

Portable Mass Spectrometer for Explosives and Narcotics Detection

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The portable mass spectrometer is based on a linear ion trap (LIT) analyzer with an atmospheric pressure (API) interface. A novel ion funnel design is implemented to achieve efficient ion transmission using a small vacuum system. TSA screeners and other security professionals currently conduct sample collection using swab sampling. A thermal desorber (TD) is interfaced to the LIT analyzer to liberate sample from the swab surface. Desorbed sample vapors are ionized using a dielectric-barrier discharge (DBD). The TD-MS prototype system has been evaluated by depositing explosive and narcotic standards directly onto swabs.

Spectra were recorded and post-processed using detection algorithms developed in-house. The detection algorithm was designed for detection of threats in real-time, using dynamic thresholds that adjust to changes in the environment during continuous sampling. Threat peak windows contained within a library are monitored, and the peak amplitudes are compared against dynamically calculated thresholds to determine if peaks in these windows are statistically significant compared to the background spectral features. Scores are calculated based on the degree of significance and are accumulated over time. Once the score exceeds a pre-defined alarm threshold, an alarm is generated. Analytical figures-of-merit, including sensitivity and selectivity, will be presented to demonstrate the capability of the system for detecting trace levels of target explosives in an aviation security environment.