The ability to manage leachate during post closure care (PCC) of a landfill may be increasingly difficult as leachate organic matter (LOM) becomes recalcitrant when a landfill ages, requiring advanced and costly treatment technologies. This research investigated the ability to treat LOM through sunlight driven processes, with a focus on photolysis, to provide insight to landfill operators on the potential of wetlands treatment as a means for reducing long-term risks and costs associated with leachate treatment during PCC.

The study was completed in eight batch tests, where leachate was exposed to natural sunlight in central Florida for a period of 90 days. It was hypothesized that through photolytic reactions, in particular photolysis, high molecular weight recalcitrant LOM would be degraded to labile, low molecular weight material. To identify the treatment mechanisms, transformation processes were measured using ultraviolet-visible (UV-Vis) spectroscopy, fluorescence excitation-emission matrix spectroscopy (EEMs), size exclusion chromatography (SEC), and chemical oxygen demand (COD) from the beginning to the end of the test period. Additionally, the ability for nitrogen species to become bioavailable when exposed to sunlight was evaluated for two of the leachate samples using solid phase extraction (SPE) to fractionate recalcitrant dissolved organic nitrogen (rDON) and bioavailable dissolved organic nitrogen (bDON).

The results suggest that treatment of leachate organic matter through sunlight driven processes is possible. Treatment is highly dependent upon the dilution of leachate, which must be high enough to allow sunlight to penetrate the depth of the liquid. UV-Vis, EEMs, and SEC show that high molecular weight recalcitrant material is undergoing transformation into lower molecular weight material as a result of photolytic and likely biological reactions promoted by sunlight. The ability for nitrogen to become bioavailable when exposed to sunlight was shown to be dependent upon nitrogen concentrations in the sample.

Major: Environmental Engineering

Educational Career:
Bachelor's of Environmental Engineering, BS, 2016, University of Central Florida

Committee in Charge:
Debra Reinhart, Chair, Civil, Environmental, & Construction Engineering
Woo Hyoung Lee, Civil, Environmental, & Construction Engineering
Stephanie Bolyard, Civil, Environmental, & Construction Engineering

Approved for distribution by Debra Reinhart, Committee Chair, on March 18, 2018.

The public is welcome to attend.