LIGNIN-BASED PHOTOPOLYMERS FOR 3D PRINTING

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3D printing based on photopolymers, also known as lithography-based additive manufacturing technologies (L-AMTs), is a well-established process which is used in various application fields, such as electronics, optics, biomedical engineering or dental materials. However, commercially available photopolymer resins are predominantly based on petrochemical products with a very low sustainability. Over the past years research and development efforts increased towards implementation of bio-based and environmentally friendly materials in L-AMTs [1]. Lignin, the second most abundant biopolymer on earth and cheap waste product of the pulp and paper industry, is a promising candidate for the development of renewable photopolymers.

In this work, wheat straw soda lignin was modified in a two-step procedure to obtain photo-curable monomers. First, lignin was liquefied through oxyalkylation with propylene oxide under alkaline conditions in a solvent free procedure to homogenize the different functional hydroxyl groups, improve the solubility and increase the reactivity. Further modification of propoxylated lignin with reactive compounds, e.g. (meth)acrylates or vinyl esters [2], converts the polyol into a photopolymerizable macromonomer. Several qualitative and quantitative methods, including ^{31}P-NMR-, ^{1}H-NMR-, ATIR-spectroscopy and photorheology studies [3], were used to evaluate the potential of modified lignin in 3D printing applications.

A methacrylate lignin-based resin was successfully processed by L-AMTs as an additive and, for the first time, as a pure component. This motivating concept shows the potential of bio-based precursors as an alternative to non-renewable derivatives for 3D printing and opens a new field of application for lignin in radical photopolymerization.

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[2] C. Heller et al., *J. Polym. Sci, Part A: Polym. Chem.* **2009**, *47*, 6941-6954.

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