EQUILIBRIUM AND KINETIC STUDIES OF ATRAZINE ADSORPTION AND DESORPTION ON SOILS AND SOIL CONSTITUENTS

by

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ABSTRACT

Adsorption-desorption of pesticides is critical in controlling the concentration of pesticides in the soil solution and thus the amount that will be leached. Equilibrium and kinetic aspects of atrazine adsorption-desorption were investigated on humic acid, montmorillonite, vermiculite, goethite, humic acid-coated montmorillonite and goethite, and two selected Delaware soils. The equilibrium and long-term kinetic studies were carried out using a batch technique. The short-term kinetic studies on vermiculite were conducted using a stirred-flow method. The equilibrium studies showed that adsorption of atrazine on humic acid (K_d= 95.60 L Kg^{-1}) was considerably higher than on montmorillonite (K_d=18.52 L Kg^{-1}) and vermiculite (K_d=26.80 LKg^{-1}). Adsorption of atrazine on goethite was negligible. Humic acid coatings significantly increased atrazine adsorption on montmorillonite and goethite. Atrazine adsorption-desorption on montmorillonite was completely reversible, while nonsingularities were observed for vermiculite and humic acid. The short-term adsorption kinetic studies on vermiculite indicated that a concentration-dependent kinetic model is suitable to describe the reaction rates. The long-term kinetic studies indicated that atrazine adsorption-desorption on humic acid continued up to 90 days, while equilibrium on montmorillonite was reached in 2 h. The humic acid coating on montmorillonite decreased the reaction rate compared to that

observed on the uncoated montmorillonite. Adsorption-desorption on a Pocomoke surface soil, which has a high organic matter (OM) content was slower than on a Matapeake subsoil which was mainly a mineral soil with a low organic matter content. A two-site model and a radial pore diffusion model described the kinetics reasonably well, capturing the fast initial desorption and the relatively slow desorption that followed.