
The development of electrochemical scanning tunneling microscopy (EC-STM) provides the capability at a given electrical potential to image the resultant morphologies of solution and surface oxidation-reduction reaction products. Similarly, one can determine the effect of varying surface electrical potentials on the morphology of sorbed macromolecules initially present in an overlying suspension. In this presentation, the principles and sample preparation techniques of EC-STM will be discussed in detail. Examples of EC-STM studies with Ag(I), Fe(II), Fe(III), Au(III), and Cu(II) will be presented. The utility of various image analysis algorithms -- roughness indices, fractal dimensions, and bearing ratios -- on comparison of resultant surface morphologies will be demonstrated.

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Structure of a Simple Fluid in a Rough Micropore
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Equilibrium properties of a Lennard-Jones fluid confined in a rough micropore were computed using the Molecular Dynamics and Monte Carlo methods. Each wall of the rough micropore was consisted of 6000(1000) planes of rigidly fixed Lennard-Jones atoms. At least one of the walls had no defects (defects). By changing the depth and width of the defects different degrees of surface roughness were achieved. The densities in the directions parallel and perpendicular to the walls indicates the pore structure in the defects differs from that in the remainder of the pore. Diffusion coefficient coefficients also show significant variation within the micropore.

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Effect of Anions on Copper-Sodium Exchange Selectivity on Montmorillonite. Z.Z. ZHANG*, D.L. SPARKS, and G.N. LAMBLE, Univ. of Delaware and Brookhaven National Laboratory.

Copper-sodium exchange experiments were conducted on Wyoming and Arizona montmorillonites in four anion backgrounds, namely, chloride, perchlorate, nitrate, and sulfate. The effect of anions on the exchange selectivity coefficients was studied. The copper exchange capacity (CuEC) was measured using the above four copper salls to further evaluate if CuCl\textsuperscript+ and CuNO\textsubscript{3}\textsuperscript- complexes were formed on the clay surfaces. In addition, extended x-ray absorption fine structure (EXAFS) spectroscopy experiments were conducted using synchrotron radiation to investigate the local coordination environment of copper ions on clay surfaces.

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Perturbation of Taranakie Formation by Ferrous and Ferric Iron.
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Taranakie is an important redox product of phosphate fertilizer with soils. Its formation affects the transformation of nutrients in soils. The effect of different ratios of iron (ferrous or ferric) to aluminum on the formation of taranakie was studied. The results indicated that ferrous iron can perturb the formation of taranakie for 4 weeks when the molar ratio of FeOA\textsuperscript2+/Al\textsuperscript3+ was greater than 2.5 (Al\textsuperscript3+ = 1×10\textsuperscript{-3} M and NH\textsubscript{4}\textsuperscript+PO\textsubscript{4}\textsuperscript{3-} = 1 M) whereas under the same conditions some crystalline taranakie was observed in the ferric system. Although Fe\textsuperscript3+ had a less effect on the crystallization of taranakie than Fe\textsuperscript2+ at a low ratio of FeO/Al, it can completely perturb the formation of taranakie when its crystallization was high enough (molar ratio of Fe/Al = 2.5). As a comparison, Na\textsuperscript+, Ca\textsuperscript2+, Mg\textsuperscript2+, and Mn\textsuperscript2+ ions did not affect the crystallization of taranakie, even the concentration of the ions was 10 times higher than Al in the systems. The perturbation of taranakie formation was caused by the complexation of the iron and phosphate. The less effect of Fe\textsuperscript2+ was due to the hydration of the ions to form a separate precipitate phase. Therefore, the formation of taranakie in the soil can be affected by ionic environments of soil.

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Div. S-3 — Soil Microbiology and Biochemistry

Adsoption and biodegradation of herbicids in maddens formed under no-till and conventional tillage by Lumbiricus terrestis. N.M. AKHOURI*, R.F. TURCO, E.J. KLADIVKO and M. BISHOFF, Purdue Univ.

Lumbiricus terrestis has been found to establish more frequently under no-till cropping system than under conventional tillage system. L. terrestis form maddens above their burrow, where the midden is an accumulation of cast materials and crop residues. In fields well populated with night crawlers, it is common to find about 10 maddens per m<sup>2</sup>. Little information is available about the fate of herbicides in maddens formed by L. terrestis. The midden structure and surrounding soil, was collected from fields under no-till and conventional tillage. Materials were contrasted in their ability to sorb and biodegrade atrazine and imazaquin. For samples from conventional tillage system, atrazine sorption was similar in maddens and soil; imazaquin sorption was higher in soil than in the midden. In no-till bean and corn no differences in sorption of imazaquin on midden or soil materials was observed; atrazine sorption was higher on maddens than soil. Degradation of imazaquin was higher in soils than in maddens from either of the two tillage systems and no effects from the cropping system were noted. Atrazine degradation was similar in all systems.

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Chemical and Biological Degradation of Atrazine in the Rhizophore of Axenically and Non-Axenically Grown Corn. S.R. Alvey* and D.E. Crowley, University of California Riverside.

Ring labeled and chain labeled atrazine were applied to unsterile and initially sterile soils with and without corn plants to determine plant and rhizosphere effects on atrazine degradation. Degradation was monitored by capturing <sup>14</sup>C<sub>2</sub>O in a NaOH scrubber system and scintillation counting. Unsterile soils with and without plants showed no significant difference in <sup>14</sup>C<sub>2</sub>O liberaion. Total <sup>14</sup>C<sub>2</sub>O evolution was greater for soils containing chain labeled atrazine than for soils amended with ring labeled atrazine. Unsterile chain labeled treatments evolved 11% of the total radioactivity added while unsterile ring labeled treatments evolved 1% of the total radioactivity as <sup>14</sup>C<sub>2</sub>O over the 5 week period. Ring and chain labeled initially sterile treatments evolved less <sup>14</sup>C<sub>2</sub>O than the corresponding unsterile treatments. Soils were extracted and analyzed by HPLC and scintillation counting for atrazine, and metabolites. A mass balance was completed for planted treatments by measuring <sup>14</sup>C analysis in plant stems and roots.

Atrazine degradation rates were unaffected by the presence of plants.

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The Role of The Rhizophore in Facilitating Biological Degradation of Hazardous Organic Chemicals. T.A. ANDERSON* and G.W. WALTON1, and J.R. COATS, Iowa State University, and Oak Ridge National Laboratory1.

The complex, xenobiotic nature of fugitive chemicals encountered by microorganisms involves interactions of microbial communities at the molecular, physiological, and ecological levels for complete chemical transformation to occur. The plant root zone fosters these types of interactions in many ways. The greater density and diversity of microorganisms commonly observed in the rhizosphere, compared with less diverse microbial communities in nonvegetated soils, may result in greater rates of xenobiotic metabolism. The secretion of readily degradable substrates by roots can also facilitate cometabolic transformation of hazardous organic compounds in the rhizosphere. These phenomena have important implications in biological remediation of waste sites where establishing or accelerating degradation of unwanted organics. Recent advances in understanding microbial degradation of organic compounds by rhizosphere microbial communities will be discussed.

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