Current status for prospects on advanced biofuel production: how to get through scientific and technological challenges as part of bioeconomy success?

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Abstract

In recent years, important steps into the transition towards biofuels have been taken in order to reduce environmental impacts linked to fossil fuels and to increase energetic independence. Worldwide bioenergy boom – from sciences, technologies, resources, policies – is an important part of the success and sustainability of the bioeconomy.
An updated overview of advanced biofuels' production (alcohol, lipids and hydrogen mainly) from real lignocellulosic resources using yeasts or bacteria is proposed. Only few studies have focused on the advanced biofuel production from real lignocellulosic substrates when complex and synergistic effects of inhibitory compounds occur.

Lignocellulose pretreatments to produce liquid or gaseous carbon sources for microbial biofuel production are reported and their scientific and technological bottlenecks i.e. initial low carbon content, generation of inhibitors, limitations to gas-liquid transfers, low yields of products from the initial carbon are underlined. The most recent advances on new engineered strains and innovative integrated bioprocesses for alcohol, lipids as biofuel precursor and hydrogen production are discussed. Prospects focus on the development of genetically modified strains, heat valorizations, recycle of by-products and innovative bioprocesses can contribute to the economic and environmental viability of the lignocellulosic pathway for the production of biofuels.

On overview of French academic partners involved in biofuels'production in accordance with French National Research Agency strategy is reported and the evolution during the ten passed years is discussed.

Recent publications

Alfenore S, Molina-Jouve C (2016). Current status and future prospects of conversion of lignocellulosic resources to biofuels using yeasts and bacteria. Review Article. Process Biochemistry 51(11) 1747-1756 doi:10.1016/j.procbio.2016.07.028
Bideaux C, Montheard J, Cameleyre X, Molina-Jouve C, Alfenore S (2016). Metabolic flux analysis model for optimizing xylose conversion into ethanol by the natural C5-fermenting yeast *Candida shehatae*. Applied Microbiology and Biotechnology 100(3):1489-1499 doi:10.1007/s00253-015-7085-0
Julien Cescut, Luc Fillaudeau, Carole Molina-Jouve, Jean-Louis Uribelarrea (2014) Carbon accumulation in *Rhodotorula glutinis* induced by nitrogen limitation. Biotechnology for Biofuels, 7:164
Montheard, J., Garcier, S., Lombard, E., Cameleyre, X., Guillouet, S., Molina-Jouve, C., Alfenore, S., (2012) Assessment of *Candida shehatae* viability by flow cytometry and fluorescent probes. J.Microbiol.Meth. 91, 8-13
Ben Gaida, L., Andre, C., Bideaux, C., Alfenore, S., Cameleyre, X., Molina-Jouve, C., Fillaudeau, L., (2012) Modelling of hydrodynamic behaviour of a two-stage bioreactor with cell recycling dedicated to intensive microbial production. Chem. Eng. J. 183, 222-230

Biography



Carole Molina-Jouve is a Professor in the Department of Biochemical Engineering at the Institut National des Sciences Appliquées, an Engineering School in Toulouse, and, since 2016, head of the Laboratoire d'Ingénierie des Systèmes Biologiques et Procédés involving 320 persons. She received her Ph.D. in Chemical Engineering from the Institut National Polytechnique de Toulouse in 1991. She investigated mass transfer in multi-phase systems with chemical and biological reactions and since 1999, her works focus on the investigation of the intensification of the bioprocess performances dedicated to the biofuel production. Since 2005, she is involved in 21 projects in bioenergy supported by national agencies, industrial partners and European Union. She is member in Energy from Biomass Group in the Alliance Nationale de Coordination de la Recherche pour l'Energie (French National Alliance for Energy Research Coordination). She then contributes to pinpoint scientific and technological barriers and identify R&D programs.

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