Coupling of Flowing Atmospheric Pressure Afterglow and Differential Mobility Separation toward Fieldable Post-Detonation Debris Analysis by Mass Spectrometry

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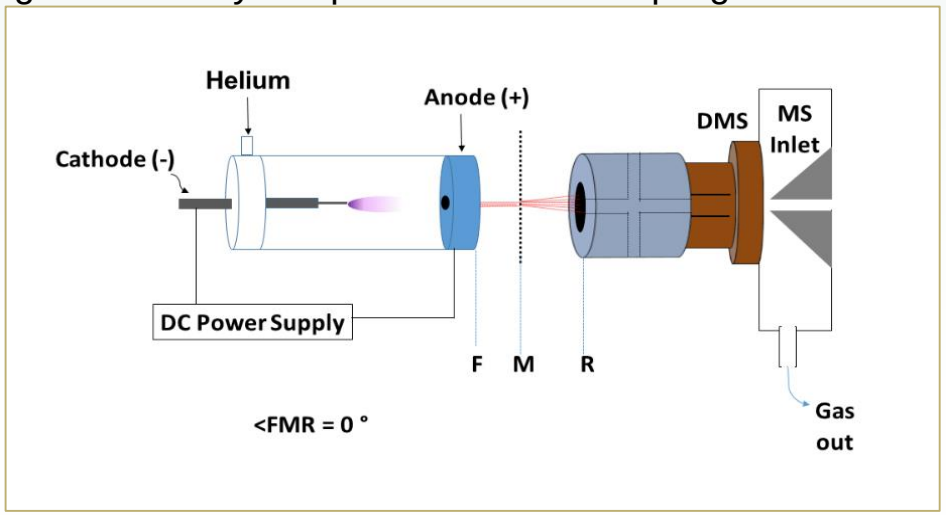
Overview

Need: Rapid on-site screening of radio-nuclear debris and environmental contaminants.

Methods: Integration of an atmospheric pressure ionization (API) source with ion trap mass spectrometry interfaced with differential mobility spectrometry (separation) is studied with varying levels of integration.

Goal: Portable Mass Spectrometric Analysis of post-detonation radiological debris by simplified surface sampling.



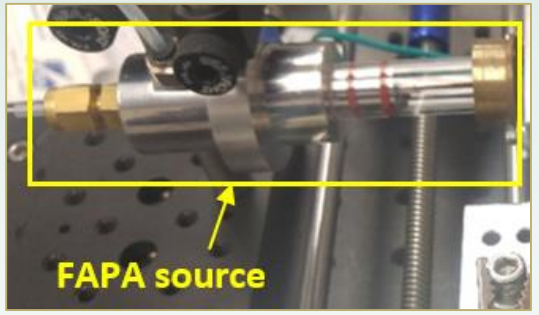
Methods

Ionization

- Nano-electrospray (NSI)

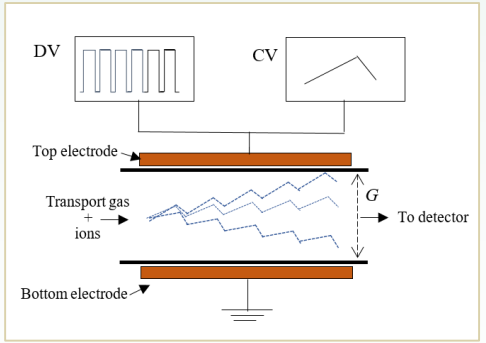
Plasma based surface Ionization

- Direct Analysis in Real time (DART)
- Flowing Atmospheric Pressure Afterglow (FAPA)



Rapid filtering

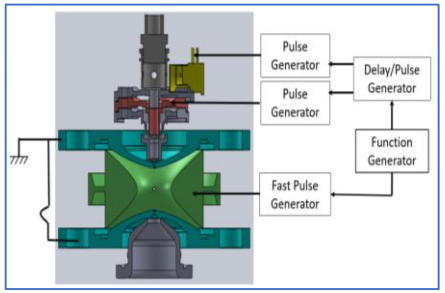
- Differential Mobility Spectrometry (DMS)



