Sustainable Functional Circular Polyesters from Biomass

Dr Thomas J Farmer (thomas.farmer@york.ac.uk), Green Chemistry Centre of Excellence, University of York, Heslington, York YO10 5DD, UK

Polymers arguably represent the most important family of products from the chemical industry, finding use as plastics, biomedical applications, coatings, adhesives, composites and components in consumer and agriculture liquid formulations to name but a few. As we move towards development of more sustainable polymers there is need to source the relevant monomers from renewable resources, ideally from waste biomass. Key to this conversion of biomass through to polymers are a set of bio-based small building-block chemicals, so called Platform Molecules. Indeed, a recent study by the Lignocellulosic Biorefinery Network (LBNet) proposed a list of the 10 most promising platform molecules for the UK (http://ukbiochem10.co.uk/), and these are seen as fundamental to delivering the 2018-2030 UK Bioeconomy Strategy. Similar initiatives have taken place across Europe. The elemental composition difference between conventional fossil resources vs biomass means that Platform Molecules, and the resultant sustainable monomers, will most likely contain significantly higher oxygen content relative to their petrochemical predecessors. This brings both challenges and opportunities for future sustainable polymers as either the oxygen must be removed, or new chemistry, new properties and new polymers embraced. Diacids, diols and lactones are readily accessible from Platform Molecules and so it follows that polyesters are a logical major target, bringing with them potentially improved end-of-life options and enhanced circularity. Both drop-in and new monomers are currently under extensive investigation, the latter often leading to interesting new properties and performance. The talk summarises the points above and gives examples of work in the Green Chemistry Centre of Excellence, York, and our ongoing BBI-JU CHAMPION project, leading to sustainable circular polyesters of the future.