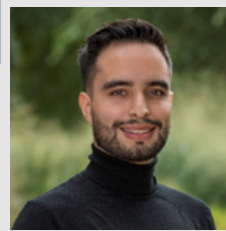


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ENHANCED SORPTION AND DESORPTION OF PFAS VIA SWELLABLE IONOMERS AND ALL-AQUEOUS REGENERATION SOLUTIONS

ABSTRACT

Dr. Seetha Coleman-Kammula and Dr. Jimmy Murillo-Gelvez from the Center for PFAS Solutions, in New Castle Delaware, will present their work on precision detection and research for remediation of Per- and Polyfluoroalkyl Substances (PFAS), a group of chemicals of concern. A broad overview of the organization will be followed by a deeper dive into two patent-pending technologies: a polymeric PFAS absorbent and an all-aqueous desorption solution for spent PFAS media.

Adsorption, via hydrophobic interactions and/or ion exchange, is a cost-effective and widely applied technology for removing PFAS from water. However, some of the most commonly used adsorbents face critical drawbacks: (1) production often requires high temperatures or hazardous chemicals, increasing environmental footprints; (2) most are used once and discarded, but landfilling and incineration are becoming less viable under evolving regulations; (3) regeneration typically involves organic solvents or high temperatures, creating secondary waste streams; and (4) many exhibit limited affinity for short-chain PFAS, leading to rapid breakthrough and more frequent media change. Thus, there is a pressing need for sorbents that capture both short- and long-chain PFAS, are regenerable under mild conditions, and are produced following green chemistry principles. To address these drawbacks/limitations, we have developed a novel class of PFAS adsorbents called ionomers—solid, swellable, and water insoluble polyelectrolytes which are designed to have granular form and consist of amine functional groups distributed along an organic polymer backbone. Batch experiments demonstrate that ionomers adsorb PFAS more rapidly and to a greater extent than granular activated carbon (GAC) and ion exchange (IX) resins. In addition to their high sorption performance, ionomers can be effectively regenerated using an all-aqueous desorption solution composed of salt and biodegradable additives (>97% water by weight). Batch desorption recovered 90–100% of adsorbed PFAS, and small-column studies confirmed that the ionomers could be regenerated and reused without any loss of performance. Ionomers combine rapid, high-capacity PFAS sorption with effective, all-aqueous regeneration, and the spent solution is compatible with PFAS destruction technologies. Together, these features could expand PFAS treatment options while reducing costs and environmental impact.

BIOS

Dr. Seetha Coleman-Kammula, is the President of PFAS Solutions and former Senior Vice President at Basell a Royal Dutch Shell and BASF JV, and global executive at Royal Dutch Shell with experience of managing groups of scientists and technologies. She is a physical organic chemist by training.

Dr. Jimmy Murillo-Gelvez is the Lead Research Engineer at the Center for PFAS Solutions. He obtained his Ph.D. in Civil and Environmental Engineering from the University of Delaware (UD), where he investigated the reductive transformation of energetic (munitions) compounds under enhanced natural attenuation scenarios. As a postdoctoral researcher at UD and Temple University, he studied PFAS degradation via hydrothermal alkaline treatment (HALT) and non-equilibrium plasma. He also utilized computational tools to estimate key physicochemical properties of PFAS, such as K_{OW} and pK_a , to improve fate and transport predictions. At the Center for PFAS Solutions, he leads the development of PFAS adsorbents and regeneration solutions and oversees PFAS treatability testing for water utilities at the bench and pilot scales.

