

Technical report prepared in December 2019

Deliverable A1.D3

Regulations and protocols on modified hop-waste components defined.

Qualities and functionalities of raw components obtained from the hop waste deposits.

Deliverable prepared by associated beneficiary **ZELFO TECHNOLOGY GmbH (ZT)**

Table of contents

Hops/PLA processing for further transformation into Pulp Formed Products and Plastics based Products.

Optimum Source Material Quality

Preparation for Fibre Engineering

Fibre Engineering - Qualities / Quantities

Regulations regarding handling and disposal of the supplied materials.

Storage / Shipping

Derivative Products

Images

Optimum Source Material Quality

ZT has experience with a vast spectrum of new, post consumer/industrial, and Agro-based lignocellulose fibre. ZT processed fibre functions as an end product in itself (composite) or as a component in a 3rd party product.

Received Fibre Qualities

Basic conditions for the delivery of Hops stalks are outlined in A1.D2 protocol, page 10. ZT has made recommendations for technologies to assist this process.

Moisture content:

Dry fibre to moisture quantity of received source fibres is between 25% and 70% dry content dependent on source fibre qualities and desired end result. Hops stalks can be delivered to the ZT processing plant anywhere along this spectrum dependent on the extent of the current or extended objectives of the BioThop project.* Wetter fibres will require extended drying periods after processing, however they will be less prone to damage during processing.

Fibre condition:

Decomposing hops stalks will produce more fines (filler or 'dead' material) and less strong engineered fibres.

Leaves which form part of the delivered material will have similar characteristics to decomposing stalks as the cellulose is limited, fragile and short fibred.

PLA Component:

The PLA component will be micronised and reformed to a lesser extent than the hops stalk.

Preparation for Fibre Engineering

The hops stems and the PLA fibre will in future be delivered as short 3 cm lengths ready for immediate processing by ZT.

There will be no foreign objects those having been removed by the hops/PLA chord mix supplier.

Fibre for plastics based products use:

The ready prepared materials will be co-fed at appropriate speeds into the extruder in order to achieve the desired engineered form/size of material for use in the plastics compounding process.

Fibre for use in Pulp Moulding:

The PLA component will be removed from the source material mix by the hops/PLA chord supplier and the pre separated hops stalks will be fed at appropriate speeds into the extruder in order to achieve the desired engineered form/size of material for use in the pulp moulding process.

The separated PLA fibre will be further micronised for compounding and use in plastics based products.

Fibre Engineering - Qualities / Quantities

Fibre for plastics based products use:

First tests were successful with two optional percentage added materials being created (Nov. 2019) as reported by Tecnopackaging. Further hops fibres processing will be subject the fibre and PLA mix to substantial size reduction determined by an agreed post Test 1 assessment by Tecnopackaging (compounder).

Adjustments will be made to the extruder running parameters and configuration depending on the rate and quantity required.

Fibre for Pulp Moulding based products use:

Regarding ZT running parameters the first tests were successful. Standard Pulp Moulding suitable materials were produced.

Technical discussions have lead to the review of the material mix requiring that further processing will focus on the hops alone after pre-PLA separation. Product tests will follow in January/February 2020.

Adjustments will be made to the extruder running parameters as required by the pure hops based material.

Microscope images have been made of the end product and will be used to determine all next steps.

A monthly technical forum using telecoms (Skype/FaceTime) has been setup to be called and led by ZT.

Regulations regarding handling and disposal of the supplied materials

ZT have not been made aware of any problematic pesticides or feed chemicals used during the growing of the hops that can contaminate the end product or that lead to health issues in the processing (heat/pressure/friction) of the hops/PLA mix.

Disposal of any waste or non usable material is extremely problematic in Germany as the material does not fit in to any waste stream bracket. I.e. it is not strict bio-waste (compostable under normal circumstances), cannot be used as 'building infill') nor can it go to landfill. It can only therefor be burned which is an expensive option.

Waste of any sort is to be kept to an absolute minimum.

Storage / Shipping

ZT have dried all materials after processing. This has been unproblematic and has used ambient conditions. The limited kilogram amounts have allowed this to be possible.

3rd party users of the material will require that it is delivered in the dry state and therefore the drying on a 'ton based scale' will require further drying technologies as ambient drying is not a practical solution. Renting / purchasing of such technologies is under review by ZT.

Derivative Products

During the first material processing ZT identified potential suspension based extracts. These are under review by the Slovenian Institute oh Hop Research and Brewing.

Further options for extract properties exploitation, storage, transport etc. will form part of the monthly technical discussions and appropriate actions will be taken.

[Images](#)



Processing.



Floor drying of Hops/PLA processed fibres.