



Bio-based Industries  
Consortium



Horizon 2020  
European Union Funding  
for Research & Innovation



ALGAE FOR A BIOMASS  
APPLIED TO THE  
PRODUCTION OF ADDED  
VALUE COMPOUNDS

# NEWSletter

Issue n° 6  
MAR. 2021

## In this issue-----

### - Recap of the ABACUS project

ABACUS BBI-JU project: Algae for a biomass applied to the production of added value compounds



"A joint European initiative to foster algae as a biomass applied to the production of added value compounds for high-end applications"

### ABACUS project at a glance:



39 months

01/05/2017-31/07/2020



9 European partners

2 large industries, 3 SMEs, 4 RTOs



H2020-BBI JU  
Research & Innovation Action



Project Total Cost: € 5,135,861

BBI Contribution/Funding: € 4,653,659



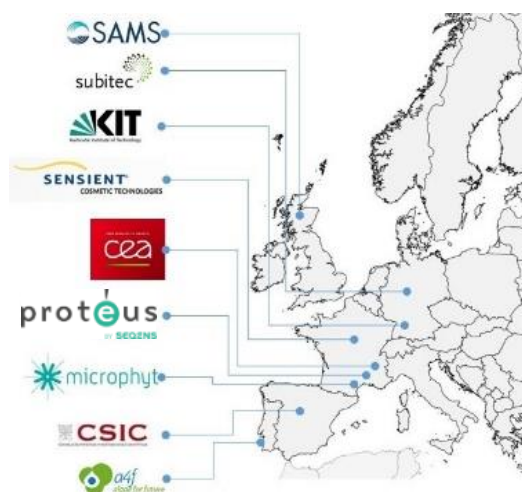
Exploiting algae and other aquatic biomass for production of molecules for pharma, nutraceuticals, food additives and cosmetic applications - Feedstock: Micro/macro algae



Project structure: 10 WPs



ABACUS BBI-JU project developed 5 new algal biorefinery pathways to bring competitive & innovative algae-based products to the cosmetics and nutraceuticals markets. It also made decisive steps towards improved profitability and reliability of algae cultivation steps.



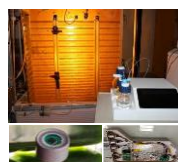
# Summary of results

Market opportunities were qualified for terpenes and carotenoids molecules in cosmetics, fragrances and nutraceuticals fields. Specifications were defined for target products. Candidate cyanobacteria and microalgae species were chosen to afford five product-species couples exploited along the project.



Most promising algae strains with high biomass & product productivities were selected among 150 candidate microalgae/cyanobacteria varieties. Genetic engineering of 17 cyanobacteria allowed to attain production of light terpenes.

Cultivation of 7 algae strains was improved in photobioreactors (PBRs) at pilot scale to reduce maintenance and operational costs. New sensors were developed and integrated for online process monitoring and control of microalgae cultures.



4 biorefinery scenarii - *D. salina*/β-carotene, *T. lutea*/fucoxanthin, *H. pluvialis*/astaxanthin, *P. cruentum*/zeaxanthin - were run at industrial scale, delivering altogether more than 200kgs of carotenoid-rich biomasses with high productivities up to 1g/L/day and high concentrations up to 10g/L. A proof-of-concept was also established for continuous production of light terpenes using GM-cyanobacteria.

Green extraction and fractionation/purification procedures employing innovative compressed fluids were developed to increase yields (>20%) and purities (15% total carotenoids). In addition, an integrated green biorefinery process yielding multiple active fractions from one single biomass was developed at pilot scale.



Raw and purified algae extracts were analytically characterized. Their technical acceptability and applicability was assessed for the targeted markets. Formulation and preservation strategies for active extracts to be used in cosmetic sector were elaborated and tested experimentally.

The whole value chain of astaxanthin production from 3 scenarii with different technological and geographical options was evaluated through LCA and TEA required for market acceptance of algae biomass production.

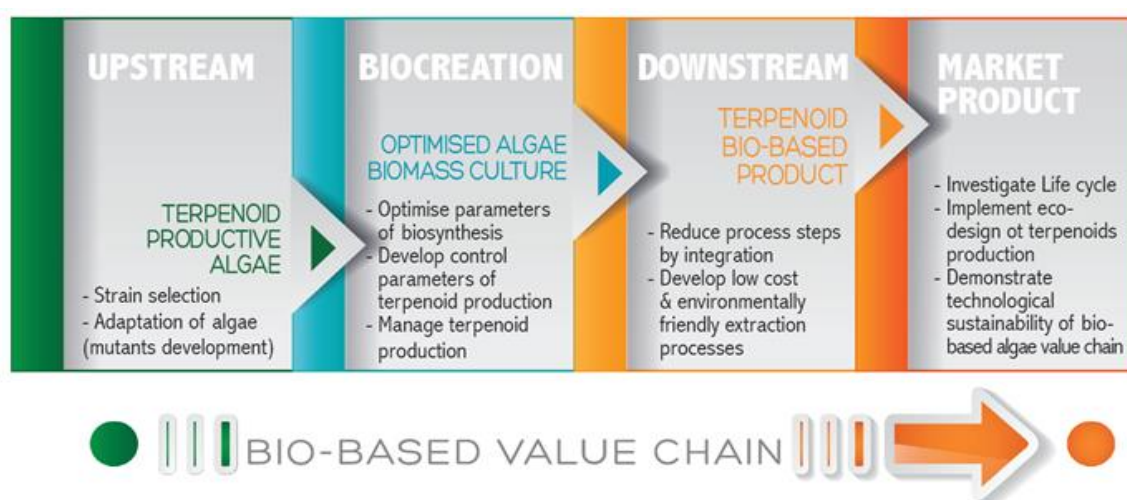


The whole project was valorised through 27 original publications and a 2-day international workshop organised in 2019 (>100 attendees). The project also met the ethics requirements for engineering and contained cultivation of genetically modified cyanobacteria.

**WP1**
**Roadmap to markets**
**WP2**
**Algae selection**
**WP3**
**Process design**
**WP4**
**Upscaling**
**WP5**
**Fractionation**
**WP6**
**Applicability**
**WP7**
**Product & market acceptance**
**WP 8-9-10**
**Communication Management Ethics requirements**

## Highlights of the ABACUS project

Taking advantages of complementary background and expertise of its consortium, ABACUS was able to deliver significant biological and technical advances at **every level of the algae-to-product value chain**, ranging from market identification, upstream process to market product step.



ABACUS provides a range of new algae-based molecules for bringing competitive products to cosmetics and nutraceuticals markets. Overall, ABACUS brings **innovative technical and biological solutions** to improve the **reliability and profitability** of the **algae sector**.

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