

The Spiced project: Seasonable doubt...

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Partners Spiced WP4: BfR, BIOR, Fuchs, DLO-RIKILT



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Are we dining on deception?



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Souls for sale?

Food product adulteration and counterfeiting is a thriving multi-billion euro global industry. It is highly profitable and the risks of significant legal consequences are low.



43% MARKET PRICE*
1400/SFT

The Cumin Scandal: Accidental or Fraudulent

March 17, 2015 • By Ted Agres

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The ongoing recall of cumin and cumin-containing foods due to undeclared peanuts or almonds is almost certainly the result of purposeful economical adulteration (EMA), food safety experts say. Last year, food agencies in the U.S. have been tracking and reporting what is the "largest recall of an allergen in spice products" have been recalled by manufacturers and retailers in the last year.



Does your spice rack contain fake oregano?

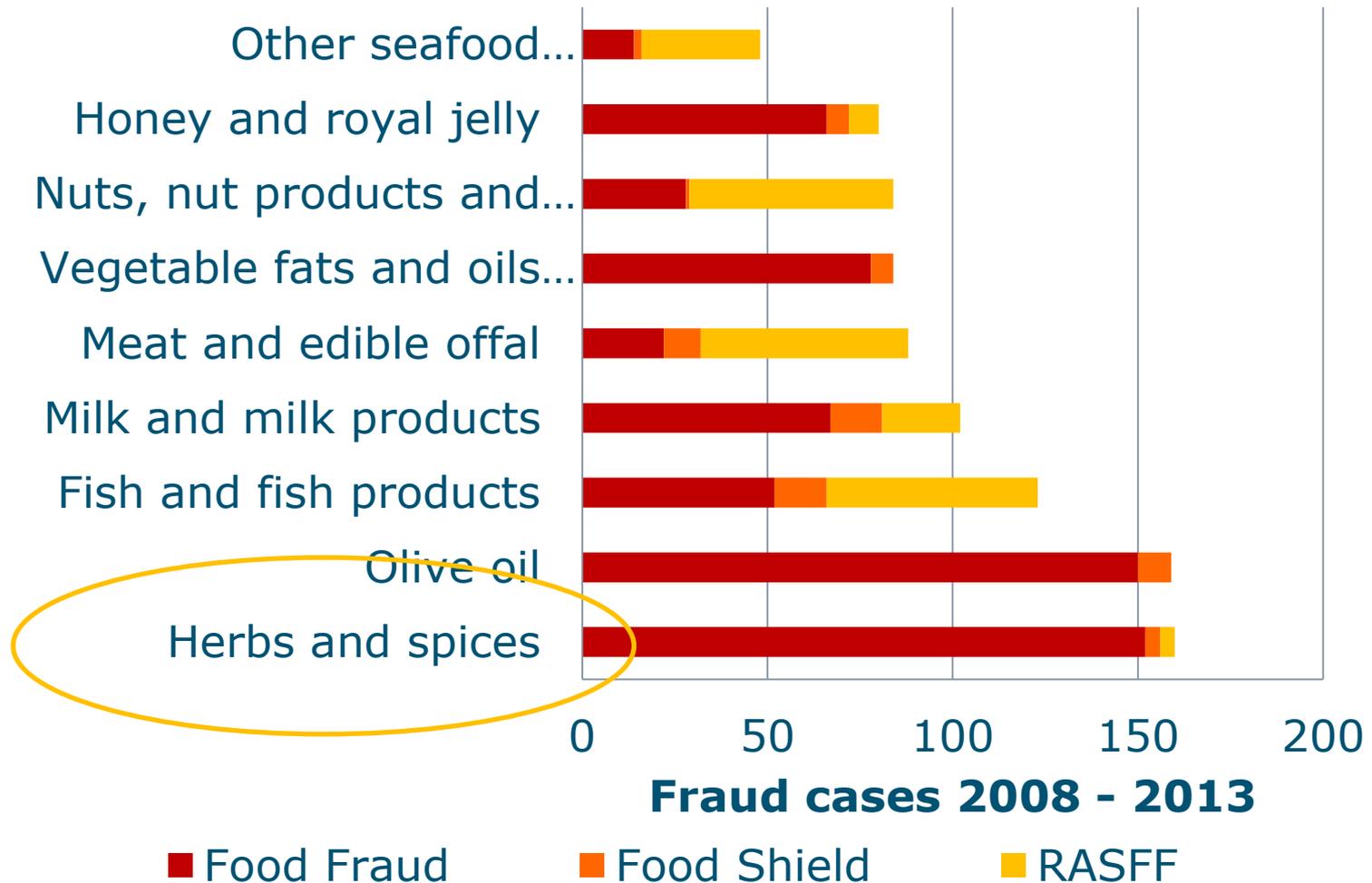
We've found food fraud in the supply chain of oregano, with only five of twelve samples we tested 100% oregano.

