

# Quenching of metastable decay of negatively charged oligonucleotides in MALDI-MS through sodium adduct formation

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Metastable decay of pre-selected parent ions in Matrix Assisted Laser Desorption / Ionization Mass Spectrometry (MALDI) is a powerful tool for the identification and sequencing of proteins. At the same time, however, the metastable and prompt decay in MALDI when acquiring mass spectra of oligonucleotides is a major obstacle. Furthermore, the strong affinity of oligonucleotides to form sodium adducts complicates the sample preparation considerably and often sets limits to the achievable resolution.

We have studied the metastable decay of the sodium free and the sodium adducts of all combinations of the synthetic hexameric nucleotides 5' TTXYTT, whereby X and Y are C, G or A. The gas phase fragmentation of their negative (deprotonated ions) is studied on a MALDI instrument where the metastable decay can be observed by gating selected ions into the flight tube and analyzing their fragmentation patterns in reflectron-mode (Post Source Decay). The predominant dissociation channels observed for the sodium free hexamers are the formation of  $Y_3$  ( $w_3$ ) and  $X_3^*$  ( $a_4-B_4$ ) ions, i.e. a 3' phosphate ester cleavage at the third position and a 3' phosphate ester cleavage at the fourth position accompanied by a base loss from the same sugar, respectively [1,2]. . In the first case the charge retention is on the 3' fragment in the second case on the 5' fragment. Also the formation of  $(TTp-H)^-$  is observed from all sodium free oligonucleotides, as is the loss of a single base from the fourth position. An exchange of three of the four acetic protons of the phosphate rest against sodium, however, leads to a close to quantitative suppression of the  $w_3$  and  $a_4-B_4$  fragment formation and when all protons are exchanged against sodium those fragments are not observed.

Here we show, that the sodium adduct formation may be used to quantitatively quench dissociation channels in oligonucleotide MALDI-MS, and we argue, that by means of effective steps in the sample preparation that lead to per-sodiation of the sample, the sample preparation and the mass resolution of oligonucleotide mass spectra in MALDI may be improved considerably. [odduring@hi.is](mailto:odduring@hi.is)

[1] E. Nordhoff, M. et al. J. Mass Spectrom. 30 (1995), p. 99.

[2] S.A. McLuckey et al., J. Am. Soc. Mass Spectrom. 3 (1992)

This work was supported by the Icelandic Centre for Research (RANNIS), the University of Iceland Research Fund and by the European Science Foundation (ESF) program; Electron Induced Processing at the Molecular Level (EIPAM).