7CE.5

UV Photooxidation Results in Efficient and Accelerated Remediation of PFAS Water Contaminants in Aerosol Microdroplets. RILEY WEATHERHOLT, Kaitlyn Chung, Bailey Bowers, Ryan Sullivan, *Carnegie Mellon University*

Per- and Poly-fluorinated Alkyl Substances (PFAS) are a class of thousands of synthetic compounds characterized by carbon-fluorine bonds, which impart both hydrophobic and hydrophilic properties. PFAS are extremely persistent, ubiquitous, and many are known carcinogens, immunosuppressants, and endocrine disruptors. PFAS therefore pose a great challenge to sustainability and chemical remediation. Photo-oxidative remediation is a promising technology for the degradation of PFAS. The high surface activity of PFAS allows their concentration to be enhanced through aerosolization, placing them in a unique chemical environment that can accelerate degradation kinetics. The oxidation rate of 6:2 fluorotelomer carboxylic acid (FTCA) in the droplet phase and in bulk solution was measured to determine if a rate enhancement was observed in microdroplets. Aqueous 6:2 FTCA droplets and bulk solution were subjected to VUV/UVC light, which also produces gas-phase ozone and hydroxyl radical oxidants in situ. We compared substrate degradation, defluorination, and transformation products between droplets and bulk using both targeted HPLC-QQQ-MS and nontargeted UPLC-Orbitrap-MS. By using wavelengths that split water and molecular oxygen, we observed facile degradation of 6:2 FTCA in droplets and bulk solution without any added reagents. We observed fluoride production and a homologous series of perfluorocarboxylic acid (PFCA) transformation products, indicating perfluoryl chain-shortening of the 6:2 FTCA in addition to removal of the $–CH_2C(O)OH$ head group. Actinometry and radical probe experiments measured the steady-state hydroxyl radical concentration in droplets and bulk to determine when the kinetics are droplet-accelerated. More recent experiments compared the kinetics and products of 254 nm UVB to 193 nm VUV aerosol photodegradation. The Iodide CIMS method we recently developed enabled direct measurements of the degradation kinetics and gas and aerosol-phase products. These results represent an important step toward lower-cost PFAS remediation and mineralization, which can enable water treatment and reuse by removing ultrapersistent micropollutants.

7HR.1

Development of a Flow Imaging Microscopy-based Method for Rapid and High-throughput Measurement of Fiber Count and Length Distributions. BON KI KU, Pramod Kulkarni, *Centers for Disease Control and Prevention, NIOSH*

Measurement of the distribution of airborne fiber length and number count in an air sample is important to assess exposures to asbestos and elongated mineral particles (EMPs) in workplace atmospheres. Exposure to noncommercial EMPs with the potential for asbestos-like health effects is an emerging issue. Phase contrast microscopy (PCM; NIOSH method 7400) is commonly used for assessing inhalation exposure to airborne asbestos or other EMPs; however, the method is labor- and time-intensive, especially for dilute samples. In addition, PCM lacks the capability to accurately count, size, and identify all fibers collected on filters with robust counting statistics. In this study, a flow imaging microscopy (FIM) method was investigated for measurement of number and fiber length distribution. First, monodisperse polystyrene latex count and size standards with microspheres in the diameter range of 2 µm -70 µm were used to examine counting and sizing accuracies of the FIM method, with objective lens magnifications of 4X and 10X for spherical particles. Then, test glass fibers were either i) prepared as a suspension in deionized water from bulk fiber powder or were ii) aerosolized by vortex shaking of glass fiber powder and collected on cascade mesh micro-screens with different pore sizes to obtain fiber samples with different lengths. Sizing accuracy of the FIM for spherical particles was verified in the range 5-70 µm with less than 13 % and 3 % difference for 4X and 10X, respectively. FIM measurement of fiber length distributions with 10X for geometric mean lengths in the range of 14.0 to 20.0 µm was in reasonable agreement with the PCM, resulting in about a 12.4.% difference. The study demonstrates that the high-throughput measurement capability of FIM shows promise for conducting fiber analysis of workplace air samples at significantly reduced time and/or cost and robust counting statistics.