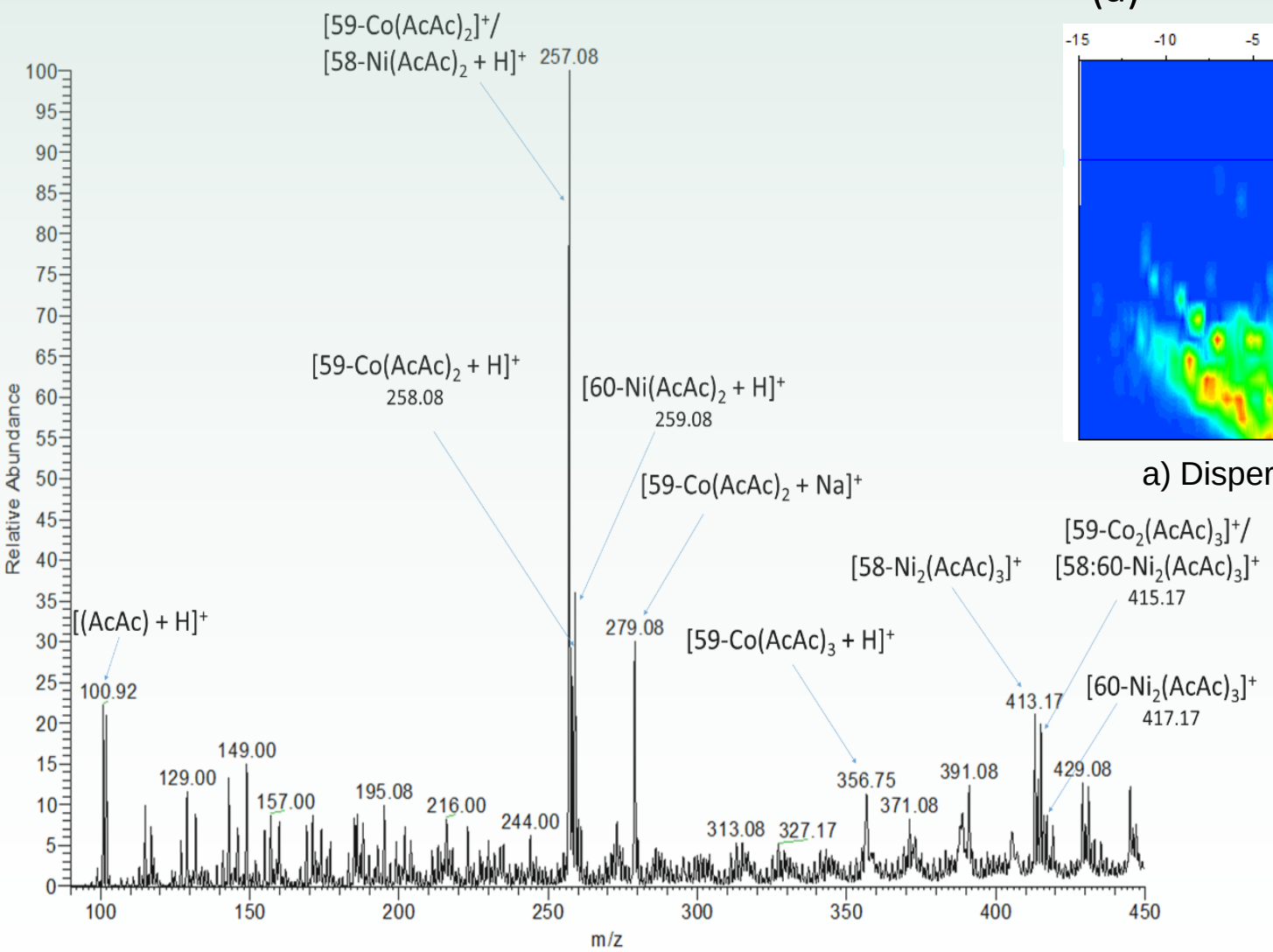
Detection

Mass spectrometry(MS):

