SUSTAINABLE VALORIZATION OF AGRO-FOOD WASTE RICH IN LIGNIN

CONTACT DETAILS:

Research Results Transfer Office-OTRI
University of Alicante
Tel.: +34 96 590 99 59
Email: areaempresas@ua.es
http://innoua.ua.es

ABSTRACT

The Analytical and Circular (bio)Chemistry Research Group (bioCir) at the University of Alicante has developed an efficient and sustainable method for extracting lignin from agro-food waste, such as coconut husk. This innovative method combines ultrasound and deep eutectic solvents (DES), achieving lignin extraction of at least 80% of the waste in a reduced time.

The combination of the chemical action of DES and the effect of ultrasound enables efficient dissolution and extraction of lignin. This sustainable and scalable method represents an innovative alternative to valorize agricultural waste within a circular economy model.

The technology, protected by a patent application, has been developed at laboratory scale. The solid lignin obtained through this method could be used as a raw material for various industrial applications, including the chemical, pharmaceutical, cosmetic, and advanced materials sectors. Companies interested in commercial exploitation are sought.

ADVANTAGES AND INNOVATIVE ASPECTS

TECHNOLOGY ADVANTAGES

The main advantages of the technology in terms of sustainability, efficiency, and competitiveness are:

- **Higher yield and efficiency:** The combination of deep eutectic solvents (DES) and ultrasound allows for lignin extraction above 80%, outperforming conventional methods.
- **Faster processing and lower energy consumption:** Process optimization significantly reduces extraction times, saving energy and resources.
- **High selectivity and product purity:** The obtained lignin has lower contamination from other biomass components, making it more suitable for advanced industrial applications.
- **Industrial scalability:** The method is adaptable to larger-scale processes without requiring costly investments in specialized equipment.
- **Reduction of agro-food waste:** The technology enables the use of lignin-rich waste, such as coconut husk, avoiding landfill accumulation or uncontrolled burning.
- **Substitution of aggressive solvents:** Unlike traditional processes with sodium hydroxide (NaOH) or other polluting chemicals, the use of DES minimizes hazardous waste generation.
- **Lower ecological impact:** The methodology reduces the carbon footprint of the extraction process by lowering energy consumption and avoiding aggressive chemicals.
- **Contribution to the circular economy:** Transforms waste into high-value raw material, fostering sustainability in sectors like chemicals, cosmetics, and advanced materials.
- **Replacement of fossil-derived compounds:** The lignin obtained has the potential to replace petroleum-derived polymers and additives in multiple applications, supporting the transition toward a more sustainable industry.

- **Sustainability differentiation:** Companies in the chemical, pharmaceutical, or advanced materials sectors can enhance their environmental reputation by incorporating sustainably extracted lignin.
- **Opportunities in green markets:** The demand for sustainable and bio-based products is growing, offering competitive advantages to early adopters of this technology.
- **Feedstock flexibility:** The methodology is adaptable to different types of lignocellulosic waste, allowing implementation across various regions and supply chains.

INNOVATIVE FEATURES OF THE TECHNOLOGY

The main innovative aspects of this technology are twofold: the **combined use of DES** and **ultrasound for lignin extraction** and the **achievement of high-purity lignin with fewer impurities**.

The integration of DES with ultrasound in a single process represents a significant innovation in lignin extraction. While DES offer a sustainable and highly efficient alternative to conventional solvents, ultrasound accelerates disruption of the lignocellulosic matrix and enhances mass transfer, optimizing extraction. This synergistic combination not only improves recovery yield but also reduces energy consumption and minimizes chemical waste generation, setting it apart from traditional methods based on aggressive reagents like sodium hydroxide or volatile organic solvents.

Unlike other extraction technologies, this method isolates lignin with a more preserved chemical structure and lower polysaccharide and contaminant content. The higher purity of the final product broadens its applicability in advanced industrial sectors without requiring additional purification steps. This is a key competitive advantage, reducing processing costs and enhancing the versatility of the extracted lignin.

These innovative aspects position this technology as an efficient, sustainable, and highly adaptable alternative for agro-industrial waste valorization, opening new opportunities in the development of bio-based materials and products.

MARKET APPLICATIONS

The lignin obtained could be used as a raw material in industrial applications, including the chemical, pharmaceutical, cosmetic, and advanced materials sectors.

Lignin extracted through this technology presents characteristics that make it suitable for diverse industrial applications in both established and emerging markets. The main application areas include:

- **Chemical industry**
- **Advanced materials**
- **Cosmetic and pharmaceutical sector**

Beyond these current sectors, the purity and versatility of the obtained lignin open opportunities for developing new materials and products within the circular bioeconomy, contributing to the replacement of fossil-derived products in various industrial applications.

COLLABORATION SOUGHT

Companies are sought to acquire this technology for **commercial exploitation** through:

- Patent licensing agreements.
- R&D collaboration agreements to tailor the technology to company needs.
- Proof-of-concept projects.
- Scientific-technical advisory services.
- Etc.

Target companies:

- Companies producing biopolymers and/or sustainable materials.
- Chemical industry specializing in lignin derivatives.
- Manufacturers of natural cosmetics and pharmaceuticals.