News Home » City » Kochi

Iron dust chilli!

TNN | Mar 19, 2015, 04.08

Fraud reports in three databases



ESA Adulteration Awareness Document

21 July 2014

Search...

The European Spice Association (ESA) represents the interests of European producers and consumers of spices that are true to name.



The Voice of the U.S. Spice Industry

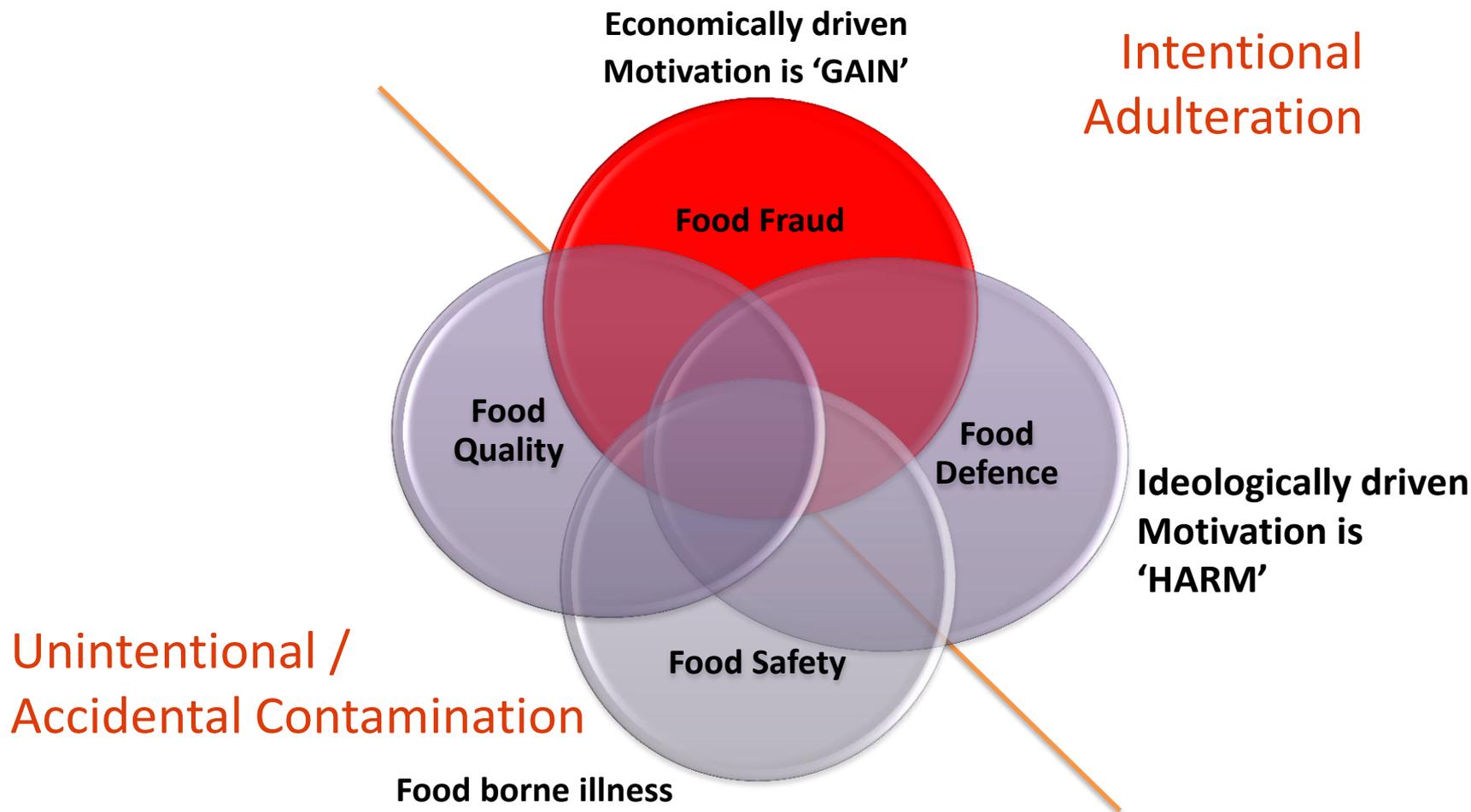
Home About ASTA Membership **Food Safety** Government Relations & Advocacy Education Trade Resources

Adulteration and Food Fraud



Adulteration and food fraud can pose serious issues for companies. The most common examples of economically motivated adulteration involve the addition of materials to make a food seem more valuable and while this is frequently not a safety issue, it is of concern to the entire food industry. A number of resources are available from ASTA and other organizations to address adulteration and food fraud.





Petra Wissenburg, Danone Corporate Quality & Food Safety



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EU project SPICED fraud detection methods

➤ The aim?

