

## Electroremediation of Saturated and Unsaturated Nickel-Contaminated Soils

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**Abstract :** Electrokinetic remediation was undoubtedly proven to be one of the most efficient techniques used to clean up soils contaminated with polar charged contaminants (such as heavy metals) and non-polar organic contaminants. It can be efficiently used to clean up low permeability mud, wastewater, electroplating wastes, sludge, and marine dredging. This study presented and discussed the results of electrokinetic remediation processes to clean up soils contaminated with nickel. Two types of electrokinetics cells were used: an open cell and an advanced cylindrical cell. Two types of soils were used for this investigation; the Azraq green clay which has very low permeability taken from the eastern part of Jordan (city of Azraq) and a sandy soil having, relatively, very high permeability. The clayey soil was spiked with 500 ppm of nickel, and the sandy soil was spiked with 1500 ppm of nickel. Fully saturated and partially saturated clayey soils were used for the clean-up process. Clayey soils were tested under a direct current of 80 mA and 50 mA to study the effect of the electrical current on the remediation process. Chelating agent (Na-EDTA), disodium ethylene diamine tetraacetatic acid, was used in both types of soils to enhance the electroremediation process. The effect of carbonates presence in the contaminated soils, also, was investigated by use of sodium carbonate and calcium carbonate. pH changes in the anode and the cathode compartments were controlled by use of buffer solutions. The results of the investigation showed that for the fully saturated clayey soil spiked with nickel had an average removal efficiency of 64%, and the average removal efficiency was 46% for the unsaturated clayey soil. For the sandy soil, the average removal efficiency of Nickel was 90%. Test results showed that presence of carbonates in the remediated soils retarded the clean-up process of nickel-contaminated soils (removal efficiency was reduced from 90% to 60%). EDTA enhanced decontamination of nickel contaminated clayey and sandy soils with carbonates was studied. The average removal efficiency increased from 60% (prior to using EDTA) to more than 90% after using EDTA.

**Keywords :** buffer solution, EDTA, electroremediation, nickel removal efficiency

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