

CERTIFICATION AND AUTHENTICATION OF FOOD PRODUCTS

The regulatory framework of the food industry impacts, among others, the agreement between what is described on labels and the content of products sold on the market. This concern is shared by the consumer.

The traceability of raw materials as well as the quality control of end products must contribute to this requirement. On the one hand, the manufacturer is required to implement analytical tools to reach these goals. On the other hand, the different existing control agencies must warrant of the quality of the end products and ensure that they match the label.

In order to answer these different issues, Nuclear Magnetic Resonance (NMR) is a tool of choice to detect potential frauds or adulterations of raw materials or finished products.

Which expertise is proposed by SPECTROMAITRISE?

- Fraud detection
- Checking whether adulterant(s) is(are) added or not
- Checking whether norms imposed by control instances are observed or not
- Authentication of the origin of products: natural vs synthetic, geographical origin, botanical and/or animal origin

What are the innovative and differentiating methodologies used or proposed by SPECTROMAITRISE?

- Profiling with high field or benchtop NMR
- Isotopic analyses on targeted molecules
- Quantitative and targeted analyses by NMR
- Isotopomic approaches

To which matrices can the SPECTROMAITRISE expertise be applied?

- Liquids: wines, juices, oils, etc.
- Raw materials and food ingredients: flavors, coffee, tea, etc.

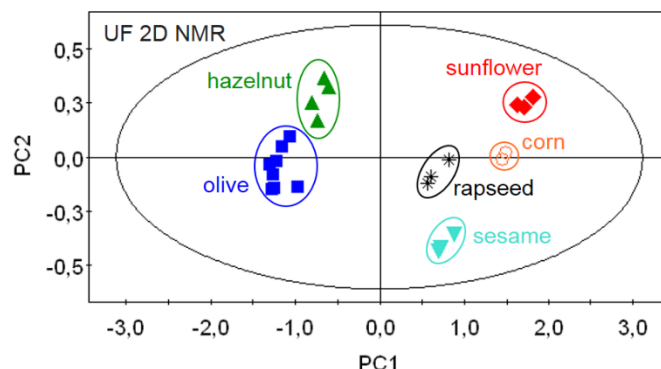
Examples of scientific and technical supports

High-throughput authentication of edible oils with benchtop Ultrafast 2D NMR,

B. Gouilleux *et al.*, *Food Chemistry*, 2018, 244, 153-158

In this article, the potential of new benchtop NMR systems is demonstrated to detect the botanical origin of edible oils. By combining our fast 2D NMR approaches with chemometric tools, we show that benchtop NMR can help to discriminate oils from different origins (sunflower, olive, hazelnut, etc.) and to underline adulteration processes such as the addition of hazelnut oil into olive oil.

Efficient discrimination of edible oils according to their botanical origin by ultrafast 2D NMR on a benchtop spectrometer



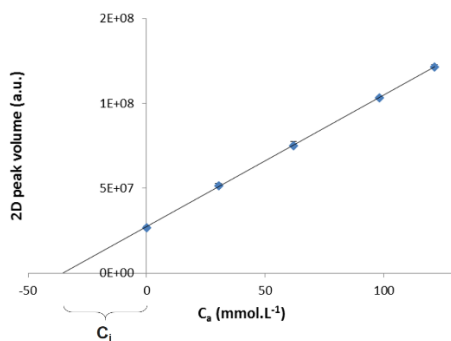
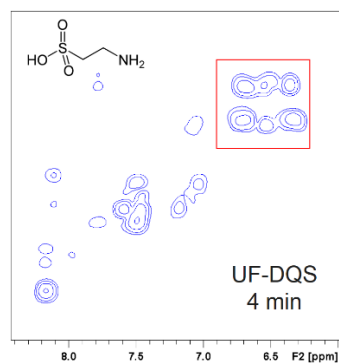
Position-Specific Isotope Analysis of xanthines: a ^{13}C NMR spectrometric method to determine the intramolecular natural abundance $\delta^{13}\text{C}$ values,

D. Diomande *et al.*, *Analytical Chemistry*, 2015, 87, 6600-6606

The natural xanthines (caffeine, theobromine, and theophylline) are of major commercial relevance, as flavors constituents in coffee, tea or cocoa, and their price varies according to their origin. In this article, an isotopic analysis by quantitative ^{13}C NMR is developed to measure position-specific variations of the $^{13}\text{C}/^{12}\text{C}$ distribution in caffeine: this target molecule will help to certify the origin (synthetic or natural, geographic or varietal) of theobromine (cocoa) and caffeine (tea, coffee, guarana, cola, and mate).

Ultrafast double-quantum NMR spectroscopy with optimized sensitivity for the analysis of mixtures,

L. Rouger *et al.*, *Analyst*, 2016, 141, 1686-16922

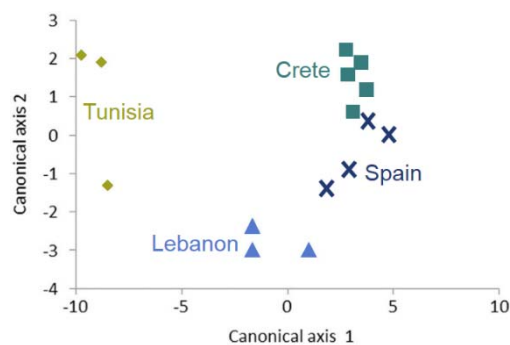


In this article, we have developed a specific ultrafast 2D NMR pulse sequence (UF-DQS) for the quantification of various compounds in complex mixture. The example of the quantification of taurine in commercial energy drinks demonstrates the efficiency of the method.

Quantification of taurine in an energy drink by combining ultrafast 2D NMR with a standard addition procedure

Precise and rapid isotopic analysis by ^1H - ^{13}C 2D NMR: application to triacylglycerol matrices,

N. Merchak *et al.*, *Talanta*, 2016, 156-157, 239-244



In this article, the parameters of the HSQC pulse sequence (NUS, aliasing) are optimized in order to determine the metabolic and isotopic profiles of triacylglycerol matrices in a high-throughput fashion. Thirty-two commercial vegetable oils were analyzed after showing that this sequence was efficient to perform isotopic measurements: thanks to this isotopic approach, we could classify different oils according to their geographical and botanical origins.

Classification of edible oils according to their geographical origin thanks to a 2D NMR based isotopic approach