

Tiny Time-of-Flight (TOF) Mass Spectrometer for Biodetection

Wayne A. Bryden

The Johns Hopkins University Applied Physics Laboratory
11100 Johns Hopkins Road
Laurel, MD 20723-6099

The mass spectrometer is known as the most powerful laboratory analytical tool for analysis of a broad spectrum of chemical and biological materials. The applicability of mass spectrometers to field detection problems has been quite limited given the large size, heavy weight, and prohibitive power requirements of the instrumentation. DARPA has funded a program at JHU-APL with the objective of integrating new and emerging mass spectrometer technologies into a highly sensitive, broadband miniaturized detection systems suitable for use in a field setting

The matrix assisted laser desorption/ionization (MALDI) technique has revolutionized biological mass spectrometry. Using this technique in the laboratory, large molecules (particularly proteins) can be employed as signatures biological materials. These signatures have been used with the proper algorithms to identify microorganisms down to the strain level using mass spectrometry. The DARPA funded system is being developed to carry this technology into the field in a package with low logistics burden and capable of being operated by lightly trained personnel. The system has demonstrate rapid classification and identification of a variety of bioaerosol components including bacteria (both spores and vegetative cells), viruses and toxins. The biodetection system include an optimized mass analyzer with tandem capabilities; an automatic collection system for transport of concentrated airborne particle samples into the mass analyzer; an automated analytical methodology; and automated signal processing, decision aids and data displays. This system is applicable to the rapid (<5minute) identification of airborne microorganisms in a mixed environment.