BENEFITS OF HIGH RESOLUTION ION MOBILITY SEPARATION ON THE CYCLIC IMS FOR DESI MASS SPECTROMETRY IMAGING

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Introduction

Desorption DESI™ is a powerful and sensitive MS ionisation technique for the profiling and imaging of metabolites and lipids direct from unmodified complex biological samples, such as mammalian tissue sections. However, the direct analysis of small molecules can be challenging due to the structural diversity and isobaric nature of these types of compounds. Ion mobility separation (IMS) has proven to enhance system peak capacity, improve specificity and separate structural isomers.

Here we describe the implementation of DESI mass spectrometry imaging (MSI) where ion mobility separation was improved using a multi-pass cyclic IM travelling-wave device where the number of passes around the device can be scaled to improve resolution.

Experimental

Experiments have been carried out on porcine liver and mouse brain tissue sections. DESI XS source was coupled to a SELECT SERIES™ Cyclic™ IMS system equipped with a high-performance sprayer (Figure 1). Solvent (MeOH/water 98:2) was delivered at 2 µL/min. Datasets were processed with modified Driftscope™ 2.9 High Definition Imaging (HDI™) 1.6 and MassLynx™.

Figure 1. DESI-XS source with Cyclic IMS.

Results

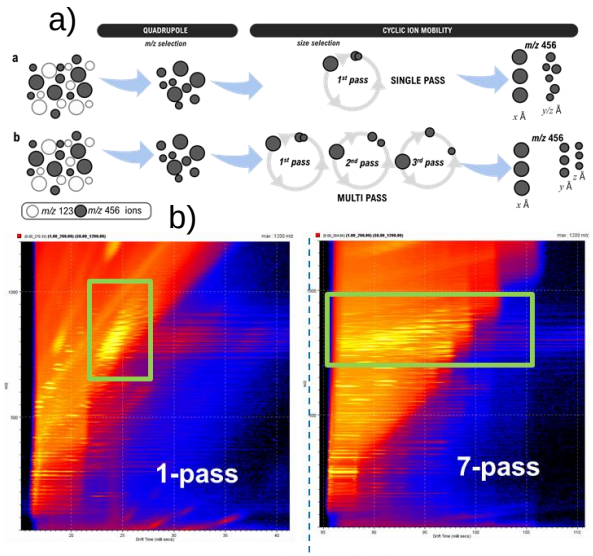

Figure 1.a) diagram showing separation after a single and multiple passes on the cyclic IMS device. b) 2D-mobility plots (*m/z vs.* drift time) a single pass and 7-passes of cyclic IMS device result ins partial separation of the complex phospholipid region from a DESI imaging experiment in positive mode on the brain mouse tissue section.

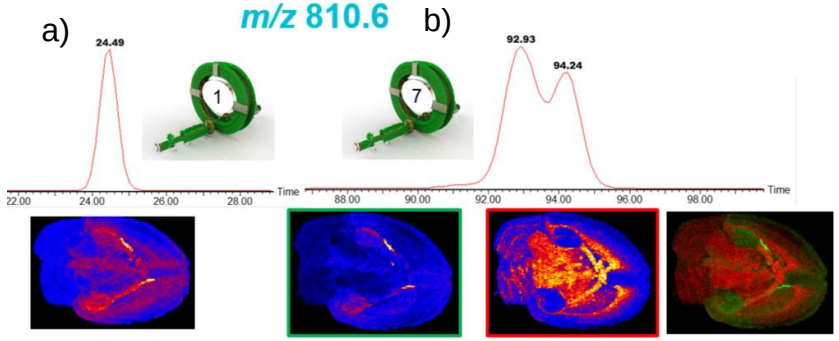

Figure 2. a) In single pass DESI imaging, for *m/z* 810.6, a single mobility peak was observed with a drift time of 24.49 ms showing the ubiquitous localization throughout the brain tissue section. (b) Two conformers were observed for same *m/z* value after seven passes, at drift time 92.93 and 94.24 ms showing distinct distributions for the two molecules with differing mobilities within the mouse brain.

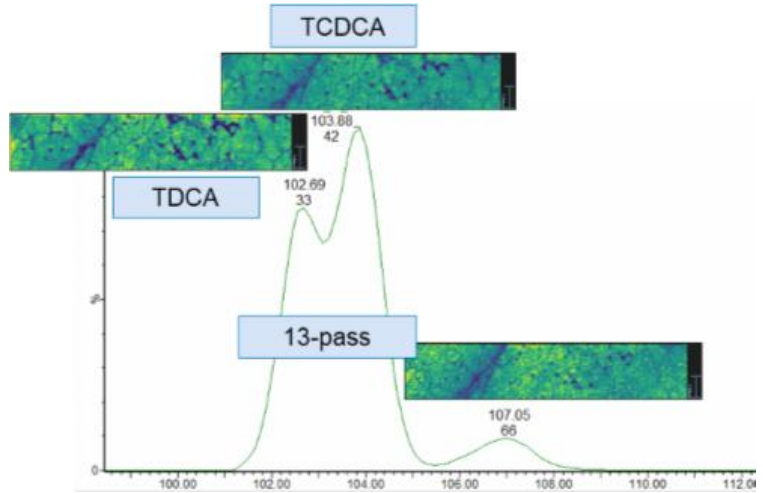

Figure 3. Extracted mobilogram of *m/z* 498.29 from a DESI imaging cyclic IMS experiment in negative mode after 13-passes, acquired from a porcine liver section, showing the ion images of isomers TDCA (drift time of 102.69 ms) and TCDA (drift time of 103.88 ms).

Conclusions

- DESI imaging workflow is fully compatible with cyclic ion mobility for single and multi-pass image acquisitions.
- Multi-pass ion mobility separation afforded by cyclic MS increased the peak capacity of the DESI imaging experiment.
- High-resolution ion mobility separated isobaric lipid species and isomeric bile acid conjugates.