Drug Des 2018, Volume 7
DOI: 10.4172/2169-0138-C3-029

1,6-Diphenyl-1,3,5-hexatriene (DPH) as a novel matrix for MALDI MS imaging of fatty acids, phospholipids, and sulfatides in brain tissues

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Statement of the Problem: Various phospholipids and with fatty acids have been identified as biomarkers of diseases such as Alzheimer's disease, coronary heart diseases and cancers. The direct Mass Spectrometry Imaging of lipids is difficult and conventional organic matrices do not allow the detection of low mass molecules due to background signals at the mass range of fatty acids. The purpose of this study is to propose the use of 1,6-Diphenyl-1,3,5-hexatriene (DPH) as a new matrix which binds selectively to hydrophobic acyl chains in lipids structure and allows their highly sensitive detection. Methodology: 10 μm thick coronal and sagittal brain sections from male mice and rats were thaw-mounted onto indium tin oxide coated glass slides. DPH was applied as a matrix by sublimation; its amount, temperature and duration were optimized for 250 mg at 200 °C for 3.0 min. MS data were obtained using a SCIEX 5800 MALDI TOF-TOF mass spectrometer. Findings: DPH permits the highly sensitive detection of small fatty acids (m/z 200−350) as well as a variety of large lipids up to m/z of 1000, including lyso-phospholipid, phosphatidic acid, phosphoethanolamine, phosphatidylserine, phosphatidylglycerol, phosphatidylinositol, and sulfatides in mouse and rat brain. In presence of these analytes,it has been reported the suppression of DPH background which is one of ideal characteristics of MALDI matrix and allows small molecules detections. Conclusion & Significance: we have successfully demonstrated the application of commercially available DPH as a new MALDI matrix and its favorable interaction with the acyl chain in lipid structure. This allowed the simultaneous visualization of both fatty acids and a variety of lipid distributions from mouse and rat brain tissues. By keeping the laser power relatively low, we were able to minimize fragmentation of phospholipids and obtain high quality MALDI MSI data in the negative ion mode.

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