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VENDOR SEMINAR:

Advanced Methods to Ensure the Quality of Foods using Mass Spectrometry

Using Bruker HRMS-techniques for the development of novel methods for food authenticity and fraud investigation

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During the last decade, food authenticity studies have been found on the frontline of scientific research. The development in the field of food science aimed to achieve high nutritious, superior quality and safe food. Thus, efforts are being made, not only to reassure that the product meets the quality standards, but also to highlight the qualifications of each product that declare its uniqueness. More specifically, special attention has been paid to the assurance of variety and geographical origin (Protected Designation of Origin) of the products. Serving this purpose, recent advances in mass spectrometry have led to the development of novel methods, applicable in food chemistry and technology. In our laboratory with strong cooperation with Bruker, high resolution mass spectrometric (HRMS) methods have been being developed and applied for the detection and substantiation of food authenticity. For that purpose novel methods and workflows have been developed for the identification of target, suspect and unknown compounds in an extensive variety of food matrices. Integrated screening workflows, based on both LC/GC-QToF-MS technologies, provided excellent analytical performance allowing the determination of a wide range of compounds in food matrices like olive oil, honey, wine, juice, milk and dairy products. Furthermore, a novel methodology utilizing Trapped Ion Mobility Spectrometry (TIMS) combined with LC-HRMS has recently been introduced and applied for the first time in olive oil, in order to separate and identify isomers that could be used as potential authenticity markers (variety discrimination). For complex assessment of food authenticity studies, like cheese fraud, Matrix-Assisted Laser Desorption Ionization-Time of Flight Mass Spectrometry (MALDI-ToF-MS) presented to be a fundamental high-throughput analytical technique. Advances in MALDI technology have led to the development of novel omics-based methods, heading on maximum collection of information on sample composition. Recently, highly automated proteomics- and lipidomics-based workflows have been developed for rapid detection of PDO dairy products adulteration and possible contamination, exploiting the total protein/lipid profile. Overall, novel MS-techniques in their entirety, proved to be powerful analytical tools, highly-applicable to food authenticity studies, with remarkable possibilities and breakthrough achievements.

Keywords: Food authenticity, LC/GC-QToF-MS, LC-TIMS-HRMS, MALDI-ToF-MS

Mass spectrometric solutions for accurate screening and quantitation of chemical residues in food extracts

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The use of pesticides to reduce crop damage and increase horticultural productivity has been implemented on a global scale for many decades. Due to their toxicity, the potential migration of these chemicals into the human food and water supply chains presents considerable health concerns for the population at large. Therefore, the maximum residue levels (MRL) permitted for pesticides in food and feedstuffs are strictly controlled by local and international regulatory bodies. One of the most important aspects in reducing pesticide exposure is to monitor their levels in food extracts. However, with increasing demands for lower detection thresholds to cover hundreds of pesticides originating from numerous sample types, accurate and reliable pesticide screening is a critical and complex analytical task. To meet these challenging demands, new UHPLC-QTOF and GC-APCI-QTOF based solutions have been developed and these, including software enhancements will be presented.

Fast and comprehensive full scan accurate mass screening and quantitation became an excellent tool in food control when the presence or absence of hundreds of pesticides, veterinary drugs, mycotoxins or dioxins must be proved in a short time frame. Additional to the high number of targets being screened for, the technique takes advantage of unknown evaluation and retrospective analysis. The new TargetScreener HR 4.0 application kit is based on the Bruker impact II QTOF. A central part of the solution is the new TASQ 2.1 Screening & Quantitation Software for rapid data processing, including ready methods for multi-target screening. Central to minimizing false positives or negatives is the high quality, robust TargetScreener databases with more than 3000 entries relevant for food safety, environmental protection, and toxicology screening and research. Depending on the compound classes, food extracts can be separated with the Bruker Elute UHPLC connected to the QTOF or with GC-APCI-QTOF, if e.g. pesticides or dioxins are more amenable to GC/MS.