

Background

Hexafluoropropylene oxide-dimer acid (GenX) was introduced as an alternative for long-chain per- and polyfluoroalkyl substances (PFAS), resulting in a growing prevalence in the environment. Past methods that used LC-MS/MS to detect GenX have encountered difficulty achieving the level of sensitivity needed to detect GenX due to baseline contamination. This research aims to develop a treatment of blanks prior to analysis which potentially can improve further research into GenX contamination detection.

Methods

Degradation of GenX in DI water was optimized by evaluating the following parameters with subsequent solid phase extraction (SPE) to quantify final GenX concentrations

- MDL: 5.99 ppt

Experimental Parameters: UV (λ 254nm), sonication (400W), sodium sulfite (Na_2SO_3), stir stick

Instruments used: Rayonet Photochemical Reactor 200; Agilent 1290 Infinity II Triple 114 Quad LC-MS (Drying Gas Temp: 150 C; Sheath Gas Temp: 400 C)

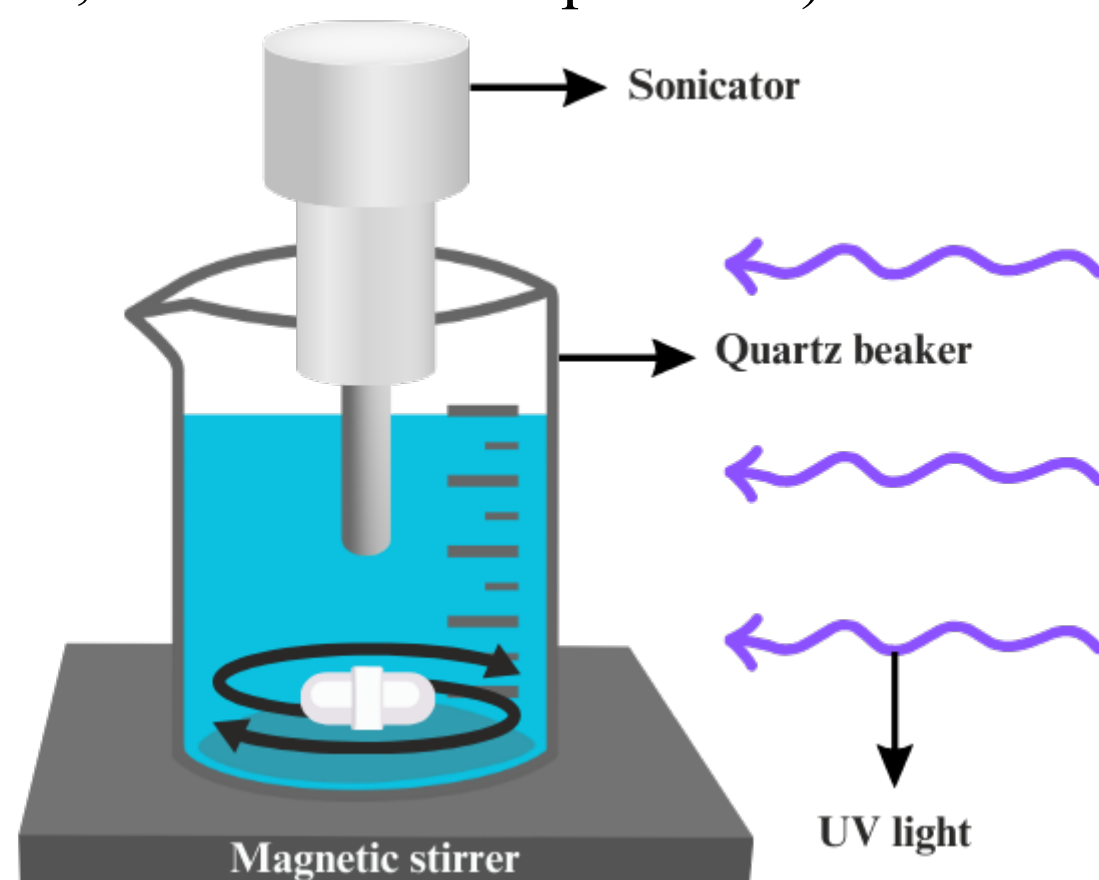


Figure 1. Simple schematic of experiment set-up inside the photochemical reactor

Results

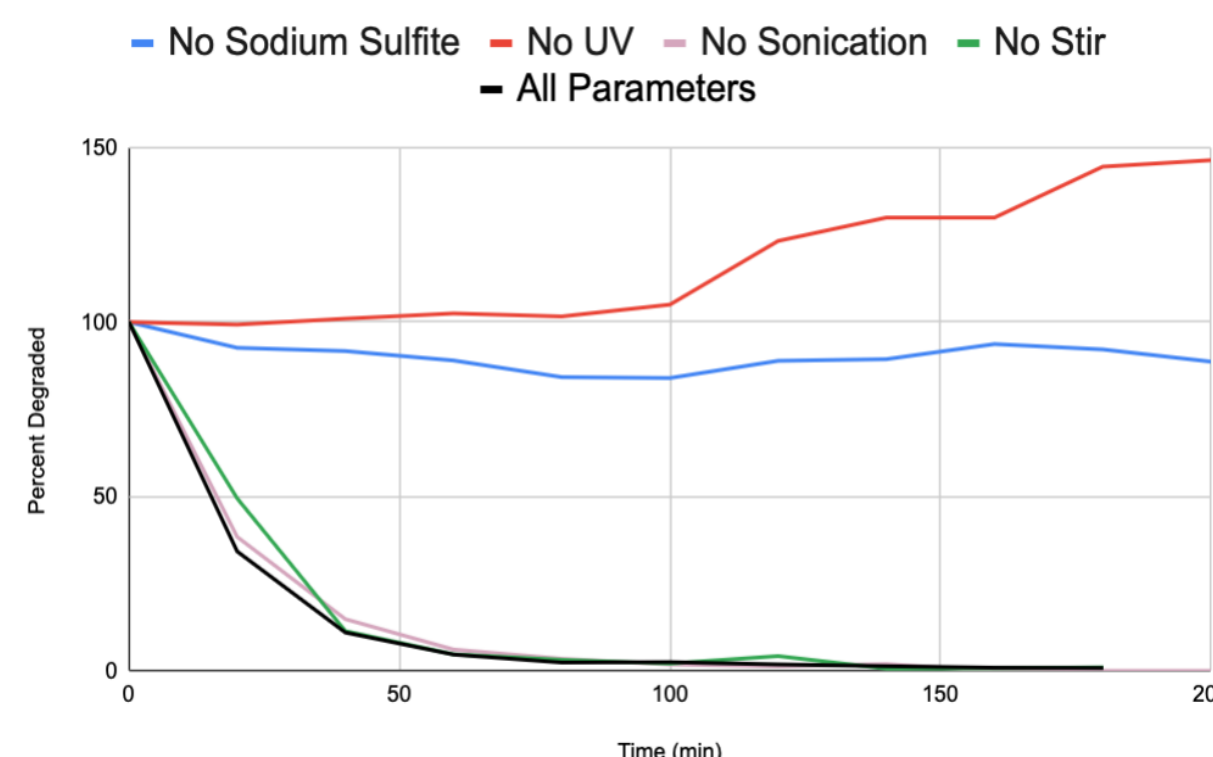


Figure 2. Degradation of GenX over 200 minutes for all 5 trials

Table 1. Final GenX concentration

Sample	Concentration (ppt)
No Na_2SO_3	750.52
No UV	252.87
No Sonication	0.65
No Stir Stick	2.65
All Parameters	9.49

