

applicable to any mass spectrometer that employs ion trapping for accumulation, storage, and/or m/z analysis.

We claim:

1. A method for selectively filtering ions having a low mass to charge ratio from a current of flowing ions in an ionization electrospray, said method comprising the steps of:

generating an independent electric field having a preselected voltage at an exit end of an electrodynamic ion funnel; and

flowing an ion stream comprising ions having a variety of drift velocities defined by their individual ion mobility therein in a carrier gas at a preselected carrier gas velocity through said electric field; whereby ions having a drift velocity greater than and opposite to said preselected carrier gas velocity are removed from said ion stream and ions having a drift velocity less than, and in the same direction as, said carrier gas are left within said ion stream.

2. The method of claim 1, wherein said preselected voltage is a preselected DC voltage.

3. The method of claim 1, wherein ions removed from said ion stream have a mass cut-off value in the range from about 50 m/z to about 500 m/z.

4. The method of claim 1, wherein said independent electric field is configured to remove ions having a preselected mass cut-off value above an m/z of about 500 and a voltage gain that compensates for signal attenuation.

5. The method of claim 1, further comprising the step of directing said continuously flowing ion stream into a device for performing gas-phase ion separation and analysis selected from the group consisting of ion mobility spectrometry (IMS), field asymmetric waveform ion mobility spectrometry (FAIMS), mass spectrometry (MS), tandem MS, multiple MS stages of any kind, gas chromatography (GC), LC-MS, photoelectron spectroscopy, photodissociation spectroscopy, and combinations thereof.

6. The method of claim 1, further comprising the step of directing said continuously flowing ion stream into a device coupled on-line or off-line that performs at least one method for separations and analysis of substances in solid or liquid phases selected from the group consisting of liquid chromatography (LC), normal phase LC, reversed phase LC, strong-cation exchange LC, supercritical fluid chromatography, cap-

illary electrophoresis, capillary isoelectric focusing, gel separations in one or more dimensions, SDS-PAGE, 2-D gel, and combinations thereof.

7. The method of claim 1, wherein said flowing ion stream includes ions that are macro-molecular ions selected from the group consisting of proteins, protein complexes, peptides, polypeptides, oligonucleotides, DNA, RNA, polymers, oligosaccharides, dendrimers, fragments thereof, and combinations thereof.

8. The method of claim 1, wherein said electric field is generated by applying said voltage to an electrode of said electrodynamic ion funnel.

9. The method of claim 8, wherein said ion funnel includes a carrier gas pressure in the range from about 1 Torr to about 10 Torr.

10. The method of claim 8, wherein said ion funnel includes a carrier gas pressure in the range from about 1 Torr to about 3 Torr.

11. The method of claim 2, wherein said preselected voltage is a positive voltage for positively charged ions in said ion stream or a negative voltage for negatively charged ions in said ion stream.

12. The method of claim 2, wherein said electric field is dynamically adjusted in real time to remove ions selectively from said continuous ion stream.

13. The method of claim 12, wherein said electrical field is adjusted by selection of voltages that produce an electric field in the range from about 0 V/cm to about 100 V/cm or greater, selected as a function of the velocity of said carrier gas.

14. A method for reducing space charge effects in an analytical electrospray system said method characterized by the step of:

continuously flowing an ion stream having ions with differing ion mobilities suspended in a carrier gas through an independent electric field positioned at the exit end of an electrodynamic ion funnel whereby ions having a drift velocity greater than and opposite to the preselected carrier gas velocity are removed from said ion stream and ions having a drift velocity less than and in same direction as the carrier gas are left within said ion stream.

15. The method of claim 14, wherein said preselected voltage is dynamically adjusted in real time to selectively filter said portion of said ions from said continuously flowing ion stream.

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