WASTEWATER TREATMENT RESIDUALS AND NATIVE PER- AND POLYFLUOROALKYL SUBSTANCES

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Per- and polyfluoroalkyl substances (PFAS) are a class of exclusively anthropogenic and environmentally persistent contaminants commonly detected in biosolids. PFAS enter the terrestrial environment via a variety of pathways, including land-application of biosolids. The physiochemical characteristics of wastewater residuals (WWRs) (e.g., biosolids and sewage sludges) are known to affect PFAS release to water; thus, mobility and bioavailability may vary with different wastewater treatment plant (WWTP) processes. The release from WWTP residuals to water can be described using biosolid-water partition coefficients--making development of predictive tools to estimate these coefficients of critical utility to regulatory bodies and informing WWTP design. For twelve WWRs, we measured both partition coefficients (Kds, L/kg) and total incidence of a range of PFAS native to the residuals along with biosolids characteristics including oxalate extractable Fe and Al, organic matter content, dissolved organic carbon, and total protein content. Total detected PFAS concentrations ranged from ~600 to 3500 ng g^{-1}. Simple linear regression analysis yielded significantly associated physiochemical characteristics that varied for each PFAS, indicating that no overarching characteristic controls partitioning behavior. While OM was strongly associated for some PFAS, the association of total protein and both Fe and Al oxides indicates that forces other than hydrophobic partitioning affect many PFAS retention/release behavior in WWRs. Analysis of partitioning trends as a function of number of fluorocarbon units also suggested that while hydrophobicity and relative molecular size of a given PFAS influences retention in WWRs, the relative significance likely varies due to individual PFAS characteristics. Results are expected to be of high interest to academia, government, and industry and to potentially influence WWTP configuration and biosolids disposal practices.

PRESENTER BIO: Caleb Gravesen is a recent Phd graduate from the University of Florida, Department of Soil and Water Sciences. His past research areas include biosolids-borne PFAS and antibiotics work, as well as trace element contaminated soils.