

07-04: Mass spectrometry imaging in chemical ecology

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Laterally resolved metabolomics (LRM) is an innovative way studying metabolites in different tissues including plants. A particular area of LRM is mass spectrometry imaging (MSI), where MS data are acquired from predefined spots. Typically an area of interest is scanned as a raster with predefined spot-to-spot steps. Achieved lateral resolution is related to focus of desorption/ionization beam of ions or light. In our labs UV or IR lasers are used for ion desorption/ionization. A commercial SMALDI probe connected to Q-Exactive+ spectrometer combines 2-3 μm lateral resolution with 250,000 mass resolution and attomolar sensitivity. When samples contain substantial amounts of water, mid-IR laser (2940 nm) can be used for ion evaporation from tissue. IR-laser ablated metabolites are further ionized in perpendicular electrospray plume and formed ions are detected in Synapt G1 tandem mass spectrometer. We are operating a prototype of such an LAESI instrument, where profilometry on samples are measured prior MSI and z-coordinates are corrected to achieve constant laser focus on real samples with pronounced topography. Lateral resolution is currently 40 μm sufficient for LRM of individual plant cells. In summary IR-Laser ablation can be guided in the 3rd dimension to overcome the influence of surface topography on laser focus for consistent laser ablation marks size in mass spectrometry imaging experiments. Diverse chemical can be imaged both in positive/negative ion mode.

These MSI tools are used to understand site of chemical signals biosynthesis, accumulation and emission. Additionally, physiological reactions of plants upon biotic stress are intensively studied. Recently semiochemicals from microorganisms are in our focus.

References

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