

Monitoring the Impact of Heavy Metals on Plant Reflectance and Internal Leaf Structure During Phytoremediation Process

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ABSTRACT

The long-term objective of this study is to monitor the physiological responses of plants growing in contaminated environments by using hyperspectral remote sensing. The physiological status will then be used as an indicator of the presence of contaminants, such as heavy metals or radionuclides in the growing environment. Bioaccumulation of heavy metals affects the structural integrity and composition of plant tissues and cells. These changes also affect plant spectral reflectance, which is governed by leaf surface properties, internal structure and chemical composition. In the present study, we are investigating the impact of heavy metal accumulation on plant reflectance and internal leaf structure during the process of phytoremediation of toxic heavy metals. Potted plants of barley (*Hordeum vulgare*) and Indian mustard (*Brassica juncea*) are subjected to varying levels of Zn, Cd, and other metal contaminants. Reflectance spectra of the potted plants are collected daily using a portable spectroradiometer system with solar radiation in the field and artificial illumination inside a laboratory. Leaves of intact plants are collected for cross-sectioning and microscopic studies to assess changes in cellular structure and localization of metals. Diffuse reflectance spectra of the sample leaves are also collected inside our laboratory. Finally, the shoots and roots of the plants are harvested at the end of experiments for total accumulated metal concentration analysis. The outcome of this research will contribute to developing non-intrusive, cost-effective methods for long-term monitoring of some large sites contaminated by heavy metals and radionuclides.