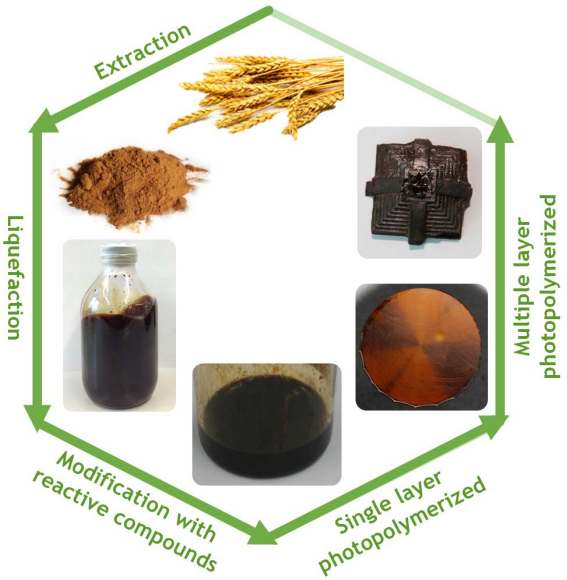
Lignin – alternative renewable resource for 3D printing based on photopolymers

Sarah Keck[a], Olga Liske[a], Christian Gorsche[b], Bernhard Steyrer[b], Stefan Baudis[a] and Simone Knaus[a]

[a]Institute of Applied Synthetic Chemistry, Technische Universität Wien, Getreidemarkt 9/163, 1060 Vienna, Austria
[b]Cubicure GmbH, Gutheil-Schoder-Gasse 17, 1230 Vienna, Austria

Application of photopolymers in lithography-based additive manufacturing technologies (L-AMTs) is a powerful tool to manufacture complex parts. [1] Commercially available materials predominantly base on petrochemical products with a low sustainability. Lignin, the second most abundant bio-based polymer and cheap waste product of pulp and paper industry, is a promising candidate for the development of renewable photo-curable polymers.

In this work, wheat straw soda lignin was modified in a two-step procedure and characterized via qualitative and quantitative methods such as ^{31}P-NMR, ^{1}H-NMR-, ATIR-spectroscopy and photorheology [2] to evaluate its potential in 3D printing applications. Oxyalkylation of lignin with propylene oxide not only improves the solubility, decreases the viscosity and homogenizes the different functional hydroxyl groups but also increases the reactivity. Due to their radical inhibition capacity, the masking of phenolic OH groups is of particular importance. Further modification of propoxylated lignin with reactive compounds, e.g. (meth)acrylates or vinyl esters [3], converts the polyol to a photopolymerizable macromonomer. Acrylate-based, propoxylated lignin was successfully processed by L-AMTs and opens a new field of application for lignin in radical photopolymerization.



[1] J. Stampfl et al., *J. Micromech. Microeng.* **18**, 125014 (2008)

[2] C. Gorsche et al., *Anal. Chem.* **89**, 4958-4968 (2017)

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