

University of Louisville  
Department of Chemistry

## Rojita Panta Literature Seminar

When: October 6, 2022

Time: 2:30 p.m.

Location: CBL-16

# Fenton chemistry for microplastic degradation

### Abstract:

Plastic particles with sizes of 5 mm or less are considered as microplastics (MPs). MPs are ubiquitous with adverse effects on all living creatures. In order to minimize its effects, various methods have been developed for the degradation of MPs. Recently, advanced oxidation processes (AOP) using Fenton chemistry to generate hydroxyl radicals ( $\cdot\text{OH}$ ) radicals have been reported. This seminar will review various methods using Fenton chemistry to produce  $\cdot\text{OH}$  and its effectiveness for the degradation of MPs. Hu and coworkers applied hydrothermal coupled Fenton system for the degradation of ultra-high molecular weight polyethylene microplastics with 95.9% weight loss in 16 h with 75.6% efficiency. This method was also applicable for the degradation of MPs from real water bodies.<sup>1</sup> Miao and coworkers performed the electrocatalytic Fenton degradation of polyvinyl chloride microplastics via cathodic reduction dechlorination and  $\cdot\text{OH}$  radical oxidation simultaneously with 75% dechlorination efficiency achieved at  $-0.7$  V versus Ag/AgCl over 6 h.<sup>2</sup> Nabi and coworkers used photocatalytic degradation for the decomposition of polystyrene and polyethylene microplastics using three types of fabricated  $\text{TiO}_2$  nanoparticle catalysts including water-based, ethanol-based, and triton-x-100 based. Triton-x-100 based  $\text{TiO}_2$  nanoparticle showed almost complete mineralization of 400-nm polystyrene in 12 h producing the  $\text{CO}_2$  as the final product.<sup>3</sup> Together, with all these approaches, various MPs degradation can be converted for the useful products such as  $\text{CO}_2$ , carboxylic acids, esters etc. However, it needs an acidic pH, large amount of  $\text{H}_2\text{O}_2$  and high temperature. So, in near future, we could develop a new approach which can decompose MPs in broader pH range, low concentration of oxidants and in benign temperature.

### References:

1. Hu, K.; Zhou, Y.Y.; Hall, T.; Nie G.; Yao, Y.; Duan, X. Degradation of Microplastics by a Thermal Fenton Reaction. *ACS EST Engg.* **2022**, 2, 110-120.
2. Miao, F.; Liu, Y.; Gao, M.; Yu, X.; Xiao, P.; Wang, M. Degradation of Polyvinyl Chloride Microplastics Via an Electro-Fenton-Like System with a  $\text{TiO}_2$ / graphite Cathode. *J. Hazard. Mater.* **2020**, 399, 1-9.
3. Nabi, I.; Bacha, A-U-R.; Li, K.; Cheng, H.; Wang, T.; Liu, Y.; Ajmal, S.; Yang, Y.; Feng, Y.; Zhang, L. Complete Photocatalytic Mineralization of Microplastic on  $\text{TiO}_2$  Nanoparticle Film. *iScience.* **2020**, 23, 101326.