Novel bio-based materials are urgently needed to replace the unsustainable petroleum-based polymers. One attractive compound for novel polymeric materials is isosorbide (Scheme 1). It is readily derived either directly from glucose or from other lignocellulosic biomass and is very interesting due to its rigidity, chirality, relative stability, and nontoxicity.

The objective of our work was to prepare novel isosorbide-based methacrylates, that can be efficiently polymerized. A highly regioselective and upscalable biocatalytic approach to obtain variously substituted isosorbide methacrylate monomers was first developed (Scheme 1).

Scheme 1: Biocatalytic synthesis and radical polymerization of isosorbide-based monomethacrylates.

Following radical polymerization of these monomethacrylates afforded film-forming isosorbide-poly(methacrylates) with high glass transition temperatures (up to $T_g = 150 \, ^\circ\text{C}$) and high thermal decomposition temperatures ($T_d = 190$-$290 \, ^\circ\text{C}$).

Herein we present a high yielding, highly regioselective, and easily upscalable biocatalytic strategy for the isosorbide-based methacrylates. These monomers polymerize via conventional radical polymerization to afford rigid bio-based polymers suitable as high-performance plastics in demanding applications.

Keywords: biocatalysis, bio-based polymers, isosorbide