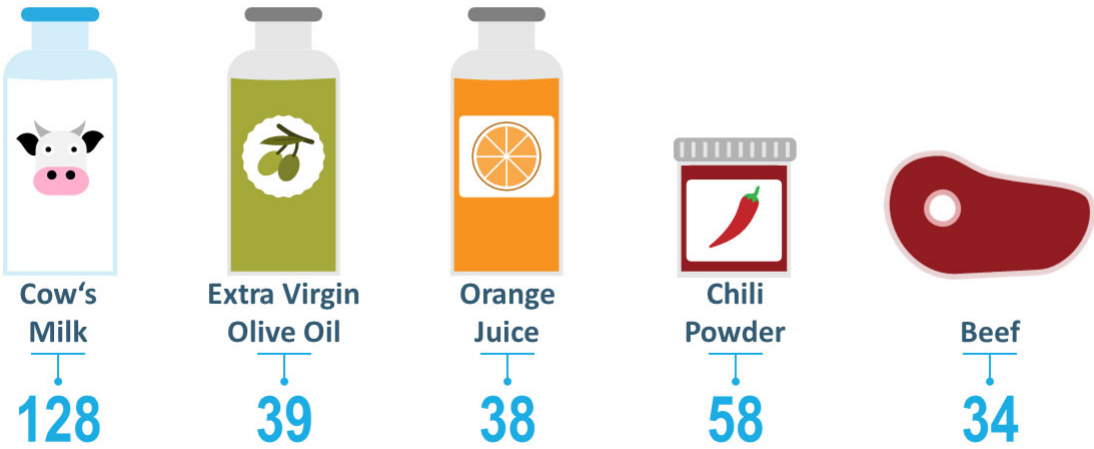
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The Need for Non-targeted Methods

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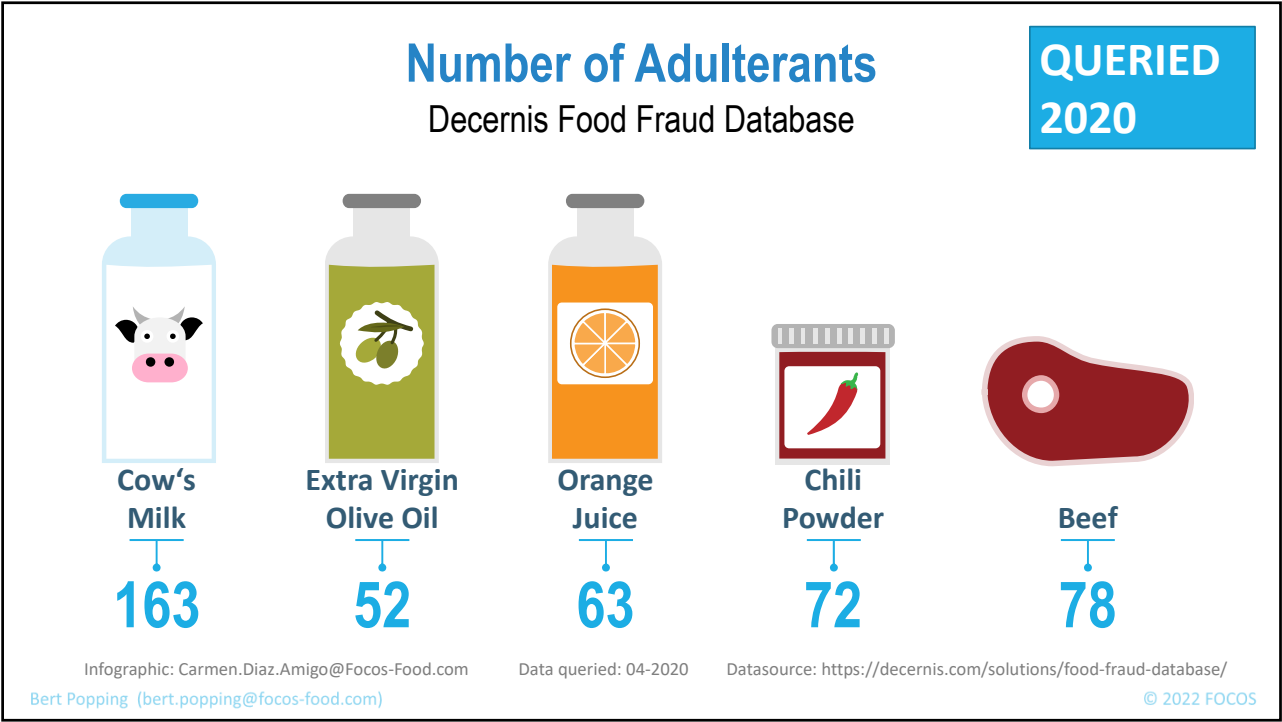
Number of Adulterants in USP* Food Fraud Database 2

