Algemene gegevens	
TKI-projectnummer	AF-EU-13003
Titel	SPLASH: Sustainable Polymers from Algae Sugars and Hydrocarbons
Topsector en innovatiethema	A&F
Projectleider (onderzoek)	Dr. Lolke Sijtsma
Werkelijke startdatum	1 September 2012
Werkelijke einddatum	28 Februari 2017
Korte omschrijving inhoud (bij voorkeur 4 regels, max. half A4)	Wageningen Research is responsible for projectmanagement, sequencing of the algae *Botryococcus braunii* and, in close cooperation with projectparters, strain improvement, optimization of algal cultivation and product formation, separation and conversion technologies and development of a pilot facility.

uitvoerende partijen	
betrokken kennisinstellingen	Wageningen Food & Biobased Research (WFBR) Wageningen Plant Research (WPR)
overige partijen	Companies: PAQUES BV, Netherlands (till 1.3.2015), AVANTIUM CHEMICALS BVNetherlands, PNO CONSULTANTS BV Netherlands, NIELS-HENRIK NORSKER, Denmark , VALUE FOR TECHNOLOGY Belgium, ORGANIC WASTE SYSTEMS NV Belgium, LIFEGLIMMER GMBH Germany, NOVA-INSTITUT FUR POLITISCHE UND OKOLOGISCHE INNOVATION GMBH Germany, LANKHORST EURONETE PORTUGAL Portugal, Rhodia Operations, France, Cellulac, Ireland, F&M, Italy Knowledge institutes WAGENINGEN UNIVERSITEIT, Netherlands, UNIVERSITAET BIELEFELD, Germany, FRAUNHOFER-GESELLSCHAFT ZUR FOERDERUNG DER ANGEWANDTEN FORSCHUNG E.V ,Germany, WESTFAELISCHE WILHELMS-UNIVERSITAET MUENSTER, Germany, THE UNIVERSITY OF CAMBRIDGE, United Kingdom, UNIVERSIDAD DE HUELVA, Spain, EGE UNIVERSITESI EGE Turkey

Resultaten en deliverables	
1. Welke deliverables zijn opgeleverd, en is dit conform het projectplan? (geef een korte	The aim of the 4.5-year SPLASH project was to develop a new biobased industrial platform using microalgae as a renewable raw material for the sustainable production and recovery of hydrocarbons and (exo)polysaccharides from the species

beschrijving per deliverable uit het projectplan)	*Botryococcus braunii* and further conversion to renewable polymers. Main focus points were: • Understanding of product formation of two *B. braunii* strains that produce mainly hydrocarbons or polysaccharides respectively, based on in-depth gene analysis • Development of understanding and procedures for production, in situ extraction and isolation of hydrocarbons and carbohydrates from selected *B. braunii* strains for further product development • Conversion of hydrocarbons or polysaccharides to products • Process demonstration at pilot scale, Process integration, sustainability assessment and market analysis
Deliverables	All deliverables, as agreed on in the project proposal, have been accepted by the EC.
Management deliverables	Management of the project
Information on Genome and transcriptome of *B. Braunii*	Sequence the genome of B. braunii race A, and by combination of transcriptomics, proteomics and metabolomics, together with metabolic modelling, construct metabolic maps for the production of hydrocarbons and cell wall polysaccharides.
Optimized growth and production of hydrocarbons and polysaccharides	For the optimisation of growth and production conditions two different approaches will be followed being a statistical/empirical approach that will enable a fast optimization of the medium and conditions and a mechanistic approach, which will lead to a better understanding of *B. braunii*
Process for continuous product recovery of hydrocarbons and polysaccharides from *Botryococcus*	Development of in situ DSP methods
Biosafety	A Biosafety Officer will be appointed who will be responsible for drawing up a plan to ensure that all partners comply with the Biosafety regulations required by EU directives 219 & 90, and local Health and Safety regulations
Hydrolysis of algae polysaccharides into monomeric sugars	The polysaccharide fraction produced in WP3 will be characterized. The polysaccharides will be depolymerized into their constituting monosaccharides by chemo-enzymatic methods
Conversion of fucose and rhamnose to 1,4-pentanediol	Rhamnose and fucose both are excellent starting materials for the subsequent chemo–enzymatic synthesis of 5-methyl furfural. This approach has the potential to lead to both a more environmentally benign as well as cheaper route to 5-methylfurfural
2. Indien bepaalde deliverables niet gehaald zijn, wat was daarvoor de reden?	
3. Heeft het project onverwachte (neven)uitkomsten opgeleverd, die vooraf niet waren voorzien?	No

