Ion Mobility Mass Spectrometry of Native Protein Complex Anions

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Key Outcomes
- Ion mobility (IM) mass spectrometry used to characterize protein complex anions.
- Anions adopt smaller average charge states than the corresponding cations, which may be consistent with lower field-emission energies for the loss of charge carriers from anions.
- Triethyamine addition results in the appearance of additional, charge-reduced cations.
- Cations, anions, and charge-reduced cations all have similar collision cross section (Ω) values, suggesting that they all have similar structures that depend weakly on charge state.
- These anion Ω values can be used to measure accurate calibrated Ω values with traveling-wave IM.

An RF-confining drift tube has been implemented in place of the traveling-wave ion mobility cell on a Waters Synapt G2 HDMS, which controls all potentials and regulates gas flow.

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Charge States
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Charge Reduction
- The addition of 10 mM triethyamine to the protein solution results in the appearance of a much wider charge-state distribution. Charge-reduced avidin and β-galactosidase (blue) are shown below. The original positive (red) and negative (black) ion mode spectra are shown as a guide to the eye.
- Anion drift times calibrated using anion Ω values ( ) are more accurate than those calibrated with anion Ω values ( ). Similarly, cation drift times calibrated using cation Ω values ( ) are more accurate than those calibrated with anion Ω values ( ).

Conclusions
- Here, we observed that anions of protein complexes formed by nongenetic coinoculation have significantly smaller average charge states than the corresponding cations. This result is consistent with anions having lower field-emission energies for the loss of charge carriers. Interestingly, cations, anions, and charge-reduced cations all have similar Ω values, suggesting that they all have similar structures that depend weakly on charge state. We also demonstrated that these Ω values can be used to measure accurate calibrated Ω values with traveling-wave IM.

Thanks
- The Richard A. Schaeffer Memorial Fund

References