

Improved Selectivity and Isolation Efficiency Using High Resolution Isolation in an Ion Trap Mass Spectrometer

PSB 123

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MS^n analysis of ions in an ion trap mass spectrometer is a differentiating technique for the structural identification of a wide variety of compounds. The simplest approach involves, isolating ions with a specific m/z value of interest, energetically exciting these ions, generating fragment ions through collisions with a buffer gas, and performing mass analysis of the fragments produced. The isolation step is critical to the process since it determines the selectivity and can limit the sensitivity of the MS^n experiment. A new ion isolation technique which can achieve high resolution ion isolation (HRI) is available for improved selectivity such as isobaric separation, as well as non-dissociative isolation of labile ions.

HRI combines the traditional isolation waveform technique with the slow resonance ejection scanning techniques used for high resolution mass analysis on ion traps. The process is depicted in Figure 1 and starts with application of a multi-frequency, resonance ejection waveform which includes a wider than necessary isolation notch. This waveform eliminates unwanted ions from the trap while efficiently keeping the ions of interest and nearby ions. Next, the RF trapping voltage is slowly decreased, scanning the nearby ions of higher m/z toward a lower Q and ejecting them. The RF voltage is then scanned upward, moving the ions toward higher Q values in order to eject nearby ions with m/z lower than the ion of interest. Finally, the ion of interest is moved back to the center of the isolation notch and its starting Q value.

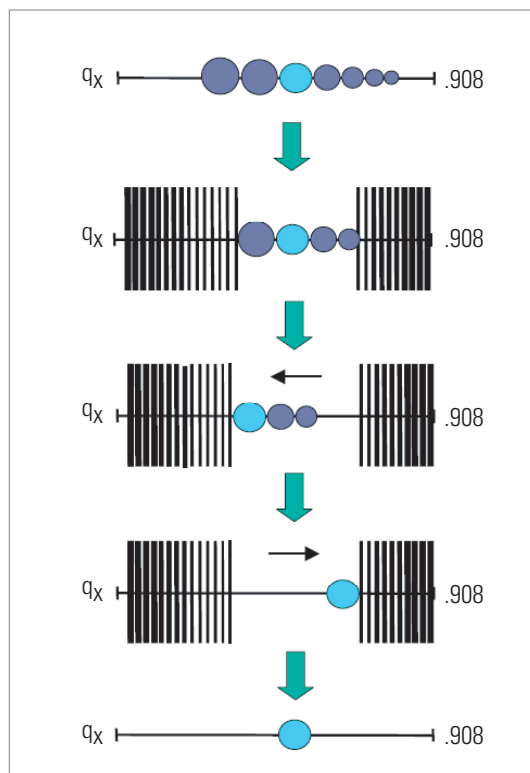


Figure 1: Schematic of the HRI process

of higher m/z toward a lower Q and ejecting them. The RF voltage is then scanned upward, moving the ions toward higher Q values in order to eject nearby ions with m/z lower than the ion of interest. Finally, the ion of interest is moved back to the center of the isolation notch and its starting Q value.

The HRI method allows for the separation of precursor ions with high enough resolution to enable MS^n analysis without interference from isotopic ions. In the example shown in Figure 2, the use of a narrow isolation window enabled the separation of an isobaric interfering species at m/z 525.9 close to the C_2^{13} ion of the peptide MRFA at m/z 526.2. This resulted in the generation of unique MS/MS spectra for each ion (not shown). The HRI isolation method

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is also a “softer” isolation technique; it helps increase the efficiency of isolating labile ions. Naproxen is a labile compound and tends to fragment when using the traditional isolation waveforms resulting in low isolation efficiency and, therefore lower sensitivity. Results for naproxen using HRI (Figure 3) showed a 500-fold increase in signal intensity for the parent ion over the traditional isolation method for the same selected isolation width. This also resulted in significantly higher quality MS/MS and MS³ spectra.

