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**Combining Pretreatment with Modified Poplar Increases Sugar Yields**

Genetically-modified Zip-lignin™ poplar results in higher sugar yield compared to untransformed poplar when subjected to Cu-AHP pretreatment.

**The Science**

The copper-catalyzed alkaline hydrogen peroxide (Cu-AHP) deconstruction process is highly effective at pretreating a genetically-modified type of poplar called “zip-lignin” poplar, resulting in high sugar yields for biofuel fermentation even when inputs are reduced. Zip-lignin poplar incorporates weak linkages into lignin, the hard-to-process compound that gives plant cell walls their sturdiness, rendering the poplar especially amenable to the Cu-AHP deconstruction method.

**The Impact**

Woody biomass such as poplar has the potential to be an economically sustainable feedstock for advanced biofuels if we can find ways to reduce the cost of pretreating biomass and separating plant lignin from plant sugars for fermentation. Scientists at the Great Lakes Bioenergy Research Center previously developed both the Cu-AHP pretreatment process and genetically-modified zip-lignin poplar as ways to lower these deconstruction costs. When combined, Cu-AHP pretreatment of zip-lignin poplar results in higher sugar yields, potentially lowering the cost of producing advanced biofuels.

**Summary**

Pretreatment costs for lignocellulosic biomass such as poplar are currently high because it is quite recalcitrant to many deconstruction methods due to the lignin found in the plant cell walls. If plants can be engineered to produce lignin that is easier to deconstruct without negatively impacting plant growth and development, it may be possible to decrease the severity of pretreatment and therefore improve the economics of lignocellulosic biofuel production. GLBRC-developed zip-lignin poplar, which has ester bonds in the lignin backbone, is especially amenable to alkaline deconstruction methods such as Cu-AHP. Following Cu-AHP pretreatment and enzymatic hydrolysis, improved glucose and xylose yields were observed for zip-lignin poplar (85% and 91%, respectively) compared to wild-type poplar (77% and 84%, respectively). More importantly, when zip-lignin poplar was used as the feedstock, hydrogen peroxide, bipyridine, and enzyme loadings could all be substantially reduced while still maintaining high sugar yields. This validates the potential of zip-lignin poplar as an improved feedstock for the advanced biofuels and bioproducts industry.

**Contacts (BER PM)**

N. Kent Peters
Program Manager, Office of Biological and Environmental Research
kent.peters@science.doe.gov, 301-903-5549

**(PI Contact)**

Eric L. Hegg
Michigan State University
erichegg@msu.edu, 517-353-7120

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**Publications**

Bhalla, A. et al. “Engineered lignin in poplar biomass facilitates Cu-catalyzed alkaline-oxidative pretreatment.” *ACS Sustainable Chemistry & Engineering.* DOI:10.1021/acssuschemeng.7b02067

**Related Links**

<https://pubs.acs.org/doi/10.1021/acssuschemeng.7b02067>

**PM Recommendation for SC Web Publication**