- To develop rapid and cost-efficient methodologies for detection of contamination (adulteration) of spices/herbs with chemical agents
- Aiming at early detection of anomalies in view of food integrity, i.e. signalling/flagging for unusual samples (authentic vs adulterated)

➤ By which means?

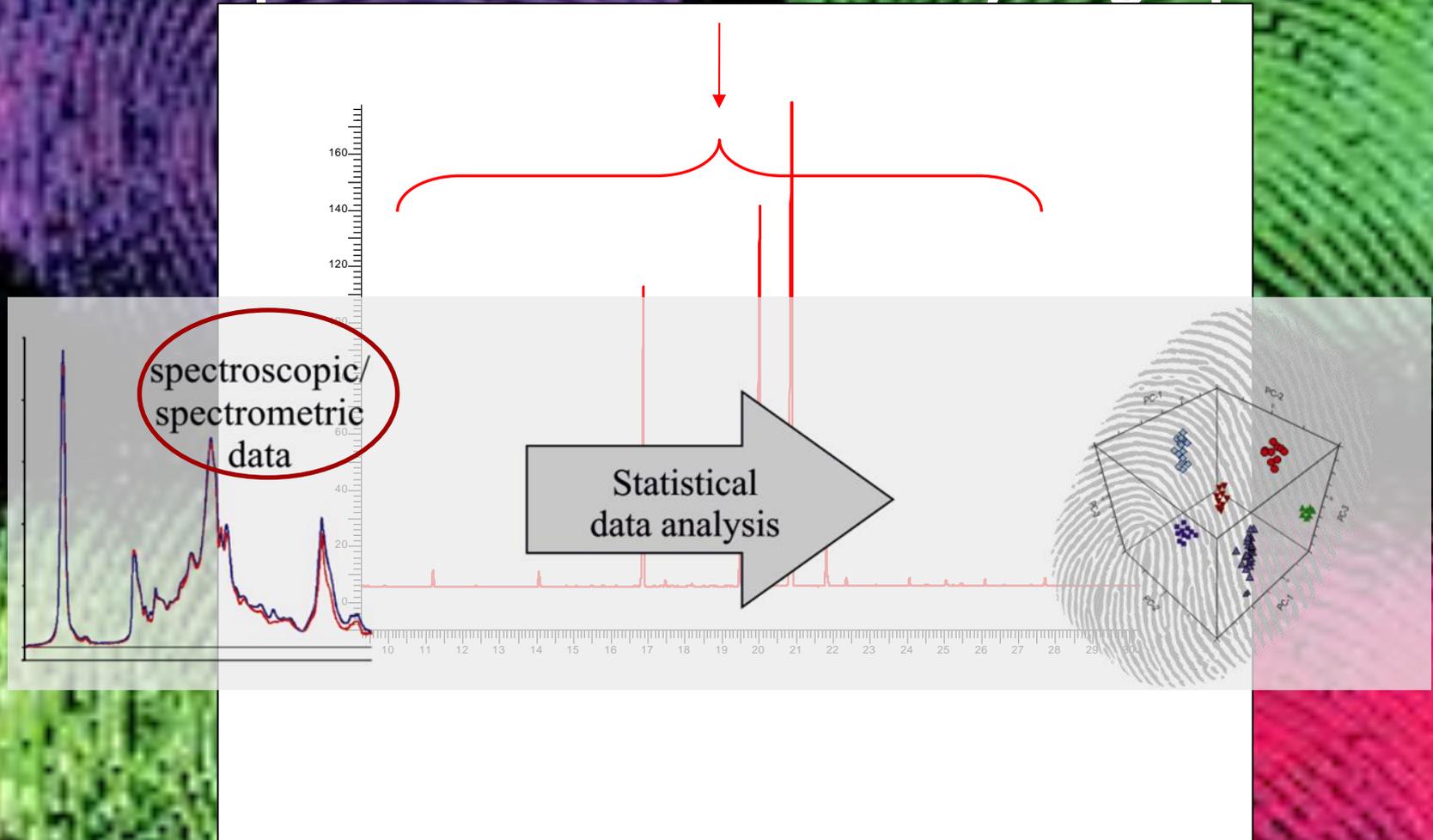
- By exploring spectroscopic and spectrometric fingerprinting techniques

