

Trichloroethylene Plume Migration Analysis using Hyperspectral Imaging

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Phytoremediation is an effective way to remove chlorinated organic solvents, such as Trichloroethylene (TCE), from contaminated groundwater areas. However, post-installation monitoring of TCE plume migration can be expensive, time consuming, and potentially have adverse effects on plant health. Newer, more modern approaches of plume delineation analysis are needed to mitigate these limiting factors. TCE is metabolized by plants, particularly poplar, into the metabolites Trichloroacetic acid (TCAA) and Dichloroacetic acid (DCAA). These metabolites accumulate in the leaf tissue making leaves an easily-accessed sample for TCE exposure analysis. Thus, a hyperspectral imager can be used to scan leaf tissue to test for TCE exposure. It has been previously shown that leaves containing TCAA and DCAA will have different spectral patterns than those not exposed to TCE. This non-invasive method could be miniaturized into a portable unit to be use in situ for real-time analysis of TCE plume migration. Ideally, it could also provide valuable information to scientists considering establishment of new phytoremediation sites; to have the ability to determine area of highest TCE plume consolidation. This novel, multi-faceted approach contains two major phases. The first will be repeating previously reported studies in which TCAA and DCAA were detected in leaf tissue of a variety of plant species, including poplar, using hyperspectral imaging. Secondly, we will begin the development of a portable hyperspectral imager which will be designed specifically for TCE metabolite detection in plants. However, this method need not to be limited only to organic solvent analysis, but could also be used in a wide-range of contamination studies.

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