

Differential Ion Mobility Separation of Iso-Elemental Lipid Species

SelexION® Technology

The resolution of iso-elemental lipid species is a major challenge facing the field of lipidomics. Iso-elemental refers to compounds that are different chemical entities but have identical elemental composition and therefore mass. These lipid species possess the same accurate mass however their function may vary vastly. Therefore, the ability to distinguish these iso-elemental species is critical for the characterization, identification and quantitation of lipids.

The Challenge:

A high resolution accurate mass spectrometer can resolve many of the near-isobaric lipid isomers; however, no high resolution instrument will resolve iso-elemental compounds. Furthermore, during product ion analysis, ions are typically isolated by a quadrupole which is relatively low resolution, so isobars and near-isobars will contribute to the MS/MS spectrum. The ability to selectively isolate lipid classes prior to MS analysis would reduce isobaric interference in MS and produce cleaner MS/MS spectrum for easier identification and quantitation.

The Solution:

Used with or without LC flow, SelexION Technology readily distinguishes molecular isobars among different lipid categories, classes and molecular species.

Using SelexION Technology on a TripleTOF® 5600 System, a lung lipid extract was infused and the DMS CoV was ramped from -40 to 20V in the negative ion mode (isopropanol used as DMS modifier). All PE species are found in the CoV peak at -4.7 minutes and the accurate mass TOF MS data underlying this peak can be viewed. An XIC of the 750.5446 m/z peak reveals two peaks in the corresponding ionogram. The large peak is PE 38:5 and has a COV of -4.4 whilst the smaller is a PC ether-linked 30:0 with a COV of -8.5.

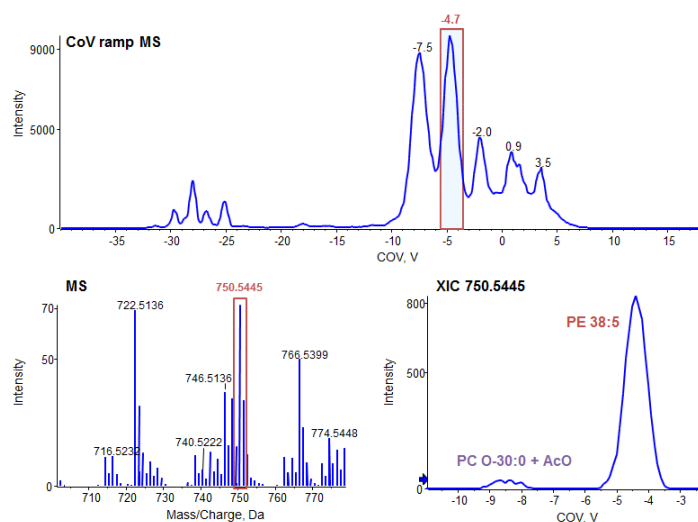


Figure 1. Resolution of Iso-Elemental Lipid Species by DMS. A number of CoV peaks are observed in the lung lipid extract when a DMS CoV ramp is performed (top). Phospholipids and cardiolipins have more negative CoV values whereas the free fatty acids closer to zero. The phosphoethanolamine lipid class is found at CoV -4.7. One of the PE species in this sample is PE 38.5 with m/z 750.5446 (bottom left). Generation of an XIC for this mass reveals two CoV peaks (bottom right) - one for PE and one for PC. These two species are iso-elemental and thus cannot be resolved with any high resolution instrument, but they have clearly different COV values. Subsequent MS/MS analysis of 750 at the appropriate COV value gives an MS/MS spectrum that clearly confirms each lipid molecular species.

SelexION Technology readily distinguishes iso-elemental lipid species as demonstrated here by the separation of PE and PC ether-linked species.