Bioavailability of Silver and Silver Sulfide Nanoparticles to Alfalfa (*Medicago* sativa)

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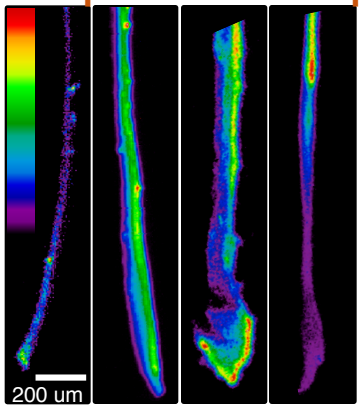
Experimental Setup

- Alfalfa sprouts were exposed hydroponically to three Ag treatments: suspensions of Ag^0 and Ag_2S nanoparticles and the control, $AgNO_3$
- Root tips were examined using Synchrotron-based X-ray Fluorescence (XRF) and Transmission Electron Microscopy (TEM)
- Silver specific XRF maps were generated to visualize the distribution of Ag in the plant tissue while TEM was used to identify dense particles in the cell walls.

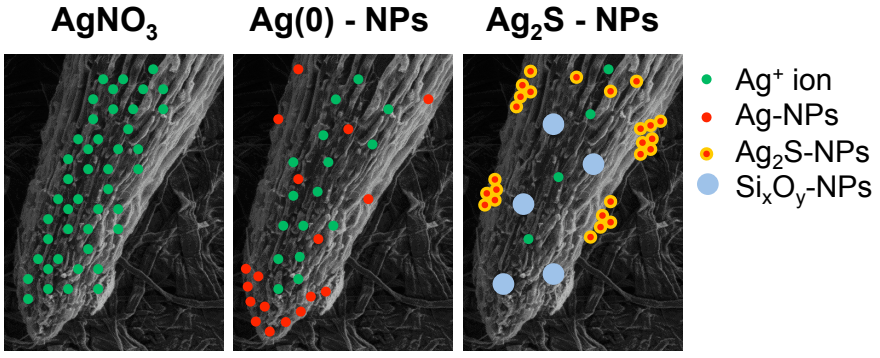
Silver specific XRF maps



Alfalfa root tips

- An unexposed alfalfa root is shown (1st)
- Ag is pervasive in the $AgNO_3$ exposure (2nd)
- Ag is more discrete in Ag^0 and Ag_2S NP treatments (3rd and 4th column, respectively)

Silver exposed alfalfa root tips



Major Results

- Silver accumulated similarly in/on the roots of alfalfa plants for Ag^+ and Ag^0 & Ag_2S nanoparticles.
- Distribution and speciation of Ag in the roots was different of Ag NPs compared to Ag ions.

Implications:

- The low solubility of the Ag_2S NP does not prevent the uptake and translocation throughout plant tissue.
- This suggests Ag solubility, although directly related to toxicity, may not predict the fate of these NPs exposed to plants.

Stegemeier, J.P.; Schwab F.; Colman, B.P.; Webb, S.; Newville, M.; Lanzirotti, A.; Winkler, C.; Wiesner, M.; Lowry, G.V. Speciation Matters: Bioavailability of Silver and Silver Sulfide Nanoparticles to Alfalfa (*Medicago* sativa). Environmental Science and Technology Submitted - 2015,

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