Optimization of Phytoremediation Process by Monitoring Plant Fluorescence

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Phytoremediation is based on the ability of particular plants to extract contaminants in large quantity from soil or groundwater. Heavy metal removal is accomplished by concentrating the contaminant in above-ground plant parts, such as leaves, that can be harvested and removed from the site. To enhance metal accumulation and increase the rate of phytoextraction, a chelator (e.g., EDTA) is added to the soil. This mobilizes bound metals, thus making them more available for uptake by plants and dramatically increasing the rate of uptake. Monitoring the temporal variation of plant fluorescence provides a measure of the plants' health status, before any stress-related damage to the plants appears. A computerised, portable chlorophyll fluorometer, CFM-636973, was used for optimization of the phytoremediation process. At high EDTA concentrations the uptake is rapid but is quickly saturated and plants die as they reach their tolerance threshold. By reducing the concentration of EDTA, the uptake will be slower but plants will be able to invoke tolerance mechanisms that allow them to adapt to stressful environments. This mechanism can be exploited by increasing the tolerance threshold. In this way, the final accumulation can be increased by a factor of 3-5, significantly reducing total clean up time and cost. Studies of a similar optimization for the phytoremoval of chlorinated solvents e.g., TCE and PCE, is under way.