PFAS Assimilation during Bacterial Biosynthesis

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Background/Objectives. Per- and polyfluoroalkyl substances (PFAS) are anthropogenic chemicals with multiple fluorine atoms attached to an alkyl chain. A major group of PFAS contaminants are perfluoroalkyl carboxylic acids and polyfluoroalkyl carboxylic acids. PFAS, including polyfluoroalkyl carboxylic acids, are widely distributed in the environment, and these chemicals have been linked to birth defects, infertility, increased cholesterol, and cancer. PFAS are recalcitrant and our understanding of microbial transformation and attenuation of PFAS is very limited. The soil bacterium Pseudomonas sp. strain 273 utilizes terminally fluorinated C7−C10 alkanes as sole carbon and energy sources under oxic conditions. During fluoroalkane utilization, inorganic fluoride is released and concomitantly organofluorine catabolites are directed towards biosynthesis and incorporated into phospholipids resulting in a fluorinated lipid bilayer. The lipid bilayer in strain 273 is a novel sink for organofluorine. In order to explore cometabolism of PFAS and fluorinated alkanes and the extent of organofluorine that can be covalently incorporated into strain 273, various bacterial conditions were cultured.

Approach/Activities. The unusual fluoroalkane degradation and organofluorine lipid incorporation suggest an expanded capacity of strain 273 to assimilate components of organofluorines into microbial biomass. To explore the ability of strain 273 to assimilate PFAS, strain 273 was cultured in a defined mineral salt medium with acetate and 8:3 fluorotelomer carboxylic acid (8:3 FTCA). Growth assays were performed to determine strain 273 viability with and without the presence of PFAS. Biomass from each culture was collected and lipids were extracted and used for untargeted mass spectrometry. Predicted mass libraries including potential 8:3 FTCA incorporation into fatty acid tails were used to annotate and integrate peak abundances for the strain 273 lipidome.

Results/Lessons Learned. *Pseudomonas* sp. strain 273 grew to OD values of 0.5 or higher with acetate in medium with and without 8:3 FTCA. Furthermore, various PFAS species and microorganisms were tested to understand the capacity of PFAS incorporation into microbial cells. Lipids with PFAS incorporated tails were found in two lipid classes and several lipid species. These results suggest that at least some polyfluoroalkyl carboxylic acids can be attenuated by bacteria.