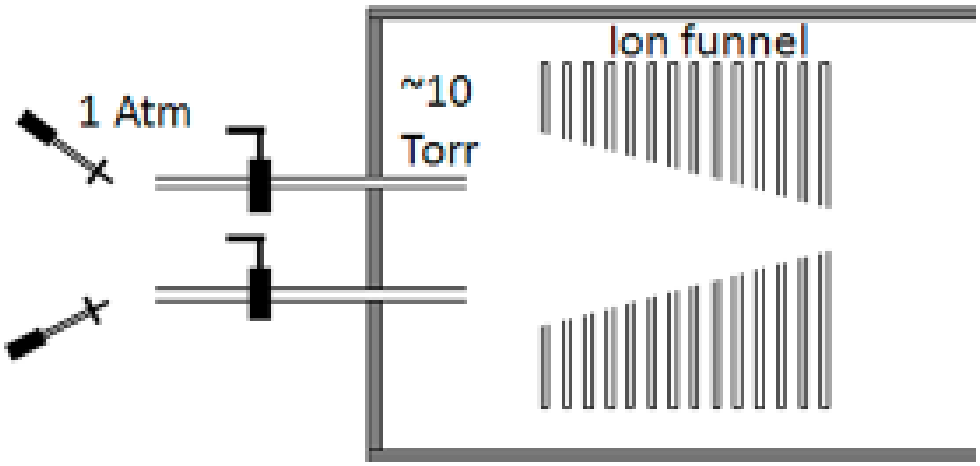
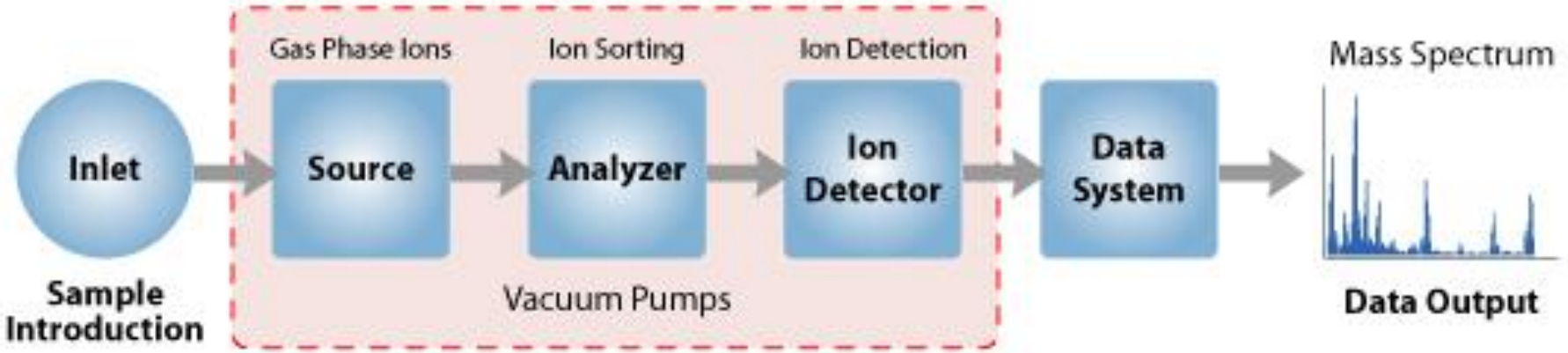
INSTRUMENTAL TECHNIQUE PRESENTATION

Multiplexed Ion Source



Madhuri Jash
16/02/2019

How does a mass spectrometer work?



Different ion sources

Ion source	Type and/or properties of suitable compounds
EI	Micro molecules (1-1000 u), low polarity, volatile
CI	Micro molecules (60-1200 u), moderate polarity, volatile
FD	Difficult gasification, poor stability
FAB	Carbohydrates, metallo-organic compounds, proteins, nonvolatiles
LSI	Carbohydrates, metallo-organic compounds, proteins, nonvolatiles
MALDI	Proteins, polypeptides, nucleic acids
ESI	Thermal instability, polar molecules, nonvolatile, proteins, polypeptides
APCI	Micro molecules, low polarity, thermal stability
APPI	non-ionizable with conventional ion sources

What is multiplexed ion source?

Combination of different ion sources in a single mass spectrometer without any interference between them.