Table 2. Other PFAS compounds detected in All Parameters experiment and the percent decrease in response

PFAS	Percent Decrease
4,8-Dioxa-3H-perfluorononanoic acid	48.0%
6:2 Fluorotelomer sulfonic acid	94.8%
Perfluoro-2-methyl-3-oxahexanoic acid	96.6%
Perfluorodecanoic acid	72.7%
Perfluorododecanoic acid	85.5%
Perfluoro-n-butanoic acid	98.3%
Perfluorooctanoic acid	67.3%
Perfluorotetradecanoic acid	66.1%
Perfluorotridecanoic acid	81.1%
Perfluoroundecanoic acid	81.4%

Discussion & Conclusions

- The interaction between sodium sulfite and UV is crucial for degradation of GenX
- All parameters was the most effective method with a decrease of 98% of GenX
- The rate of reaction was faster for all parameters compared to the no sonication method
- Background levels of GenX in DI water were found to be 60 ppt and treatment shows ability to decrease concentration to below 10 ppt
- The most effective method (All parameters) demonstrates promising evidence for destruction of other common PFAS compounds present as baseline contaminants in DI water

Future Work

- Time-of-flight (TOF) LC-MS to screen degradation pathways and fluorine recovery percentages
- Ion exchange resin to treat GenX contaminated water. The waste product from this process can then undergo photocatalytic degradation

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