Distribution and Degradation of Bisphenol A (BPA) substitutes BPAF and BPS Compared to BPA in Aerobic Soil and Anaerobic Sludge

Monday, June 6, 2016

5:30 PM LILLY Hall 2-425

Abstract

One chemical of emerging concern due to its estrogenic disrupting activity is bisphenol A (BPA), which has been widely used a monomer in polycarbonate plastic industry among other things and can enter the environment through effluent discharge and land-application of biosolids. Pressure to ban BPA has led to the production of alternative BPA analogues BPS and BPAF; however, recent research suggests they have similar estrogenic activity as BPA. Little is known about their persistence once they enter the environment or in the wastewater treatment (WWT) process. The present research focused on obtaining the data necessary to predict the environmental fate and transport of these alternatives including quantifying the sorption and partitioning behavior of BPA, BPS and BPAF and their degradation in aerated soil and anaerobic sludge from a WWT systems. Bisphenols are weak acids, thus can exist as an anion or a neutral form in the environment depending on pH. For the neutral form, octanol-water distribution coefficients (K_{ow}) followed: BPAF>BPA>BPS. For sorption on four different soils with varying soil properties, organic matter (OM) was the primary factor controlling sorption with sorption increasing with OM. Soil pH had a secondary role since the neutral species dominated in the soil pH range investigated (pH=4.3-8.6). In aerobic degradation studies with two slightly acidic soils with varying % OM, the half-lives of both BPA and BPS were less than one day in both soils whereas BPAF persisted with half-lives close to a month. In anaerobic sludge under methanogenic conditions, no degradation was observed in a 4-week period with the bisphenols remaining primarily in the sludge solids, thus likely to be present in land-applied biosolids with BPAF perhaps being of greatest concern given its additional slow aerobic degradation once land-applied.