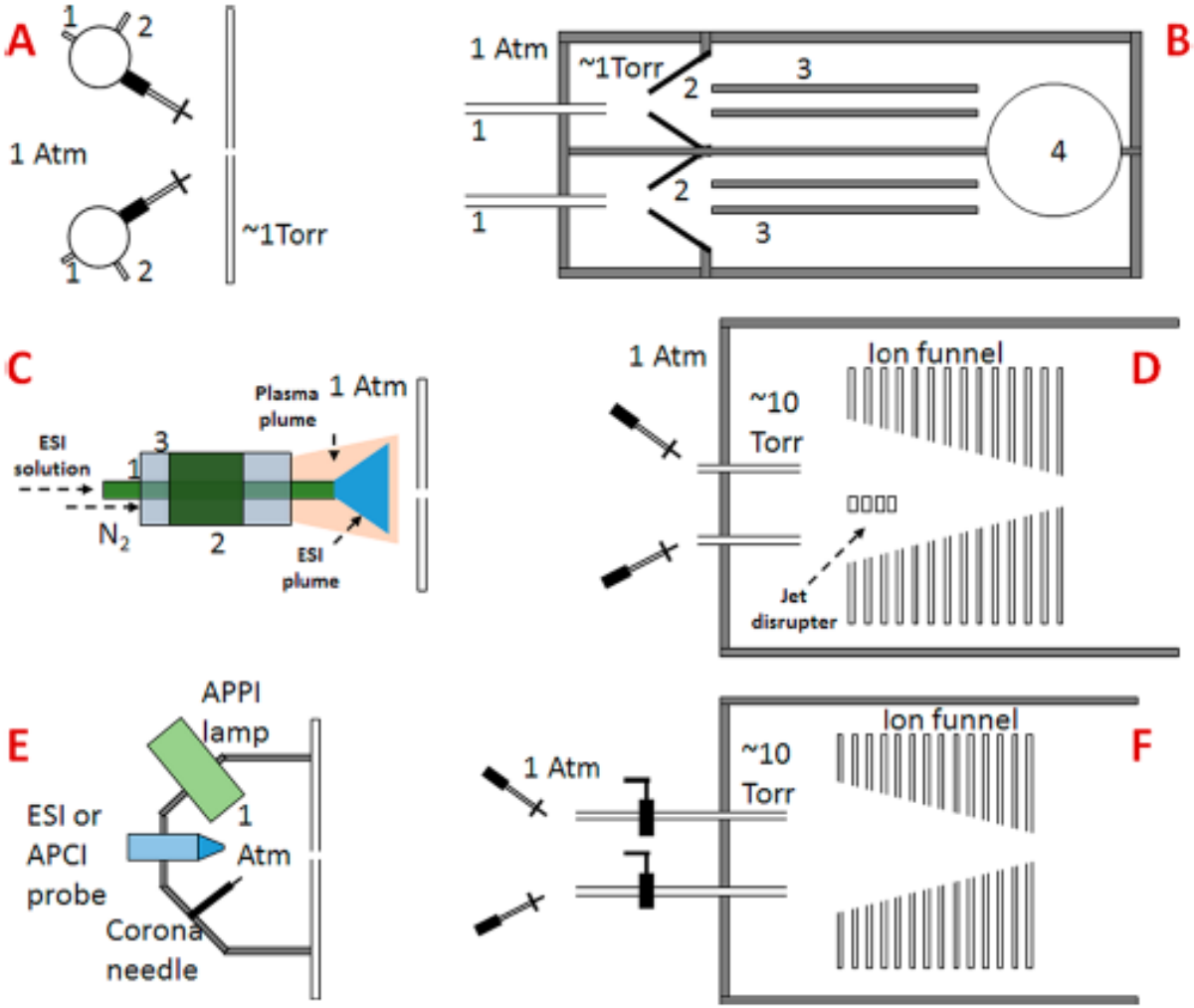


Fig: Different designs of the multiplexed ion sources

Developed multiplexed ion source

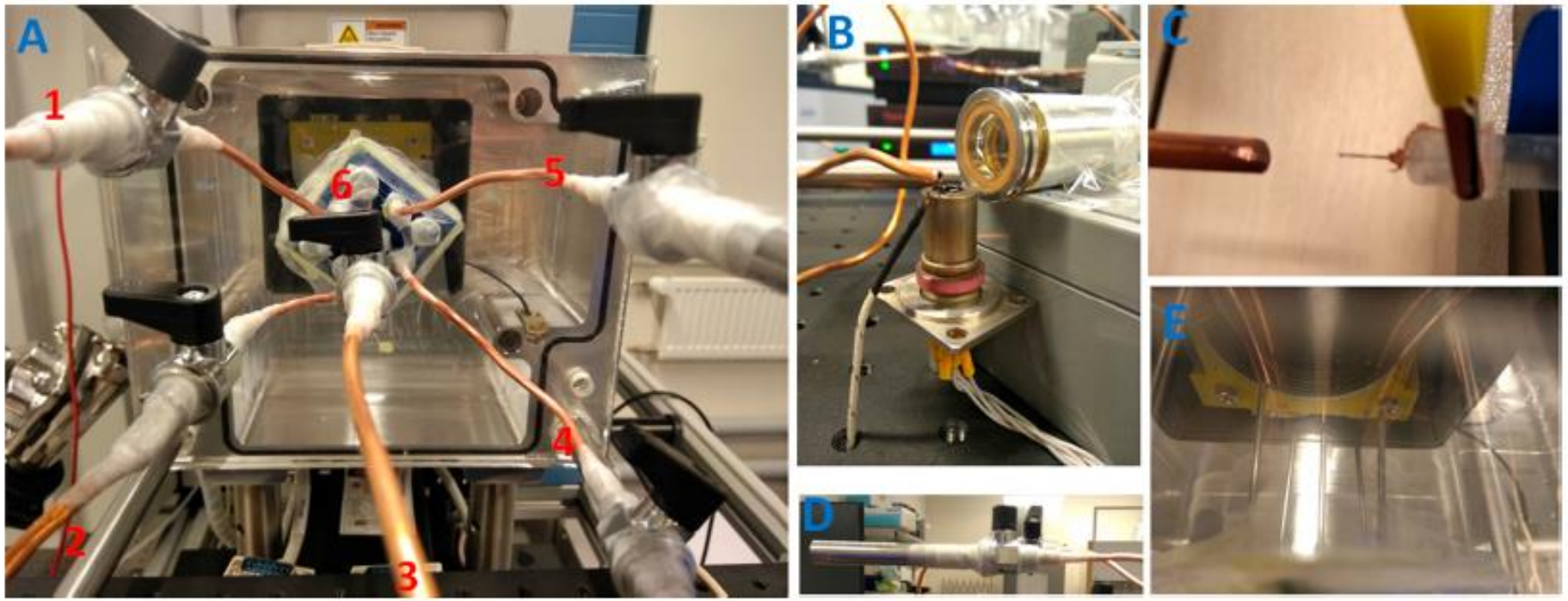


Fig : (A) Multiplexed ion source with 5 independent inlets; tubes go to different ion sources: (1) thermal desorption of oil + APPI, (2) ESI of ubiquitin, length of tube 1.5 m, (3) ESI of ubiquitin, length of tube 5m, (4) native ESI of streptavidin, (5) radioactive ionization of air impurities, (6) manifold for connecting inlet capillaries and copper tubes. (B) Design of the ion source for thermal desorption of oil + APPI. (C) ESI source based on dispensable medical syringes. (D) Radioactive (3H) ion source. (E) inlet capillaries inside vacuum system. Vacuum plate is made from opaque organic glass.

