New technological advancements and application developments for increased sensitivity and high-spatial resolution mass spectrometry imaging

Speaker:

Dr. Janina Oetjen

Janina is an Application Specialist for MALDI Imaging at Bruker Daltonics GmbH & Co. KG. She joined the company in 2018 and is acting as a demo scientist for mass spectrometry imaging on the timsTOF fleX instrument.

Abstract:

The timsTOF fleX is a versatile, dual-source (ESI+MALDI) mass spectrometer enabling sensitive and high-spatial resolution MALDI-based molecular imaging of (bio)molecules from plant or human tissue sections combined with Omics analyses. It also features unique dual TIMS device allowing for ion mobility analysis without any ions loss and CCS (Collision Cross-Section) values determination.

In this webinar, we provide an introduction into the mass spectrometry imaging technique which provides information on the spatial occurrence of metabolites and lipids in their *in-situ* cellular context. We will highlight the capabilities of the timsTOF fleX platform and introduce new applications, method developments and software solutions in the field of mass spectrometry imaging which help brining spatial context into disease as well as agricultural research.

MALDI Mass Spectrometry Imaging – Application and Challenges

Speaker:

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Abstract:

Matrix-assisted Laser Desorption Ionization Mass Spectrometry Imaging (MALDI-MSI) is considered one of the most advantageous label-free *ex vivo* techniques for visualising the spatial distribution of various molecules throughout a tissue section (1). Using this technique, it is possible to analyse biomolecules, including proteins, peptides, and lipids, as well as drugs and other xenobiotics. MALDI-MSI can be used to study human, animal, and plant tissues.

The MALDI-MSI technique has been widely used in biomedical research for pathology diagnosis. Research is mainly directed towards the search for potential biomarkers of carcinogenesis. In our lab, we have used this technique for the spatial proteomic analysis of two ovarian tumours - borderline ovarian tumour and ovarian fibrothecoma (2). We have observed regiospecific features correlating with the results of histopathological staining.

MALDI-MSI is also applied for insect and plant research. The findings help better understand living organisms' physiological and pathological processes. They may also reflect the impact of anthropogenic activity on flora and fauna. In our lab, using the MALDI-MSI approach, we have studied

the honeybee (*Apis mellifera*) larvae. The performed analyses allowed us to select the MS peaks differentiating between sections of the insects' bodies.

The recent worldwide studies highlight the great potential of the MALDI-MSI in the detailed characterisation of tissue composition, giving a more in-depth insight into the tissue structure. However, this advanced technique presents significant challenges, making the identification of molecules directly from tissue problematic. The difficulties result mainly from the complexity and heterogeneity of the biological matrices (3). Moreover, delocalisation and degradation of the analyte, size of the MALDI matrix crystals, laser focus restrictions and detector sensitivity still limit spatial resolution. For this reason, sample preparation methods and analytical equipment are continuously improving.

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3. Seeley E.H., Caprioli R.M.: Trends Biotechnol. 29(3), 136 (2011).