

The Chancellor of Ghent University has the honour of inviting you to attend the public defense of the doctoral dissertation of

Laia Vulart Bach

Title of the doctoral dissertation:

Sustainable resource recovery via thermophilic fermentation and microbial electrolysis cells: insights for Earth and space applications

The public defence will take place on 26 May 2026 at 11:00 in the Sala de Graus at the Escola d'Enginyeria, Universitat Autònoma de Barcelona

There will be a contiguous reception to which you are heartily invited.
Please confirm your attendance by 15 May 2026 at laia.vulartbach@ugent.be

Dissertation supervisors

Prof. dr. Ramon GANIGUÉ
Faculty of Bioscience Engineering,
Ghent University

Prof. dr. Francesc GÒDIA
Escola d'Enginyeria,
Universitat Autònoma de Barcelona

Dr. Àngel ESTÉVEZ
Faculty of Bioscience Engineering,
Ghent University

Board of examiners

Prof. dr. Albert GUIASOLA
Chairman
Escola d'Enginyeria,
Universitat Autònoma de Barcelona

Prof. dr. ir. Nico BOON
Secretary
Faculty of Bioscience Engineering,
Ghent University

Dr. Heleen de WEVER
Flemish Institute for Technological
Research (VITO)

Prof. dr. Sebastià PUIG
Escola Politècnica Superior,
Universitat de Girona

Dr. Lucie POULET
Institut Pascal,
Université Clermont Auvergne

Abstract of the doctoral research

In future space missions to the Moon or Mars, current resupply and waste management strategies will not be feasible. To address this limitation, the MELiSSA (Micro-Ecological Life Support System Alternative) project aims to develop a bioregenerative, closed-loop life support system that converts the waste generated by the crew into food, potable water, and a breathable atmosphere. At present, closing the carbon cycle by oxidizing the carbon in the organic waste to CO₂ remains one of the main challenges in the loop. Similarly, on Earth, growing environmental pressures resulting from increased resource extraction and waste accumulation highlight the urgency of transitioning toward a more circular bioeconomy.

Thermophilic mixed-culture fermentation and microbial electrolysis cells have emerged as promising technologies for recovering resources from organic waste streams. This thesis explored the influence of several operational parameters (pH, feeding regime, substrate concentration) on microbial community dynamics and process performance in thermophilic mixed-culture fermentation. The biodegradability of protein- and polysaccharide-based bioplastics via thermophilic mixed-culture fermentation was also assessed to identify new valorisation routes for these materials. Furthermore, this thesis investigated the capacity of a microbial electrolysis cell to oxidize complex fermentation effluents to CO₂, providing insights into the effect of various operational parameters on microbial community composition and process performance. Together, the findings of this thesis contribute to optimizing microbial processes for efficient carbon recovery, supporting the development of sustainable resource management strategies for applications on both Earth and in space.

Brief Curriculum Vitae

Laia Vulart (Sant Celoni, Spain, 12 July 1998) holds a Bachelor's degree in Biotechnology from the Universitat de Barcelona and a Master's degree in Advanced Biotechnology from the Universitat Autònoma de Barcelona. Following her studies, she started a joint PhD at the Center for Microbial Ecology and Technology at Ghent University, in collaboration with the MELiSSA Pilot Plant at the Universitat Autònoma de Barcelona. During her PhD, Laia co-authored three scientific papers submitted to international peer-reviewed journals, and presented her research at several international conferences, including IWA AD18 and ISME19. She also supervised two Bachelor's and Master's students. In addition, she was a member of the CAPTURE Sustainability Team, where she contributed to the implementation of measures to reduce the environmental impact of laboratory activities.