Conclusions

This chapter has introduced the DMA, particularly for tandem IMS-MS, with an emphasis on the peculiar characteristics distinguishing it from other mobility separation methods. Some of these idiosyncrasies have been illustrated from examples based mostly on unpublished studies carried out by the author during 2007-2008, in brief visits to the only DMA-MS facility then available (Boecillo, Valladolid). The performance of that prototype instrument has since improved considerably, as a number of articles now in preparation, under review or in press will hopefully show soon. The range of applications is also growing rapidly, thanks in part to the new DMA-MS facility hosting visitors at Yale (since early 2009), to cover various facets of the analysis of high molecular weight ions. Of particular interest are several discoveries enabled by the ability to isolate in the DMA many previously undetected metastable ions, which normally decay into other ions prior to MS. We observe a diversity of ion evaporation events, some reducing the charge of initially electrosprayed protein, polymer, and solid or liquid cluster ions; others detaching relatively long singly charged polymer chains initially entangled within a multiply charged rod-like polymer ion. We have also found neutral evaporation events of the form $(AC)nC+ \rightarrow (AC)n-1C++(AC)$. The use of the DMA as a tool for tandem studies is not restricted to unstable clusters. Virtually any ion selected by the DMA (with no apparent m/z limit) may be activated prior to MS analysis. This possibility has been found useful for simultaneous determination of protein structure (prior to declustering) and mass (after declustering). Also for fragmentation studies of mobility selected ions of known mass in TOF-MS instruments which either do not have a quadrupole or have one with insufficiently high mass range.

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