Improving ion transmission efficiency of mass spectrometers

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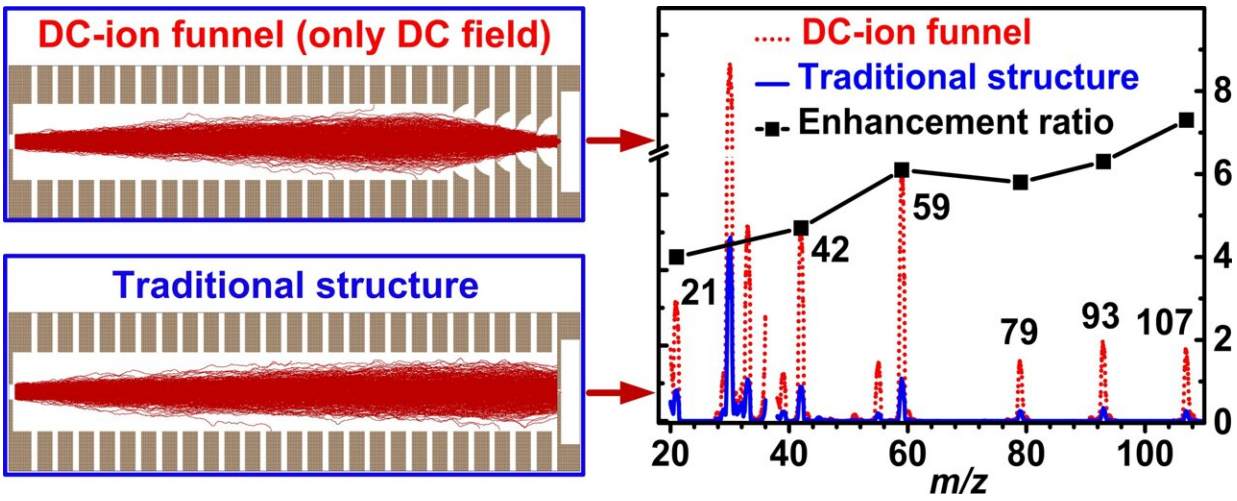

Focusing effect of the DC-ion funnel. Credit: Zhang Qiangling

A recent study by researchers from the Hefei Institutes of Physical Science and published in *Analytical Chemistry* presents a novel electrostatic field ion funnel focusing technology called direct current (DC)-ion funnel. It realizes ion focusing with only a DC electric field, thus improving the sensitivity of mass spectrometers.

Proton transfer reaction mass spectrometry (PTR-MS) is a valuable tool in many fields. However, how to ensure the high sensitivity while reducing volume and power remains a difficult problem for miniaturized

mobile PTR-MS (M-PTR-MS). To improve the sensitivity of PTR-MS instruments, researchers generally use a radio frequency (rf)-focusing electric field in drift tubes to focus ions, which increases power consumption and volume and is therefore not suitable for M-PTR-MS.

In this study, the researchers replaced the traditional ring electrode with five curved electrodes and a metal mesh welded to the curved electrode. The diminishing inner diameter of the five curved electrodes they designed helps the efficient ion focusing. That's how they realized the DC-ion funnel focusing in DC electrical field.

The new structure has many advantages. Compared with traditional drift tube, the sensitivity of the DC-ion funnel tube was increased from 3.8 times to 7.3 times. In addition, the new DC ion funnel drift tube retains the soft ionization in PTR-MS.

The researchers applied this DC-ion funnel technology to the M-PTR-MS for mobile monitoring of atmospheric volatile organic compounds. And the result was impressive.

In addition, the DC-ion funnel can easily be coupled to other types of mass spectrometers to improve their detection sensitivity, which can provide key technical support for the development of frontier mass spectrometers.

More information: Qiangling Zhang et al, Evaluation of a New DC-Ion Funnel Drift Tube for Use in Proton Transfer Reaction Mass Spectrometry, *Analytical Chemistry* (2022). DOI: 10.1021/acs.analchem.1c05086

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