

Abstract

Enhanced Biodegradation of Polyethylene Terephthalate (PET) via Microwave-Assisted Green Bio-Based Deep Eutectic Solvent Pre-Treatment Technique [†]

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Abstract: Most plastic degradation methods are currently inefficient and are limited by processing difficulties, quality loss, and diminished value. This research focuses on the development of novel mechano-chemical disintegration processes for the breakdown of waste plastics. The outputs will be biocatalyzed and used as building blocks for new polymers or other bioproducts. For the purpose of this research, microwave pre-treatment technology was used. Microwave technology is an ideal pre-treatment process for the degradation of plastics due to its lower treatment times under lower energy inputs. In the previous work, extensive research has been carried out utilizing different solvents and catalysts to develop efficient degradation mechanisms under microwave irradiations. A new class of ionic liquids (deep eutectic solvents) were used as catalysts to make a suspension with poly(ethylene terephthalate) (PET) and develop an alcoholysis reaction. Certain degradation parameters like crystallinity index, weight loss, and carbonyl index were depicted using differential scanning calorimetry (DSC), thermogravimetric analysis (TGA), and Fourier-transform infrared spectroscopy (FTIR) characterization techniques. Furthermore, enhanced enzymatic degradation using LCC variant ICCG proved that microwave technology is an efficient process for the alcoholysis reaction and degradation of PET under mild conditions into its monomers.

Keywords: poly(ethylene terephthalate); chemical recycling; enzymatic degradation; alcoholysis; deep eutectic solvents; sustainability



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