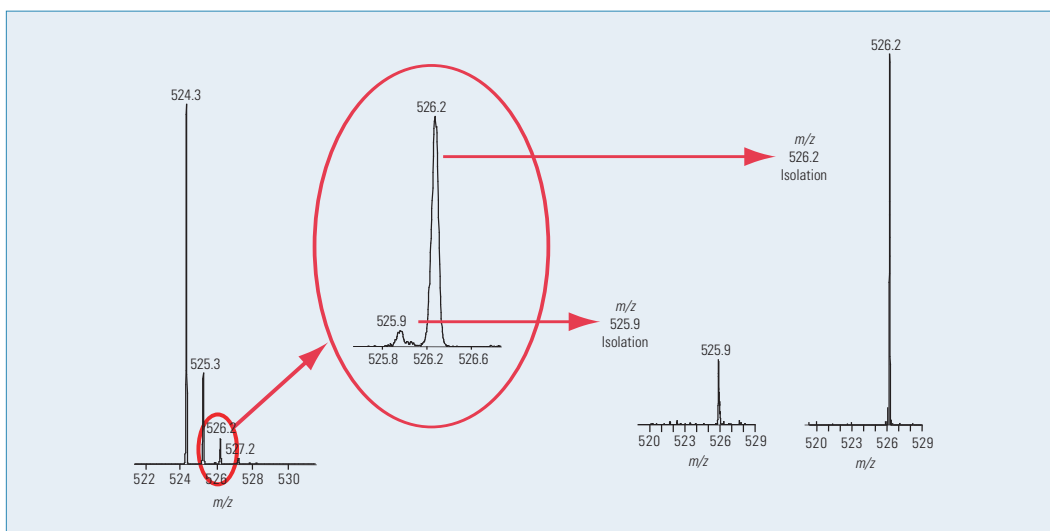


Figure 2: Isobaric isolation of MRFA

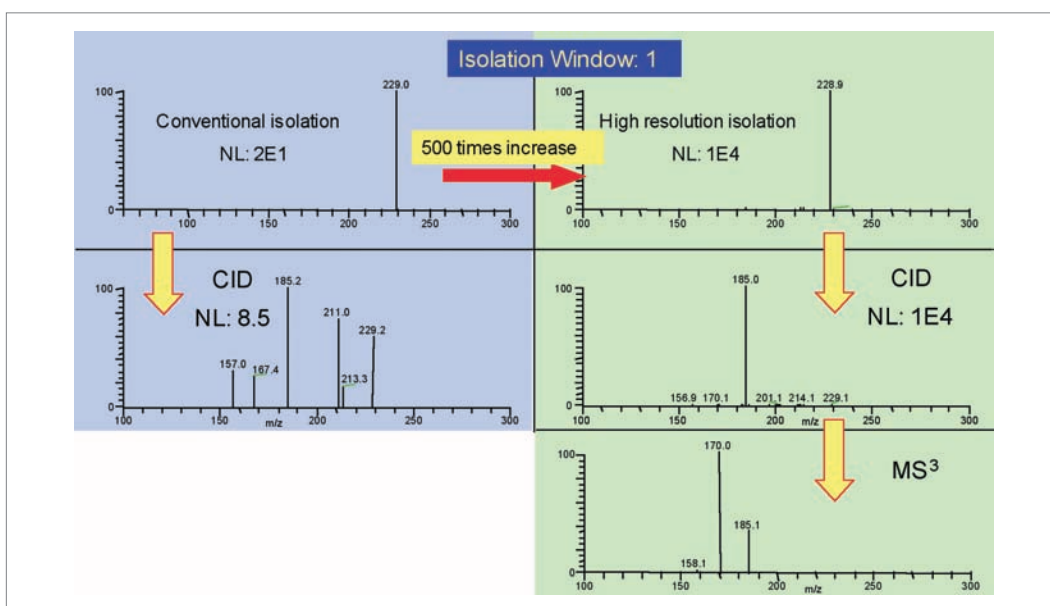


Figure 3: Isolation and MSⁿ spectra of naproxen with both conventional isolation and HRI