Simultanious infusion and detection

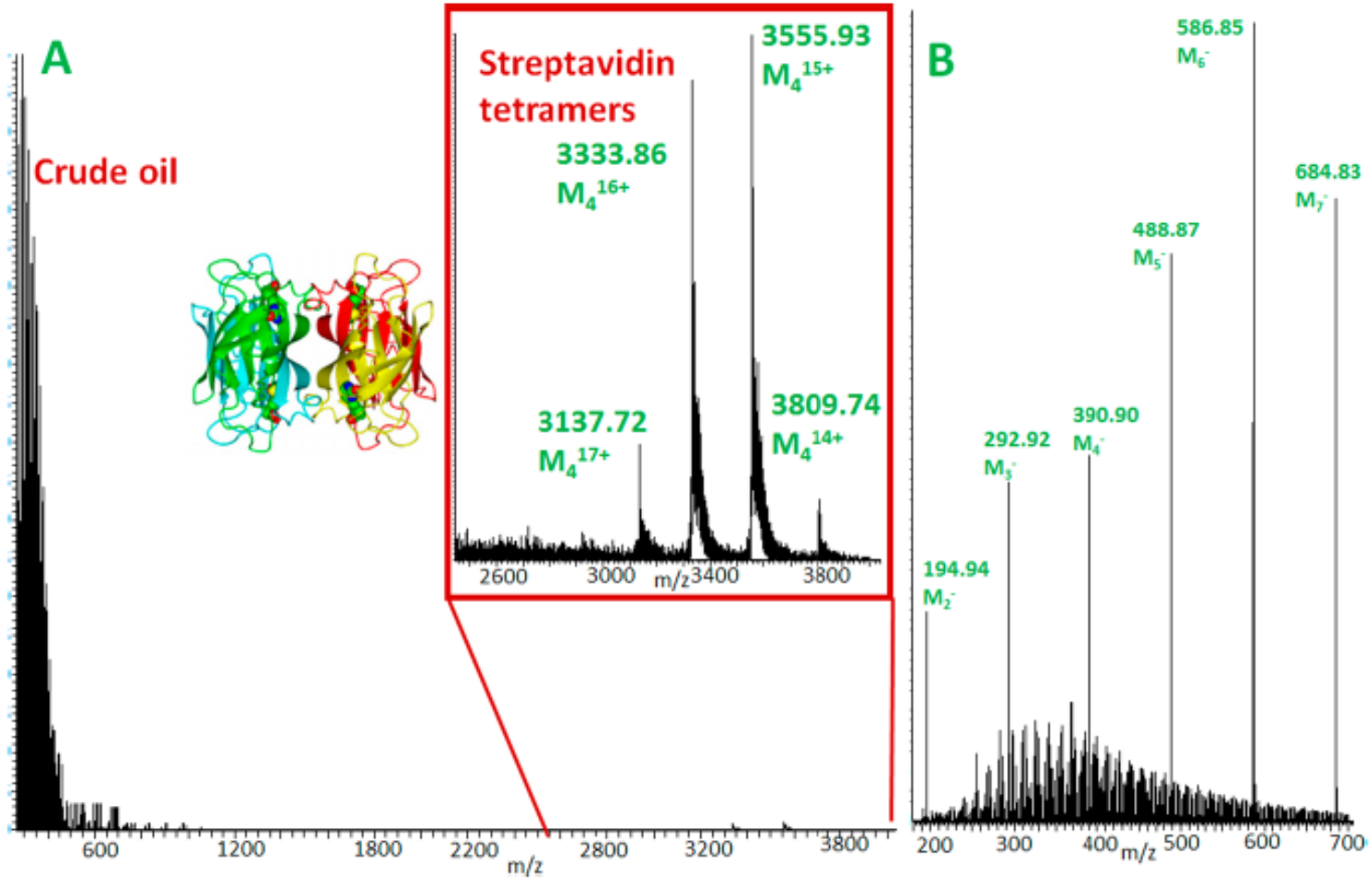
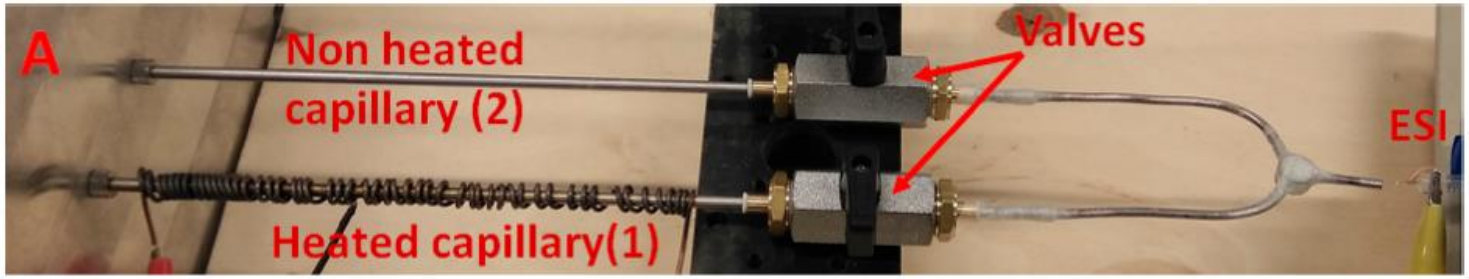


Fig : (A) Simultaneous infusion and detection of crude oil ions produced by APPI of thermally desorbed vapors and streptavidin tetramers produced by native ESI. Dimensions and temperature of the ion transport system were optimized. (B) Simultaneous infusion and detection of ions produced by two different ESI sources: clusters of phosphorus acid and SRDOM.

