

low concentrations of phenol (0.1% by weight) in the cement matrix (after 28 days of curing) could be leached and exceed the regulatory limit of 14.4 ppm. Test results show that polyester polymer can be used effectively for solidifying/stabilizing phenolic waste very rapidly. A simple non-linear model has been developed to represent the phenol leachate from the cement matrix.

---

## Solidification/stabilization of toxic metals — leaching, FTIR and silicon-29 solid-state NMR studies of lead, zinc, chromium and cadmium in portland cement and montmorillonite

J. Dale Ortego, Scott Jackson, Richard Barlow and Ching Tsai

*Environmental Chemistry Laboratory, Department of Chemistry, Lamar University, P.O. Box 10022, Beaumont, TX 77710 (USA)*

Portland cement samples doped with lead and zinc nitrate have been investigated using  $^{29}\text{Si}$  solid-state NMR and Fourier-transform infrared spectroscopy. Results indicate that silicate polymerization is slightly enhanced with lead doping and retarded in the presence of zinc. Studies reveal that silicate polymerization occurs when the samples are exposed to acidic leaching media. The degree of cross-linking is directly proportional to the acidity of the leaching solution, being pronounced when pH 5 buffers are employed. In separate studies, the adsorption of the metals chromium, lead and cadmium from aqueous solution by montmorillonite clay was found to increase with addition of phosphates, sulfates and arsenates.

---

## Sorption and degradation of organic vapors in unsaturated soil

C.S. Vail, C.W. English and R.C. Loehr

*Environmental and Water Resources Engineering Program, Department of Civil Engineering, University of Texas at Austin, Austin, TX 78712-1076 (USA)*

### Abstract

The need to provide treatment for soils contaminated with hazardous ma-

terials from accidental spills and land based handling operations has become increasingly apparent. Many of these hazardous materials contain volatile organic compounds (VOCs) that can volatilize into the air and/or sorb to the soil. To develop adequate treatment and control for volatile air emissions and to predict the fate of chemical constituents in soil, it is necessary to understand the fundamental processes and interactive mechanisms that occur in the unsaturated soil. In addition, such knowledge can be utilized both to provide criteria for designing soil decontamination projects such as soil vapor extraction and to evaluate the feasibility of alternative treatments for industrial vapors and exhaust gases.

It is commonly assumed that volatile compounds in the vapor phase pass unaffected through the soil and enter the atmosphere with no change in mass. This assumption impacts decisions on air emissions, transport and fate estimation, regulatory limits, on-site controls and treatment strategies. An evaluation of this assumption and the identification of removal mechanisms for mixtures of compounds in unsaturated soil is the focus of this research. The major mechanisms that have been identified are sorption, degradation, and vapor loss.

Data from batch reactors were collected for the vapor phase sorption of five compounds: benzene, ethylbenzene, trichloroethylene, toluene and *o*-xylene on unsaturated soil. These data were used to determine sorption and degradation coefficients for single compounds and sorption coefficients for mixtures of compounds. The results indicate VOCs are sorbed and then removed by degradation as they pass through soil in the vapor phase. Sorption coefficients for mixtures determined from laboratory data were compared with predictions obtained from an ideal adsorbed solution model (IAST).

---

## Supercritical CO<sub>2</sub> extraction/catalytic oxidation of aromatics from contaminated aqueous streams

F. Carl Knopf, D. Ghonasgi, S. Gupta, M. Ye and K.M. Dooley

*Department of Chemical Engineering, Louisiana State University, Baton Rouge, LA 70803 (USA)*

### Abstract

Distribution coefficients (*K*-values) between water and supercritical CO<sub>2</sub>