PURDUE UNIVERSITY | Environmental and Ecological Engineering

EEE Research Seminar

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The importance of assessing abiotic and biotic degradation to inform sustainable polymer design

Abstract

Polymers are one of the most used materials in our modern society. However, the currently employed polymer environmental degradation testing standards are slow and provide limited information to inform material design. Furthermore, most of the employed international polymer degradation standards address biotic degradation (i.e., biodegradation) and disregard abiotic degradation (i.e., photodegradation, mechanical degradation and hydrolysis). In this work, we show that assessing for both abiotic (i.e., photodegradation and hydrolysis) and biotic degradation provides a much more representative and quantitative understanding of polymer fate in the environment. In addition, we show that dissolved organic carbon derived due polymers abiotic degradation is bioavailable for microbial utilization. This work was conducted on a suite of commercial and new lab-synthesized polymers to get an understanding of how controlling chemical composition influences material fate to inform design principles. Finally, this work shows the need to improve our polymers degradation testing methods to meet our material sustainability goals.

Bio

Omar Tantawi is a PhD candidate in the Plata Lab in the Department of Civil and Environmental Engineering at MIT. His work focuses on developing and applying novel methods to assess novel plastic material degradation, ultimately with the goal of informing sustainable design. As a Fulbright fellow, Omar completed his Master of Science in Environmental and Ecological Engineering at Purdue University under the supervision of Prof. Inez Hua in 2020. At Purdue, Omar worked on understanding and quantifying the temporal variation of smartphones metal content. He obtained his Bachelor of Science in Chemistry from the American University of Beirut on a USAID scholarship in 2017. When not working, Omar enjoys hanging out with friends and cooking.