SUCCESS STORY

Wood K plus
WOOD: Transition to a sustainable bioeconomy

Programme: COMET – Competence Centers for Excellent Technologies

Programme line: BMK, FFG-production for future

Type of project: Duration 01.04.2021 – 31.10.2023, multi-firm

PRODUCTION OF BIO-BASED RESOLS FROM STRUCTURE DEFINED LIGNIN OLIGOMERS (LIGNOWERT)

IN THE LIGNOWERT PROJECT, WOOD K PLUS TOGETHER WITH THE TU VIENNA AND THE INDUSTRIAL PARTNERS DEVELOPED BIO-BASED PHENOL BUILDING BLOCKS FROM THE BIORAFINERY PRODUCTS LIGNIN AND LIGNOSULFONATES AND WAS SUCCESSFULLY PRODUCING BIO-BASED BINDERS

Phenol from petroleum fractionation is a basic chemical for the production of phenolic resins. Phenol is reacted with aldehydes under alkaline or acidic conditions. The three-dimensional network of the cured polymer is responsible for the high chemical and thermal resistance and the good mechanical properties. Phenols are found in abrasives, friction, and other engineering applications such as foaming or high temperature applications, in addition to some wood composites or insulation products. For this reason, thermoset polymers were developed from the bio-based building blocks phenols, lignin and lignosulfonate for use as binders. The thermoset polymers were developed along the value chain from organosolv lignin and kraft lignin as well as lignosulfonate as a side stream of pulp production. The key was the use of radical scavengers for hydrothermal degradation and simultaneous modification of the lignins. The modified lignins were characterised using FT-IR, DSC, 31P-NMR. The lignins obtained were used in resin production both alone and in combination with lignosulfonates. A standard

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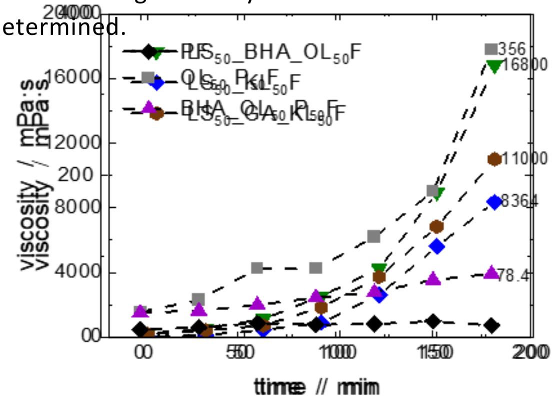
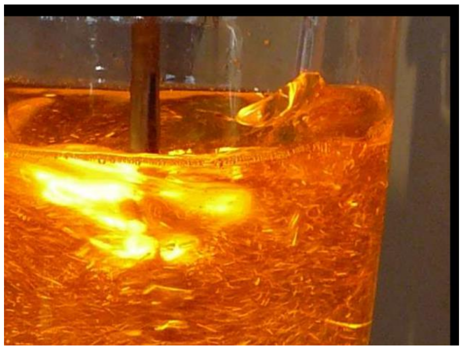
recipe for classic phenolic resin production was tested. In the case of modified lignins, up to 80% petrochemical phenol could be replaced and in the case of lignosulfonate, 100% phenol could be replaced. In the resin production process, the modified lignins show a higher reactivity compared to unmodified lignin. The undesirable effect of very high viscosity and long curing times for lignosulfonate resins, known in resin chemistry, could be overcome by combining them with the new modified lignins and moderate viscosities and curing times could be achieved. The molecular weights, melting behavior and thermogravimetry of the resins were also determined.



Viscosity curves of lignin-formaldehyde resins
Left: Phenol-formaldehyde resin (black), 50% substitution of phenol by organosolv lignin (OL) (gray) and BHA modified OL (purple),
Right: Phenol substitution by 50% lignosulfonate and (1) BHA modified OL (green), (2) kraft lignin (blue) and (3) gallic acid modified kraft lignin (brown)

Impacts and effects

The project contributes to the economic and ecological provision of bio-based resols from the biorefinery products lignin and lignosulfonate. By linking lignin production and direct modification, a gap in the value chain of producing environmentally friendly binders is closed.



Phenolic resins as versatile binders (© Photo: E. Fliedner, Prefere)

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Project partner

- TU Vienna, Austria
- Lenzing AG, Austria
- Prefere Resins GmbH, Germany

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