EVALUATION OF SIMPLE POLYETHYLENE PLASTIC STRIPS AS BIOMIMETIC PASSIVE SAMPLING DEVICES FOR ESTIMATING BIOAVAILABILITY OF BROMINATED FLAME RETARDANTS IN SEWAGE SLUDGE INTENDED FOR LAND APPLICATION

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ABSTRACT

About 8 million dry tons of sewage sludge is generated annually in the US. More than half of this is now routinely disposed of via application to agricultural and public lands. Sewage sludges disposed of in this manner are euphemistically known as Biosolids. Though rich in beneficial plant nutrients, biosolids also contain complex mixtures of hazardous organic chemicals, such as the persistent, bioaccumulative and toxic brominated flame retardants (BFRs). When land-applied, biosolid-associated BFRs can accumulate to high levels in soil and biota and compromise ecological and human health. Traditional risk assessments of BFR bioavailability to soil biota are onerous (and expensive) due in part to the need for living organisms. Thus, simpler and more cost effective materials are desired that can mimic biosolid-associated BFR bioaccumulation by ecologically critical soil biota (e.g., earthworms). We evaluated the biomimetic potential of simple polyethylene plastic strips to sample (coincident with live earthworms) the fraction of BFRs available for uptake from soil amended with BFR-contaminated biosolids. BFR accumulation patterns and levels in immersed plastic strips were consistent with those in the amended soil, and BFR accumulation patterns were consistent with earthworm bioaccumulation patterns. Though BFR levels in plastic strips were only about 1% of earthworm tissue levels, our results demonstrate the potential for these devices to mimic real-world BFR bioaccumulation by exposed soil organisms. These devices could be deployed at land application sites to provide more rapid and cost effective estimates of biosolid-associated BFR bioavailability to exposed soil biota.