

Developing Bark-based, Eco-fungicidal Packaging Materials

Javane Oktaee¹, Daniela Einer¹, Bernhard Torger², Martina Bremer², Steffen Fischer², André Wagenführ¹

About the project

Dendromass4Europe (2017 – 2022) aims at establishing sustainable, Short Rotation Coppice (SRC)-based, regional cropping systems for woody biomass (dendromass) production on marginal agricultural land. The dendromass produced in SRC (ligneous biomass, bark and wood) are supplied to dedicated bio-based value chains that create additional income and job opportunities in rural areas. The supply chains will be tailored for optimum efficiency of supply logistics and for reducing CO₂ emissions. Innovative bio-based materials will help to replace fossil-based materials.



Our tasks

Our research group is focused on the identification of the potential fungicidal substances in the bark of various poplar hybrids. The aim is to find out which substances are the most effective in decelerating the mold growth as well as introducing the hybrids with the highest concentration of these substances in their bark. A treatment method is to be developed to apply these relevant substances to fiber molded packaging material. The final bio-based fungicidal product should be able to prevent the growth of mold on the packaging materials for a period of at least six months.

Realization

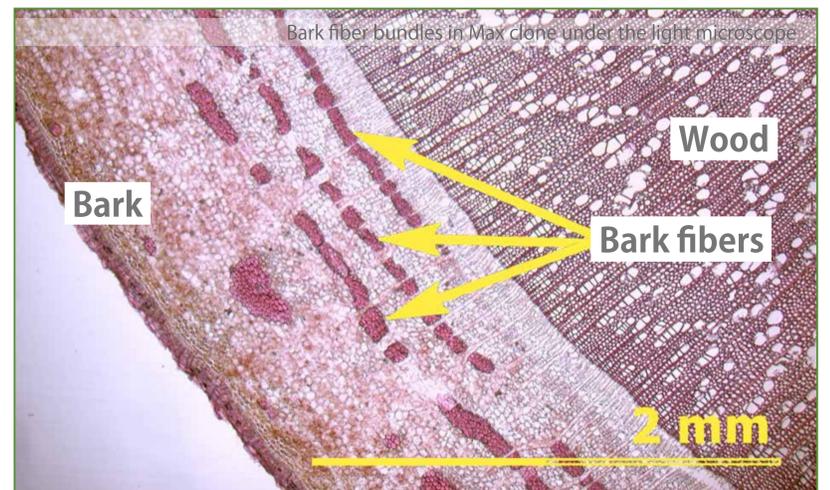
Two approaches were considered to add bio-fungicidal properties of the bark to the packaging materials:

- to add bark straight to the structure of the packaging material
- to apply the isolated substances to finished products

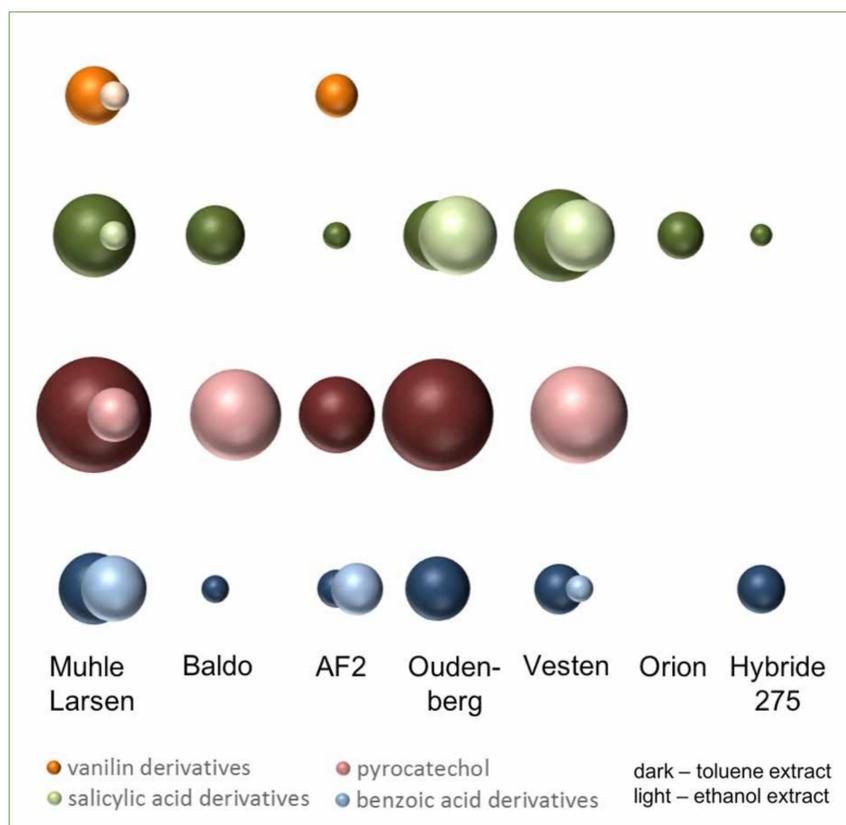


Pathway to the solution

- Fungicidal substances were extracted with the soxhlet apparatus, using solvents of different polarities (hexane, toluene, ethanol, acetone, water) from bark of various poplar clones
- The combination of the extracts were analyzed by gas chromatography-mass spectrometry (GC-MS) method
- The content of extractable fibers were measured under the microscope
- Industrial fibers were produced with thermo-mechanical pulping



First Results



• Content of the fungicidal substances in toluene and ethanol extracts after extraction of poplar bark (*Populus* spp.) in different hybrids, comparing the bark thickness and the percentage of bast fibres contained in the bark of some hybrids; samples from breast height of three years-old trees on the same site

Clone	Outer bark thickness (mm)	Inner bark thickness (mm)	Bast fibre percentage of the inner bark (%)
Max 1	0.10 ± 0.02	1.31 ± 0.23	13.47 ± 2.44
Muhle Larsen	0.10 ± 0.02	1.33 ± 0.18	13.30 ± 2.66
Fritzi Pauley	0.32 ± 0.42	3.96 ± 0.45	10.61 ± 1.66
Hybride 275	0.11 ± 0.09	1.36 ± 0.14	13.88 ± 2.65
Oudenberg	0.15 ± 0.02	1.32 ± 0.12	16.31 ± 1.34

• Results of the GC-MS analysis showed that bark in poplar clones of Muhle Larsen, Oudenberg, Vesten, Max 1, and AF2 have a content of phenolic substances and terpenes that are considered as fungicidal substances.

• Considering the bark fiber content, the difference between the clones with the same age and same growth conditions was negligible. It was possible to extract these fibers with mechanical and thermo-mechanical methods.

• Primary results showed the presence of the antifungal substances in the bark of SRC poplars and feasibility of extraction and combination of bark fibers to the packaging material. In the second phase of the research, establishment of a method for applying these fungicidal substances to packaging material is under investigation.



¹ Technische Universität Dresden, Institute of Natural Materials Technology, Chair of Wood and Fibre Material Technology

² Technische Universität Dresden, Institute of Plant and Wood Chemistry