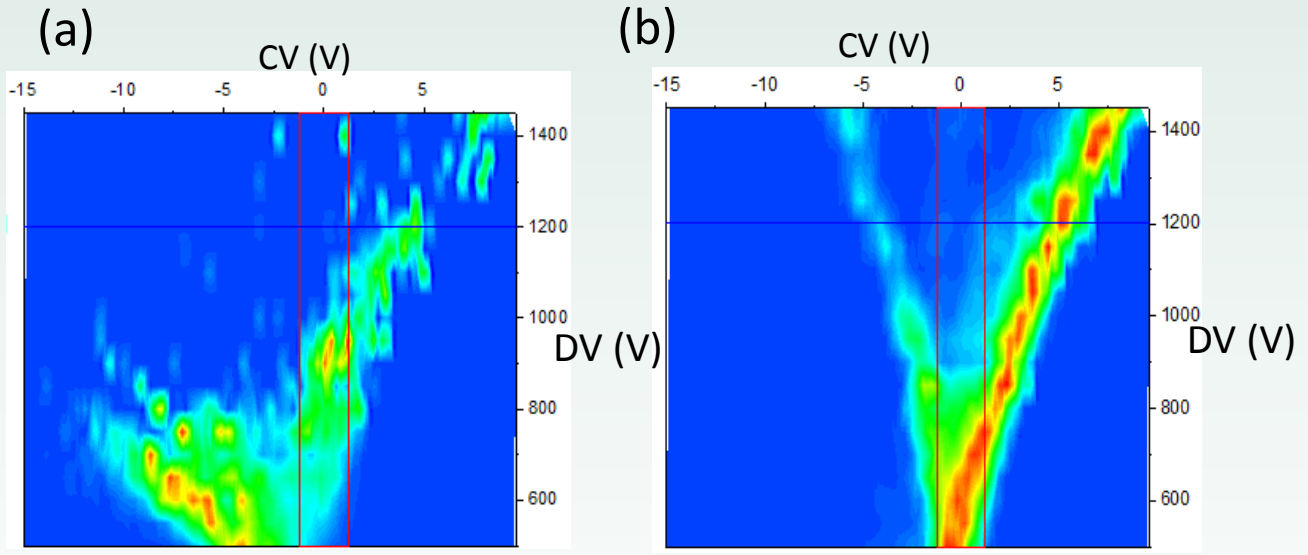
- Commercial MS
- Portable MS (Quadrupole Ion trap)



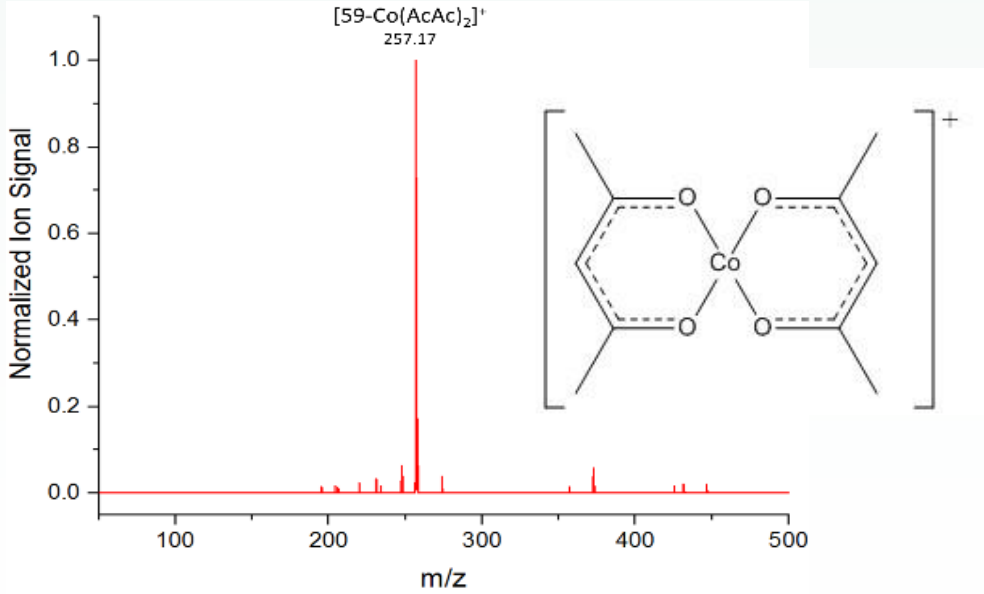
Results



FAPA- DMS Mass Spectrum of all $Co(AcAc)_2$ and $Ni(AcAc)_2$ mixtures in DMS transparent mode.



a) Dispersion plot of $[(AcAc)+H]^+$; m/z =101. b) $[Co(AcAc)_2]^+$; m/z =257



Neat mass spectrum of $[Co(AcAc)_2]^+$ after DMS filtration at fixed DV 1200 V and CV -4.5 V