



A Hybrid IMS-FTICR-MS Instrument for Biological Samples

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OVERVIEW

Purpose Construction of a hybrid IMS-FTICR-MS instrument that allows both isomer resolution gas phase separation and high mass measurement accuracy.

Method Interface a dual-gate atmospheric IMS with FTICR-MS via a flared inlet capillary for improved ion transmission efficiency.

Results Separations of peptides and phospho-peptide isomers are presented.

INTRODUCTION

The complexity of biological samples requires the development of analytical techniques that can achieve high resolving power and high accuracy measurement. Ion mobility spectrometry (IMS) has long been explored for fast separation and detection of gas phase ions based on their differential travel time through a low homogeneous electric field. The size-to-charge ratio separation mechanism of IMS is different from the mass-to-charge ratio (m/z) measurement mechanism employed by mass spectrometry, thus the combination of these two techniques allows two-dimensional separation. High performance FTICR-MS, when combined with IMS, will enable superior resolving power for analysis of complex biological samples. Here we report the first hyphenation of these two instruments and demonstrate the utility of atmospheric IMS/FTICR-MS for peptide analysis.

EXPERIMENTAL METHODS

- The atmospheric pressure IMS was built at Washington State University
- Synthetic phospho-peptide was made by 431A Peptide Synthesizer (Applied Biosystems, Foster City, CA).
- FTICR-MS used is a commercial instrument (Apex-Q 7T, Bruker Daltonics, Billerica, MA).
- A flared inlet capillary interface¹ allows improved ion transmission.
- Control software was coded with LabVIEW 6.1².
- Dual gate design allows synchronization of IMS cycle with FTICR-MS acquisition.

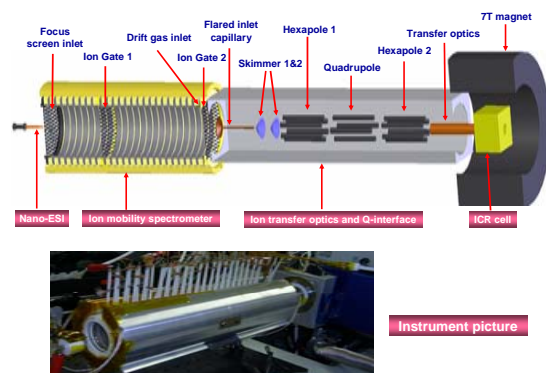


Figure 1. Schematic of hybrid ESI-IMS-Q-FTICR-MS instrumentation

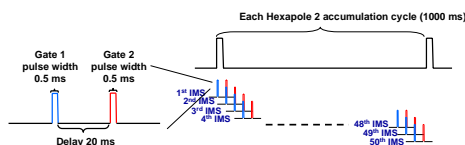


Figure 2. Timing sequence for IMS-FTICR-MS data acquisition

RESULTS

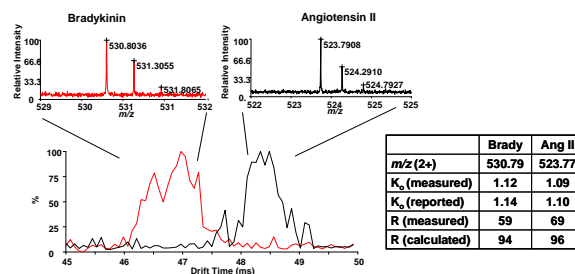


Figure 3. IMS-FTICR-MS analysis of a mixture of Brady and Ang II

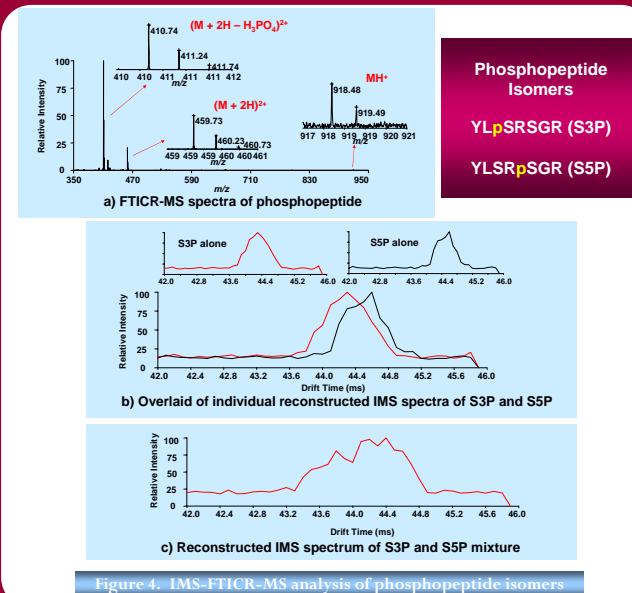


Figure 4. IMS-FTICR-MS analysis of phosphopeptide isomers

CONCLUSIONS

- A hybrid IMS-FTICR-MS instrument was built and demonstrated for peptide analysis.
- IMS separation of isomeric phosphopeptides was demonstrated.
- Further work includes improvement on ion transmission at the IMS-MS interface and incorporation of CID, ECD, or IRMPD fragmentation.

REFERENCES

- Prior, D.C., Price, J. & Bruce, J.E. Sample inlet tube for ion source. *United States Patent* 6,455,846 (USA, 2002)
- Clowers, B.H. & Hill, H.H., Jr. Mass analysis of mobility-selected ion populations using dual gate, ion mobility, quadrupole ion trap mass spectrometry. *Anal Chem* 77, 5877-85 (2005).

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