

Authenticity Verification

A Quick Guide Through The Maze

The Future of Food
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Dilution.....Substitution..... Unapproved Enhancement.....



Rumsfeld Theory and it's Application to Testing

“As we know, there are known knowns; there are things we know we know. We also know there are known unknowns; that is to say we know there are some things we do not know. But there are also unknown unknowns—the ones we don't know we don't know”

Donald Rumsfeld 2012

The Verification Challenge

- No golden bullet in methodology
- Need to understand the key components of the product
 - Will routine testing detect a change?
 - What would be likely to change?
 - Can it be measured?
- Will analytical testing actually help?
 - Halal

The Known Knowns

The Known Knowns



- Product
- Specific Product Characteristics
 - Product specifications
 - Unique formulation
 - Origin (organic, geographic location)
- Established approved supplier programs, process parameters, and routine analysis to ensure compliance



The Known Unknowns

The Known Unknown – measuring the known risks

- Product baseline data / characteristics are key
- Known risks have previously occurred to allow for methodology to be available for detection
- Examples:
 - Milk dilution with water
 - Honey dilution with syrups or sugars
 - Organic Claims (GMO and Pesticides)
 - Fish Species

The Known Unknown – Milk Dilution

- Addition of water to milk
- Routine test methods can detect this risk
 - Freezing point analysis
 - Solids non fat (NIR or wet chemistry)



The Known Unknown – Is it Organic?

- The use of GMO or pesticides need to be excluded
- PCR analysis can be used for GMO
- Pesticide testing can be complex
 - Instances where reference materials have been contaminated with pesticides residues
 - With differences in what is used globally reference materials may not be available



The Unknown Unknowns

We don't know, what we don't know!

- Routine testing and monitoring may or may not be helpful
- Issues become known when
 - Routine results are slightly out of specification
 - When a supplier raises an issue
 - When others in industry have the same issue

BUT.....most often large scale problems are identified when consumers are effected – food safety

The Unknown Unknown – Melamine in milk and infant formulas

- Warning signs were there
 - Economic driver
 - Increased demand of product
 - Increase in cases of infants with Kidney stones
- Raw milk with low protein levels had melamine added to increase protein values, melamine was cheap!
- Issue – routine test methods for protein detecting nitrogen did not find the issue

The Unknown Unknown – Undeclared allergens in spices

- 2014 Undeclared peanut and almond in several spices
 - Peanut in cumin was confirmed by several methods (ELISA, SDS-PAGE + others)
 - Almond in Paprika was confirmed by several different ELISA methods but:
 - IgE binding proteins were not found
 - Almond DNA was not detected
 - Cross reactivity blamed – Mahlab
- 2016/7 Undeclared peanut in garlic
 - Peanut detected in various levels in ELISA
 - Possible comingling blamed, evidence do not support this

Authenticity Verification for Provenance / Product Claims

- The concern not only centres around addition / substitution of ingredients but also their origin
- Free range verse caged eggs
- Extra Virgin Olive Oil – $\sim < 10\%$ worlds production meets the criteria
- Geographic Origin authentication
 - Australian Wine
 - Manuka Honey

Have we found the wholly grail?

- **Stable Isotope Ratio**
 - Allows the establishment of an isotopic “profile”
 - Detects stable isotopes from elements such as
 - C – Botanical
 - N – Animal
 - H & O – geographic
 - Unique to the geographical location and also origin
- Can be coupled with other methodology to and statistical modelling to provide information regarding product profiles

