**Ambient Ionization Mass Spectrometry for Chemical Imaging and Detection of Inorganic and Organic Explosives, Narcotics, and Other Forensically Relevant Analytes**

**Overview**
- **Purpose:** Desorption/ionization promises for the trace detection and chemical imaging of explosive device signatures, narcotics, radionuclides, and gunshot residues under ambient conditions.
- **Platforms:** Employ platforms for desorption from solid surfaces and atomization of liquid samples for mass spectrometry (MS) analyses.
- **Trends:** Explore direct detection and chemical mapping of trace analyses collected on solids and potentially resolved distributions within artificial inorganics from forensic evidence.

**Methods**
- **In-source collision induced dissociation (CID) for enhanced detection of inorganics:**
- **Meas:** Measuring the extent of increased ion generation and frequencies of collisions with atmospheric gas molecules for improved inorganic detection.
- **Limitations:** Limitations of detection for inorganic and organics compounds.

**DEFFI (MS)**
- **Analytical flow focusing technique developed by** Affero Galfano-Calvo [2] and demonstration electrospray ionization (DESI) methodology developed by Deal Caves [1].
- **Adapted:** Adapted into a demonstration-based ambient ionization source for mass spectrometry [1, 4, 6].
- **Advantages:** Convergent gas flow focuses sample array from a nano-flow electrosprayer with a slit orifice.
- **Charging:** Charging electric field applied across the jet formation region - self-contained electric field.
- **Extraction:** Separates charged jet flow from external environment; space charge, absolute surface charging.

**Results**
- **DEFFI, USN-EESI, and LDI sources were characterized and fabricated for trace detection and/or mass spectrometry imaging (MSI) of forensically relevant analytes - organics/inorganics.
- **DEFFI demonstrated trace detection and imaging of organics/inorganics compounds and explosives device signatures on surfaces.**
- **Implications:** USN-EESI demonstrated rapid detection of and isotopic distribution measurements for organics compounds from microenvironmental samples from complex matrices.
- **Integration:** DEFFI demonstrated rapid detection and chemical imaging of inorganics compounds without sample preparation or matrix-assisted ionization.

**In-S converse Collision Induced Dissociation**
- **Organic & Inorganic Compounds - In-source CID**
- **Incorporating in-source CID enhanced detection of inorganic compounds - radiolabeled and inorganics explosives [1].**
- **Ion acceleration & increased collisions with gas:**
- **Enhanced inorganic detection:**
- **Reduced organic contaminants & noise:**
- **Isotopic measurements:**
- **High sensitivity & high limits of detection for both organic and inorganic compounds with DEFFI.**

**Conclusions**
- **Incorporating in-source collision induced dissociation enhanced detection of both organic and inorganic: forensically relevant compounds.**
- **Explosives:** Explosive device signature nitric, radionuclides, gunshot residues.
- **Inorganic:** Inorganic elemental and molecular speciation and isotopic measurements.
- **Chemical imaging of analyte spatial distributions from surfaces, solids, carbon stubs, and within artificial fingerprints using DEFFI and LDI.

**In-S converse Collusion Induced Dissociation**
- **Enhanced chemical imaging of inorganic compounds.**

**Acknowledgments / Publications**

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**References**