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**Zip-lignin improves poplar processing**

Pulping studies show that Zip-lignin poplar is easier to degrade and extract during biomass processing.

**The Science**

In this study, we tested Zip-lignin poplar vs. wild-type hybrid poplar to determine if Zip-lignin’s strategic lignin modifications, specifically engineered to reduce recalcitrance, enhance chemical pulping efficiencies. As predicted, Zip-lignin poplar demonstrated improved processing.

**The Impact**

Technologies to reduce lignin recalcitrance, such as Zip-lignin poplar, can improve the economics of biomass processing.

**Summary**

We examined hybrid poplar genetically engineered to possess chemically labile ester linkages in its lignin backbone (Zip-lignin™ poplar) to determine if the strategic lignin modifications would enhance chemical pulping efficiencies. Kraft pulping of Zip-lignin and wild-type hybrid poplar was carried out in lab-scale reactors under varying severity conditions of time, temperature, and chemical charge. We analyzed the resulting pulps for yield, residual lignin content, and cellulose DP (degree of polymerization), as well as changes in carbohydrates and lignin structure. We created statistical models of pulping, and evaluated pulp bleaching and physical properties. Compared to wild-type, the Zip-lignin hybrid poplar cooked under identical conditions showed extended delignification, confirming the Zip-lignin effect. Statistical prediction models facilitated comparisons between pulping conditions that resulted in identical delignification, with the Zip-lignin poplar needing milder cooking conditions and resulting in higher pulp yield (up to 1.41% gain). These results already suggest significant value and strengthen the case for pursuing even higher “zip” (ester linkage) content in lignin to maximize the economic impact of this technology.

**Contacts (BER PM)**

N. Kent Peters  
Program Manager, Office of Biological and Environmental Research  
[kent.peters@science.doe.gov](mailto:kent.peters@science.doe.gov), 301-903-5549

**(PI Contact)**

Troy Runge   
University of Wisconsin - Madison  
[trunge@wisc.edu](mailto:trunge@wisc.edu)

John Ralph  
University of Wisconsin - Madison  
[jralph@wisc.edu](mailto:jralph@wisc.edu)

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**Publications**

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<http://onlinelibrary.wiley.com/doi/10.1002/cssc.201701317/full>

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