

# SUSTAINABLE MATERIALS, PROCESSES AND SYSTEMS FOR ENERGY TRANSITION

## Biochemical processes for green fuels

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<b>Context of the research activity</b>	<p>There is an urgent need to develop sustainable solutions for CO<sub>2</sub> recovering and to replace fossil fuels with green solutions based on renewable feedstock, in a logic of low-carbon and circular economy. In this scenario, the development of sustainable biochemical processes aimed at the exploitation of sunlight for the simultaneous valorization of CO<sub>2</sub> and agro-industrial wastes for biofuels production represents a solution of major current interest to both the scientific community and the industrial energy sector. Compared to second generation biofuels, the third generation biofuels based on microalgal biomass represent a promising alternative energy solution, since it allows to recover at the same time the CO<sub>2</sub> from the atmosphere or from industrial off-gases and the nutrients present in wastewater and industrial effluents and do not compete with agricultural land, water resources, and food crops.</p> <p>Strategic sectors such as aviation and naval are progressively aiming for an increasing reductions in emissions. Thus, the aim is to investigate synthetic biofuel solutions that allow the content of the algal fraction in the blend to be progressively increased, while maintaining competitive combustion and lubrication properties. The research will focus on a combined biochemical and reactor engineering approach to optimization and scale-up in innovative photobioreactor systems a sustainable process based on microalgae for biofuel production from agro-industrial wastes.</p>
	<p>Scholarship funded by IIT.</p> <p>Main seat to carry out the research: CENTER FOR SUSTAINABLE FUTURE TECHNOLOGIES, ISTITUTO ITALIANO DI TECNOLOGIA, Torino</p> <p>Supervisors: Prof. Fabrizio Pirri, fabrizio.pirri@polito.it; Dr. Alessandro Cordara, alessandro.cordara@iit.it; Dr. Barbara Menin, barbara.menin@iit.it</p> <p>The main research objectives of this PhD thesis include (not necessarily all):</p> <ul style="list-style-type: none"> <li>• Optimization of biotechnological processes based on mixotrophic/heterotrophic cultivation of microalgae for efficient recovery of</li> </ul>

<b>Objectives</b>	<p>CO<sub>2</sub> and nutrients from waste and production of biomass with high lipid fraction content;</p> <ul style="list-style-type: none"> <li>• Implementation of biochemical process efficiency monitoring tools;</li> <li>• Drawing, design and implementation of innovative photo-bioreactor systems to increase process efficiency;</li> <li>• Implementation of downstream processes;</li> <li>• Development of computational models of fluid dynamics to evaluate process scalability;</li> <li>• Study of mass balances for determining process efficiency and techno-economic sustainability.</li> </ul>
<b>Skills and competencies for the development of the activity</b>	<p>Candidates should have a good background in industrial biotechnology and biochemistry and strong motivation to learn through advanced research in engineering and process areas.</p> <p>Direct experience in molecular biology laboratories is preferred.</p> <p>Problem solving ability, strong communication, time-management skills and commitment to innovation for sustainability is preferred.</p> <p>Candidates should have a strong motivation to learn through advanced research.</p>