

## **Analysis of Physical and Biological Degradation of PBDEs in Historical Limed Biosolids and THP-AD Treated Biosolids**

**Taylor Motley** (tmotley@umd.edu), Sarah Fischer, Birthe Kjellerup, Natasha Andrade, and Alba Torrents (University of Maryland, College Park, MD, USA)

**Background/Objectives.** Biosolids are rich in recovered nutrients and are often land applied to amend soil. However, biosolids are known to contain persistent organic pollutants, such as the flame retardant polybrominated diphenyl ethers (PBDEs). These chemicals were phased out of production and manufacturing in the U.S. by 2013 but are still ubiquitous in households and buildings. PBDEs are removed during the wastewater treatment process (WWTP) to varying extents and may persist in the environment. In 2014, a Mid-Atlantic region WWTP plant implemented thermal hydrolysis process (THP) and anaerobic digestion (AD) in an effort to produce Class A biosolids. This THP-AD system replaces the production of Class B biosolids by lime stabilization previously produced at this WWTP. Past work has shown that at this WWTP plant, the total concentration of PBDEs was lower in THP-AD treated final biosolids samples than in historic lime-stabilized final biosolids samples. This research further investigates (i) the effect of the THP-AD system on physical and biological degradation of PBDE-contaminated biosolids during the treatment process, and (ii) trends in falling PBDE concentrations in historical biosolids samples that may be associated with the chemical's phase out.

**Approach/Activities.** The anaerobic digestion of sludge was modeled on a laboratory scale using bottled anaerobic mesocosms. Mesocosms were inoculated with either THP-treated or non-THP-treated sludge from the target WWTP plant. Methods including polymerase chain reaction (PCR), gel electrophoresis, and quantitative PCR were used to assess the abundance of anaerobic dehalogenating bacteria *Dehalobacter* and *Dehalogenamonas* during anaerobic treatment, post physical treatment. The concentration of PBDEs in (i) biosolids samples from the mesocosm experiment and (ii) historical Class B limed biosolids samples will be quantified using GC-MS and presented as well.

**Results/Lessons Learned.** Quantitative analysis of sludge from the AD mesocosms revealed growth of the dehalogenating bacteria *Dehalobacter* in digesters fed with both THP-treated and non-THP-treated sludge. Gel electrophoresis results also indicate the presence of *Dehalogenamonas* in both environments. This suggests that ADs fed with both THP and non-THP treated sludge have the potential to support the biodegradation of the halogenated contaminant PBDE. Future work will assess the trend in falling total PBDE concentrations in historical limed biosolids samples from 2008 to 2014. PBDE concentrations will be quantified in limed biosolids sampled from 2011 to 2013, the time period during which PBDEs were phased out of production in the U.S. These results will address the gap in available PBDE concentration data from this NRF in an effort to discern if the chemical phase-out or change in solids treatment is responsible for lower concentrations of PBDEs in Class A biosolids. This work supports the assessment of waste stabilization technologies currently being used to treat biosolids that may enhance debromination of flame retardants.