The Bioaccumulation, Toxicity, and Electrical Discharge Plasma-Treatment of the Emerging Perfluorinated Contaminant, GenX

Volety, Uma (School: John T Hoggard High School)
Kinsey, Elizabeth (School: North Carolina School of Science and Mathematics)

GenX is a perfluorinated compound that has been contaminating the Cape Fear River, NC for over 20 years. Environmental contaminants like GenX often accumulate in tissues of aquatic organisms. This project tested the hypotheses that 1) GenX bioaccumulates in tissues of the oyster, Crassostrea virginica, and 2) the levels of bioaccumulation are sufficient to induce toxicity in mammalian cells (non-human). Juvenile oysters were exposed to seawater only, or to seawater with 1, 10, or 100 parts per billion (ppb) GenX for 8 weeks. After 8 weeks, GenX was analyzed in oyster tissues using liquid chromatography-mass spectrometry. The 100 ppb treatment yielded detectable concentrations of GenX, where approximately 2 ppb was found in the oyster tissue. We therefore used GenX concentrations of 1 ppb and 10 ppb, which bracketed the levels that accumulated in tissues, to evaluate its effects on cultured mammalian cells. We examined mitochondrial respiration as an early warning sign of cellular stress using a Seahorse Metabolic Flux Analyzer following 24 hours of exposure to GenX. Mitochondrial respiration was significantly reduced in the 10 ppb dose, suggesting cellular toxicity. Further, we evaluated cell growth and development during 9 days of treatment. Both the 1 ppb and 10 ppb doses led to reduced cell differentiation and cell death. These results support our hypotheses that GenX bioaccumulates in oyster tissues at levels that are toxic to mammalian cells. Finally, GenX in water were exposed to electrical discharge plasma to determine if it can be used to treat GenX contaminated water.

Awards Won:
National Oceanic and Atmospheric Administration - NOAA: Second Award of $500