Rapid, Direct Technique for the Discrimination of Meat Tissues Originating from Different Animal Species for Food Authenticity

Sara Stead, Simon Hird, Julia Balog, Alex Hooper, Steve Pringle, Mike Wilson and Mike Morris
Waters Corporation, Slaford Avenue, Altnincham Road, Willows, Cheshire, SK944X, UK

INTRODUCTION

The quality, safety and authenticity of food of animal origin are regulated by legislation. Food fraud is a collective term used to encompass the deliberate and intentional substitution, splicing, addition, tampering, or misrepresentation of food, food ingredients, or food packaging; or false or misleading designation of fish species. It is a criminal offense in the UK to sell food that is not in accordance with the food law. Food fraud is a growing problem and is estimated to cost the European Union over €12 billion annually. Food fraud is a complex and poorly understood phenomenon. It can be driven by economic or political motives, or by consumers trying to avoid established dietary advice. There is a need for a rapid, direct technique to differentiate meat from different animal species.

METHODS

Samples of different types of meat and fish were procured from commercial sources. Muscle patties were prepared containing different quantities of beef and horse meat. All samples were analyzed using an atmospheric pressure ionization time of flight mass spectrometer (Xevo G2 quadrupole time of flight mass spectrometer. Molecules are ionized at the heated impactor and the output from each “burn” is clustered ionised and neutral mass spectra. The mass spectra showed a correlation between the fish species and the location on the PCA plot. The mass spectra showed a correlation between the fish species and the location on the PCA plot. The mass spectra showed a correlation between the fish species and the location on the PCA plot.

RESULTS AND DISCUSSION

1. Determination of fish species by identification of markers

Figure 1. Photograph showing the cutting of the tissue surface

Figure 2. Schematic showing how the aerosol is sampled, how ions are formed and transferred to the HTof MS for mass measurement

Figure 3. Workflow used for investigation of fish speciation

Figure 4. Workflow used for investigation of fish speciation

Figure 5. Mass spectra acquired from analysis of fillets of different species of white fish from the Gaddidge family

Figure 6. PCA plot using spectra from different fish species

Figure 7. Figure 5. 3-D plot showing significant markers for whiting

Figure 8. OPLS-DA plot showing four distinct sample groups

Figure 9. Workflow used for investigation of meat adulteration

Figure 10. The first three principal components after PCA on spectra from pure beef and horse spectra: raw and cooked

CONCLUSION

• Combining REIMS with multivariate statistics provides a useful tool for the rapid analysis of animal tissues with no sample preparation required.
• We have demonstrated its potential for the discrimination of adulteration at both the family and level of adulteration in fish and meat using:
  - A system using Progenesis QI for classification of spectra from raw and cooked samples and the identification of the significant markers
  - A system using Progenesis QI for classification of spectra from raw and cooked samples and the identification of the significant markers
• A system using Progenesis QI for classification of spectra from raw and cooked samples and the identification of the significant markers
• A system using Progenesis QI for classification of spectra from raw and cooked samples and the identification of the significant markers
• A system using Progenesis QI for classification of spectra from raw and cooked samples and the identification of the significant markers

To download a copy of this poster, visit www.waters.com/posters

©2015 Waters Corporation