

Removal of PFAS from Drinking Water

Alec Krumm¹, Jake Greene¹, Shu Yu Hsu², Chung Ho Lin², Maria Fidalgo¹

University of Missouri- Civil and Environmental Engineering
University of Missouri- School of Natural Resources



Maria Fidalgo I fidalgom@missouri.edu I 573-884-6777

What are PFAS?

- Perfluoroalkyl substances are chemicals containing strong bonds
- PFAS do not break down naturally
- PFAS can cause cancer and liver damage
- Used in fire and water retardant materials
- Rising presence in bodies of water over the last 50 years
- No current simple and economical way to remove PFAS from water
- Perfluorooctanoic acid (PFOA) as a model compound for PFAS:

(c_{in}=600 ng/L



Analytical Method for PFOA



PFOA (600 ng/L)



Heterogeneous Photo Fenton Reactions

 $= Fe(III)-OH + H_2O_2 \rightarrow = Fe(III)-OH-H_2O_2$

 $= Fe(III)-OH-H_2O_2 \rightarrow = Fe(II) + H_2O + HO_2$

 $= Fe(II) + H_2O_2 \rightarrow = Fe(III)-OH + OH$

=Fe(III)-OH + HO₂ / O²⁻ \rightarrow =Fe(II) + H₂O / OH⁻ + O₂

- Neutral pH ; Catalyst is reused and can be fixed
- Requires UV light (365 nm)

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- Challenge: high reactive, short lived OH*
- Iron oxide: sintered at 400C to convert to hematite

Future Research

Results

- PFOA (isotope labeled) determined by Waters Acquity-H Ultra-HPLC system coupled with Waters Xevo TQ-XS triple quadrupole mass spectrometer (UPLC-MS/MS).
- The analytes were separated by a Waters CORTECS UPLC C18 (100 mm x 2.1 mm; 1.6 µm particle size) reversephase column. Mobile phase consisted of 100% acetonitrile (A) and 0.01% formic acid and in MilliQ water.

% of initial PFOA concentration as a function of time. UV trials: PFOA (600 ng/L) exposed to UV light. H₂O₂ trials: H₂O₂ (100 mmol/L) + PFOA (600 ng/L)



% of initial PFOA concentration as a function of time. Fe + H_2O_2 trials: iron oxide (1 g/L) + PFOA (600 ng/L) + H_2O_2 (100 mmol/L). Full batch trials introduce UV light exposure to Fe + H_2O_2 trials.

This work was supported by US EPA grant # 84040301, "Hybrid Filtration/AOP Membrane Process for Point of use PFAS Removal From Drinking Water", People, Prosperity and the Planet (P3) Student Design Competition.

- Determine efficiency of reaction under different conditions of H_2O_2 conc.
- Fabricate supported catalyst
- Continuous reaction mode







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