Speciation of Meat

Application Note 6

Background

In recent years there have been a number of scandals involving fraudulent mislabelling of meat in the human food sales chain, in order for the perpetrators to gain criminal monetary advantage. One prominent example in 2013 was the horsemeat scandal in Europe, where food products labelled as "beef" were found to contain significant amounts of horsemeat. While not hazardous to health, this activity nevertheless constitutes criminal fraud, as the consumer is paying for a premium product (beef) but receiving a cheaper one (horse). To combat this activity it is important that reputable food producers and regulators have methods at their disposal to quickly and reliably check that a meat product is what it is claimed to be.

The traditional method of analysis

The traditional method for identification of meat species is Polymerase Chain Reaction (PCR) and/or gene sequencing which, although highly specific, takes several hours to complete. Enzyme-linked immunosorbent assay (ELISA) tests are also used and although they are cheaper and quicker than the PCR tests, they are still more expensive per test than the **X-Pulse** method.

X-Pulse

X-Pulse is a high performance benchtop Nuclear Magnetic Resonance (NMR) spectrometer operating at 60MHz proton frequency. It uses a permanent magnet, so does not require liquid nitrogen, liquid helium, or compressed gasses, and it has no special health and safety requirements. It can be operated in a normal analytical laboratory by non-NMR expert laboratory technicians.

The X-Pulse method

The **X-Pulse** method has been developed in collaboration Quadram Institute Bioscience (formerly the Institute of Food Research) in Norwich, UK. The method works by analysing the high resolution 60MHz NMR spectrum of oil or fat extracted from a meat sample to determine the fatty acid composition of the meat (see **X-Pulse** application note 5). Different meat species exhibit different fatty acid profiles, and these profiles can be used to identify the meat species being tested (see Figure 1). In practice, there is a certain amount of natural variation between samples of the same meat species, due (for example) to origin, method of feeding, the cut of the meat, etc., so a chemometrics approach has been developed to classify the fatty acid profiles and provide automated differentiation.

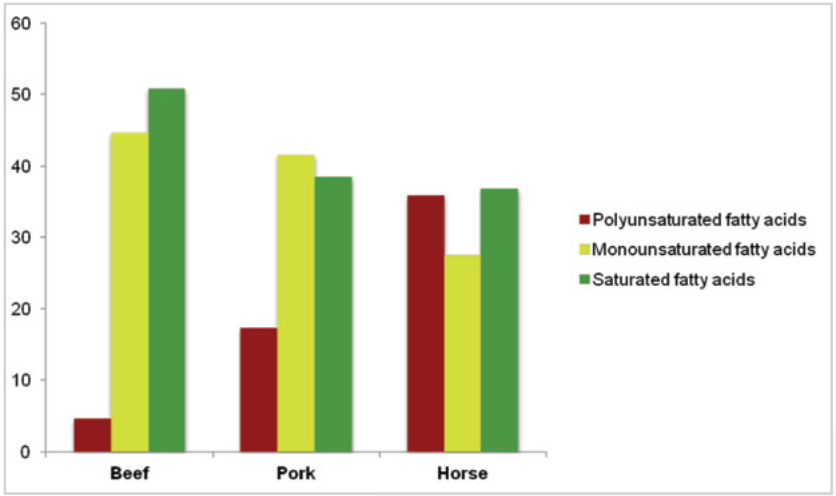

Figure 1 Fatty acid profiles of common meat species

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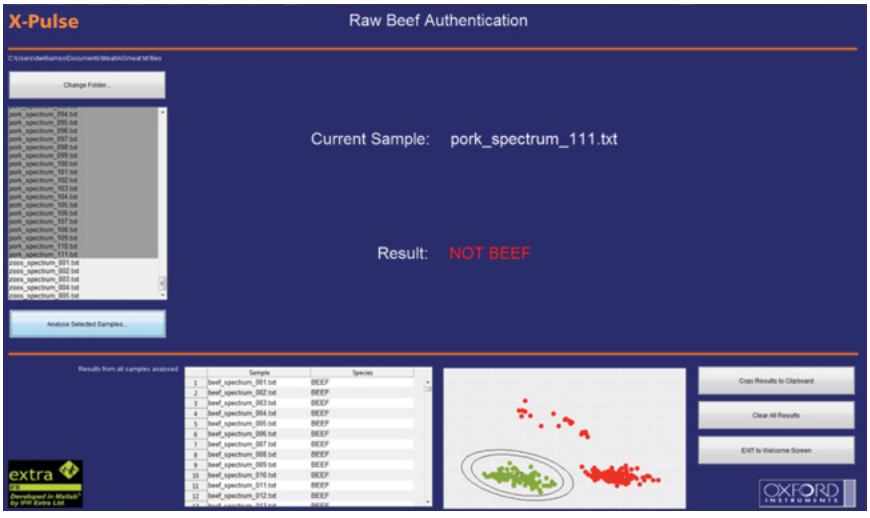
Measurement process

