

A Completely Handheld Ambient Ionization Source for Mass Spectrometry Based on a Low-Temperature Plasma (LTP)

Student Abstract Award Winner

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A novel adaptation of the Low-Temperature Plasma (LTP) ambient ionization source has been developed and coupled to a miniature mass spectrometer, offering portability for true in-field analysis. Advantages of low gas and power consumption as well as no solvent usage have aided in developing the field-ready, handheld device for trigger-based, “point-and-shoot” sampling/ionization. A small lithium polymer battery was used to power a home-built circuit within the device, which provided ~2 kV ac to ignite a dielectric-barrier discharge in either helium or air. The excited species from the plasma are capable of directly interacting with gaseous, liquid or solid samples, resulting in sample desorption/ionization.

Analytical figures of merit for a few classes of compounds (mainly pesticides, explosives and drugs of abuse) under various operating conditions will be presented. In particular, the performance of conventional LTP versus handheld LTP has been evaluated, interestingly yielding increased performance for handheld LTP. An increase in proton transfer ionization was observed when the air discharge gas was replaced with helium (from a small He cartridge). However, the formation of nitrate adducts, as occurs with many explosives, was found to occur roughly the same extent with both gases.

The reduced gas flow rates and electric fields exhibited by handheld LTP have enabled a smoother coupling to mini MS when compared with conventional LTP. Initial results have indicated superior sensitivity, without the use of supplemental pumping, for the analysis of analytes in neat solution and complex mixtures. Results for the long-distance transfer of sample ions from the ionization region to the MS inlet will also be presented, illustrating the full advantages and potential of a handheld ambient ionization source.