Organic chemical contaminants in the aquatic environment: new tools for the characterization and remediation of impacted environments

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Abstract. There are hundreds of thousands of chemicals used around the world to meet global demands for food, energy, and a higher standard of living. Decades of environmental monitoring studies have demonstrated that the fate of many of these chemicals following use and disposal is to the environment. The incredible number of chemicals that may be present in any given water system poses challenges for water quality monitoring and concomitant engineered solutions. In the first part of the presentation, two field projects will be introduced that incorporate monitoring for trace organic chemicals by means of high-resolution mass spectrometry. The first project aims to evaluate the cycling of trace organic chemicals in an urban water system in New York State. The second project aims to improve our understanding of the fate of organic chemical additives used in unconventional shale gas development (hydraulic fracturing, HF). The focus is on developing analytical methods to identify known (and unknown) chemicals used in HF operations and screen for their occurrence in HF produced waters and adjacent ground and surface water resources. In the second part of the presentation, a new polymer will be introduced that has the potential to disrupt the market for engineered adsorbents used to sequester organic chemicals. The polymer rapidly adsorbs a variety of organic chemicals with adsorption rate constants 15-200 times greater than activated carbon and can be regenerated with no loss in performance using a mild washing procedure. The polymer outperformed a leading activated carbon for the instantaneous removal of a complex mixture of organic micropollutants at environmentally relevant concentrations. Recently collected data characterizing the selectivity of the polymer will be presented.

Bio. Damian Helbling did his undergraduate work at The Pennsylvania State University where he received a BS in civil engineering with a minor in environmental engineering. During his years as an undergrad, DH also held a position as a National Science Foundation REU fellow at the Center for Biofilm Engineering in Bozeman, Montana. Following graduation, DH worked for several years as an environmental engineering consultant before turning to graduate school. He received his MS and PhD in civil and environmental engineering from Carnegie Mellon University. His graduate research focused on the use of sensor networks within drinking water distribution systems to monitor and control post-treatment water quality. DH did his postdoctoral work at the Swiss Federal Institute for Aquatic Science and Technology (Eawag) in Dübendorf, Switzerland where he explored the fate and transport of organic chemical contaminants in the environment with a particular focus on biological transformation processes. DH joined the School of Civil and Environmental Engineering at Cornell University as an assistant professor in January 2014. He currently advises one postdoctoral researcher, three PhD students, and one MS student.