~~FRAUD~~

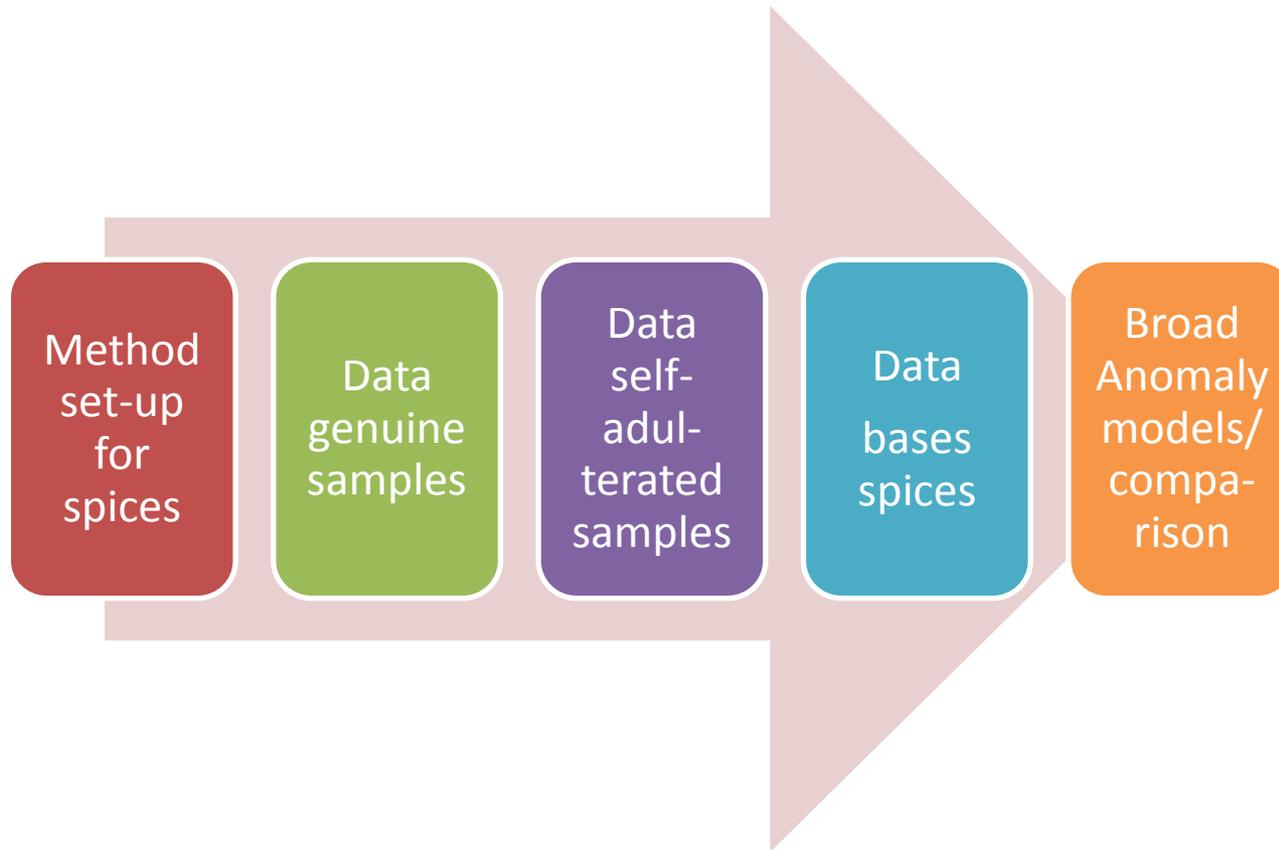


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Development of broad anomaly fingerprint tests



Overview of activities



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Development of techniques for broad anomaly testing of spices

➤ Spices

- Pepper
- Chili paprika
- Nutmeg



➤ Herbs

- Basil
- Thyme
- Oregano



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Oregano and product foreign material: leaves



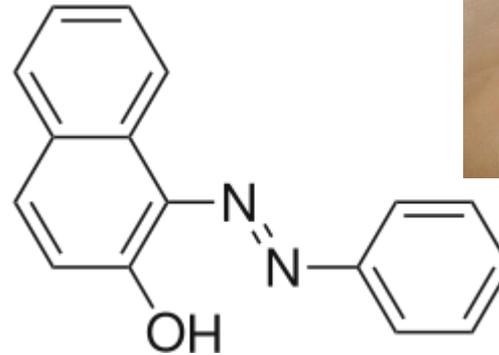
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Nutmeg and product own material/removal of valuable fractions



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Paprika powder and unapproved 'enhancements': colourants



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Selected analytical techniques

