Highly Branched Bio-Based Unsaturated Polyesters by Enzymatic Polymerization

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A one-pot, enzyme-catalyzed bulk polymerization method for direct production of highly branched polyesters has been developed as an alternative to currently used industrial procedures. Bio-based feed components in the form of glycerol, pentaerythritol, azelaic acid, and tall oil fatty acid (TOFA) were polymerized using an immobilized Candida antarctica lipase B (CALB) and the potential for an enzymatic synthesis of alkyds was investigated. The developed method enables the use of both glycerol and also pentaerythritol (for the first time) as the alcohol source and was found to be very robust. This allows simple variations in the molar mass and structure of the polyester without premature gelation, thus enabling easy tailoring of the branched polyester structure. The postpolymerization crosslinking of the polyesters illustrates their potential as binders in alkyds. The formed films had good UV stability, very high water contact angles of up to 141° and a glass transition temperature that could be controlled through the feed composition.

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