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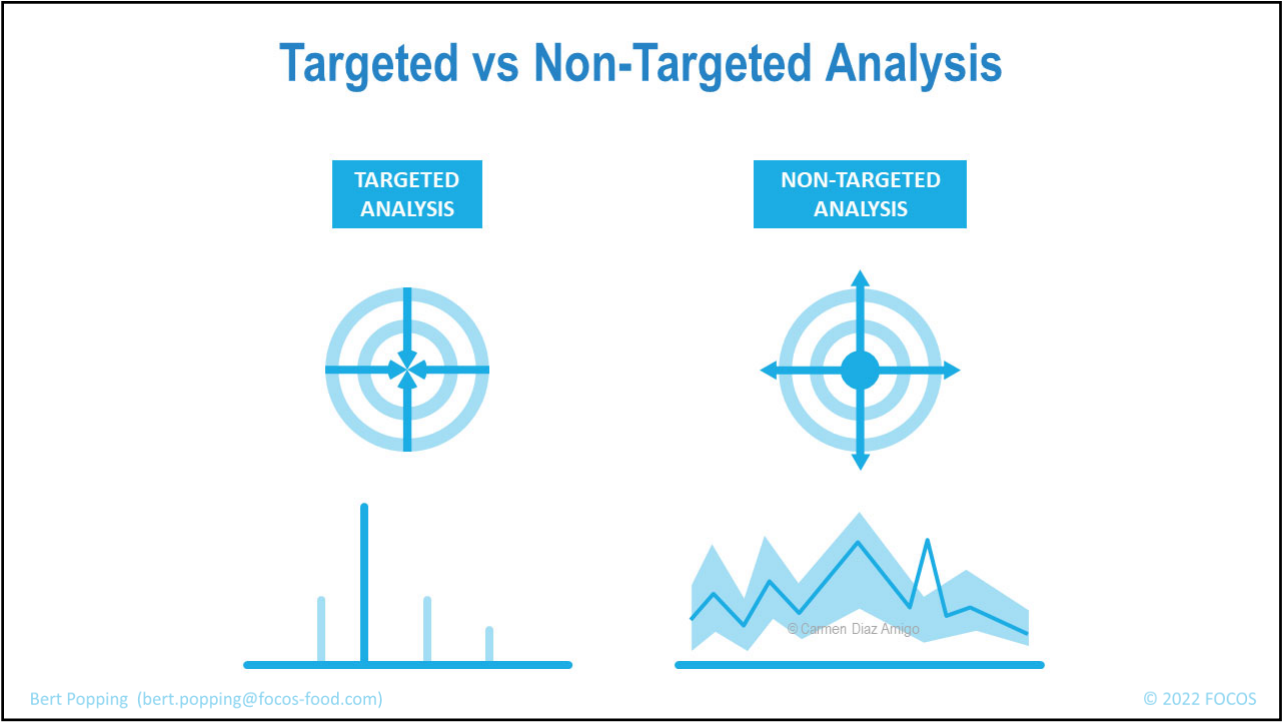


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Non-Targeted Testing



JOHN SZPYLKA
NON-TARGETED ANALYSIS



- Concept
 - Create a standardized fingerprint for an ingredient.
 - Compare new lots of the ingredient to the fingerprint.
 - Chemometric examination to reveal if the differences are outside normal variability.
 - Binary Result: Adulterated or Authentic



Picture courtesy of John Szpylka

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Requirements for Honey

Test	Adulterant	%Adulterant in Test Materials	Number of Samples to be Tested ¹	Number of Test Results Qualified as Adulterated
Baseline	None (Authentic Honey)	0%	Establish Baseline Fingerprint ²	
Validation using Authentic Samples ³	None	0%	30	0
Validation ⁴	Sugars	5%	30	30
Validation ⁴	Molasses	5%	30	30

1. Multiple samples from the same batch of adulterated material can be used for method evaluation.

2. Full details on protocol used to establish an authentic fingerprint must be supplied.

3. Samples used for this step must be independent than those used to create the baseline and must cover the entire scope of the method.

4. Method validation using adulterated samples shall cover the entire scope used in creating the baseline fingerprint.

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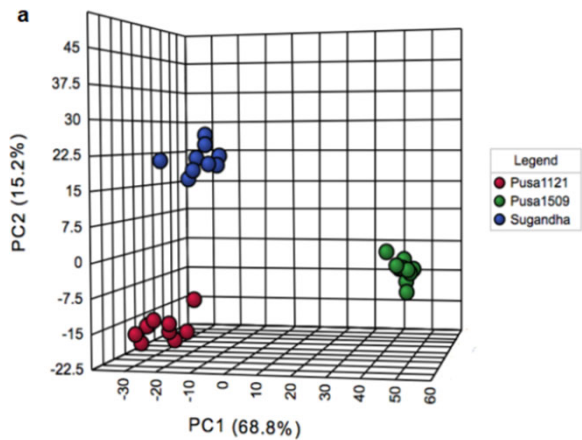
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J. AOAC Special Section on Portable Food Safety Testing Devices



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Rice Authenticity using NIR



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Source: Special Guest Edited Section J. AOAC International, 2020

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Authenticity of Olive Oil using Multi-Sensor Approach

Sample	Combination (Decision tree)	Only FLUO	Only NIR	Only VIS
EVOO	75%	70%	89%	75%
Olive oils composed of refined olive oils and virgin olive oils	100%	100%	37%	99%
Olive-pomace oils	100%	100%	50%	100%
Other edible oils	100%	100%	67%	100%
Adulterated EVOOs with non-EVOO olive oils (10, 25, 50 % (v/v))	97%	97%	31%	83%
Adulterated EVOOs with other edible oils (10, 25, 50 % (v/v))	91%	89%	52%	56%



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