



Mechanisms Controlling Leaching of Trace Elements from Soil Stabilized with Fly Ash

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Motivation and Problem Statement

- Large quantity of fly ash produced annually
 - ~ 72.4 million tons of fly ash produced (ACAA, 2006)
 - ~ 32 million tons (~ 45%) reused (ACAA, 2006)
- Coal fly ashes can be effective in stabilizing inorganic and organic clays (Acosta et al. 2003)
- Leaching of trace elements is a concern of using coal fly ash
- Numerous studies have reported leaching from fly ash and soil-fly ash mixtures
- None of the studies has investigated leaching mechanisms for soil-fly ash mixtures

Leaching from Fly Ash

- Leaching: Phase transfer from solid → liquid
- Trace elements in fly ash: As, B, Ba, Be, Cd, Cu, Hg, Mo, Ni, Pb, Sb, Se, V and Zn
- Reuse or disposal of fly ash can be a potential risk to the environment

Equilibrium-Controlled Release Mechanism

- Percolation thru the waste occurs slowly
- Equilibrium condition exists between solid phase and water phase
- Chemical processes, such as dissolution of minerals and adsorption, control release

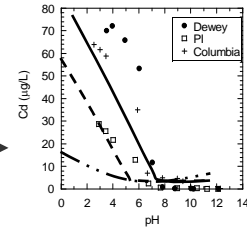
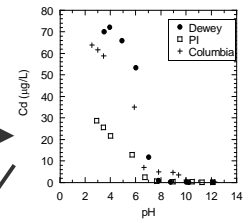
Objectives

- To evaluate whether leaching of trace elements from soil-fly ash mixture is controlled by dissolution/precipitation reactions
- To determine how type of soil and fly ash used in a stabilization application affects the leaching mechanism and leaching behavior

Test Methods

- Acid-Base Neutralization Capacity (ANC)
- Leaching as a function of pH
- X-Ray Diffraction (XRD)
- X-Ray Fluorescence Spectrometry (XFS)

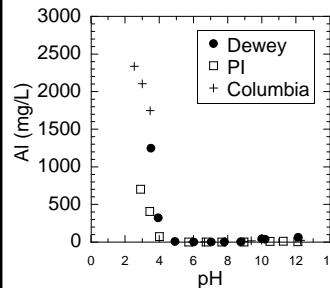
Approach to Identification of Leaching Controlling Mechanisms



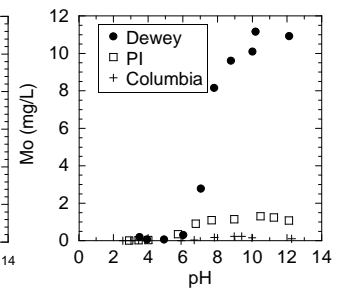
Modified after Rob N. J. Comans

Results: Leaching as a function of pH

Decreasing Pattern



Increasing Pattern



On-going Work

Geochemical modeling (MINTEQA2) study:

- Determine oxidation states of elements existing in leachates from fly ash and mixtures of soil and fly ash
- Identify the presence of controlling solid phases
- Predict pH-dependent leaching behavior in term of dissolution/precipitation reactions

Evaluate effects from type of soil and fly ash used in soil-fly ash mixtures