

Optimizing soil remediation process by controlling nutrient injection rate

Yasushi Mori[1]

[1] Life&Environ.Sci., Shimane Univ.

Bio-remediation was conducted for oil-contaminated soils in unsaturated zone. A Bio-stimulation method, which inject nutrient and oxygen to soil profile to activate microbes in the profile, was employed for effective soil treatment. Usually engineers employed fast injection and large amount of chemicals was used. However, the injection sometimes failed because cracks or macropores easily conduct the remediation chemicals, leaving the soil matrix from remediation process. Because macropore/cracks in vadose zone are more rules than exceptions, thus, the success of bioremediation depends on how we can manage this structural heterogeneity. In our experiment, slow injection rate was employed so that unsaturated condition was achieved and let the solute show full dispersion in the soil matrix. Remediation experiments were conducted for 30 days to four 5000ppm oil-contaminated soils. Four conditions were employed to see the effect of macropore and injection rate, namely, fast with/without macropore, slow with/without macropore. Effluent was measured with ion-chromatography to examine nutrient leaching from the soil column. Fluorescein Diacetate

(FDA) hydrolysis was employed to examine biological activity in effluent and soils. Results showed fast injection was suffered from clogging caused by microbial activity or their colony.

Also nitrate amount from the effluent was higher in fast injection than slow injection. FDA biological activity showed biological activation for both fast and slow injection, however, biological activity in slow injection was caused by oxidation condition while fast injection by reduction condition. Also macropores in the soil column helped air conduction keeping soil column oxidation condition for whole experimental period. The remediation results were similar for four conditions, however, taking into consideration of oxidation and nutrient use efficiency, slow injection with macropore was the most effective condition for bio-stimulation.