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Rapid methods for food authentication and quality confirmation

Key external stakeholders:
Food manufacturers, consumers, regulatory agencies

Practical implications for stakeholders:
The outcome is a clear indication of the power and utility of rapid, non-destructive spectroscopic methods for demonstrating conformance to specification of foods and food ingredients.

- Variations in raw material quality may be detected and defective material rejected
- In-process changes may be mapped and controlled
- Final product consistency may be measured and assured
- This technology facilitates the application of PAT (Process Analytical Technology) in the food industry

Main results:
- Spectroscopic models have been developed which are capable of discriminating between closely-related food products e.g. extra virgin olive oils from Liguria and other regions in Italy, Corsican honey and honey from neighbouring territories.
- A spectroscopic method for confirming the identity of a branded product was demonstrated. Spectroscopy combined with mathematical modelling has been demonstrated to be suitable for demonstrating conformance to specification in a range of food products.

Opportunity / Benefit:
By interaction with this expertise at Teagasc Food Research Centre Ashtown, food processors can reduce variability in the functional and other characteristics of their products, and move towards a PAT approach in food processing.

Collaborating Institutions:
See page two of the full Technology Update

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1. Project background:

An increasing number of foods on supermarket shelves carry claims which imply either specific quality attributes or quality levels which are higher than the norm for a given food. Foods bearing such claims carry a price premium. To protect the food processor and consumer, some rapid, non-destructive method for confirming provenance and quality claims is required. Spectroscopic techniques are non-destructive and take fast measurements (spectra) which can act as fingerprints of a food sample. Complex mathematics enable information extraction from these spectra. Confirmation of any particular quality claim or brand may then be possible by collecting its fingerprint and applying the mathematical model. This process requires only seconds to perform and is therefore potentially very suitable for retail or process plant applications.

2. Questions addressed by the project:

- Can spectroscopic techniques (NIR and MIR) in combination with chemometric methods confirm or refute provenance or other quality claims on foods?
- What are the most effective tools for such applications?
- How can the results of such analysis be made transparent to processors and consumers?

3. The experimental studies:

Authentic samples of honey and olive oil were acquired over 3 seasons and then analysed using both NIR and MIR spectroscopy. Several mathematical methods including both discriminant and class-modelling approaches were applied to the specific provenance issue in each case. Models were assessed using rates of correct classification.

4. Main results:

- Models have been developed which are capable of discriminating between closely-related food products e.g. extra virgin olive oils from Liguria and other Italian regions, Corsican and other honeys.
- A method for confirming the identity of a branded beverage (a Belgian beer) was successfully implemented.
- The combination of spectroscopy and mathematical data analysis has been demonstrated to be suitable for authenticity screening and quality confirmation in a range of foods.

5. Opportunity/Benefit:

Food processing companies interested to improve product quality and reduce inconsistency should contact Teagasc Food Research Centre Ashtown for discussions regarding collaborative application development.

6. Dissemination:

Dissemination has been effected through scientific conferences, workshops (annual European events during the lifetime of the TRACE project) and seminars (e.g. IFSTI Seminar on Food Labelling, Dublin, January 2011). A booklet summarising the work of the spectroscopic group in TRACE, aimed at technical staff in food industries, was published in three languages in 2010 (English version: http://www.trace.eu.org/img/BOOKLET_Trace_150dpi+final.pdf). Because of the strategic competencies

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developed during the project, technology transfer will continue through Teagasc activities with the food industry involving quality measurement or monitoring in many sectors.

Main publications:

- Woodcock, T., Downey, G., Kelly, J.D.K. and O'Donnell, C. (2007) 'Geographical Classification of Honey samples by Near Infrared Spectroscopy: A Feasibility Study.' *Journal of Agricultural and Food Chemistry*, 55: 9128-9134.
- Woodcock, T., Downey, G. and O'Donnell, C.P. (2008) 'Better quality food and beverages: the role of near infrared spectroscopy.' *Journal of Near Infrared Spectroscopy*, 16: 1-29**.**
- Oliveri, P., Di Egidio, V., Woodcock, T. and Downey, G. (2011) 'Application of class-modelling techniques to near infrared data for food authentication purposes.' *Food Chemistry*, 125: 1450-1456.

Popular publications:

- Downey, G. (2009) "NIR approaches to food provenance determination and confirmation." *Newfood*, 1, 18-21
- Downey, G. (2011) "NIR and class-modelling methods for brand protection in food and beverages." *Newfood*, 14(4), 11-14

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