A combined electrodynamic ion funnel and ion trap coupled to orthogonal acceleration (oa-)TOF MS was developed. The performance of the ion trap was characterized in the trapping and continuous modes.

The improvements in sensitivity were accompanied by a significant reduction in the background noise level, leading to an order of magnitude increase in S/N for a peptide mixture.

**Results**

**Current Pulse Measurements with 1 µM Reserpine Solution**

- Signal is measured at the collisional quadrupole rods at various accumulation times.
- The number of ions accumulated in the ion funnel trap increases proportionally to the accumulation time.
- The current pulses generated by ions accumulated in the trap are two orders of magnitude higher than the total ion current of the continuous beam.
- The amount of neurotensin consumed was 0.3 attomoles.

**Mass Spectrum of 10 nM Peptide Mixture in Trapping and Continuous Modes**

- The ion trap is a “stacked-ring” type device.
- The RF frequency of 4 V/µm in the trap is controlled independently of the funnel (20 V/µm).
- 180° phase-shifted RF was applied to adjacent electrodes.
- The trap has a charge capacity of ~3x10⁷.
- The trapping efficiency is the ratio of the number of ions accumulated in the trap (measured at the collisional quadrupole) to that introduced into the trap.
- Sensitivity in trapping mode is an order of magnitude higher than in continuous mode at low concentrations.
- Most of background noise is observed in the low m/z range, so that no chemical noise reduction was observed for fibronectin A 2+ (m/z 768.8).

**Improvement of S/N and Limit-of-Detection (LOD)**

- In the continuous mode, 0.1 nL neurotensin 3+ signal is hardly distinguished from chemical noise.
- Upon trapping, the chemical noise is significantly reduced and the analyte peak S/N increased to 37.

**Conclusions**

- The ion trap / oa-TOF MS showed an order of magnitude increase in S/N compared to the continuous beam regime.
- The improvement in S/N was due to an increase in sensitivity and reduction in the level of background noise.
- The background noise reduction is due to more efficient desolvation during trapping.
- Further increase in the trap pressure is feasible, provided adequate ion ejection is implemented.

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**Contact Information**

Yehia Ibrahim, Ph.D.
Mass Spectrometry Sciences
Pacific Northwest National Laboratory
P.O. Box 999, Richland, WA 99352
email: yehia.ibrahim@pnnl.gov
Phone: (509) 387-2704

**Abstract**

Electrodynamic Ion-Funnel as a Trap: Performance and Initial Results

**Authors**

Yehia Ibrahim, Mikhail Belov, and Richard D. Smith

**Affiliation**

Biological Sciences Division, Pacific Northwest National Laboratory, Richland, WA 99352