



SENSBIOSYN



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SENSBIOSYN

Biosensors and Sensors for the industrial biosynthesis process of widely used commercial antioxidants: Nutraceuticals as additives for food and aquaculture promoting public health and safety

The Challenge

One of the major challenges faced by microalgae companies today, especially in the production of natural carotenoids in comparison with the relatively cheap synthetic analogues, is the lack of existing devices able to provide online rapid automatic and reliable information on active compounds accumulation profile and efficacy during their biosynthesis.

Project Objective

The purpose of this collaborative research project is to develop sensors and biosensors for on-line monitoring growth parameters of algal biomass and their bioactive compounds produced by large scale systems, with a particular focus on a group of relevant industrial processes for the natural synthesis of antioxidant xanthophylls.

Key Points

- Develop sensors and biosensors for on-line monitoring growth parameters of algal biomass and their bioactive compounds produced by large scale systems, with a particular focus on the natural synthesis of antioxidant xanthophylls.
- Use as sensing mediator engineered Photosystem II complex extracted from the algae *Chlamydomonas reinhardtii*.
- Develop an optical sensor to measure the fluorescence emitted by chlorophyll inside the *Haematococcus pluvialis* cells in culture medium.
- Develop an optical sensor to measure the density of the *Haematococcus pluvialis* cells culture medium through a light transmission measurement.
- Develop an electrochemical biosensor to measure the antioxidant potential of astaxanthin by measuring the amperometric current generated by stabilised Phosphatidylcholine derivatives bound to magnetic nano-particles.
- Develop an electrochemical biosensor to measure the astaxanthin concentration by measuring the output current of a NanowireFET.
- Develop micro and nanofluidic systems.
- Increase production efficiency and product quality.

EATiP Thematic Area of Relevance

TA1: Product Quality, Consumer Safety and Health

TA2: Technology and Systems

TA3: Managing the Biological Lifecycle

TA4: Sustainable Feed Production

TA5: Integration with the Environment

TA6: Knowledge Management

TA7: Aquatic Animal Health and Welfare

TA8: Socio-Economics and Management

Key Words

microalgae, carotenoids, biosensors, monitoring, antioxidant, Xanthophylls

Project Information

Contract number:

232522

Contract type:

Research for SMEs

Research area:

Research for the benefit of SMEs

Duration:

24 months (01/11/2009 – 31/10/2011)

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- Economic and business exploitation of project results.

Key New Knowledge Expected

- The identification of the industrial bioprocess requirements; the definition of the biosensors specifications; and the biosensors design.
- Screening, identification, characterization and purification of wild-type and molecular engineered *Chlamydomonas reinhardtii* photosystem II complexes for biosensor development. Set up the purification protocols, calibration and validation tests.
- The development of a set of optical and electrochemical sensors able to assess the content and the antioxidant efficacy of accumulated xanthophylls.
- Control of the biosensors application in field analysis; sensor response validation; manuals preparation, application notes.

Potential Impacts



Market:

- SENSBIOSYN targets a particularly effective application field, for which it is possible to preview in the medium period a market of interesting dimensions: the natural production of Xanthophyll metabolites and, more generally, of algal biomass.
- SENSBIOSYN will contribute to increase the applicant SMEs' market share being attractive world-wide to international companies, public/private research institutes and laboratories, operating in the above mentioned fields and in the more recent field of algae-based bioenergy.



SME

- will have the chance of collaborating with research performers with a deep knowledge and experience in algae, microalgae, their large scale cultivation systems and monitoring tools, biomediators and biosensors.
- will have the opportunity to push the production of new products toward real problems solution with the help of a directly involved end-user, Algatechnologies, with specific knowledge and patents on photobioreactor systems.



SMEs & RTD

- This project is significantly relevant to the industrial and applied research and development. The prototypes developed, intended for field trials, feature a high potential for commercialisation.



Knowledge transfer

- An efficient and constant interface between partners from scientific institutions and enterprises will be supported to help joining expertise and offering research contracts and new employments in the companies.
- The project will give the opportunity to the involved young people of both the scientific and the industrial sector to be trained on the latest RTD progress and products.
- SENSBIOSYN will be the result of the convergence of Molecular Biology, Nanotechnologies, Electronics, Software and Automation.
- Every time a multidisciplinary innovative project is proposed, the creation of a transnational partnership is sought to combine different expertises and to access several markets, thus achieving scientific and technological excellence and increasing products and SMEs' visibility, future sales, commercialization and license agreements in different countries.