Simultaneous binding of cations and anions by valinomycin

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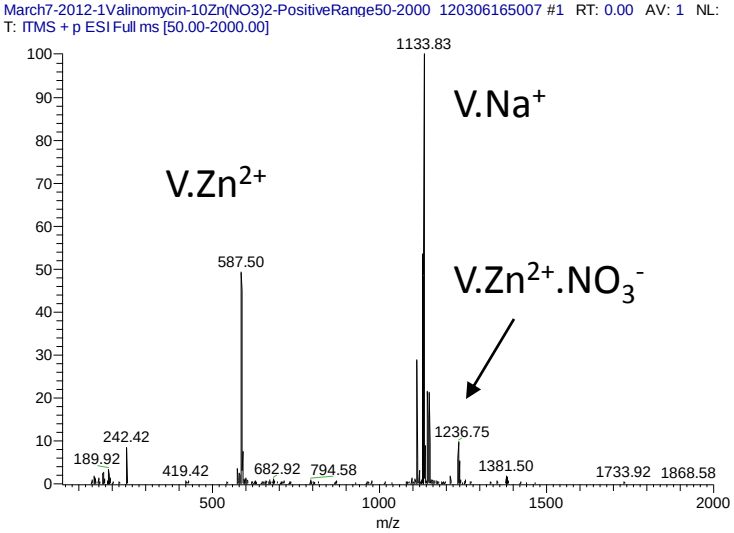
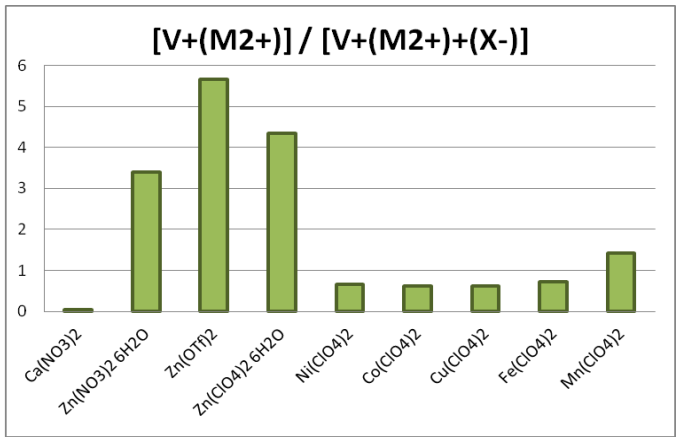
The antibiotic valinomycin is a potassium selective ionophore, which increases the transport of potassium across cell membranes and thereby causes damage to bacteria cells. Valinomycin has been extensively studied as an ionophore for cations. Last year, we reported for the first time the direct binding of anions to valinomycin using electrospray ionization mass spectrometry and ^{1}H NMR spectroscopy.

In the process of exploring the binding of valinomycin with doubly charged cations, we have made the serendipitous discovery that valinomycin simultaneously binds to doubly charged cations and singly charged anions. A representative mass spectrum is shown on the right. A summary of results is shown below.



Positive-mode ESI mass spectrum of valinomycin (0.010 mM) in the presence of zinc nitrate(0.10 mM). The peaks correspond to the adducts of valinomycin, abbreviated as V. The adduct with Na+ is due to NaCl, an impurity.



For each salt, the ratio of the ESI mass spectral intensities of $V.M^{2+}$ and $V.M^{2+}X^{-}$ is shown.

These studies, conducted in collaboration with undergraduate students, Professors Fujita (Chemistry) and Swamy-Mruthinti (Biology) were presented at SERMACS, 2012 and will be submitted to *Supramolecular Chemistry*.