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THE FATE AND TRANSPORT OF VETERINARY ANTIMICROBIALS, SULFADIMETHOXINE AND ORMETOPRIM, IN THE ENVIRONMENT

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ABSTRACT: During the past decade there has been an increasing concern over antimicrobials found in the environment. However, little information is available on the fate and transport of antimicrobials once they are discharged in the environment through human and animal waste. This study investigated two veterinary antimicrobials, Sulfadimethoxine and ormetoprim commonly used as medicated feed for poultry and aquaculture. A series of batch equilibrium experiments were conducted to determine the sorption capacity of these antimicrobials in sand and two southeastern U.S. soils. The sulfadimethoxine and ormetoprim concentrations were chosen to be in the range of antimicrobial concentrations that have been found downstream from poultry farms, in fish ponds, and in manure. Data from batch equilibrium experiments were fitted best by the Freundlich sorption isotherm and the linear sorption isotherm. The linear isotherm distribution coefficients, Kd, for sulfadimethoxine and ormetoprim were low, ranging from 1.3 to 58.3 L∙Kg-1, indicating high mobility of these compounds in the selected soils and sand. To further study the sorption and mobility of these compounds, miscible displacement soil column experiments were performed as they yield more realistic solute transport parameters than batch sorption experiments. Retardation factors, R, from these experiments ranged from 3.4 to 83.1 with ormetoprim being retarded more strongly than sulfadimethoxine. Since these antimicrobials are often present in mixtures in the environment, further studies are being performed to investigate the fate of these antimicrobials when applied in mixture. Considering that the sorption is likely to be competitive, the presence of one antimicrobial may cause the other antimicrobial to be more mobile, yielding a decrease in one antimicrobial's sorption coefficient. It is indicated by these experiments that sulfadimethoxine and ormetoprim are mobile in soils and efforts need to be directed towards developing best management practices to protect our nation's surface and groundwaters. Because these antimicrobials will be bioavailable to microorganisms and have potential to alter microbially-mediated ecosystem processes, additional studies are being conducted to investigate the soil microbial community structure in the presence of sulfadimethoxine and ormetoprim.

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