# Utilising lignin as a raw material: Making furniture lighter, more modular and recyclable

## About this project

## LignoLight

### Utilising lignin as a raw material: Making furniture lighter, more modular and recyclable

**Markets:**

**Material:** Bioplastics, Biocomposites, Wood, Aramid fibres, Natural fibres, Thermoset plastics, Elastomers, Thermoplastics, Meshes, Laid webs, Crocheted fabrics, Woven fabrics, Nonwovens, mats, Natural fibre reinforced plastics (NFRP), Closed-pore, Open-pore

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This project is funded by the Technology Transfer Programme Leichtbau (TTP LB) of the Federal Ministry of Economics and Energy.

Technology Transfer Program Leichtbau

### Context

The furniture industry is facing a double challenge: on the one hand, furniture must be flexible and modular in order to adapt to changing living situations. On the other hand, there is increasing pressure to use sustainable materials and close recycling loops. Although current lightweight construction concepts reduce weight, they are often made of composite materials that are difficult to recycle. A lot of furniture made from these materials ends up in bulky waste or thermal utilisation, as it is not possible to separate them by type.

At the same time, lignin, a by-product of the pulp and paper industry, remains largely unutilised and is usually incinerated. However, lignin offers great potential for bio-based materials due to its high carbon binding capacity and specific material properties.

### Purpose

This is where the LignoLight research project comes in. The project team wants to develop modular lightweight furniture made from lignin-based materials. The aim is to utilise thermoplastic lignin compounds, lignin foams and a completely bio-based imitation leather for furniture construction. These materials should not only enable long-term CO# sequestration, but also reduce transport emissions thanks to their low weight. A modular construction extends the service life of the furniture, as damaged or obsolete components can be replaced in a targeted manner.

The project team also wants to optimise recyclability: The materials should be able to be separated by type and reprocessed for new products. At the same time, the researchers are investigating the potential for transfer to the fashion and caravan industry.

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### Procedure

The project team is developing various lignin materials with specific mechanical and processing properties: the researchers are optimising thermoplastic lignin compounds with a lignin content of at least 40 per cent for use in 3D printing, injection moulding, extrusion and thermoforming. They are also developing lignin foams in various degrees of hardness with lignin contents of up to 80 per cent for use as a core material for panel and upholstery structures. The team is also testing a 100 per cent bio-based lignin leather with a lignin content of over 70 per cent as an alternative to synthetic coatings.

At the same time, the researchers are developing design concepts that enable the disassembly and reuse of entire modules (design for recyclability). They want to use take-back systems to ensure that the materials are returned to the material cycle. The project team is testing the developed materials and designs in a modular cupboard system and a piece of seating furniture and checking these prototypes for their industrial scalability.

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**Funding duration:**

| | | | |
|---|---|---|---|
| **Funding sign:** | 03LB3065 | **Funding amount:** | EUR 2.2 million |

**Final report**

**Further websites**

foerderportal.bund.de/foekat/jsp/SucheAction.do?actionMode=view&fkz=03LB3065A - LignoLight in the federal funding catalogue

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## Project coordination

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## English (EN){{ Projektpartner }}

## Utilising lignin as a raw material: Making furniture lighter, more modular and recyclable

### Lightweighting classification

| | Realisation |
|---|---|
| **Offer** | |
| **Products**<br>Semi-finished parts, Materials | ✓ |
| **Services & consulting**<br>Consulting, Testing and trials, Engineering, HR services, Prototyping, Validation, Technology transfer, Others (Material development) | ✓ |
| **Field of technology** | |
| **Design & layout**<br>Hybrid structures, Lightweight construction concepts, Lightweight material construction | ✓ |
| *Functional integration* | |
| **Measuring and testing technology**<br>Visual analysis (e.g. microscopy, metallography), Materials analysis, Destructive analysis, Non-destructive analysis | ✓ |
| **Modelling and simulation**<br>Life-cycle analysis, Processes, Materials | ✓ |
| **Plant construction & automation**<br>Others (Process development) | ✓ |
| **Recycling technologies**<br>Material separation, Recycling, Upcycling | ✓ |

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## Lightweighting classification

| | Realisation |
|---|---|
| **Manufacturing process** | |
| **Additive manufacturing**<br>3D printing | ✓ |
| **Coating (surface engineering)**<br>Painting | ✓ |
| *Fibre composite technology* | |
| **Forming**<br>Compression moulding, Thermal converting, Deep-drawing, Fluid active media based forming | ✓ |
| **Joining**<br>Adhesive bonding, Sewing, Riveting, Screwing | ✓ |
| *Material property alteration* | |
| **Primary forming**<br>Extrusion, Injection moulding | ✓ |
| **Processing and separating**<br>Drilling, Turning, Milling, Sawing, Grinding, Cutting | ✓ |
| **Textile technology**<br>Textile surface treatment and finishing, Nonwoven & mats production, Weaving, Knitting, laid web production | ✓ |

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## Lightweighting classification

| | Realisation |
|---|---|
| **Material** | |
| **Biogenic materials**<br>Bioplastics, Biocomposites, Wood | ✓ |
| **Cellular materials (foam materials)**<br>Closed-pore, Open-pore | ✓ |
| **Composites**<br>Natural fibre reinforced plastics (NFRP) | ✓ |
| **Fibres**<br>Aramid fibres, Natural fibres | ✓ |
| *Functional materials* | |
| *Metals* | |
| **Plastics**<br>Thermoset plastics, Elastomers, Thermoplastics | ✓ |
| *Structural ceramics* | |
| **(Technical) textiles**<br>Meshes, Laid webs, Crocheted fabrics, Woven fabrics, Nonwovens, mats | ✓ |