The chemical complexity of energy waste streams

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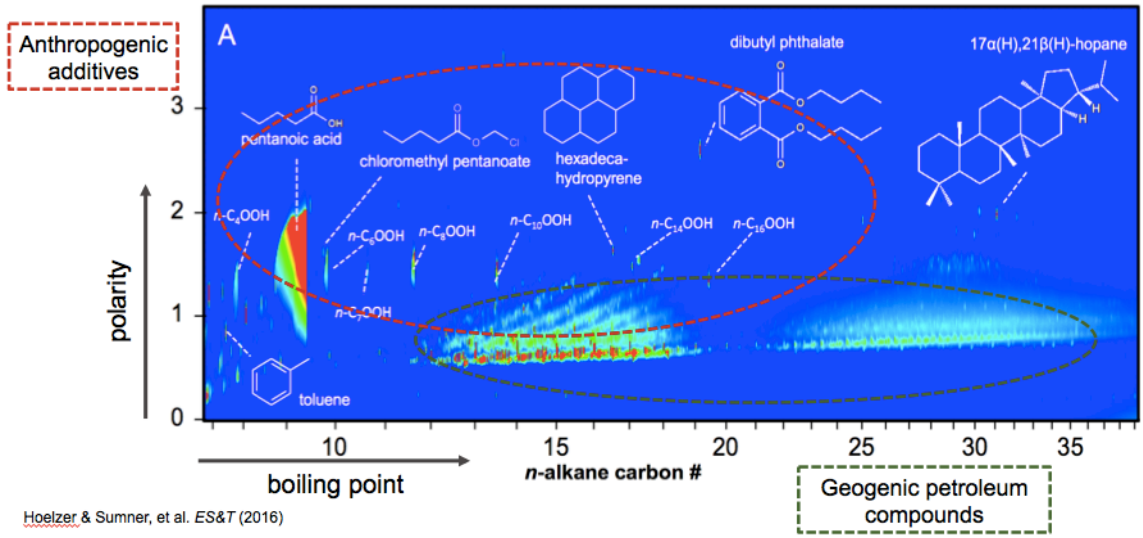

Abstract: Over the past ten years, unconventional oil and gas extraction technologies (e.g., horizontal drilling with hydraulic fracturing (HDHF)) have transformed the US energy landscape and disrupted global energy markets. Simultaneously, there has been a transition away from the utilization of coal power and an expansion of reliance on wind and solar power. Each of these energy sources present unique challenges with respect to the characterization and management of their potential environmental impacts. In this talk, I will detail the chemical composition of the salient waste streams for each of these energy sources and utilize that information to identify improved management practices. For HDHF fluids and oil sands produced fluids, organic chemical composition was evaluated via comprehensive two-dimensional gas chromatography (GCxGC) with time-of-flight mass spectrometry (TOF-MS). Computational methods to predict and avoid the formation of unanticipated transformation products *a priori* and limit the release of volatile materials will be introduced briefly. For coal ash and electronic devices, the complex metal and metalloid composition was evaluated via solid-phase extraction (SPE) with inductively coupled plasma mass spectrometry (ICP-MS), and occasionally complimented with scanning electron microscopy with energy dispersive x-ray spectroscopy (SEM-EDX). Opportunities to recover valuable metals from these waste streams using a novel electrochemical precipitation device will be described. Here, I note that these recovered metals could provide a more environmentally and economically sustainable source of rare earth and specialty metals, ultimately supporting a more secure and stable domestic energy supply.

Bio: Desirée Plata's research seeks to maximize technology's benefit to society while

minimizing environmental impacts in industrially important practices through the use of geochemical tools and chemical mechanistic insights, with a particular focus on energy technologies. Plata earned her doctoral degree in Chemical Oceanography and Environmental Chemistry from the Massachusetts Institute of Technology and the Woods Hole Oceanographic Institution's Joint Program in Oceanography (2009) and her bachelor's degree in Chemistry from Union College in Schenectady, NY (2003). Plata is an NSF CAREER Awardee (2016), an Odebrecht-Brasken Sustainable Innovation Awardee (2015), a National Academy of Engineers Frontiers of Engineering Fellow (2012), a two-time National Academy of Sciences Kavli Frontiers of Science Fellow (2011, 2013), and a Caltech Resnick Sustainability Fellow (2017). Having previously served as John J. Lee Assistant Professor of Chemical and Environmental Engineering at Yale University and Associate Director for Research at the Center for Green Chemistry and Green Engineering at Yale, Plata is now Gilbert W. Winslow Career Development Assistant Professor of Civil and Environmental Engineering at MIT.