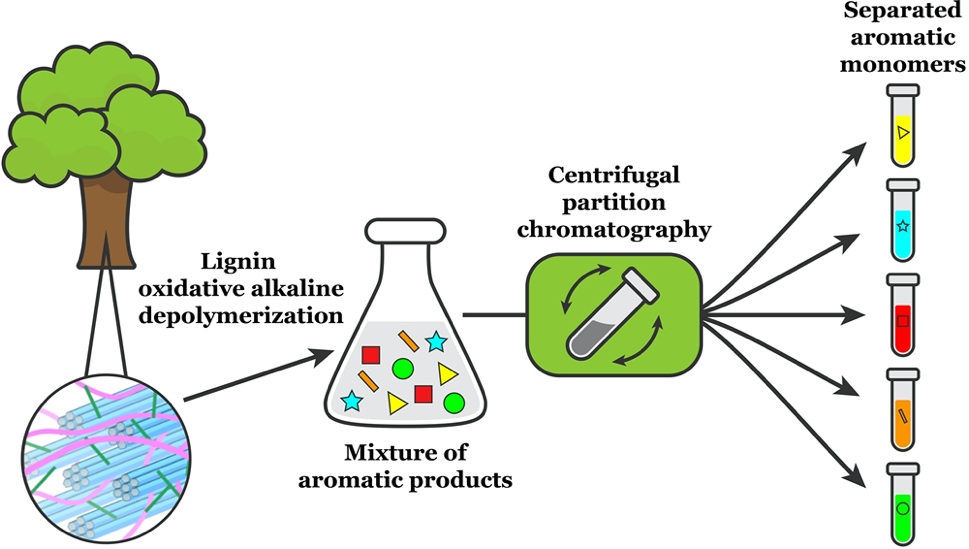
06 December 2021

**Isolating valuable compounds from complex mixtures of lignin products**

The ability to collect individual useful chemicals may increase the value derived from biomass processing.



*Centrifugal partition chromatography provides an effective strategy to separate valuable aromatic products obtained from lignin depolymerization mixtures.*

**The Science**

Current methods used to convert plant sugars into biofuels leaves behind the complex polymer lignin as a waste product. Extensive efforts are underway to convert lignin into valuable compounds that could be used in the food, pharmaceutical, or chemical industries. Lignin processing yields a complex mixture of products with little direct market value. In a new study, a team from the Great Lakes Bioenergy Research Center (GLBRC) describes a multi-solvent extraction process that can isolate five major products obtained from poplar lignin.

**The Impact**

Methods to isolate individual aromatic monomers from a complex product stream, such as that produced by breaking down lignin, will increase the potential value of biofuel crops. Previous purification efforts have typically focused on isolating a single compound, such as vanillin. The method introduced in the new study separates five individual compounds, requires only a few steps, uses no expensive added chemicals, and can be adapted to large-scale use.

**Summary**

The researchers used a liquid-liquid extraction process called centrifugal partition chromatography, which separates individual monomers from a mixed solution based on the different solubility of each compound in two non-mixing solvents.

The GLBRC team started with lignin extracted from poplar using a copper-alkaline hydrogen peroxide pretreatment process developed in the GLBRC. They digested the lignin in the presence of oxygen gas to break it down into a mixture of oxygenated aromatic compounds, including the useful industrial chemicals vanillin and *p*-hydroxybenzoic acid. The researchers then applied the centrifugal partition chromatography to the mixture and found they could successfully isolate vanillin, syringic acid, syringaldehyde, vanillic acid and *p*-hydroxybenzoic acid in two stages of extraction.

These findings suggest that centrifugal partition chromatography can provide a scalable way to isolate valuable industrial chemicals from lignin and other biomass-derived feedstocks.

**Contacts**

**Program Manager**

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

**Corresponding Author**

Shannon Stahl  
University of Wisconsin–Madison  
[stahl@chem.wisc.edu](mailto:stahl@chem.wisc.edu)

**Funding**

Financial support for this project was provided by the Great Lakes Bioenergy Research Center, U.S. Department of Energy, Office of Science, Office of Biological and Environmental Research (award DE-SC0018409), the National Science Foundation (grant CHE-1048642) for use of a Bruker AVANCE 400 NMR spectrometer, and the Bender Fund for use of a Bruker AVANCE III 500 NMR spectrometer.

**Publication**

Alherech, M., Omolabake, S., Holland, C.M., Klinger, G.E., Hegg, E.L., Stahl, S.S., “From lignin to valuable aromatic chemicals: lignin depolymerization and monomer separation via centrifugal partition chromatography.” *ACS Central Science* (2021) [DOI: [10.1021/acscentsci.1c00729]](https://pubs.acs.org/doi/10.1021/acscentsci.1c00729)

**Related Links**

https://pubs.acs.org/doi/10.1021/acscentsci.1c00729