➤ Spectroscopy

- FTIR
- NMR



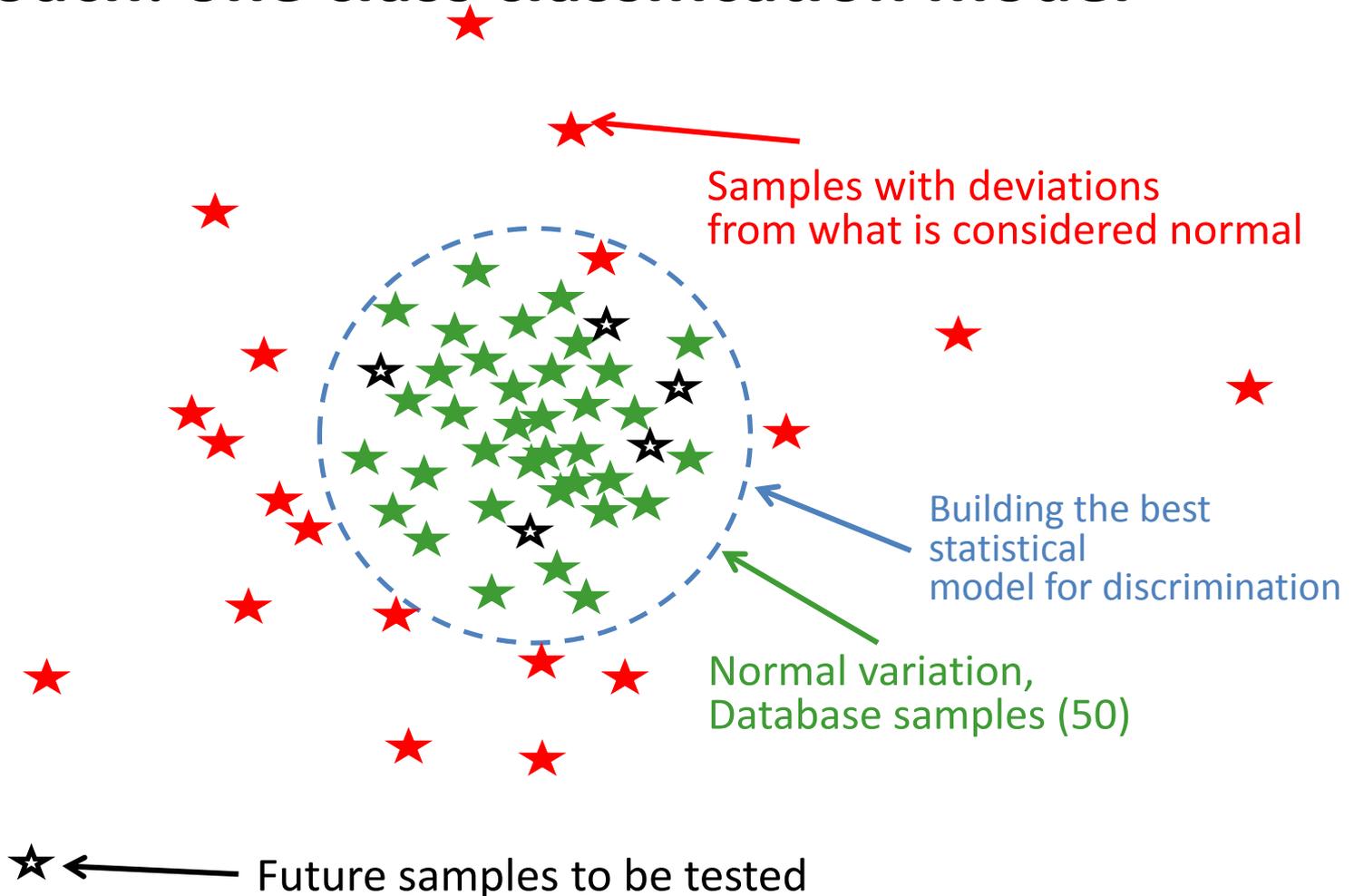
➤ Mass spectrometry

- PTR-MS
- (LC)-HRMS
- DIMS
- ICP-MS



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Approach: one class classification model



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Approach

- 50 Authentic baseline samples of each spice were analysed with each method
- One class classification models were built based on those authentic samples
- Inferior/adulterant material, and mixtures of authentic and inferior/adulterant material were analysed
- The models were challenged with the authentic and modified sample material
- Optimised classification models of the various methods were compared to select most promising approaches