Zo ja, benoem deze.	
4. Op welke wijze is over het project en de resultaten gecommuniceerd	Public and potential stakeholders were informed about the outcome and benefits of the project. Conferences, meetings and a summer school were organised in order to inform and train researchers (academic and industrial) in the fields of metabolic modeling and engineering, bioconversion, microalgae cultivation, downstream processing, conversion of biomass (especially hydrocarbons and polysaccharides into chemicals), life cycle assessment and process modeling.
5. In hoeverre heeft het project bijgedragen aan de ontwikkeling van de betrokken kennisinstel-ling(en)? (bijv. wetenschappelijk track record, nieuwe technologie, nieuwe samenwerkingen)	The project has largely contributed to enhancement knowledge and tools of WPR in the field of systems biology, genome sequencing and annotation. WFBR build knowledge on algal cultivation, product extraction, conversion of sugars to polymer building blocks and techno economic analysis. The work resulted in a number of presentations and publications (track record)
6. Krijgt het project een vervolg in de vorm van een nieuw project of een nieuwe samenwerking? Zo ja, geef een toelichting.	Although ideas for future cooperation projects have been generated and discussed at the final project meeting, no new projects on this specific topic have been submitted yet. This is partly due to difficulties in stable production of *B. braunii* at industrial scale. Based on expertise and visibility, however, 2 new projects have been submitted within the blue bioeconomy topic, of which one already is granted (WU coordinator)

Highlights: geef een korte beschrijving van de belangrijkste resultaten (deze beschrijving wordt als publieke samenvatting op de websites van de TKI's/topsectoren geplaatst)

Around the world steps are being taken to move from today's fossil based economy to a more sustainable economy based on biomass. The 4.5-year European project SPLASH aims to develop a new biobased industrial platform using microalgae as a renewable raw material for the sustainable production and recovery of hydrocarbons and (exo)polysaccharides from the species Botryococcus braunii and further conversion to renewable polymers.

After 4,5 years of research we developed tools and technologies needed for the establishment of a new industrial sector: Industrial Biotechnology with algae and/or algal genes for the manufacture of industrial raw materials. We built a foundation for future commercialisation of hydrocarbon production with the B. braunii. We developed knowledge to understand the product formation of two B. braunii strains that produce mainly hydrocarbons or polysaccharides respectively, based on in-depth gene analysis. We improved algae production and were able to recover hydrocarbons and polysaccharides while keeping the algae viable, although further improvements are required. Furthermore, we made substantial progress in the analytics of carbohydrate and hydrocarbon fractions and the conversion of carbohydrates into building blocks and subsequently polymers such as fibres for yarns. As industry, however, needs relatively cheap and pure raw materials, costs for sugars produced by B. braunii are currently far too high. Furthermore, separation of sugars from mixtures remains an important item to be addressed. We developed a pilot facility capable of demonstrating an optimized process for the production and utilisation of both polysaccharides and hydrocarbons and identified potential business cases for B. braunii hydrocarbons based on realistic assumptions.

For details I would refer to the cordis website:
https://cordis.europa.eu/docs/results/311/311956/final1-17-05-23-final-report-splash-2017-summary.pdf

Aantal opgeleverde producten (geef in een bijlage de titels en/of omschrijving van de producten of een link naar de producten op openbare websites)					
Wetenschappe-lijke artikelen	Rapporten	Artikelen in vakbladen	Inleidingen/ workshops/ invited lectures	Aangevraag-de octrooien /first filings	Spin-offs (*)
11			10		

(*) Hiermee wordt bedoeld: contractonderzoek dat voortkomt uit dit project, aanvullende subsidies die zijn verkregen en spin-off bedrijvigheid.

Verwacht u nog een octrooiaanvraag naar aanleiding van dit project?	NEE

Bijlage: Titels van de producten of een link naar de producten op een openbare website

All information on project results, presentations and publications are presented at the SPLASH and cordis websites.

http://eu-splash.eu/

https://cordis.europa.eu/project/rcn/104994_en.html

https://cordis.europa.eu/result/rcn/212762_en.html

https://cordis.europa.eu/docs/results/311/311956/final1-17-05-23-final-report-splash-2017-summary.pdf

https://www.wur.nl/nl/project/SPLASH-duurzame-polymeren-uit-algen.htm

Akkoord: Hans van der Kolk (Topsectorsecretaris).

APPENDIX.

2015

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