Solid meat samples are first homogenised, then a representative sub-sample of 3 - 4g is shaken in a vial with 1.5ml chloroform. The mixture is then filtered, and pipetted into a 5mm NMR tube. The tube is then inserted into the **X-Pulse** instrument and a spectrum is collected. The spectrum is transferred to the special applications software for analysis.

Measurement time

The total measurement time, including sample preparation, is typically less than 5 minutes for most samples, but could be up to an hour for very lean samples.



Results

The special **ConfirMeat** software displays the predicted meat species of the sample, and indicates where the measurement result lies in the chemometric model. See Figure 2 for an example of the results output.

Figure 2 *Output of* ***ConfirMeat*** *method*

Applicability and limitations

The **ConfirMeat** method is intended for the testing of unblended meat samples, to verify whether or not the sample is of the species it is claimed to be. The method cannot be used to quantify constituents in mixtures of meat species, or to detect trace contamination of one meat species with another. Currently a database is available containing samples of beef, pork and horse. Identification of other meat species is perfectly possible, but requires the user to build up a suitable database of samples for comparison.

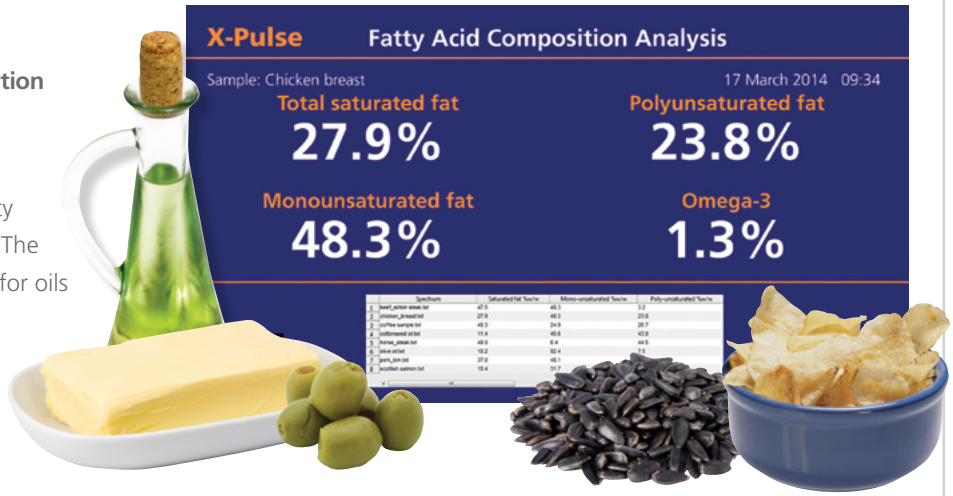
Summary

X-Pulse provides a fast, convenient and reliable method for identifying meat species. **X-Pulse** does not require liquid helium, liquid nitrogen, or compressed gases, and can be operated in a normal laboratory environment without any special health and safety considerations.

Also available:

X-Pulse for fatty acid composition of Triglycerides

X-Pulse also provides a fast and simple method for analysis of fatty acid composition in oils and fats. The method works for liquid oils and for oils extracted from solid foodstuffs, and takes typically less than 5 minutes per sample.



MQC+ benchtop NMR analysers for fast and easy measurement of total oil or fat. Applications include:

- Fat in food
- Solid Fat Content (SFC)
- Oil in snack food
- Fat in chocolate
- Oil & moisture in seeds

visit **nmr.oxinst.com/x–pulse** for more information or email **magres@oxinst.com**

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