

Monoterpenes are secondary metabolites occurring in plants, microbes, or fungi. They are available in Europe – and even Germany – in comparably high volumes from industrial side streams, predominately from pulp & paper or fiberboard production. From a chemist's perspective, they are a suitable substitute for petrochemical resources in the world of polymers. The monoterpene (+)-3-carene has been investigated for several years as a precursor for novel bio-based lactams and polyamides. These polyamides, namely Caramid-R and Caramid-S, stand as examples for bio-based polymers that can compete with their fossil-based counterparts. The polyamides are fully bio-based, have a high-performance glass transition temperature (T_g) of over 110 °C, and a decreased moisture uptake compared to PA6. Whereas Caramid-S is semi-crystalline and melts at a temperature as high as 280 °C, Caramid-R is amorphous and transparent. The synthesis of the corresponding monomers 3S-caranlactam and 3R-caranlactam aims to follow the principles of green chemistry and has been scaled by an external subcontractor to the kilogram scale, validating the feasibility of the synthesis. Hydrolytic polymerization and anionic ring-opening polymerization for cast polyamides are investigated, including co-polyamides with commercial lactams. The polyamides are suited for processing by hot pressing, extrusion, and melt spinning, and the whole value chain has been investigated in terms of an initial ecological evaluation. In addition, Caramide foams have been produced by bead foaming that possess excellent foamability and density control – a challenge requiring great effort for classic polyamides. The current results of the Caramide development are presented, including an overview of the properties of fibers, foams and cast polyamides of various Caramide types – the first monoterpene-based polyamides that have been produced, processed (fibers, foams, cast) and investigated in pre-industrial scale and environment.