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Use of Electrokinetic Technology to Enhance Chemical and Biological Remediation of Contaminated Sands and Soils

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Abstract : Contaminants such as polycyclic aromatic hydrocarbons (PAHs) are compounds present in crude and petroleum oils and are known to be toxic and often carcinogenic. Therefore, a major effort is placed on tracking their subsurface soil concentrations following an oil spill. The PAHs can persist for years in the subsurface especially if there is a lack of oxygen. Both aerobic and anaerobic biodegradation of PAHs encounter the difficulties of both nutrient transport and bioavailability (proximal access) to the organisms of the contaminants. A technology, known as electrokinetics (EK or EK-BIO for 'electrokinetic bioremediation') has been found to transport efficiently nutrients or other chemicals in the subsurface. Experiments were conducted to demonstrate migration patterns in both sands and clay for both ionic and nonionic compounds and aerobic biodegradation studies were conducted with soil spiked with Polycyclic Aromatic Hydrocarbons yielding interesting results. In one set of experiment, Self-designed electrokinetic setups were constructed to examine the differences in electromigration and electroosmotic rates. Anionic and non-ionic dyes were used to visualize these phenomena, respectively. In another experiment, a silt-clay soil was spiked with three low-molecular-weight compounds (fluorene, phenanthrene, fluoranthene) and placed within self-designed electrokinetic setups and monitored for aerobic degradation. Plans for additional studies are in progress including the transport of peroxide through anaerobic sands.

Keywords : bioavailability, bioremediation, electrokinetics, subsurface transport
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