Public Abstract
First Name:Han
Middle Name:
Last Name:Yang
Adviser's First Name:John
Adviser's Last Name:Yang
Co-Adviser's First Name:Chung-ho
Co-Adviser's Last Name:Lin
Graduation Term:SS 2010
Department:Soil, Environmental & Atmospheric Sciences
Degree:MS
Title:Enhanced Rhizodegradation of Munitions Explosives and Degradates by Selected Native Grass Species

TNT (2,4,6-trinitrotoluene) and RDX (hexahydro-1,3,5-trinitro-1,3,5-triazine) are the two most widespread explosives in the world. The manufacture, use and disposal of explosives as well as the demilitarization of military facilities can result in environmental contamination. The explosive contamination in soil and water is reported as a threat to human health and ecosystems. Compared to highly expensive and inefficiently conventional remediation methods, phytoremediation has been considered as a cost-effective way to clean up contaminated sites. The objectives of this research are to: (1) evaluate the degradation kinetics of TNT and RDX in the rhizospheres of two selected native grass species; (2) determine the environmental fate of TNT and RDX in rhizosphere ecosystems; (3) investigate the synergic effects of TNT and RDX degradation in both rhizospheres by inoculating with known explosive degraders; and (4) assess the quantitative expression of the degradative genes of inoculated degraders under rhizospheres using the real-time PCR method, an advanced technique based on polymerase chain reaction to detect and quantify one or more DNA sequences in real time. Two native grass species were selected in this study including: eastern gammagrass (EG; Tripsacum dactyloides) and switchgrass (SW; Panicum virgatum). The rhizosphere soils of these two grasses were collected and either C14 labeled TNT or RDX were applied in soils, followed by the application of the explosive-degrading bacteria. Explosive degradation profiles and mineralization rates were monitored during an 8-week incubation period. Additional studies were conducted to monitor the TNT degradation profile and functional gene copy numbers with the presence of these two species. Results suggested that the TNT was rapidly degraded into its major metabolites in both rhizospheres and control soil; the degradation of the TNT metabolites was significantly enhanced in the rhizosphere soils as compared with the control. However, the mineralization of TNT in all the treatments was limited (< 5%). In contrast, the degradation of RDX and its metabolites in the rhizosphere soils were significantly enhanced over the control. More than 13% RDX was mineralized in rhizosphere soils as compared to 5% in the control. Overall, EG appeared to be more effective for RDX degradation, while SW to be more suitable for TNT degradation. Inoculation of TNT degrader P. putida KT2440 to SW could enhance TNT degradation as compared to use SW alone.