Will the

real nutmeg

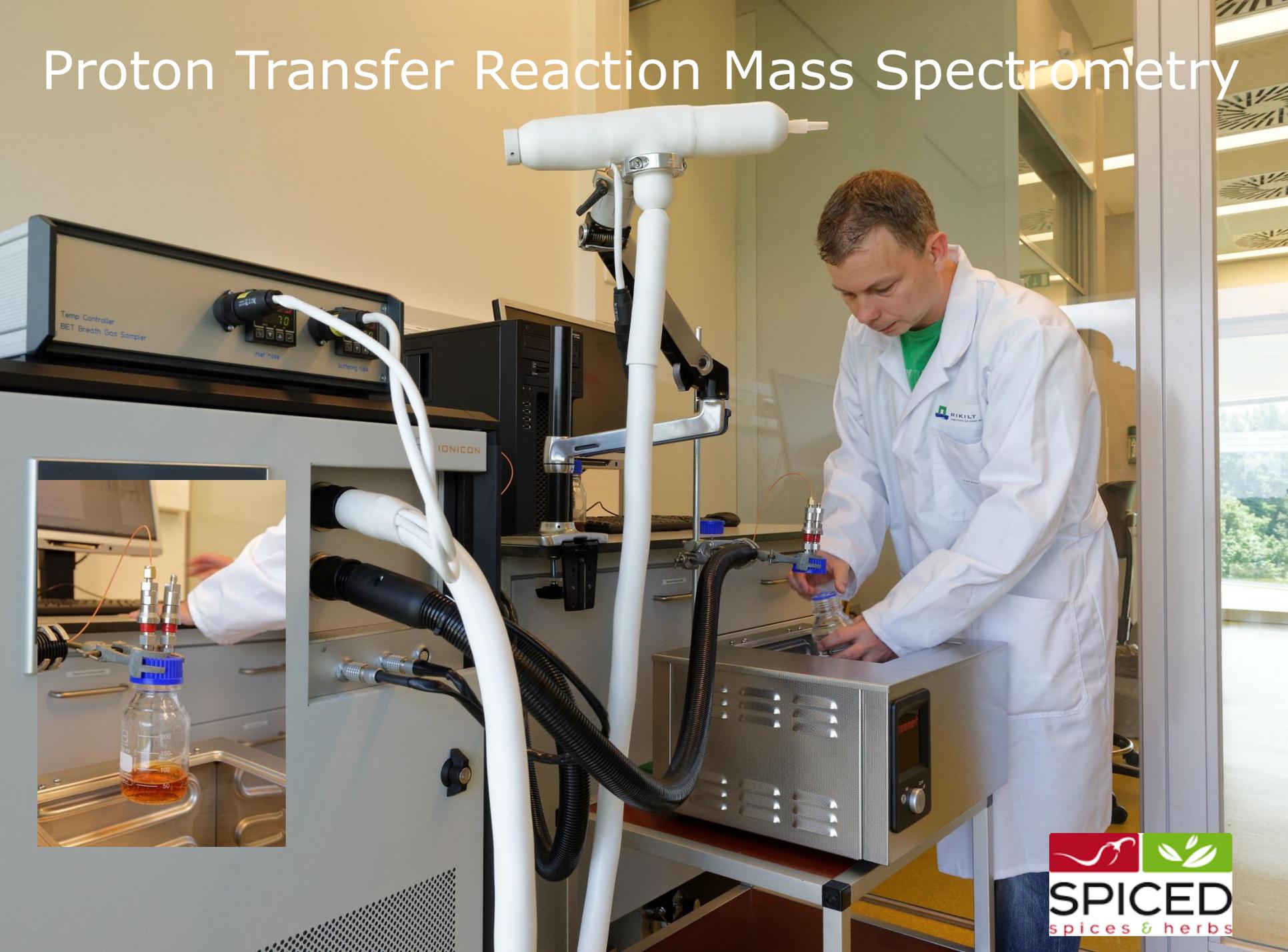
please stand up?



