



LIGNICOAT

Sustainable COATings based on LIGNIn resins and bio-additives with improved fire, corrosion and biological resistance

3rd PRESS RELEASE

LIGNICOAT Project Develops Lignin-Based Resins and Coatings to Solve Environmental Problems and Reduce VOC Emissions

May 2023

Coatings are essential to our everyday lives, providing various surfaces protection, aesthetics, and functionality. However, the environmental impact of fossil-based coatings and volatile organic compounds (VOCs) emissions has raised concerns, and regulations were implemented to diminish their use in coatings.

The LIGNICOAT project goes in this direction, introducing to the coating industry innovative sustainable solutions. The project, now halfway through its 42 months duration, has developed innovative lignin-based resins and coatings that promise to address environmental concerns associated with fossil-based coatings and reduce VOCs' emissions.

To achieve this, the solutions developed within the LIGNICOAT project involve the use of lignin. Lignin (a by-product of lignocellulosic biomass) is obtained from trees, bushes, grass, and thus, all the waste of the agriculture, forestry, pulp, and paper industries. Therefore, lignin provides a sustainable alternative compared to traditional fossil-based raw materials. Given the possibility of obtaining polymers and many other products from lignin, it can be used as a building block for producing bio-resins for coatings.



This project has received funding from the Bio-based Industries Joint Undertaking (JU) under the European Union's Horizon 2020 research and innovation programme under grant agreement No 101023342. The JU receives support from the European Union's Horizon 2020 research and innovation programme and the Bio-based Industries Consortium.



Bio-based Industries Consortium



Horizon 2020
European Union Funding
for Research & Innovation



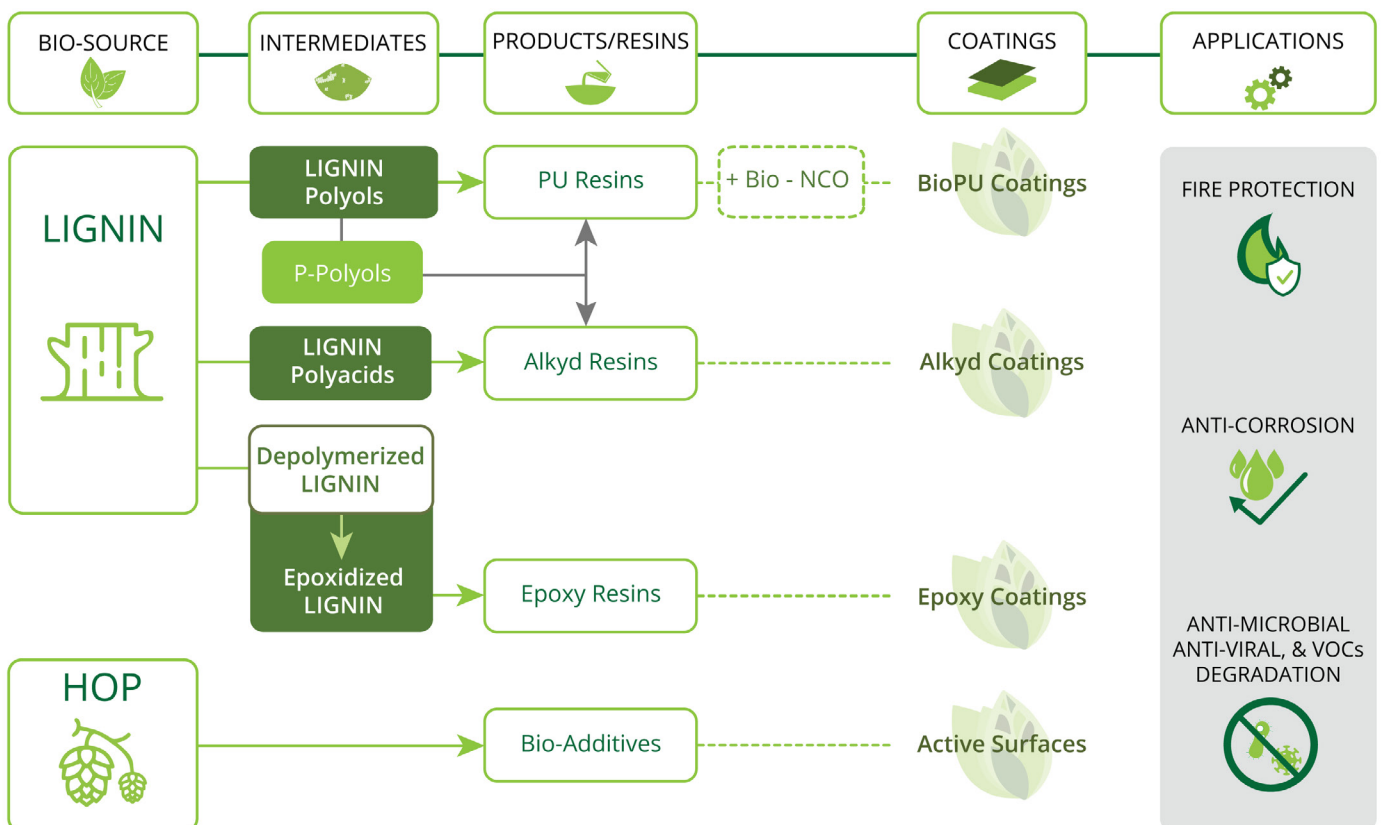
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The overall scheme below summarises the pathways followed from lignin biomass toward the development of different coatings developed within the project so far. These are indeed the first resins/coatings that have been formulated and still need to be tested to validate the applications and the replacement of fossil-based resins/coatings.



