Plasma Ion Source for Atmospheric Pressure Ionization Mass - Spectrometry

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Non-radioactive ion sources (NRIS) have received significant attention for use in analytical instruments (e.g., APCI MS, IMS), as a replacement for their radioactive counterparts (63Ni, etc.). Numerous manuscripts and patents pertaining to the development of non-radioactive ion sources, such as dielectric barrier discharge (DBD), capacitive gas discharger (CDPS), etc., have been described in recent publications. These technologies have comparable operational efficiency for positive ion formation but have limited effectiveness in negative ion formation. Plasma ignition in air generates nitric oxide (NOx-) and ozone (O3-) species, which have high electron affinity and reduces (or fully suppresses) the efficiency of formation for surviving analyte negative ions. Previous solutions did not effectively remove unwanted NOx- and O3- ions from the plasma.

We propose introducing gas at an enhanced counter flow rate, capable of removing all ions and neutral species from the plasma area, regardless of their nature and charge. An electric field is then used to extract electrons from the plasma, generating a high flux electron beam directed into the ionization chamber where analyte vapors are introduced independently and ionized. The resulting gas phase chemistry is comparable to a 63Ni ion source.

Our poster will present a dual polarity non-radioactive plasma ion source designed by MicroPlasma Systems and show experimental spectra for positive and negative ion species and our phenomenological model of the NRIS operation. Direct comparison spectra obtained under optimal conditions with NRIS and 63Ni source will show that the composition and efficiency of ion formation are comparable in both positive and negative polarities for BTEX and CWA simulants.