General information	
PPP-number	TKI-BBE-1703/AF16072
Title	Environmentally benign process starch derivatisation
Theme	
Implementing institute	WFBR
Project leader research (name + e-mail address)	Prof. Dr. P. Buwalda, Avebe, piet.buwalda@avebe.com
Coordinator (on behalf of private partners)	Dr. D. S. van Es, daan.vanes@wur.nl
Project-website address	http://topsectoragrifood.nl/project/environmentally-benign-process-for-starch-derivatisation/
Start date	01/01/2017
Final date	31-03-2020

Approval by the coordinator of the consortium The final report must be discussed with the coordinator of the consortium. The "TKI's" appreciate additional comments concerning the final report.	
Assessment of the report by the coordinator on behalf of the consortium:	☒ Approved ☐ Not approved
Additional comments concerning the final report:	-

Consortium	
Mention any changes in the composition of the project partners:	Akzo-Nobel Chemicals was split-off from Akzo-Nobel and became the company Nouryon. However, this had no consequences for the project.

Summary of the project	
Problem definition	The starch producing sector in the EU is a growing agricultural sector and is increasingly depending on adding value to its products to retain a competitive position in the world market. Derivatisation of starch enables technical applications, for instance in adhesives, construction and textile. This project aims to develop a more environmentally friendly reagent for the derivatisation of starch that will half the amounts of chemicals required, and develop technology to synthesise this reagent from biobased feedstock. If successful, the application potential is substantial: besides the above-mentioned technical applications, the biobased reagents may also be used for other products like coatings, sequestering agents for detergents or personal care products or in the derivatisation of other polysaccharides besides starch, like cellulose or inulin.
Project goals	• Develop a new derivatisation reagent from agro-residues • Develop technology for derivatising starch with the new reagent

	• Develop analytical tools to validate the efficacy of the derivatisation • Establish technical and economic viability of the new technology • Investigate properties of new starch derivatives

Results	
Planned results in the original project plan	• Prepare the new reagent • Develop catalytic technology towards the new reagent • Verify stability and reactivity of the new reagent • Develop environmentally benign derivatisation technologies • Verify efficacy of the technology • Investigate properties of the new starch derivatives
Achieved results	• The new reagent was prepared on sufficient scale to perform application testing • Catalytic technology for converting an agro-residue stream into the precursor for the new reagent is successfully under development • Both hydrolytic stability and desired reactivity of the new reagent are exceeding requirements, and outperform current product. • Starch derivatisation was successful. • Several derivatisation technologies have been successfully developed, including a water-borne, as well as fully solvent free process. • New derivatised starch products have been developed. • Colour of the new derivatised starch products is good. • The new technologies have been proven effective (higher efficiencies than current technology), leading to reduced use of chemicals and reduced waste production. • Investigation of the properties of the new materials is ongoing.
Explanation of changes relative to the project plan	Year 1 was focussed on feasibility and passing three criteria for go/no-go decision: i.e. sufficient hydrolytic stability, sufficient derivatisation efficiency and positive preliminary TEE evaluation. At the end of year 1, all three criteria were met, resulting in extension of the project to the second stage (year 2-3). Efforts in years 2 and 3 were mainly focussed on development of the catalytic processes to obtain the reagent and improving the sustainability of the starch derivatisation technology. Hence, the property evaluation of the modified starch is somewhat lagging behind original planning.

What was the added value created by the project for:	
Participating "Knowledge Institutes" (scientific, new technologies, collaboration)	This project further increased our expertise in: • Selective catalytic conversion of agro-residues to chemical intermediates • Starch derivatisation in general and specific techniques to derivatise starch in absence of solvents • Advanced analytical techniques for polysaccharide analysis
Participating private partners (practical application of the results, within which period of time?)	• New insights in catalytic conversion of agro-residues, including possibilities for DSP • New starch derivatisation technologies • New starch derivatives and applications
Society (social, environment, economy)	• Reduced need for chemical reagents and reduced waste generation (e.g. salt emissions) • New possibilities for starch derivatives outside of current application scope, e.g. in biodegradable consumer products • New value added outlets for residues from agro-food production
Possibly other stakeholders (spin-offs)	• The developed technology can also be applied to other polysaccharides than starch with other applications

Follow-up	
Did the PPP result in one or more patents (first filings)?	Patent application is currently under discussion.
Are there any follow-up projects planned? If yes, explain. (Contract research resulting from this project, additional funding, or new PPP projects)	Yes, currently still premature; but advancement of the developed technology from batch to continuous is foreseen.

Deliverables/products during the entire course of the PPP (provide the titles and/or a brief description of the products/deliverables or a link to a website.
Scientific articles: None: see IP section
External reports: None: project results are confidential pending IP filing
Articles in professional journals/magazines: None: project results are confidential pending IP filing
(Poster) presentations at workshops, seminars or symposia. None: project results are confidential pending IP filing
TV/ radio / social media / newspaper: None: project results are confidential pending IP filing
Remaining deliverables (techniques, devices, methods, etc.): None

Appendix: Names of the products or a link to the products on a public website
TKI AF:
Environmentally benign process for starch derivatisation
http://topsectoragrifood.nl/project/environmentally-benign-process-for-starch-derivatisation/

Bij de start was dit een EZ gefinancieerd project; het is later een TKI toeslag project geworden:

https://www.wur.nl/en/Research-Results/kennisonline/Environmentally-benign-process-starch-derivatisation.htm