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LIPID PRODUCTION BY *NANNOCHLOROPSIS OCEANICA* AT LARGE SCALE: ENERGY BALANCE AND TECHNO-ECONOMIC ANALYSIS

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Abstract:
Due to the robustness of its cell, the ability to accumulate lipids when subjected to stresses and culture stability, Nannochloropsis is one of the most investigated genus for biofuel production. Another important feature of this genus that impacts on the economic viability of the process is its high content of eicosapentaenoic acid (EPA).

In the EU-FP7 projects FUEL4ME and BIOFAT we have thoroughly studied the response of Nannochloropsis oceanica to nitrogen depletion. The main objective of our activity in FUEL4ME was to compare in 1-m2 GWP®-III photobioreactors the two-step process (Rodolfi et al. 2009), with the one-step process in which limiting amounts of nitrogen are regularly added to the culture according to the consumption rate. In BIOFAT the two-step process was applied at large scale: two 250 m2 GWP®-II modules were used to produce the inoculum for two 530 m2 raceway ponds which were kept under nitrogen replete conditions for optimal growth; the cultures from the ponds were then used to inoculate two 1280 m2 raceway ponds kept under nitrogen starvation for lipid accumulation. Results showed that, depending on the season and on the modality of nitrogen supply, fatty acid productivity can be higher with the one-step process, although fatty acid content is always higher in the two-step cultivation. The data obtained in the two projects were used for the calculation of NER (Net Energy Ratio) and a techno-economic analysis (TEA) of one plant entirely composed of GWP® reactors and one integrated plant composed of GWP®

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reactors and ponds, both at 1 ha and 100 ha scale.

About the author:
MSc degree in 1997 in Tropical and Subtropical Agriculture. PhD in 2001 in Food Biotechnology at the University of Florence with a thesis on "Nannochloropsis: biochemical characterization, mass cultivation and use in aquaculture". Researcher at the University of Florence where she holds a course on Environmental and Applied Microbiology and coordinates researches on photobioreactor development, and on oil and high value products from microalgae. Responsible of research units in the FP7 projects BIOFAT, FUEL4ME and SPLASH and in the H2020 project NOMORFILM. From 2005 to 2008 member of the Executive Committee of the ISAP, and since 2009 member of the Industrial Committee of the EABA. Co-founder and President of Fotosintetica & Microbiologica S.r.l., spin-off company of the University of Florence.

CONFERENCE PROGRAM

WEDNESDAY, 14 DECEMBER

09:00 - 09:10   Opening Session

09:10 - 09:40   Key note:
EU Perspectives for Algae research beyond 2020
Szilvia Bozsoki, European Commission, Directorate-General for Energy

09:40 - 11:00   Session 5:
Breakout to commercialization: 'Algae Cluster' and other 'Lighthouse' projects
Chair: Kyriakos Maniatis, European Commission, Directorate-General for Energy

FP 7 All-gas project: Demonstration scale under construction
Zouhayr Arbib, FCC Aqualia, SA, (Spain)

InteSusAl – The project's history and findings
Tom Bradley, Charles Parsons Technology Centre

Cultivation of Nannochloropsis oceanica F&M-M24 and Tetraselmis suecica F&M-M33 in the two 0.5-ha BIOFAT Pilot Plants for biofuel production
Natascia Biondi – Luis Costa, University of Florence/ A4F (Italy/Portugal)

The H2020-project Photofuel: Biocatalytic solar fuels for sustainable mobility in Europe
Hilke Heinke, Volkswagen (Germany)

11:00 - 11:30   Coffee break

11:30 - 12:50   Session 6:
Value chains in commercialization: EU biorefinery and added-value products
Chair: Olivier Lépine, AlgoSource

Sustainable integrated Algae Biorefinery for the production of bioactive compounds for Agriculture aNd Aquaculture (SABANA)
Gabriel Acien, University of Almeria, (Spain)

Production of specialties for food, aquaculture and non-food applications via multi-product biorefinery of microalgae: Progress of the EU FP7 project MIRACLES
Hans Reith, Wageningen University (the Netherlands)

Submerged Membrane Based Water Recycling & Harvesting for Microalgae Cultivation
Leen Bastiaens, Flemish Institute of Technological Research (VITO) (Belgium)

CO2Algaefix: Biofixation of CO_2 from industrial flue gases by microalgae and its transformation into added-value products
Federico G. Witt, AlgaEnergy S.A. (Spain)

12:50 - 14:10   Lunch

14:10 - 15:30   Session 6 continued

COST Action ES1408: European Network for Algal-Bioproducts
Cristina Gonzalez-Fernandez, IMDEA Enegy (Spain)

Lipid production by Nannochloropsis oceanica at large scale: energy balance and techno-economic analysis
Liliana Rodolfi, University of Florence, (Italy)

Sustainable PoLymers from Algae Sugars and Hydrocarbons (SPLASH): lessons learned
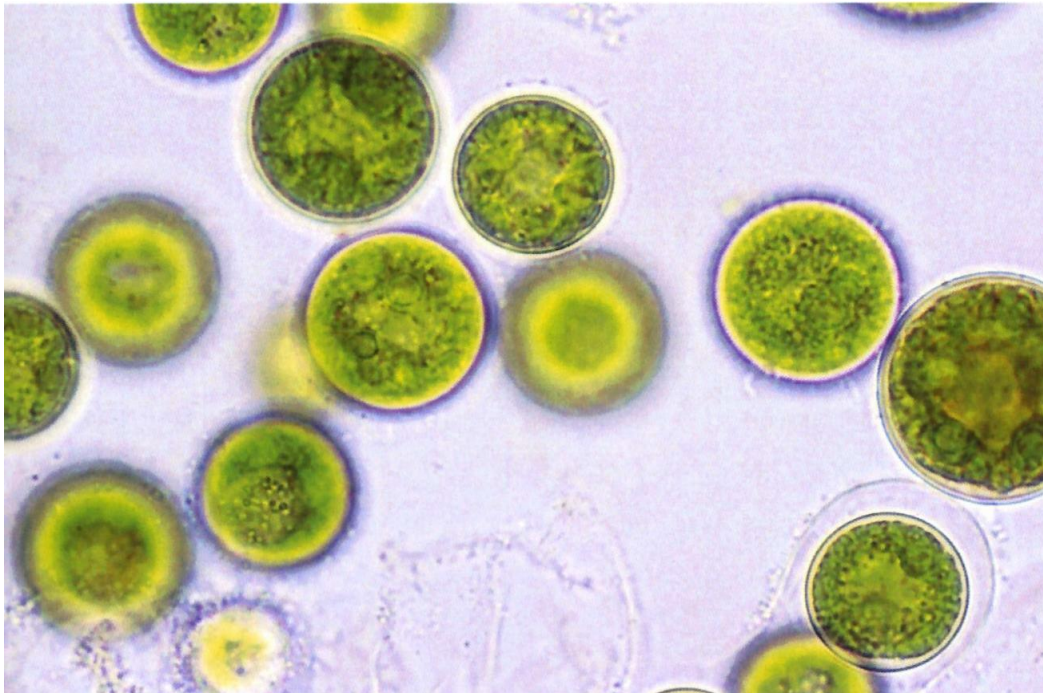*Lolke Sijtsma, Wageningen Food & Biobased Research (the Netherlands)*

Biobased polyurethanes from microalgae
Philip Sellars, University of Warwick (UK)

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