Programming the Properties and Degradation of Sustainable Polymers

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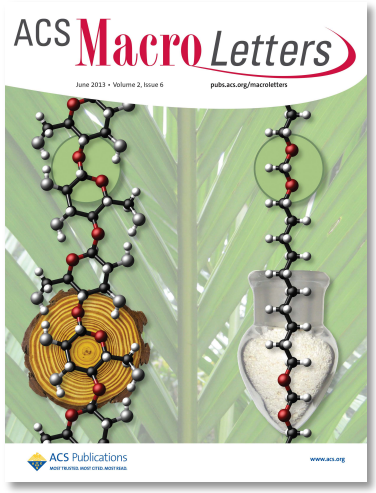
Worldwide efforts have increased greatly to identify polymeric building blocks that are not derived from fossil fuels and to employ these monomers to create polymers that readily degrade in natural environments. We have developed new methods for synthesizing linear thermoplastic polymers from a variety of biogenic feedstocks, including sugars, triglycerides, lignin, and C1 feedstocks obtained from trees.

This presentation will introduce synthetic routes for incorporating the acetal functional group into the main-chain of linear polymers. Polyacetals offer more universal degradation behaviors as they can degrade in various marine environments and under abiotic conditions. Novel methodologies will be described for preparing renewable polyesters, polycarbonates, and polyoxalates with prescribed thermal properties and degradation pathways. A strategy for creating polyesters from C1 feedstocks formaldehyde and carbon monoxide will be presented. Additionally, this presentation will describe our efforts to employ vanillin, ferulic acid, and other bio-based aromatics for the synthesis of thermally robust polymers. These various novel thermoplastics will be discussed in the context of replacing specific fossil fuel-based plastics.



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(1) Martin, R. T.; Camargo, L. P.; Miller, S. A. “Marine-Degradable Polylactic Acid” *Green Chem.* **2014**, *16*, 1768–1773. http://dx.doi.org/10.1039/C3GC42604A

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