Adina Anghelescu-Hakala, J Environ Anal Toxicol 2018, Volume 8
DOI: 10.4172/2161-0525-C4-019

9th World Convention on

Recycling and Waste Management

October 22-23, 2018 Osaka, Japan

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Current developments in closing the recycling loop of PLA

Statement of the Problem: Biodegradable polymers are potential solutions to the environmental problems generated by plastic waste. Every year, 8 million tons of new plastics are dumped into oceans. With growing market volumes of innovative bio-based and biodegradable plastics such as Poly(Lactic Acid (PLA), the recycling of these materials is becoming a more viable option. PLA has attracted particular attention as a substitute for conventional petroleum-based plastics. To increase sustainability and management of plastic waste, new methods to close the recycling loop of PLA are needed. Recycling approaches have limitations in that materials can only undergo a finite number of processing cycles before their properties are deteriorated. Production of PLA from recycled components allows substantial energy savings compared to using virgin raw materials.

Methodology: PLA depolymerization by hydrolysis leads to production of high quality LA which can be used to reproduce PLA polymers. This avoids the expensive and complex process of glucose fermentation, which is used to obtain virgin Lactic Acid (LA). In this work, combined chemical and biochemical methods for PLA depolymerization to high value and quality components are developed. The hydrolyzed PLA products were characterized by: (1) GC/MS: Evaluation of monomeric and oligomeric content; (2) Chiral GC: Evaluation of D and L-LA enantiomers content; and (3) SEC: Calculation of molecular weight and molecular weights distribution.

Findings: The PLA hydrolysis proceeds with higher rates in alkaline conditions with formation of LA monomer without changes in the original composition of D, L isomers. Acidic hydrolysis of PLA produces a mixture of monomeric and oligomeric forms and their composition depends on the reaction conditions.

Conclusion: By alkaline hydrolysis of PLA, LA monomer can be produced and repolymerized after conversion in acid form. By hydrolysis of PLA in acidic conditions, oligomeric precursors suitable for further biochemical/enzymatic depolymerization can be produced.

References

1. Avérous L (2008) Polylactic acid: Synthesis, properties and applications, Oxford, UK: Elsevier.
2. Singh N (2016) Recycling of plastic waste: a state of art review and future application. Composites; B115: 409-422.
3. Jambeck J R, Geyer R, Wilcox C, Siegler T R, Perryman M, Andrady A, Narayan R, Law K L (2015) Plastic waste inputs from land into the ocean. Science; 347: 768-771.
4. Rahimi A, García J M (2017) Chemical recycling of waste plastics for new materials production. Nature Reviews Chemistry; 1: 1-11.

Biography

Adina Anghelescu-Hakala is a Senior Research Scientist at VTT Technical Research Centre of Finland and has a 26-year extensive expertise in polymer chemistry. She has obtained her PhD in Polymer Chemistry in 2001 from Technical University “Gheorghe Asachi” Iasi, Romania. After completing PhD, she worked as a Post-doctoral Researcher at University of Helsinki, Laboratory of Polymer Chemistry and as a Principal Scientist at “Petru Poni” Institute of Macromolecular Chemistry, Bioactive and Biocompatible Polymers Department, Iasi, Romania. She has received Ecoinvent Award in 2003, Iasi, Romania. She has 53 peer-reviewed publications (28 in journal articles and 25 in conference proceedings), 10 patents, 2 patent applications and 12 invention disclosures. Her main competence areas are natural and synthetic polymers for ecological applications including treatment of waste water and water treatment chemicals, natural and synthetic polymers for biomedical applications, stimuli-responsive nanomaterials, controlled radical polymerization techniques and chemical modification of biopolymers.

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