MALDI of Bio-Aerosols in an Ion Trap Mass Spectrometer

William A. Harris, Peter T. A. Reilly, William B. Whitten, J. Michael Ramsey
Oak Ridge National Laboratory, Oak Ridge, TN

52nd ASMS Conference

Introduction: There has been an interest in the ability to detect bio-aerosols in real-time. While the ability to detect single particles with mass spectrometry has been much utilized, the typical approach of laser desorption limits the amount of information conveyed since high mass molecules are not ionized intact. One way to ionize large molecules is by matrix-assisted laser desorption ionization (MALDI). Although the ionization of biological molecules by MALDI is well-known, its use with bio-aerosols has been limited. Our approach is to detect and characterize bio-aerosols by MALDI in real-time with an ion trap mass spectrometer. Structural characterization may be enhanced with an ion trap by the ability to efficiently perform tandem mass spectrometry.

Methods: Aerosols were generated with a Collison nebulizer. They were coated with matrix in a heated saturator and condenser. Picolinic acid, sinapinic acid, and 3-nitrobenzyl alcohol were used as matrices. After passing through an aerodynamic lens, the particles were sized based on its transient time between two continuous wave 532 nm laser beams. Next, the particles entered the mass spectrometer. All experiments were performed in an ion trap mass spectrometer adapted to allow the introduction and ablation/ionization of single particles. A 266 nm laser was fired when the particle reached the center of the ion trap.

Preliminary Results: Mass spectra were obtained for bio-aerosols coated with matrix displayed a distinct protonated parent ion. Without the matrix addition, no analyte signal was visible. Experiments have been performed using erythromycin, poly-l-lysine, and polyethylene glycol as analytes. This allowed for the optimization of the choice of matrix and heated saturator temperature. One advantage of using an ion trap over other mass analyzers is the ease of performing tandem mass spectrometry. Collision-induced dissociation was successful and the resulting ms/ms spectra were similar to others displayed in the literature. Experiments are underway to study additional matrices and to apply on-line MALDI to bacteria spores.