NASF/AESF Foundation Research Reports

Project R-120 (Q3)

Electrochemical Destruction of Perfluorooctanesulfonate in Electroplating Wastewaters

Third Quarterly Report
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AESF Research Project #R-120

by
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Summary

Our labs are now at 100% capacity, laboratory work this quarter was focused on the development of a tubular reactor to test PFAS oxidation. Work was also conducted by PI Chaplin to review the literature related to electrochemical PFAS oxidation, and a review manuscript was published in *Environmental Science and Technology* **(attached). A new PhD student has been assigned to this project and we are conducting experiments once again for PFAS oxidation.

Tubular Reactor Setup

A schematic of the tubular reactor is shown in Figure 1. It is comprised of a tubular Ti_4O_7 reactive electrochemical membrane (REM) and a centrally located stainless steel rod. The reactor was initially tested for PFOA oxidation in a 100% recycle mode (recycle of both feed and permeate) in a 240 mM $NaClO_4$ background electrolyte. The $NaClO_4$ background electrolyte was chosen as a non-electroactive electrolyte that could mimic the solution conductivity of electroplating wastewater. The results are shown in Figure 2 and indicate >95% removal was achieved over the 9-hour experiment. The data fit a second-order model, with a R^2 value of 0.98. Further work is underway to investigate PFAS oxidation in synthetic wastewater samples.

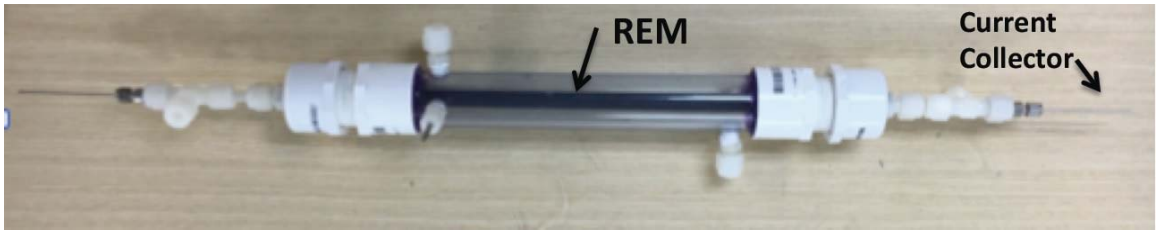

Figure 1 - Photo of tubular REM reactor module

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** J. Radjenovic, N. Duinslaeger, S.S. Avval and B.P. Chaplin, "Facing the Challenge of Poly- and Perfluoroalkyl Substances in Water: Is Electrochemical Oxidation the Answer?," *Env. Sci. & Technol.*, 54 (23), 14815-14829 (2020). Abstract, access and supporting information: https://pubs.acs.org/doi/pdf/10.1021/acs.est.0c06212.

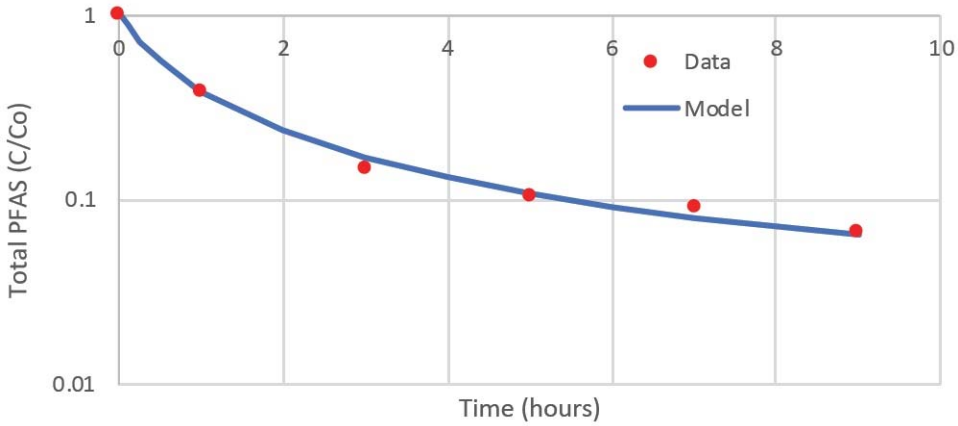

Figure 2 - Total PFAS oxidation in 100% recycle experiment.

About the author

Dr. Brian P. Chaplin is Associate Professor in the Department of Chemical Engineering, at the University of Illinois at Chicago. He holds a B. Civil Engineering (1999) and an M.S. (2003) in Civil Engineering from the University of Minnesota and a Ph.D. in Environmental Engineering (2007) from the University of Illinois at Urbana-Champaign.