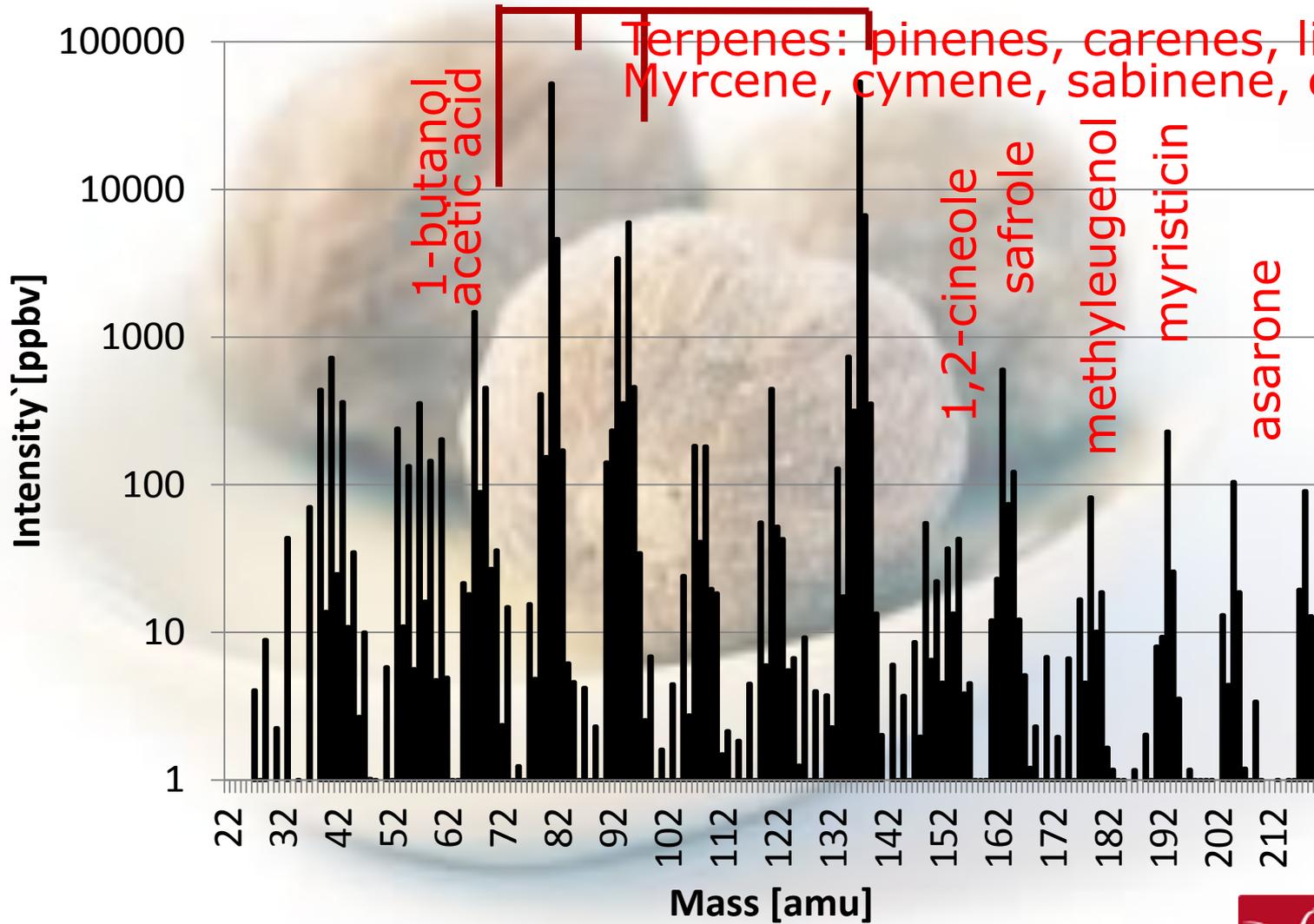
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Proton Transfer Reaction Mass Spectrometry



Nutmeg spectrum

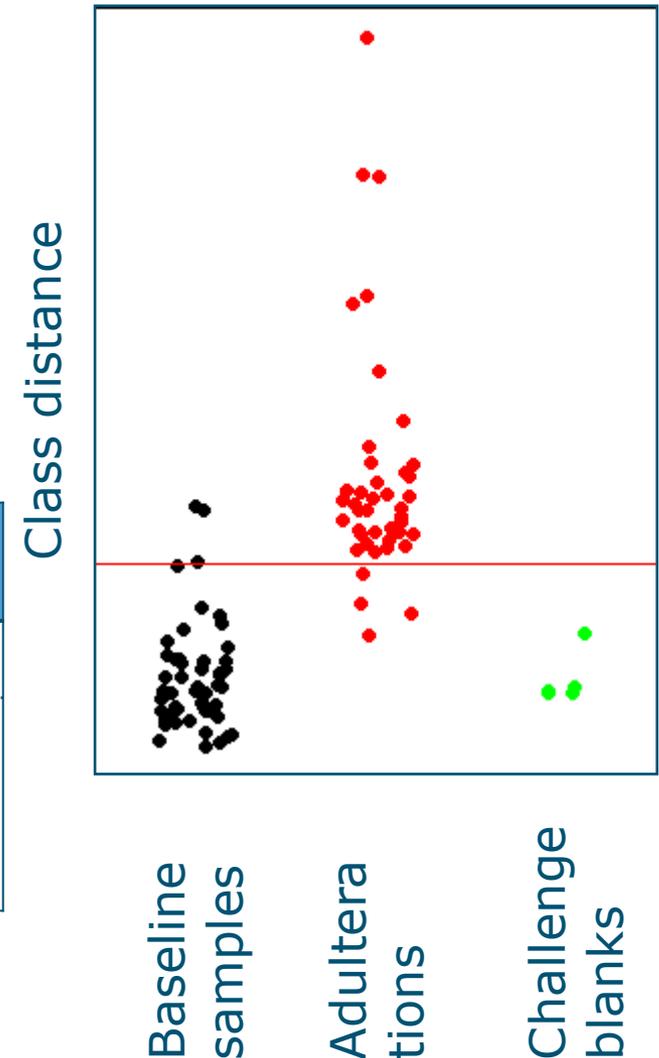


One class classification result: Nutmeg

- SIMCA model, 7 factors
- Normalised, $^{10}\log$ scaled data

Classification results:

	Prediction		
	Authentic	Adulterated	% correct
Baseline samples	47	3	94%
<i>Challenge samples:</i>			
Authentic	5	0	100%
Adulterated	4	38	90%



Best models: discrimination 100% real nutmeg and own material mixed samples

➤ Volatiles PTR-MS:

