

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

ir. Kristof Verbeeck

Title of the doctoral dissertation:

Electrifying biotechnology for the production of CO₂-based chemicals

The public defence will take place **on June 21st, 2019 at 17:00** in the August Vermeylen room of “Het Pand”, Onderbergen 1, 9000 Ghent.

There will be a contiguous reception to which you are heartily invited.
Please confirm your attendance before **June 7th** to kristof.verbeeck@ugent.be

Dissertation supervisor

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Abstract of the doctoral research

Human distortion of the Earth's long-term carbon cycle has by far exceeded the sustainability boundaries of our planet. The indispensable transition to a CO₂-neutral world economy involves a massive deployment of low-carbon energy technologies and the use of renewable carbon feedstocks, like carbon dioxide (CO₂) emitted at point sources, and methane (CH₄) produced through anaerobic digestion of organic (waste) streams. (Bio)catalytic technologies for the production of food, fuels and chemicals from these two gaseous raw materials are emerging as potential approaches to restrain climate change, though tremendous scientific and technological challenges remain to ensure that their implementation can be realized within the foreseeable future.

In this work, several value chains based on the valorization of biogas and CO₂ into value-added products were explored. First, the conversion of grid-injected biomethane to carbon monoxide (CO) and syngas, two key platform chemicals in the chemical industry, was investigated, where it was found that by coupling decentralized biomethane production to large-scale chemical synthesis *via* the existing natural gas infrastructure, chemical plants can reduce their CO₂ emissions in a cost-effective way, or, alternatively, increase the production capacity without considerably increasing CO₂ footprint. Second, microbial protein production was proposed as a way to upgrade the value of biogas and recovered ammonia while enabling partial self-supply of animal feed at farm scale. It was shown that microbial protein production opened up opportunities for a cost-efficient treatment of livestock manure. Finally, a reactor system for electricity-driven bioproduction from CO₂ was developed, enabling simultaneous production, extraction and concentration of acetic acid as a fermentation product in a solid-free extraction liquid.

Brief Curriculum Vitae

Kristof Verbeeck was born in Brasschaat on March 16th, 1991. He obtained his high school degree in Sciences-Mathematics at the Sint-Michielscollege, Schoten in 2008. In 2014, he graduated with great distinction as Master of Science in Bioscience Engineering, Environmental Technology, at Ghent University. Subsequently, Kristof received a scholarship of the Research Foundation Flanders (FWO - Vlaanderen) for a four year PhD at the Center for Microbial Ecology and Technology (CMET), Ghent University. His research focused on the conversion of CO₂ and renewable methane into value-added products. Kristof is currently working as process engineer in Europe's first ever gas fermentation plant, that is being built at the steel mill of ArcelorMittal Belgium.

During his PhD research, Kristof Verbeeck successfully mentored four undergraduate students during their graduation research project, and guided the laboratory practicals for the course 'Microbial-Ecological Processes' for three consecutive years. Kristof presented his research at several national and international symposia. He is currently (co-)author of one book chapter and seven international peer-reviewed publications, of which three as first author.