Pilot scale feasibility test for *in situ* chemical oxidation and biodegradation process to remediate the diesel contaminated millitary site, Korea

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Pilot scale experiment was performed by using the *in situ* chemical oxidation and biodegradation process to remediate the diesel contaminated military site, Korea. The soil at this site was composed of sandy loam and silt loam and the initial average TPH concentration of soil was 5202.8 mg/kg.

The *in situ* chemical oxidation process was carried out on a pilot scale test site (2.5 m x 2.7 m x 1 m), by using 17.5 % hydrogen peroxide solution as an oxidizer. Five injection wells (IW-1, IW-2, IW-3, IW-4 and IW-5) and one extraction well (EW-1) were installed in the test site. The injection rate of hydrogen peroxide solution was 140 ml/min for 5 hours per day. The pumping from extraction well proceeded every 30 minutes. Total amount of H_2O_2 injected was 718 L and 400 L was extracted from the extraction well. After stabilizing the site for 7 days, indigenous microorganisms were cultivated from the contaminated soil and 86 L of solution having cultured microorganisms were added to the site, which was already treated by the chemical oxidation process, for 2 days (May 15th and 20th, 2010).

As a result of chemical oxidation process, TPH concentration of the treated soil decreased by 2138.1 mg/kg (59 % of removal efficiency). TPH concentration of site biodegraded by indigenous microorganisms for 17 days decreased by 729.6 mg/kg (92 % of removal efficiency), which was lower than Korean Soil Pollution Warning Limit (TPH : 2000 mg/kg).

From the results of the pilot scale test, it was investigated that the combination of chemical oxidation and the biodegradation process was complementary and it could effectively remediate diesel contaminated soil.

Arsenic uptake by natural sludge occurred at coal mine drainage

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Arsenic (As) is widely known as a toxic element for humans and ecosystems. Sorption of arsenic on minerals such as metal-(hydr)oxides has been known to play a key role in controlling the fate and transport of arsenic species in natural ecosystems. Despite the importance of arsenic interaction with natural minerals in ecosystems, uptake modes of arsenic by natural minerals under different physicochemical conditions are not clearly understood. Moreover, no systematic studies of arsenic uptake by naturally ocurring sludge at mine sites has been provided, especially by the combination of marcroscopic and microscopic observations.

Systematic studies, combined batch experiments with XRD, XRF, SEM, and X-ray absorption spectroscopy (XAS), have been used to investigate arsenic sorption on slugde occurred at Ham-Baek mine, South Korea. Results show that the sludeg is mainly composed of nano-sized schwertmannite (Fe_8O_8 $(OH)_6$ $(SO_4)\cdot nH_2O$). Compared to that of synthesized schwertmannite, however, XRD and SEM show that crystallinity of the sludge particles are very poor, suggesting that the surface reactivity of particles could be different. At pH 4.0 and 7.0, sorption of arsenite and arsenate on the sludge sharply increase at $[As]_{tot.} < 370$ μM, and then followed by gradually increase with increasing As concentration without reaching any plateau, indicative of Freundlich sorption behavior. At 7.0, however, the total amount of arsenate sorbed on the sludge decreases with increasing pH and ionic strength of the solution. It is found that both arsenite and arsenate uptake by the sludge is rapid and ~95% of As is sorbed on the sludge within 30 mins, suggesting that adsorption plays an important role in the initial upatke of arsenic at the sludge-water interface. XANES shows that arsenite species sorbed on the surface of the sludge particles is changed to arsenate during the duration of the experiment.