



PPP Project Annual Report 2018

The PPP-projects that have been established under the direction of the top sectors must submit an annual report on their technical and financial progress. This format is to be used for reporting the technical progress. A separate format ('PPP final report') is available for PPP-projects that have been completed in 2018.

The annual reports will be published in full on the websites of the TKIs/top sector, excluding the blocks 'Approval coordinator/consortium' and 'Planning and progress' . Please ensure that no confidential matters are left in the remaining blocks.

The PPP Project Annual Reports must be submitted by 15 February 2019 to Hans van der Kolk

General information	
PPP number	TKI-AF-16104
Title	Cocoashell biorefinery towards marketable bioproducts
Theme	Circulair
Executive knowledge institution(s)	Wageningen Food & Biobased Research
Research project leader (name + e-mail address)	Dr. Richard Gosselink (richard.gosselink@wur.nl)
Coordinator (on behalf of private parties)	Mrs. Anne Mertens-Hoyng, Cargill Cocoa & Chocolate, Schiphol
Government contact person	Jan van Esch
Total project size (k€)	400
Address project website	https://topsectoragrifood.nl/project/cocoashell-biorefinery-towards-marketable-bioproducts/
Start date	1 March 2017
End date	30 June 2019

Approval coordinator/consortium

The annual report should be discussed with the coordinator/the consortium. The TKIs appreciate being informed of possible feedback on the annual report.

The coordinator has assessed the annual report on behalf of the consortium:	<input checked="" type="checkbox"/> approved <input type="checkbox"/> rejected
Possible feedback on the annual report:	

Short content description/aim PPS

What is going on and how is this project involved?

What will be delivered by the project and what is the effect of this?

Cocoashells are a substantial sidestream of the cocoa and chocolate industry present in the Netherlands. Cocoashells are currently used in low added value applications like coverings for garden pathways, as energy pellets and in feed. Objective of this project is to increase the added value of cocoashell by refining the cocoashell into an extractables fraction, a cellulose fibre and a lignin fraction. For this, a novel value chain will be built for the fractionation of underutilised cocoashells in an extractables fraction for flavor/food application (Cargill), a fibre fraction for added value innovative fibre application (Schut Paper) and a lignin-like fraction for the development of biobased carpet tile backings (Interface).

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Planning and progress (if there are changes to the project plan, please explain)	
Is the PPP going according to plan?	We anticipated a delay in the development of the biorefinery concept mainly due to the complex composition of cocoashells and the necessity to remove the recalcitrant proteins from the shells. More work has been performed to focus on the removal of proteins via an environmental sound step using enzymes. To perform the upscaling and techno-economic analysis of the biorefinery process to tens of kg's an extension of the project was requested and granted.
Have there been changes in the consortium/project partners?	No
Is there a delay and/or deferred delivery date?	Yes, as described above. The project results will be delivered by 30 June 2019
Are there any substantive bottlenecks?	<p>The cocoashell lignin and fibre fraction purity is not at the required level to pass the application tests, and therefore require a pre-step to remove most of the proteins from these fractions. In the water extractives, proteins could be beneficial. The work in 2019 will be devoted to this task.</p> <p>The lignin fraction can be used to substitute part of the bitumen in the carpet tile backing, but its performance is not yet at the level of polymer modified bitumen. This will be further studied in 2019 in collaboration between Interface and WFBR.</p>
Are there any deviations from the projected budget?	The overall project budget has not been changed, but some budget of WFBR (26 k€) has been allocated for 2019

<p>Results in 2018/ so far Give a short description of the high-lights and (most important) project deliverable in 2018 / so far and their target group</p>
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The development of the cocoashells biorefinery concept has been further continued in 2018 by WFBR to produce a water extract containing cocoa flavours, acids, sugars and aromatics. These compounds could be used in a food application. Extraction of individual components is not studied, but for one identified component this could be a valid route. The fibrous fraction is tested by Schut Paper and the fibre is further fractionated by soda processing into a delignified fibre and a lignin-like fraction. Both the fibre and lignin fractions contain a high content of proteins which limits its use due to slow dewatering and negative effect of the proteins on its performance in the applications. Detailed NMR study by WFBR showed that the lignin fraction has a polyphenol structure and this lignin is clearly different from a woody lignin. Additionally, its molecular weight is different.

Removal of proteins is studied at an early stage of the process, directly after the water extraction by using proteases. First results are very promising and this will be continued in 2019.

Schut Paper has performed several tests in 2018 to evaluate the usability of the unrefined cocoa pellets delivered by Cargill for papermaking. These tests were meant to find out to what extent the quality of these cocoa residues are similar to the cocoa material Schut Paper is already using to produce cocoa paper. A successful outcome of the tests would mean that Schut Paper would no longer be dependent on a single supplier of cocoa shells.

Specifically, handsheets have been made with varying amounts of cocoa shells. The cocoa hulls were added to two types of commercial cellulose, as to find the right composition to end up with a paper of which the colour that is similar to that of the cocoa paper already being produced. During preparation of the paper pulp it was found that the cocoa pellets mostly consist of thin/flat, brown skins that let themselves be processed as a decorative component in the paper sheet quite well, thanks to their limited thickness. In addition thereto, some thicker and darker-coloured 'lumps' were also found in the pulp, which will most likely cause problems when producing the paper on industrial scale. Follow-up activities therefore include experiments with different machines to reduce their size and thereby evaluate whether or not it is possible to make these particles more suitable for processing cocoa pellets into paper.

With regard to the carpet tile applications (Interface), the initial evaluation showed that cocoa shell lignin works solely as a filler and is not likely to be a performance modifier. However, lignin as such introduces a strong smell and impairs the flame retardancy of the carpet tile backing, both of which represent bottlenecks for this application. As a follow-up on this, modified lignin has been considered as an alternative. Material produced by WFBR was used for indicative trials. The initial findings of the smell and flammability were positive – smell and flammability contribution seemed significantly reduced. The addition of modified lignin to hot bitumen was accompanied with strong frothing, which is primarily to be attributed to the release of moisture still present in modified lignin.

However, no particular performance modifier effect was observed – the material still acted as just a plain filler. This will be further examined applying different physical settings during the compounding process, as well as alternative blend recipes.

Number of delivered products in 2018 / so far <i>(in an appendix, please provide the titles and/or description of the products or a link to the products on public websites)</i>			
Academic articles	Reports	Articles in journals	Introductions/workshops
0	0	0	1

Appendix: Names of the products or a link to the products on a public website

Introduction:

On February 8th 2018, the project goals and achievements were presented by Richard Gosselink for the TKI AF committee in Wageningen.



Preparation of a lignin-bitumen blend for carpet tile backing (Interface)



Papersheets made with different cocoashell loadings (Schut Paper)

<https://topsectoragrifood.nl/project/cocoashell-biorefinery-towards-marketable-bioproducts/>