- kNN model
- 100% real nutmeg and 100% correct prediction for own material mixed samples
- Estimated limit of detection 7%

➤ Non-volatiles FI-ESI-MS:

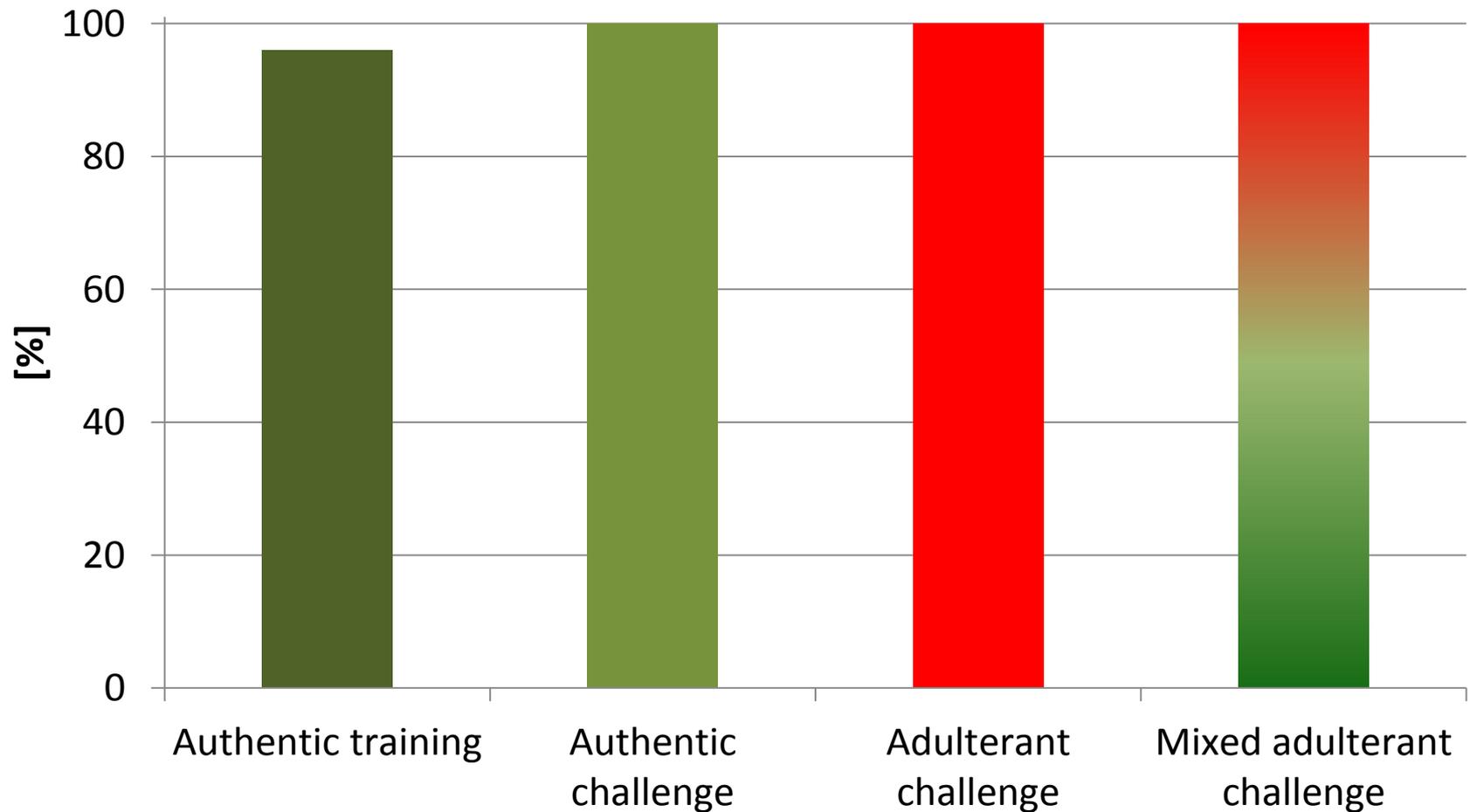
- PCA Q values
- Similar success rate predictions
- Limit of detection 30%



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Successful classification PTR-MS - nutmeg



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Conclusions

- Broad anomaly testing approaches have been developed for a variety of spices and herbs and various fraud issues in Spiced
- For each spice/herb at least a few approaches were able to distinguish well between authentic and adulterated materials
- Because of the one class classifier approach, the methods are expected to be able to detect a variety of other deviations from normal, authentic sample material
- To increase robustness the training sets of authentic material could be expanded to cover more “special but natural” variation of the spice and herb materials



More presentations on the topic to follow

- 
- Bettina Horn (BfR): More fingerprinting methods, especially on paprika powders
 - Vadims Bartkevičs: The targeted approach



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The partners



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RIKILT

WAGENINGEN UR

**Thank you for
your attention**



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