

# NEW ITEMS IN THE NBMA RESOURCE LIBRARY

## Drugs

## July 2008

### **TITLE: Biodegradation of estrone and 17 b-estradiol in grassland soils amended with animal wastes**

**Author:** Lucas, S.D., and D.L. Jones

**Source:** Soil Biol. & Biochem 2006 38:2803-2815

**Abstract:** The release of endocrine disrupting chemicals into the environment is of increasing concern due to the formation of an intersex state in freshwater organisms and potential risks to human health. The aim of this study was to investigate the persistence of the naturally occurring hormones, estrone and 17 b-estradiol in three agricultural grassland soils in the presence and absence of cattle and sheep wastes (urine and manure). Biodegradation was investigated using 14C-labelled hormones which were applied to soil in three different solvents (water, artificial urine and natural sheep urine). When applied directly to soil the two hormones degraded at a similar rate, however, the speed of mineralization was soil type and solvent dependant. The half-life ( $t_{1/2}$ ) of the hormones in soils ranged from 5 to 25 d. The hormones were also applied to the soils in sheep and cattle manure of different ages (7 d to 2 yr). Generally, the rate of degradation in the animal manure amended soils was more rapid than in the unamended soils ( $t_{1/2}$  1–9 d), with mineralization being largely independent of manure age and type. We conclude that in comparison to many xenobiotics, estrogens are not persistent in agricultural soils. However, our calculations suggest that if they are lost to freshwater via runoff or leaching then they may have an appreciable effect on freshwater organisms. Assuming normal landspreading rates our results suggest that the risk of estrogen contamination of freshwater associated with manure spreading is very low.

**Document#:** AGN.AG.GE.5.2

### **TITLE: Human pharmaceuticals in US surface waters: A human health risk assessment**

**Author:** Schwab., B.W., E.P. Hayes, J. M. Fiori, F. J. Mastrocco, N.M. Roden, D. Cragin, R.D. Meyerhoff, V.J. D'Aco, and P.D. Anderson.

**Source:** Regulatory Tox. and Pharm. 2005 42:296-312

**Abstract:** The detection of low levels of pharmaceuticals in rivers and streams, drinking water, and groundwater has raised questions as to whether these levels may affect human health. This report presents human health risk assessments for 26 active pharmaceutical ingredients (APIs) and/or their metabolites, representing 14 different drug classes, for which environmental monitoring data are available for the United States. Acceptable daily intakes (ADIs) are derived using the considerable data that are available for APIs. The resulting ADIs are designed to protect potentially exposed populations, including sensitive sub-populations. The ADIs are then used to estimate predicted no effect concentrations (PNECs) for two sources of potential human exposure: drinking water and fish ingestion. The PNECs are compared to measured environmental concentrations (MECs) from the published literature and to maximum predicted environmental concentrations (PECs) generated using the PhATE model. The PhATE model predictions are made under conservative assumptions of low river flow and no depletion (i.e., no metabolism, no removal during wastewater or drinking water treatment, and no in-stream depletion). Ratios of MECs to PNECs are typically very low and consistent with PEC to PNEC ratios. For all 26 compounds, these low ratios indicate that no appreciable human health risk exists from the presence of trace concentrations of these APIs in surface water and drinking water.

**Document#:** BIN.TP.EF.5.1

### **TITLE: Fate of Triclosan and Evidence for Reductive Dechlorination of Triclocarban in Estuarine Sediments**

**Author:** Miller, T. R., J. Heidler, S. N. Chillrud, A. DeLaquil, J. C. Ritchie, J. N. Mihalic, R. Bopp, and R.U. Halden.