Thermal dissociation of ubiquitin in a multiplexed ion source



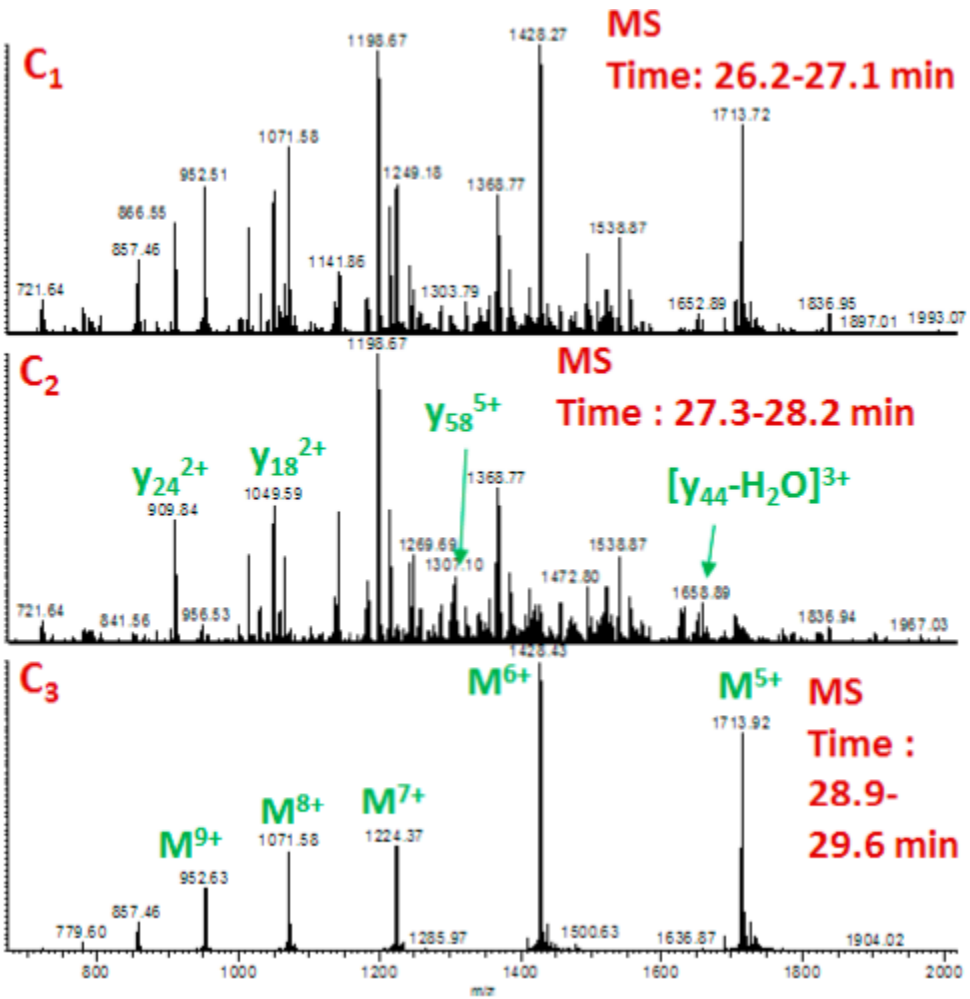
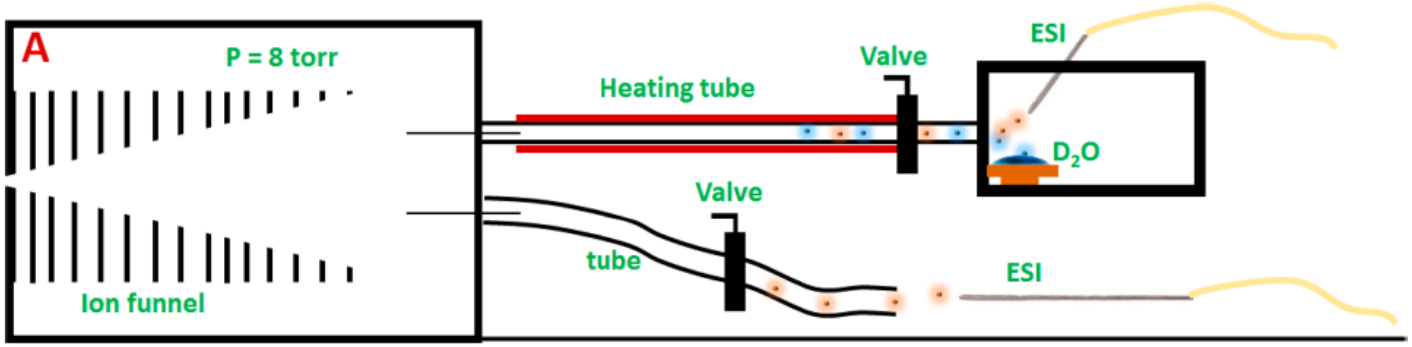


