Developing a bark-containing, eco-fungicidal packaging material

Frank Jornitz[1], Sandra Liebal[2]

About the project

Dendromass4Europe (D4EU; 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) is 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 CO_2 emissions. Innovative bio-based materials will help to replace fossil-based materials.

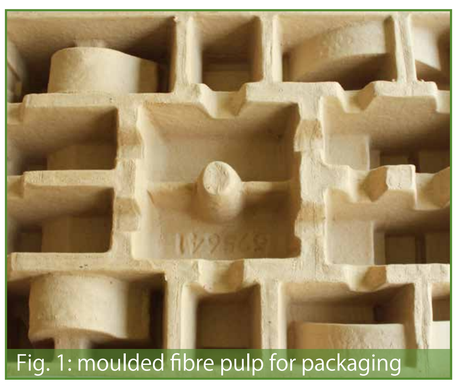

Fig. 1: moulded fibre pulp for packaging

Tasks

Poplar bark, which often serves primarily as a source for energy, will be used for an eco-fungicidal moulded fibre pulp for packaging. These fibre parts can replace plastics in packaging, are biodegradable and can also be recycled without any problems.

Our task was to determine the necessary proportion of natural bark fungicides for a protective effect of at least six months for moulded fibre parts. In addition, a cost-effective separation method is to be developed.

Fig. 2: Protective packaging made of 90 % waste paper

Fig 3: Pulp milling

Fig. 4: pulping machine at the wet end where all components are mixed together

Methods

For this study, highly concentrated bark extracts (tannins) were used. After pulp milling (see Fig. 3), optionally 5 %; 10 % and 15 % of a water-soluble tannin powder with a tannic acid content of 96 % were added and ground for 20 minutes. Sizing agent was then added to the pulper in order to achieve appropriate fixation.

The obtained pulp was pumped into the dip tank of the fibre moulding machine and moulded parts were produced (see Fig. 4-6). At this point, the process parameters were evaluated to compare the conventional cellulose moulding process with the moulding of the novel cellulose-tannin mixture.

The examined process parameters are suction time, dry suction time, part weight, mould filling, detachability from the casting mould and cycle time.

Fig 5: Application of the pulp in the pulping machine

Results

During the preparation process, the water-soluble tannin powder in combination with the sizing agent has easily bound to the fibres. The good binding was shown by the fact that the dark tannin particles adhered to the fibres and did not settle on the ground or float on top of the pulp even after the mixing process had ended. With increasing tannin content (10 % and 15 %), however, the absorption capacity decreased, so that the maximum tannin absorption under the chosen process conditions is currently between 5 % and 10 %. In order to ensure a corresponding comparison to conventional products, a wet strength agent was added with 5 mass-% as well as a coating agent.

The consistency for the processing of the new cellulose-tannin mixture was reduced in the dip tank to a processing level of 1.5 %. No difference in the moulding process has been observed compared with the conventional process. Within a suction time of 2 s the mould has already been completely filled. Similar to the conventional process, the dry suction time was 5 s. The full cycle time of 12 s remained unchanged compared to the conventional process. The part weight of 10 g also remained the same. The parts could be removed very easily from the screen fabric without leaving traces of entanglements or adhesions on the screen fabric of the suction mould.

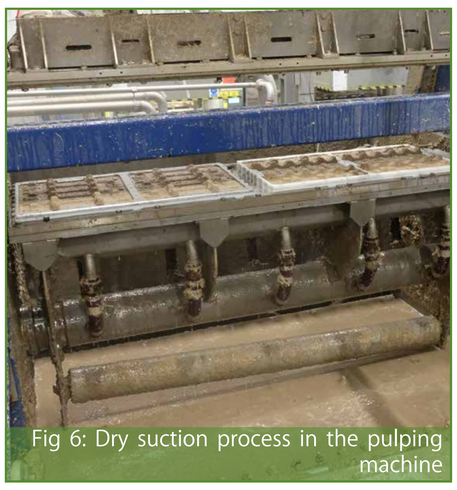

Fig 6: Dry suction process in the pulping machine

Fig. 7: Moulds for producing moulded fibre products in the dryer

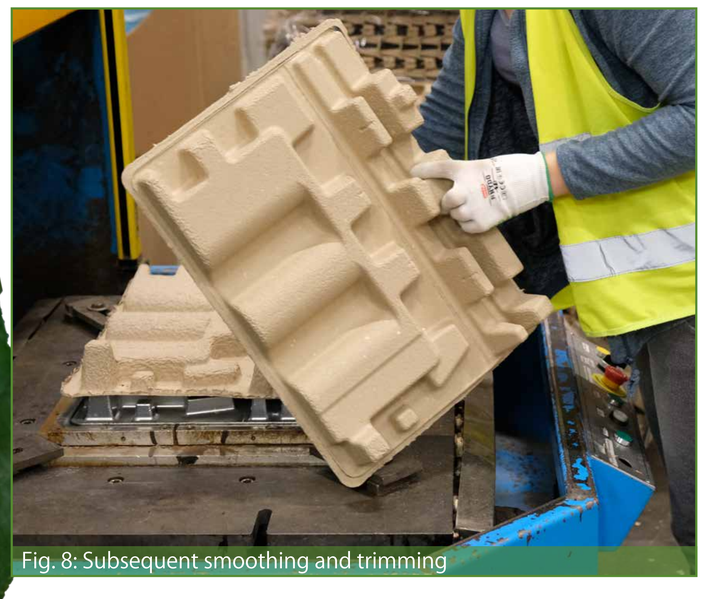

Fig. 8: Subsequent smoothing and trimming

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Fig. 9: Market application

Summary

It was possible to produce a mixture of pulp and poplar bark extracts (90% waste paper, 5% tannin and 5% other additives). This mixture is suitable for the production of fibre-shaped packaging parts, which fulfill the desired protective effect against mold growth for 6 months. All technical requirements with regard to processability and reproducibility are complied. There is no negative influence on the production process or the working conditions for the employees.

Thus, an eco-fungicidal packaging material based on poplar bark could successfully be developed and introduced on the market within the project runtime of Dendromass4Europe.

[1] Pulp-Tec Sp.Z.o.o.Sp.K. (former Pulpack Sp.Z.o.o.Sp.K.) [2] Technische Universität Dresden, Chair of Forest Policy and Forest Resource Economics

Project Coordination:
Technische Universität Dresden
Forest Policy and Forest Resource Economics
Pienner Straße 23
D-01735 Tharandt

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