Mini 11 Handheld Mass Spectrometer with Glow Discharge Ion Source and Atmospheric Pressure Interface

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The wide applicability of mass spectrometry makes it an extremely valuable method for chemical analysis. However, the size, weight and power consumption of the mass spectrometers limit the in-field applications of the mass spectrometry. A handheld tandem mass spectrometer, Mini 11 mass spectrometer, has been recently developed to provide a solution for this problem. This instrument employs a rectilinear ion trap mass analyzer and weighs 10 lbs, has a size of 10" L x 6" W x 5" H and a power consumption of 35W.
A digital control board with wireless communication capability was developed to execute pre-programmed scan functions, collect spectra and transfer data to the remote computer. The vacuum system consists of a KNF UN84.3 diaphragm pump with 5L/min pumping speed and a micro hybrid turbomolecular pump with 5L/s pumping speed. A glow discharge electron impact (GDEI) ion source was used to ionize the sample molecules introduced through a membrane, a GC capillary inlet or directly via a low flow direct leak to atmosphere. The GDEI source was shown to have advantages of low power consumption and long lifetime under high pressure operation. The effects of the discharge voltage and pressure on the discharge current were investigated. The intrinsic relationship between the discharge current and the pressure at a given discharge voltage could be used to indicate the vacuum status of the instrument. Spectra of various volatile organic compounds were recorded with the GDEI source. A mass range over m/z 800 and resolution of 2 amu was achieved.