Process for the fractional separation of lignin

Technology Description

The presented technology is a process for the separation of lignin from a non-aqueous solution by fractional precipitation.

Problem

Lignocellulosic materials, such as wood and other plant materials, are important renewable resources used in many industries. These materials consist primarily of cellulose, hemicellulose, and lignin, with lignin accounting for 20-40% of the structure. Lignin holds significant potential for various applications due to its abundance and unique properties. However, lignin's complex and heterogeneous nature makes its efficient valorization challenging. Traditional methods for lignin separation still offer further potential for improvement, in particular with regard to the specificity of the separation process and the flexibility in the lignins to be separated.

Those methods struggle to extract lignin in a way that preserves its valuable features, often leading to inconsistent quality and limiting its potential applications. This issue makes it difficult to fully utilize lignin in a resource-efficient manner, thereby restricting its use as an important renewable biopolymer.

Solution

The innovative technology addresses the challenge of lignin valorization through a process of controlled lignin precipitation in distinct fractions using solvent expansion with carbon dioxide. By adjusting the pressure, this system allows for the gradual and precise separation of different lignin fractions based on their molecular size. The process is highly flexible and water-tolerant, functioning effectively even when the solvent is saturated with water. Furthermore, the solvent used in this system is reusable, making the process both cost-effective and environmentally friendly. This approach enables the production of specific, tailored lignin fractions with enhanced properties, suitable for various targeted applications.

Potential Use

This fractionation technology offers substantial potential across various industries by providing tailored lignin fractions for targeted applications in an eco-friendly and cost-effective manner. Lignin fractions can be used as renewable substitutes for petroleum-based chemicals in the production of adhesives, coatings, textiles, and plastics. Additionally, specific lignin fractions can serve as antioxidants, UV stabilizers, or as feedstock for the synthesis of high-value chemicals. The construction and automotive sectors could benefit from lignin's potential as a sustainable additive to improve the mechanical properties of composites. Moreover, the pharmaceutical and cosmetic industries may utilize particular lignin fractions due to their bioactive properties. By obtaining lignin fractions with

Interesting for the following sectors
- Chemistry
- Materials Science
- Forestry
- Agriculture
- Textiles
- Polymeres

IP DE102021106727A1

View on DPMA

TRL
3

Contact
Dr. Philipp Grande (IBG-2)
PD Dr. Holger Klose (IBG-2)

Innovation Manager
Dr. Ann-Katrin Beuel

Keywords
Lignin, wood, biopolymers, fractionation, downstream, DSP, renewable, CO_2

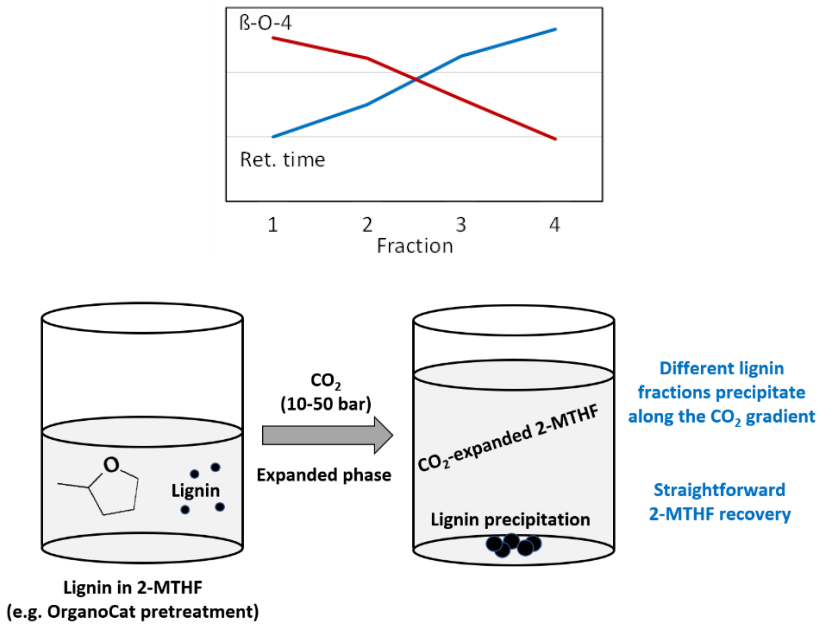
More Information
go.fzj.de/to-199

As of 10/2024

defined characteristics, this technology provides a versatile platform to meet the varying needs of different sectors, contributing to a more sustainable and circular bioeconomy.

Development Status and Next Steps

The fractionation technology is currently at a laboratory scale with a Technology Readiness Level (TRL) of 3, where it has been proven to effectively separate lignin into distinct fractions. To advance towards industrial-scale application, further upscaling efforts are required. This will involve conducting additional experiments to refine the process and adapt it to different lignin mixtures beyond the ones used in the initial trials. As the next step, we are eager to collaborate with industry partners to validate the technology's scalability and ability to tailor lignin fractions for specific market needs.



Interesting for the following sectors

- » Chemistry
- » Materials Science
- » Forestry
- » Agriculture
- » Textiles
- » Polymeres

IP DE102021106727A1

View on DPMA

TRL

3

Contact

Dr. Philipp Grande (IBG-2)
PD Dr. Holger Klose (IBG-2)

Innovation Manager
Dr. Ann-Katrin Beuel

Keywords

Lignin, wood, biopolymers, fractionation, downstream, DSP, renewable, CO_2

More Information

go.fzj.de/to-199

As of 10/2024