**Source:** Environ. Sci. Tech. 2008 42:4570-4576

**Abstract:** Triclosan and triclocarban are wastewater contaminants whose occurrence and fate in estuarine sediments remain unexplored. We examined contaminant profiles in  $^{137}\text{Cs}/^{7}\text{Be}$ -dated sediment cores taken near wastewater treatment plants in the Chesapeake Bay watershed (CB), Maryland and Jamaica Bay (JB), New York. In JB, biocide occurrences tracked the time course of biocide usage and wastewater treatment strategies employed, first appearing in the 1950s (triclocarban) and 1960s (triclosan), and peaking in the late 1960s and 1970s (24 0.54 and 0.8 0.4 mg/kg dry weight, respectively). In CB, where the time of sediment accumulation was not as well constrained by  $^{137}\text{Cs}$  depth profiles, triclocarban was only measurable in  $^{137}\text{Cs}$ -bearing sediments, peaking at 3.6 0.6 mg/kg midway through the core and exceeding 1 mg/kg in recent deposits. In contrast, triclosan concentrations were low or not detectable in the CB core. Analysis of CB sediment by tandem mass spectrometry produced the first evidence for complete sequential dechlorination of triclocarban to the transformation products dichloro-, monochloro-, and unsubstituted carbanilide, which were detected at maxima of 15.5 1.8, 4.1 2.4, and 0.5 0.1 mg/kg, respectively. Concentrations of all carbanilide congeners combined were correlated with heavy

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metals ( $R^2 > 0.64$ ,  $P < 0.01$ ), thereby identifying wastewater as the principal pathway of contamination. Environmental persistence over the past 40 years was observed for triclosan and triclocarban in JB, and for triclocarban's diphenylurea backbone in CB sediments.

**Document#:** BIN.TP.EF.5.2

### **TITLE: Persistence of Pathogenic Prion Protein during Simulated Wastewater Treatment Processes**

**Author:** Hinckley, G.T., C.J. Johnson, K. H. Jacobson, C. Bartholomay, K. D. McMahon, D. McKenzie, J. M. Aiken, and J.A. Pederson.

**Source:** Environ. Sci. & Tech. 2008. Web release 6/10/08

**Abstract:** Transmissible spongiform encephalopathies (TSEs, prion diseases) are a class of fatal neurodegenerative diseases affecting a variety of mammalian species including humans. A misfolded form of the prion protein (PrPTSE) is the major, if not sole, component of the infectious agent. Prions are highly resistant to degradation and to many disinfection procedures suggesting that, if prions enter wastewater treatment systems through sewers and/or septic systems (e.g., from slaughterhouses, necropsy laboratories, rural meat processors, private game dressing) or through leachate from landfills that have received TSE-contaminated material, prions could survive conventional wastewater treatment. Here, we report the results of experiments examining the partitioning and persistence of PrPTSE during simulated wastewater treatment processes including activated and mesophilic anaerobic sludge digestion. Incubation with activated sludge did not result in significant PrPTSE degradation. PrPTSE and prion infectivity partitioned strongly to activated sludge solids and are expected to enter biosolids treatment processes. A large fraction of PrPTSE survived simulated mesophilic anaerobic sludge digestion. The small reduction in recoverable PrPTSE after 20-d anaerobic sludge digestion appeared attributable to a combination of declining extractability with time and microbial degradation. Our results suggest that if prions were to enter municipal wastewater treatment systems, most would partition to activated sludge solids, survive mesophilic anaerobic digestion, and be present in treated biosolids.

**Document#:** BIN.TP.MI.5.18

### **TITLE: Biotransformation of Estrogens in Nitrifying Activated Sludge Under Aerobic and Alternating Anoxic/Aerobic Conditions**

**Author:** Dytczak, M.A., K.L. Londry, J.A. Oleszkiewicz

**Source:** Water Environ. Res. 2008 80:47-53

**Abstract:** Natural and synthetic estrogens present in municipal wastewater can be biodegraded during treatment, particularly in activated sludge. The objective was to assess the extent of transformation of 17- $\beta$ -estradiol (E2) and 17- $\alpha$ -ethinylestradiol (EE2) by nitrifying activated sludge and evaluate potential relationships between availability of oxygen, nitrification rate, and estrogen removal. For each batch experiment, two reactors were set up-aerobic and alternating anoxic/aerobic-which were then amended with E2 and EE2 from methanolic stock solutions. The EE2 was persistent under anoxic conditions; under aerobic conditions, the observed level of its removal was 22%. The E2 was readily converted to estrone (E1)-faster under aerobic (nitrifying) than anoxic (denitrifying) conditions. During the initial anoxic conditions, a metabolite consistent with 17- $\alpha$ -estradiol transiently accumulated and was subsequently removed when the reactor was aerated. Higher removal rates of estrogens were associated with higher nitrification rates, which supports the contention that the nitrifying biomass was responsible for their removal. Water Environ. Res., 80, 47 (2008).

**KEYWORDS:** estrogens, endocrine disruptors, nitrification, biodegradation, activated sludge.

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