At the heart of the LIGNICOAT project are bio-based resins and coatings derived from renewable sources made of lignin, such as Kraft lignin by Stora Enso and organosolv lignin by CIMV. The kraft and organosolv processes are two of the most popular processes to obtain pure lignin from biomasses.





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Intermediates are produced from the raw lignin materials, which will lead to final products, i.e., the resins, and applied as coatings to various surfaces.

However, some definitions should be first introduced to understand better the different terminology and the coating production sequence. Overall, the intermediates developed within the project are four: lignin polyols, lignin polyacids, depolymerized lignin, and epoxidized lignin.

Lignin polyols (LPOs) contain multiple hydroxyl groups -OH, while **lignin polyacids** contain multiple carboxylic acid groups -COOH.

The **bio-polyurethane (PU) resins** developed in the LIGNICOAT project are based on lignin polyols and are applied on wood surfaces. While standard PU is a polymer (i.e., a material consisting of large molecules composed of many repeating subunits) made of fossil-based polyols, in bio-PU resins, those polyols are partially substituted with bio-based materials like lignin.



Bio-intermediate for PU resin based on lignin polyols



Bio-resin (PUD) based on lignin



New coating based on lignin (PU) for wood

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Bio-intermediate for PU resin based on phosphorylated lignin

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A type of LPOs is the **phosphorylated LPOs (P-LPOs)**. The main innovation for P-LPOs relies on the possibility of copolymerizing (improving the properties) in coating resins and achieving better fire-proofing performance.



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On the other hand, **alkyd resins** are produced from **lignin polyacids**. The main coatings applications will be on metal, providing anti-corrosion and fire protection. The current bio-based alkyd binders are not as cost-effective as fossil-based binders and do not dry as well. LIGNICOAT aims to expand the bio-based binders market using lignin's molecular structure to improve drying performance and price competitiveness.



Bio-intermediate for alkyd resin based on lignin polyacids



Bio-resin (alkyd) based on lignin



New coating based on lignin (alkyd) for metal



Like LPOs and lignin polyacids, depolymerized lignin is a bio-intermediate. Depolymerized lignin is a product of lignin depolymerization, a process that breaks down lignin into smaller molecules. In the LIGNICOAT project, depolymerized lignin is produced in continuous mode at the LignoValue pilot plant of VITO (Belgium), which will be then optimized and up-scaled by Westlake. Adding epoxide groups to it achieves epoxidized lignin, and it serves as an epoxy resin for metal surfaces.



Bio-intermediate for lignin-based epoxy resins



New coating for metal based on depolymerized lignin (epoxy)





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Moreover, **bio-additives** for antiviral properties were also developed to enhance the innovation and diversity of LIGNICOAT further. Melamine board (plastic) based on **hop-extracted soft resin** with specific active surfaces can be seen in the picture.



Overall, with the showed bio-resins, the LIGNICOAT project presents an array of innovative solutions that have the potential to revolutionise the coatings industry. These solutions offer several benefits, including:

- **Environmentally friendly:** By utilizing renewable raw materials and reducing VOC emissions, lignin-based coatings have a significantly lower environmental impact compared to fossil-based coatings, contributing to the global efforts to combat climate change.
- **Sustainable and renewable:** Lignin is a natural polymer obtained from plant-based sources, making it a sustainable and renewable alternative to fossil-based materials. The use of lignin-based resins and coatings promotes the circular economy and reduces the reliance on fossil resources.

“We are thrilled to showcase the advances achieved by the LIGNICOAT project in developing lignin-based resins and coatings. This represents a significant step towards solving environmental problems associated with traditional coatings and reducing VOC emissions,” said Dr. Aitor Barrio (TECNALIA), Project Coordinator of LIGNICOAT. “Using renewable raw materials and innovative bio-intermediates, we are paving the way for a more sustainable and environmentally friendly approach to coating production.”

About LIGNICOAT:

The LIGNICOAT project is a collaborative effort between industry partners, and research institutes, intending to develop sustainable and innovative solutions for the coatings industry.

If you want to know more, visit the project's website and social media.



www.lignicoat.eu



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