

Development of tandem mass spectrometry (MS/MS) on a miniaturized laser desorption/ionization time-of-flight mass spectrometry (LD-TOF-MS)

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The mass spectrometry (MS) technique has been used in a number of prior, and current space missions. For high sensitivity detection of ions created by the laser desorption process, the time-of-flight mass spectrometer (TOF-MS) has become widely employed in a large number of analytical laboratories due mainly to its simplicity of operation, high-mass detection, and rapid analysis times. Further, for planetary/field applications the TOF-MS is particularly well suited due to lightweight packaging, simple electronics, and potential for ease of development from brass board to flight hardware. Molecular structure analysis in MS leads to the need for tandem mass spectrometry method, or MS/MS. MSMS is an extremely powerful and widely-used method for identification and structural analysis of unknown molecules, and is realized through the use of many types of mass spectrometers. In particular, it is a key advance that can help identify the origin, type, and processing of extraterrestrial organics through their molecular structure. In this study, we report our most recent development of MSMS capability on our miniaturized LD-TOF-MS, by combining the curved field reflectron and the ion gating technique coupled with post-source decay (PSD) or local collision induced dissociation (CID) processes. In this setup, no additional weight/volume and collision gas are required, thus made the instrument suitable for future space missions. The MSMS spectra of various organic standards and selected peaks in analog samples are recorded, and also compared to the commercial TOF instrument for performance evaluation.