Fig: (A) Design of the ion source. (C1) Recorded mass spectrum when valves are open in such a way that both fragment and parent ions are observed. (C2) Only heated channel is open. (C3) Only non heated channel is open

Coupling of multiplexed ion source for H/D exchange reaction



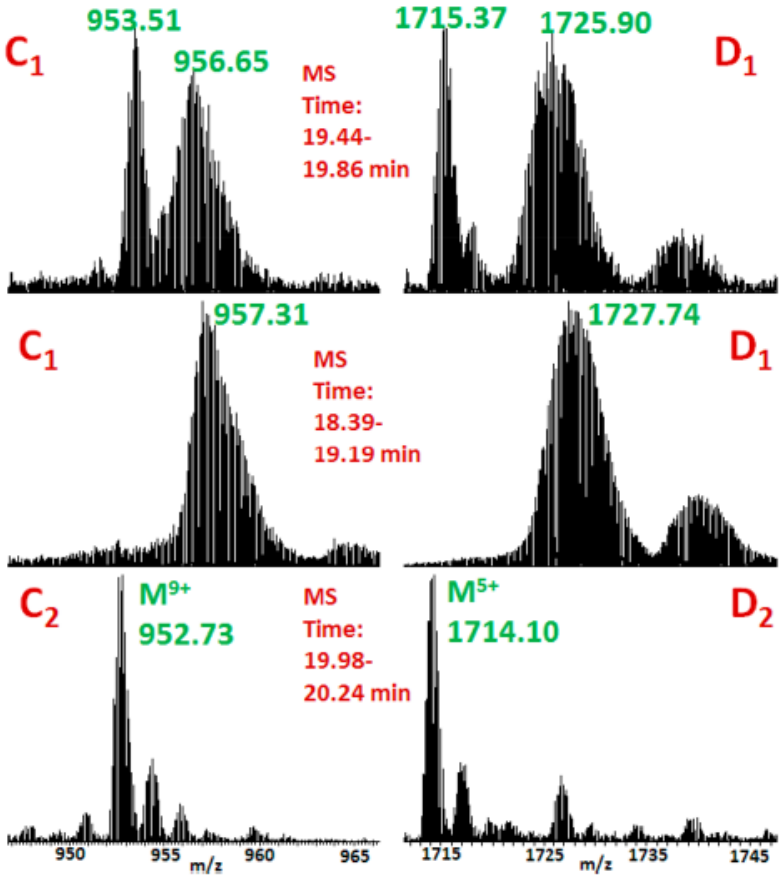


Fig: (A) Schematic representation of the experimental setup. (C1) Recorded mass spectrum of M9+ when both valves are open. (C2) Only heated channel with D2O vapors is open. (C3) Only non heated channel is open. (D1), (D2) and (D3) are for M5+.

Advantages

- Changing and optimization of ion sources consumes considerable time.
- Also allow users to analyze more samples in less time and provides superior information.
- It may be useful to use the multiple inlet system in combination with ion−molecule reactions under atmospheric pressure such as ozonation, H/D exchange, for the enumeration of the number of functional groups (−OH, −NH and others), and thermal dissociation reactions.

Disadvantages

- Singly charged peptides require higher temperatures for thermal dissociation, and this dissociation does not yield many fragments.
- Thermal dissociation at the atmospheric pressure fragments all ions even those with m/z outside of the acquisition window, but fragments of those ions can be observed.
- Different ions have different activation energies for thermal dissociation, so low abundant ions with high activation energy may be mistakenly considered as fragments.

Ref: Kostyukevich. Y and Nikolaev. E, *Anal. Chem*. **2018**, *90*, 3576−3583

THANNK YOU