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Sustainable synthesis & purification of linear & branched poly (lactic acid)

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The ring-opening polymerization (ROP) of bio-based D,L-lactide (DLLA) using a range of renewable polyol co-initiators is an essential route to tailoring the properties of poly (lactic acid) (PLA). ROP is normally conducted in the melt at high temperatures (≥ 140 ^{0}C) with the need for harsh post-reaction treatment to remove toxic catalysts and residual monomer. Using supercritical carbon dioxide (scCO2) we have shown significant reduction in reaction temperatures allowing us to investigate the use of temperature sensitive biobased co-initiators. Furthermore through the use of scCO2 extraction, we can efficiently remove residual monomer & metal-catalysts, leaving a pure product. The impact of structure on the biodegradability of these low molecular weight products strongly influences their ability to act as a dispersants. Our data shows that modifying the co-initiator and varying the PLA chain length are key to influencing the product properties. Our results could increase the potential of PLA as a renewable and biodegradable replacement for petrochemical derived polymers, whilst also widening its commercial application as a green dispersant. We believe our new "green" approaches to the production and purification of PLA are significant steps towards the development and application of the next generation of biopolymers, taking into account not only the choice of raw material but also the sustainability of processes and techniques used in synthesis.

Biography

Amy Goddard is currently in the final year of her PhD at the University of Nottingham, UK, supervised by Steve Howdle and Derek Irvine. Her project forms part of the REFINE network working towards developing new sustainable materials for the polymer industry, funded by the European Commission. She is a member of the Process Innovation Team at Croda Ltd, a world leading specialty chemical company, and is an associate member of the Royal Society of Chemistry. She has presented her work at international conferences including the Gordon Green Chemistry Conference in Hong Kong & Ecochem in Switzerland.

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