



Infrared Atmospheric Pressure Matrix-assisted Laser Desorption Ionization Mass Spectrometry

Introduction

Biomolecules prepared in aqueous solutions can be directly desorbed and ionized from solution using mid-IR pulsed laser light and atmospheric pressure (AP) ionization sources. No matrix addition or sample purification is necessary to ionize biomolecules without fragmentation. The mechanism for IR AP MALDI involves absorption of the laser light by water and subsequent gas phase expansion of the solvent along with the analyte through phase explosion or other processes. The greatest signal intensity can be found by tuning the mid-IR laser at or near the resonant absorption of the O-H stretching vibration. In this application note, IR AP MALDI MS of analytes with crystalline and water matrices will be shown.

Experimental Conditions

A solution of angiotensin and P14R peptides was prepared in methanol and mixed with α -cyano-4-hydroxycinnamic acid (CHCA) matrix solution. A 2 μ L aliquot of the mixture was placed on the sample target (1 pmol of analyte) and a heat gun was used to fast evaporate the droplet. An n-substituted oligosaccharide was dissolved in water and a 3 μ L aliquot was deposited on the sample target. The droplet was desorbed by the laser before drying. An 18 μ m thick slice of mouse tissue was prepared in a cryostat and attached to the sample target using doubled-sided tape. Samples were desorbed and ionized at 2.94 μ m using an IR Opolette HR running at 100 Hz. A Masstech AP/IRIS PDF ion source coupled to a Thermo Finnigan LCQ Deca XP ion trap mass spectrometer was used for mass analysis.

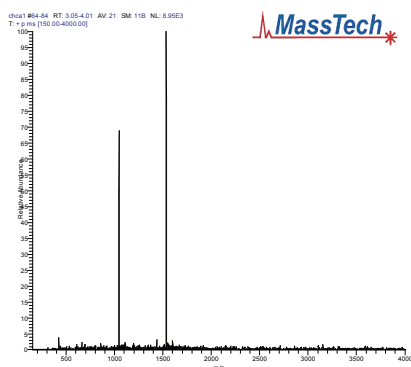


Figure 1. IR AP MALDI MS of angiotensin and P14R peptides in CHCA matrix

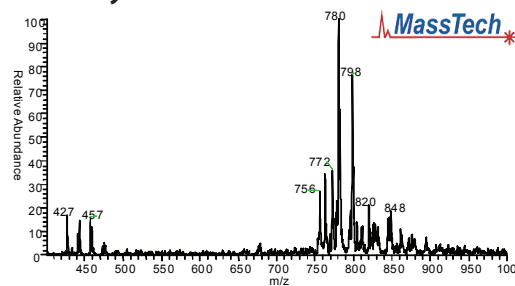


Figure 2. IR AP MALDI MS direct analysis of adult wild-type C57 mouse tissue section (18 μ m thick). No matrix added.

Results

Figure 1 shows an example of IR AP MALDI MS using a crystalline matrix. Peptide ions are detected as singly charged protonated molecules. The mouse tissue section was directly desorbed and ionized without matrix addition and the resulting mass spectrum is shown in Figure 2. Water in the tissue serves as an endogenous matrix. The IR AP MALDI MS spectrum of the oligosaccharide A2F in pure water is shown in Figure 3. The singly charged monomer and dimer of the molecule is detected as well as numerous adducts. These adducts as well as lower mass peaks are unassigned.

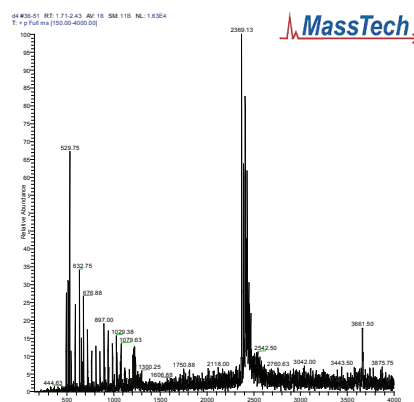


Figure 3. IR AP MALDI MS of the oligosaccharide A2F in water matrix

Conclusions

Both crystalline and liquid water were shown to facilitate ionization of peptides, tissue and an oligosaccharide using mid-IR laser light at atmospheric pressure.

Acknowledgements

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