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Project title: Increasing processing efficiency of the biomass crop poplar

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Abstract (approx. 200 words)**:**

The depletion of fossil resources necessitates renewable and climate-neutral feedstocks for bio-based products. Woody-biomass holds immense potential for building a sustainable bio-based economy but enzymatic conversion of wood into fermentable sugars is limited by lignin's recalcitrance. To improve wood quality, scopoletin was incorporated into the lignin polymer of poplar (Populus tremula x P. alba) by expressing FERULOYL-CoA 6'-HYDROXYLASE 1 (F6'H1) and COUMARIN SYNTHASE (COSY) in lignifying cells. This creates labile bonds in the lignin that cleave more easily under alkaline conditions, forming a new type of 'zip lignin'. Transgenic poplars produced scopoletin without growth defects under greenhouse conditions. Alkaline pretreated wood of scopoletin-modified poplars demonstrated an up to 30% increase in sugar release compared to wild type poplars. These promising results are currently being validated in a field trial, ensuring that the observed benefits are consistent and sustainable in a real-world setting. This approach has significant potential to improve woody biomass conversion efficiency while simultaneously reducing costs and the need of chemical-intensive pretreatment processes in industrial applications such as paper production. By addressing a major limitation in biomass conversion, our research contributes to the development of a more sustainable and economically viable bio-based economy.

Key words:
Poplar, lignin engineering, alternative lignin monomers, scopoletin, translational research, alkaline-degradation, field trial, bio-based economy