

Transport of Estrogenic Hormones in Soil

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Presence of estrogenic compounds in the environment, even in very low amounts, have become a growing cause of concern. These estrogenic compounds, such as estrone, estradiol, and testosterone are considered as endocrine disruptors that can cause abnormalities in the endocrine and reproductive systems in human and wildlife. Nichols et al. (1997) have reported reproductive abnormalities in birds, fishes and mammals due to presence of xenoestrogen in the environment.[1] Land application of poultry litter, animal manures, and sewage sludge as fertilizer increases the amount of hormones in soil. Hemming and Hartel reported that broiler litter contains 55 μg estradiol/kg and 30 μg testosterone/kg [2]. Ultimately, these hormones may contaminate surface and subsurface water and impact biota in the aquatic environment. Steroids are hydrophobic in nature so the persistence and bioavailability of these hormones depend on their sorption to particulate matter.[3] Their high sorption coefficient (K_d) indicates that estradiol and testosterone are strongly bound to soil.[4] Several soil column studies have shown that the transport of testosterone occurs more rapidly than that of estradiol.[4] The objectives of our study are 1) to evaluate the effect of organic matter in broiler litter on the transport of estradiol and testosterone through undisturbed and packed soil columns, and 2) to model hormone transport with the HYDRUS-1D or STANMOD model. Adsorption isotherms for radiolabeled hormones in soil will be used to obtain adsorption parameters to be used in the model. Radiolabeled estradiol and testosterone concentrations in column effluent will be measured by the dual label feature of a liquid scintillation counter.

1. Nichols D.J., Daniel T.C., Moore P.A., Edwards Jr.D.R. and Pote D.H., Runoff of Estragen Hormone 17-beta-Estradiol from Poultry Litter Applied to Pasture. **26** 1002-1006 (1997).
2. Hemmings S.N.J. and Hartel P.G., Mineralization of Hormones in Breeder and Broiler Litters at Different Water Potentials and Temperatures. *Environmental Quality*, **35**, 701-706 (2006).
3. Emmeric T.V., Angove M.J., Johnson B.B., Wells J.D. and Fernandes M.B., Sorption of 17-beta estradiol onto selected soil minerals. *Journal of Colloid and Interface Science*, **266**, 33-39 (2003).
4. Sangsupan H.A., Radcliffe D.E., Hartel P.G., Jenkins M.B., Vencill W.K. and Cabrera M.L., Sorption and Transport of 17-beta Estradiol and Testosterone in Undisturbed Soil Columns. *Environmental Quality*, **35**, 2261-2272 (2006).