Fate and Transport of Biosolids-Borne Triclocarban

Elizabeth H. Snyder* (UF), George O’Connor (UF), and Drew McAvoy (P&G) • Funded by USEPA • In collaboration with the Procter & Gamble Company

Abstract: Triclocarban (TCC) is an active ingredient in antibacterial bar soap and a common constituent of domestic wastewater (~10 ng L⁻¹). Significant levels of TCC are also expected in biosolids. Behavior and effects of biosolids-borne TCC in the environment have been hypothesized, but not validated. Our research addresses the TCC data gaps by measuring important physico-chemical parameters and characterizing environmental fate. Work addressing potential antimicrobial resistance will begin Summer 2008. Collected data will be used to identify the most important human exposure pathways and perform a quantitative environmental health risk assessment.

Step 2: TCC Concentrations in Biosolids

**METHOD:**
- Extraction method validated using ^14^C-TCC spikes
- 22 biosolids representative of various treatment processes extracted by shake-flask with 50:50 MeOH/acetone; extracts analyzed by HPLC/MS

**RESULTS:**
- TCC concentrations in biosolids from 5-43 mg kg⁻¹, mean concentration ~20 mg kg⁻¹

Step 3: TCC Biodegradation in Amended Soils

**METHOD:**
- Soil amended with ^14^C-TCC spiked biosolids
- 8-month incubation; periodic sample removal (T0-T8) for extraction and combustion
- Evolved ^14^CO₂ collected in KOH
- Extracts analyzed for ^14^C, and by radio thin layer chromatography (RAD-TLC) for metabolite detection

**RESULTS:**
- 2-4% mineralization by T1-T5
- No intermediate compounds identified
- TCC risks assessed from spike experiments

Step 4: TCC Leaching from Amended Soils

**METHOD:**
- 11 biosolids amended to soil columns and periodically leached (5 months)
- Leachates analyzed for TCC by HPLC/MS and limit of quantification (LOQ) calculated

**RESULTS:**
- No samples above LOQ (10 ng mL⁻¹)
- Because adverse effects observed in aquatic organisms below the 10 ng mL⁻¹, samples are being reanalyzed by HPLC/MS (LOQ = 0.03 ng mL⁻¹)

Preliminary Conclusions

- A range of TCC concentrations are present in biosolids, but typical values are 2.5 times lower than initially publicized
- Solubility, K_{ow} and K_{oc}, measurements suggest mobility and bioaccumulation potential less than predictions using estimated values
- TCC is persistent in biosolids-amended soils, but bioavailability and leachability is expected to be limited

Future Work

- Determine TCC bioavailability and toxicity to earthworms in biosolids-amended soils
- Characterize biosolids-borne TCC effects on microbial communities by assessing changes in NH₃, NO₃, and CO₂ production
- Explore antimicrobial resistance development using gene expression microarray technology
- Perform a quantitative environmental health risk assessment for biosolids-borne TCC

*Corresponding author email: lizah@ufl.edu; phone: 352-392-1804 ext. 327