LOW CHARGE STATE OF ELECTROSPRAYED POLYSTYRENE AND OTHER POLYMER IONS, AND THEIR ANALYSIS BY ION MOBILITY MASS SPECTROMETRY (IMS-MS)

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OVERVIEW

We address two obstacles in the ESI-MS characterization of industrial polymers: (i) the spectral complexity associated to the quasi-continuous distribution of mass and charge (m/z), and (ii) the difficulty to find electroendosmophoretic solvents for non-polar polymers.

For Polystyrene (Psty), the solvent N-methyl-2-pyrrolidone (NMP) with 1% of DimethylFormamide (DMF) has been proposed [1]. Its potential has been enhanced by NMP’s availability in HPLC grade, and by the realization that DMF/NMP proportions >103% (v/v) dissolve Polystyrene and produce outstanding separations.

The Spectral crowding has been generally solved by combining ion mobility with mass spectrometry (IMS-MS), which separates different charge states, as long as fully stripped gas phase chains are avoided by limiting [2], ideally down to conditions yielding globular ions. Although this control of z is not trivial, several new approaches to achieve globular ions are reported here.

For Psty, the charge states depend on the buffer, with m/z values ranging from ~1,000 m/z for m/z292 to ~20,000 m/z at m/z150 kDa. These unusly low z levels are due to the limited ability of the Polystyrene chain to bind charge, yield globular ions, and to the forming strong ionic bonds between salts.

In this work, we explore the possibilities of using globular DMA (NMP’s DMF) for a) the control of charge, b) the elimination of ionic bond formation, and c) the sprayability of electroesprayed samples.

RESULTS

A Negative Ion ESI-Mass spectrometer was used in the TOF mode to acquire m/z spectra of polystyrene and other polymers. The spectra obtained show that the main peaks of the monomers are at m/z ~1000, which is lower than the mass range of the instrument.

The DMA solution prepared for electrospray was of m/z ~2000, which is higher than the mass range of the instrument. This indicates that the solution is too concentrated for electrospray.

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METHODS: IMS-MS (DMA+QTOF)

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CONCLUSIONS AND FUTURE WORK

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REFERENCES