The Humble Coffee Bean

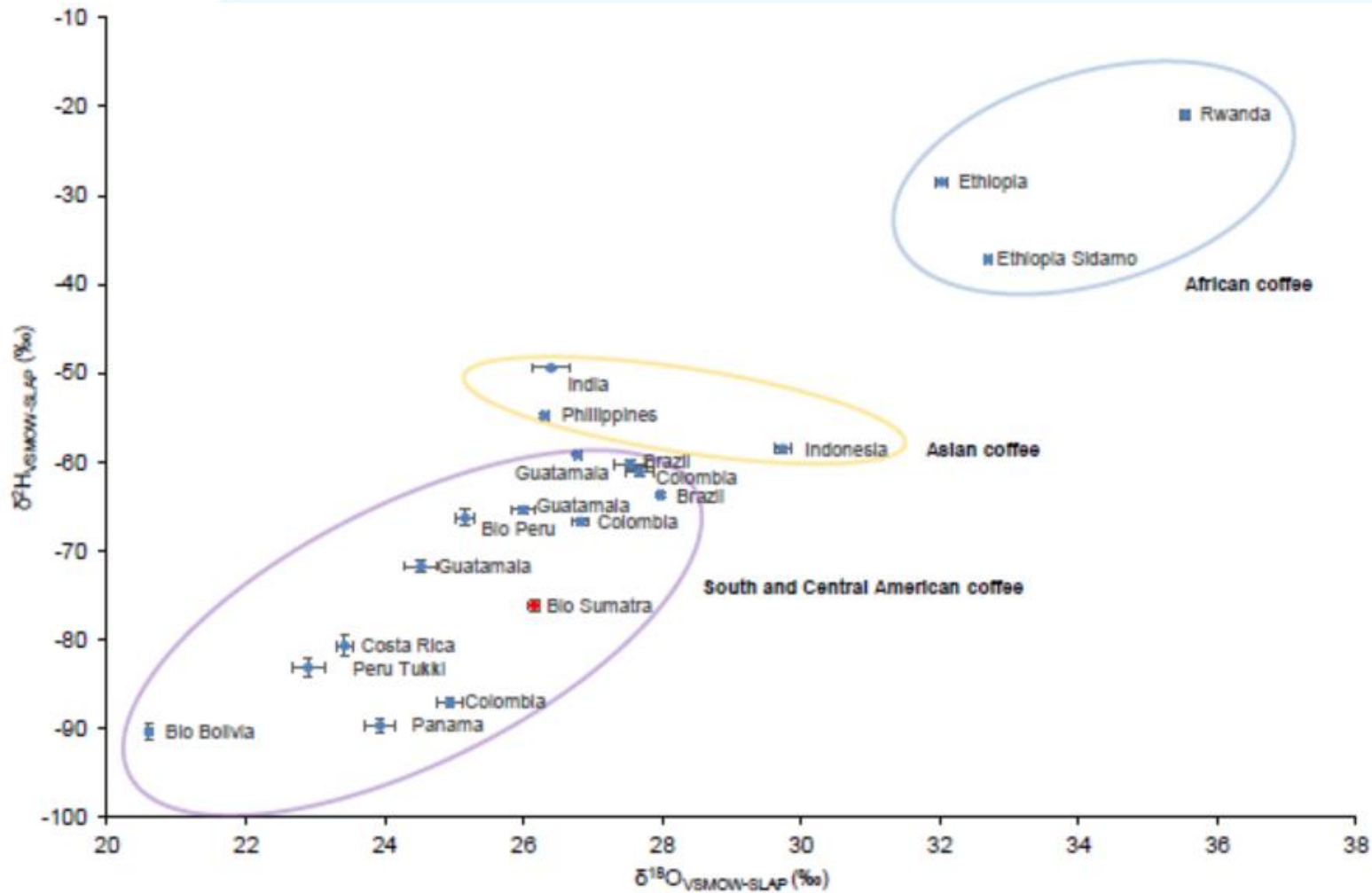


Figure 1. Hydrogen and oxygen isotope fingerprints of roasted coffee beans from Africa (blue), Asia (brown) and central and South America (purple).

Challenges with Stable Isotope Ratio

- Costly
- Robust library required of authentic reference materials
- Validated reference methods
- Applicable only to commodity products
 - Not widely used for ready to eat foods or complex matrices
- In many cases required industry support

When should you test?

- To meet local regulations (FSC) and retailer standards
- Specific Product Claims
- Product considerations
 - Country of Origin – is there a history?
 - Type of product
 - Expensive? spices
 - Shortage? Nuts
- Global recall space – has it happened somewhere else?
- Food fraud websites i.e. US Pharmacopeial Convention
 - <https://www.foodfraud.org/>

What you need to know before analysis

- Need to understand the key components of the product
- No golden bullet in methodology
- What you looking for or what you might be looking for
- Discuss the concerns with the laboratory to ensure the correct methods are used

Thank You