# Mapping Nanomaterials Dispersed in Plant Tissue

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Effective environmental nanotoxicology studies require that nanoscale materials can be identified in complex environments such as plant tissue. Ideally, this process will be conducted across relatively large areas of the tissue, while providing as much quantitation as possible.

The development of Enhanced Darkfield Hyperspectral Microscopy is providing the ability to identify nanoscale materials in complex environments, such as plant tissue, in a semi-quantitative manner. Rapid imaging and analysis of a relatively large field of view is possible with this technique and it is proving to be highly complementary to methods such as Scanning Electron Microscopy[1].
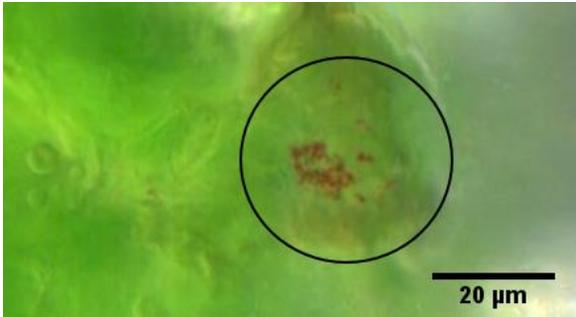

Figure 1: 60x Enhanced Darkfield Hyperspectral Image of Selenium in Leaf

Hyperspectral images captured with the CytoViva system look similar to optical images. However, each pixel of the hyperspectral image contains the spectral response for that pixel's spatial area. Using integrated hyperspectral image analysis software, the unique spectral response of nanomaterials can be identified and easily mapped throughout the sample.


Figure 2: 60x Enhanced Darkfield Hyperspectral Image with Selenium Mapped and Pseudo-Colored Red
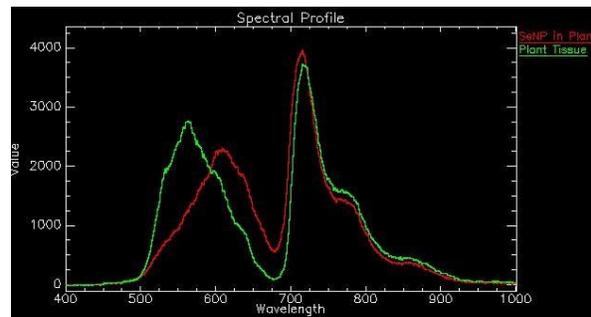

Figure 3: Spectral Comparison of Plant Tissue and Nanoscale Selenium in Plant Tissue

In Figure 1 above, the hyperspectral image of the leaf is seen with what optically appears to be nanoscale selenium, which is the dark reddish-brown area encircled. In Figure 3 we have captured the spectral response for both the leaf (indicated in green) and the selenium (indicated in red). The spectral response of the selenium does share much of the spectral characteristics of the leaf due to the chlorophyll influence. However, the selenium consistently causes a shift of the spectral peak recorded at 565nm in the leaf tissue to 610nm.

To further validate these findings, a spectral library of the selenium was created by first capturing the spectral response from several pixels of the selenium in the positive control. This spectral library was then filtered against a negative control leaf tissue to ensure no false-positive mapping. Finally, the spectral library was mapped against the positive control hyperspectral image, and as seen in the encircled area of Figure 2, all pixels matching the spectral response of the selenium were pseudo-colored red.

If your research requires the ability to identify nanoscale materials in complex environments such as plant tissue, CytoViva's Enhanced Darkfield Hyperspectral Microscope may be a vital tool in the advancement of your research.

To learn more about CytoViva's Enhanced Darkfield Hyperspectral Microscopy, contact us at info@cytoviva.com.

*References*
1. *Peña MD, Gottipati A, Tahiliani S, Neu-Baker NM, Frame MD, Friedman AJ, Brenner SA Hyperspectral imaging of nanoparticles in biological samples: Simultaneous visualization and elemental identification Microsc Res Tech. 2016 Feb 11. doi: 10.1002/jemt.22637*