



Algemene gegevens	
TKI-Nummer	AF-EU-14006
Titel	MIRACLES: Multi-product Integrated Biorefinery of Algae
Topsector (A&F of T&U)	A&F
Projectleider (onderzoek)	Dr. Lolke Sijtsma
Werkelijke startdatum	1 November 2013
Werkelijke einddatum	30 Oktober 2017
Korte omschrijving inhoud	DLO is involved in the development and management of integrated biorefinery technology, employing mild disruption, green extraction and fractionation technologies to produce multiple specialty products from microalgae biomass.

Uitvoerende partijen	
Betrokken kennisinstellingen	Wageningen Food & Biobased Research
Overige partijen	-

Highlights
<p>Microalgae are a promising feedstock for the sustainable supply of commodities and specialties for food and non-food products. Despite this potential, currently implementation is limited, mainly due to unfavourable economics. Major bottlenecks are the lack of available biomass at acceptable costs and the absence of appropriate biorefinery technologies. MIRACLES is an industry-driven R&D and innovation project aimed at developing integrated, multiple-product biorefinery technologies for the production of specialties from microalgae for application in food, aquaculture and non-food products.</p> <p>During the third year of the project analysis of the overall chemical composition of the selected algal strains for the project has been extended. Bead milling and homogenisation appeared suitable technologies for cell disruption methods and were optimized for optimal efficiency and reduced energy use. New membrane filtration as well as other technologies for protein fractionation and lipid extraction were developed.</p>

Aantal opgeleverde producten			
Wetenschappelijke artikelen	Rapporten	Artikelen in vakbladen	Inleidingen/ workshops/ invited lectures
6	-	-	3

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

2015

Bienvenida Gilbert-López, José A. Mendiol, Javier Fontecha, **Lambertus A. M. van**

den Broek, Lolke Sijtsma, Alejandro Cifuentes, Miguel Herrero, Elena Ibáñez. (2015) Downstream processing of *Isochrysis galbana*: a step towards microalgal biorefinery. *Green Chemistry* 17 (2015)9. p. 4599 - 4609.
<http://pubs.rsc.org/en/content/articlelanding/2015/gc/c5gc01256b?iscitedby=True#!divAbstract>

Hans Reith, Bert Lemmens, Hans Kleivdal, **Lolke Sijtsma**, Philippe Willems, Carlos Unamunzaga, Elke Breitmayer, Macarena Sanz, René Wijffels (2015). Production of specialties for food, aquaculture and non-food applications via multi-product biorefinery of microalgae: Progress of the EU FP7 project MIRACLES. 2nd EABA and EC Algae contractors conference and the 9th international algae congress. Lisbon, 1-3 December 2015

2016

Lambertus van den Broek, Carl Safi, Jelle van Leeuwen, Lolke Sijtsma (2016) Algae biorefinery: proteins for technical applications, Lecture, Workshop Algae & Seaweed, 18 February 2016, Wageningen, The Netherlands

Lambertus van den Broek, Carl Safi, Jelle van Leeuwen, Lolke Sijtsma (2016), Algae biorefinery for non-food applications, Poster, Workshop Algae & Seaweed, 18 February 2016, Wageningen, The Netherlands

Lambertus van den Broek, Carl Safi, (2016) Protein biorefinery. Lecture, 12th International Conference on Renewable Resources and Biorefineries, 30-31 May & 1 June, 2016, Ghent, Belgium

L.A.M. van den Broek, C. Safi, J.J.A. van Leeuwen, W.J. Mulder, L. Sijtsma (2016) Algae Biorefinery: protein for non-food applications, Abstract, Abstract book 12th International Conference on Renewable Resources and Biorefineries 30-31 May & 1 June, 2016, Ghent, Belgium. P68

Carl Safi, Lambertus van den Broek, Lolke Sijtsma (2016) Microalgae biorefinery, Poster, European roadmap for an algae-based industry, 6-8 April, Olhão, Portugal

Carl Safi (2016) La technologie des microalgues: quel potentiel? L'Orient Le Jour. Article <https://www.lorientlejour.com/article/991452/la-technologie-des-microalgues-quel-potentiel-.html>

C. Safi, L.A.M. van den Broek, W. Mulder, L. Sijtsma (2016) Microalgae Biorefinery: Obtaining an enriched protein fraction after cell disruption and ultrafiltration. Abstract, Booklet for the European Conference 6-8 April 2016, Olhão, Portugal. p45.

L. Sijtsma, B. Gilbert-López, E. Ibáñez, **L.A.M. van den Broek, C. Safi**, R. Floor, K. Schatteman, M. de Filette, C. Sagt, B. van den Burg, G. Olivieri, C. Unamunzaga (2016) MIRACLES: Development of integrated algae biorefinery technology, Abstract, Booklet for the European Conference 6-8 April 2016, Olhão, Portugal. p46

Reith, H., Leen Bastiaens, Hans Kleivdal, **Lolke Sijtsma**, Philippe Willems, Carlos Unamunzaga, Elke Breitmayer, Macarena Sanz, René Wijffels. (2016) Production of specialties for food, aquaculture and non-food applications via multi-product biorefinery of microalgae.

Multi-product Integrated bioRefinery of Algae: from Carbon dioxide and Light Energy to high-value Specialties (2013-2017). Invited lecture: European roadmap for an algae-based industry, 6-8 April, Olhão, Portugal
http://eualgaeroadmapconference.eu/fileadmin/intesusal_docs/Documents/Industry_Seminars/Presentations_2016/Welcome/7.MIRACLES_FINAL_Olhao_Pitch_Presentation.pdf

Reith, H., Leen Bastiaens, Hans Kleivdal, **Lolke Sijtsma**, Philippe Willems, Carlos Unamunzaga, Elke Breitmayer, Macarena Sanz, René Wijffels. (2016) Production of specialties for food, aquaculture and non-food applications via multi-product biorefinery of microalgae: Progress in the EU FP7 project MIRACLES". Abstract. ALGAEUROPE, 13-15 December, Madrid, Spain, pp79

Reith, H., Leen Bastiaens, Hans Kleivdal, **Lolke Sijtsma**, Philippe Willems, Carlos Unamunzaga, Elke Breitmayer, Macarena Sanz, René Wijffels. (2016) Production of specialties for food, aquaculture and non-food applications via multi-product biorefinery of microalgae: Progress in the EU FP7 project MIRACLES" Invited lecture. ALGAEUROPE, 13-15 December, Madrid, Spain, pp79

Slegers, P. M., Olivieri, G., van Boxtel, A. J. B., **Sijtsma, L.** Process chain development of five algae-to-product value chains, integrating novel process technologies. Abstract. ALGAEUROPE, 13-15 December, Madrid, Spain, <http://edepot.wur.nl/405389>

Slegers, P. M., Olivieri, G., van Boxtel, A. J. B., **Sijtsma, L.** Process chain development of five algae-to-product value chains, integrating novel process technologies. Poster. ALGAEUROPE, 13-15 December, Madrid, Spain

Link naar Kennisonline

<http://www.wur.nl/nl/project/MIRACLES-1.htm>