

ASPECTS OF NITROGEN KINETICS IN MID-ATLANTIC SOILS (RETENTION, ADSORPTION, GROUNDWATER, DELAWARE)

Carski, Theodore Henry, PhD, University Of Delaware, 1986

Abstract

The use of miscible displacement techniques to study kinetics of ion exchange on clay minerals and soils is increasing. A device that ensures constant dilution volumes, regardless of adsorbent, was developed to differentiate the adsorption and desorption processes from the dilution process. This device, the stirred-flow reaction chamber, was employed to kinetically study nitrate retention and differentiation of soil N fractions.

Anion adsorption-desorption kinetics for systems including Cl, NO₃, and SO₄ were studied using soils of the Mid-Atlantic region. Nitrate-Cl exchange was nearly 100% reversible, stoichiometric, and very rapid, indicating simple electrostatic exchange. Total amounts of NO₃ or Cl adsorbed accounted for only 11% of the anion exchange capacity (AEC) when soils were pre-saturated at very low opposing anion concentrations (0.7 mM (-) charge). Total NO₃ or Cl adsorption accounted for 90% of the AEC when the pre-saturating concentration equalled 0.2 M (-) charge. This may indicate the need for differentiation of *total* and *effective* AEC.

The chemically induced release of NH₄ from four Delaware soils was monitored over time using the stirred-flow system. The extractants used were 0.02 M KMnO₄ - 0.5 M H₂SO₄ at 297 K, and 0.01 M CaCl₂ at 368 K. The kinetic approach presented does allow direct differentiation of two NH₄ releasing reactions. The reactions were considered to represent the release of NH₄ from an inorganic and an organic source. Using this approach, estimates of these pools were made and compared with estimates based on traditional batch techniques. Neither extractant gives direct evidence for the existence of a chemically active pool, however, there is indirect evidence for such a pool.