

Characterizing the sorption of polycyclic aromatic hydrocarbons (PAHs) by petroleum-based plastic versus biodegradable bio-based plastic

This laboratory study investigated the differences in the sorption of three polycyclic aromatic hydrocarbons (PAHs), toxic compounds that are byproducts of combustion, between petroleum-based plastic versus biodegradable bio-based plastic (BBBP). Plastic has become a major pollutant in terrestrial and aquatic environments and may act as a vehicle for transporting PAHs throughout these environments. Aquatic organisms can inadvertently consume plastic, which exposes them to toxic PAHs. Because PAHs are hydrophobic, conventional plastics, which have hydrophobic structures, act as ideal sorption substrates for PAHs in the aquatic environment. Petroleum-based plastics are being replaced by BBBPs; however, little is known regarding the potential of BBBPs to sorb PAHs. In this study, a petroleum-based plastic, (low density polyethylene (LDPE)) and a BBBP, (polylactic acid (PLA)), were exposed to the same concentration of PAHs in water. The PAH equilibrium sorption capacity of each plastic was measured to compare which sorbs more PAHs. The PAH uptake of each plastic over time was measured to characterize the kinetic uptake relationships. LDPE absorbed significantly more of all three PAH compounds than PLA. The results suggest that PLA would transport a smaller concentration of PAHs throughout aquatic environments, hence the replacement of petroleum-based plastics by BBBPs would result in a lesser environmental impact.

Advisor: Carey Friedman