

Creating and Testing New Polymers to Remove the Environmental Toxin PFOA from Water

Lipton, Andrew (School: Lafayette Jefferson High School)

Perfluorooctanoic acid (PFOA) is a cancer-causing, environmental toxin that is found in the bloodstream of 98% of the U.S. population. I wanted to figure out how to remove PFOA from water using polymers that I designed and prepared. For my experiment, I made polymers that were complementary to PFOA, either fluorinated or cationic, or a combination of both. For my synthesis experiments, I investigated the ratios of fluorinated and cationic groups in my polymers as my experimental variable. I then evaluated how well each of my polymers was able to remove PFOA (10 microM, controlled variable) from water using flow through columns. The percentage of PFOA left in solution was then determined using UPLC-MS (Ultra Performance Liquid Chromatography-Mass Spectrometry). I was able to determine that polymers formed in my five reactions by physical changes between monomers and polymers, gel permeation chromatography molecular weight determinations, and infrared spectroscopy. Polymers were formed in good yields from the reactions with all monomer combinations. The fully cationic and 1:1 F:C polymers formed gels in water and so couldn't be tested with PFOA. I found that the fully fluorinated polymer removed 63% of PFOA in the first run, and rerunning this solution a second time removed a total of 85% of the PFOA from water. Similarly, the mixed F:C polymers removed more PFOA in the second run, with both removing 98%. All of the polymers that I was able to test were able to remove a significant amount of PFOA from water, which supports my starting hypothesis. In the future, I want to test new cation monomers to try and prevent the gelation of my polymers, and try out new variables in my experiments, like increasing the column length and contact time with the polymers.

Awards Won:

Fourth Award of \$500

American Chemical Society: Certificate of Honorable Mention