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Beets to Biopolymers - Characterization of partially bio-based polyamides with elevated glass transition temperatures from rigid galactaric acid derivatives

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The focus of this research is the synthesis of amorphous polyamides from bio-based, cyclic monomers. Bio-based monomers are obtained from sugar beet pulp, as a side product in food industry. They are widely available and are gaining interest of researchers and industry through the last couple of decades. Their major disadvantage, which limits their wide spread utility, is the presence of different functional groups, which cause that those molecules are very often prone to degradation at elevated temperatures. On the other hand, their unique, rigid, cyclic structure contributes to better thermal properties of the product leading to more specialized applications for those polymers. Nonetheless, their incorporation into polyamides structure is challenging, mostly because of the elevated temperatures during the synthesis. A comparative study was prepared investigating the synthesis of polyamides using bio-based building blocks, namely 2,3;4,5-(di-O-methylene)galactarate (GalXH) and 2,3;4,5-(di-O-isopropylidene)galactarate (GalXMe). Two different approaches towards the synthesis of biobased polyamides were tested: polycondensation in melt and polycondensation in solution via phosphorylation technique. The GalX monomers were combined with aliphatic, cycloaliphatic and aromatic diamines, resulting in amorphous polyamides with glass transition temperatures ranging from 50°C – 220°C. The obtained polyamides are stable at elevated temperatures above 300 °C. The polymerization of the GalXMe derivative results in polymer with narrow dispersities whereas GalXH gives polyamides with broad dispersities.

Biography

A main area of interest is the synthesis and characterization of biobased polyamides. In the past Aleksandra was working on the synthesis and modification of functionalized polyolefins at Sabic. Currently, Aleksandra became a PhD candidate in the newly formed group supervised by prof. Stefaan De Wildeman and dr. Katrien Bernaerts. Under their leadership she is synthesizing engineering plastics from biobased monomers. In this project, Maastricht University is part of the larger consortium “Beets to Biopolymers” with representatives of Cosun (NL), Philips (NL), Astron (NL) and Groningen University (NL). Together they aim at broadening the usage of biobased polymers in specialty applications. The effort made by the group from Maastricht University resulted in a couple of manuscripts which soon will be submitted to scientific journals.

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