SCIENCES & BIOENGINEERING SCIENCES

The Research Group
Industrial Microbiology and Food Biotechnology

has the honor to invite you to the public defence of the PhD thesis of

ir. Hannes Decadt

to obtain the degree of Doctor of Bioengineering Sciences

Title of the PhD thesis:

Toward solutions for challenges of present-day Gouda cheese production

Promotors:
Prof. dr. ir. Luc De Vuyst
Prof. dr. Stefan Weckx

The defence will take place on

Wednesday, December 11, 2024 at 5 p.m. in auditorium I.2.01

Members of the jury

Prof. dr. Steven Ballet (VUB, chair)
Prof. dr. Bruno Pot (VUB, secretary)
Prof. dr. Ulrich Hennecke (VUB)
Dr. Geertrui Vlaemynck (ILVO)
Prof. dr. Peter Vandamme (UGent)
Prof. dr. Siv Skeie (Norwegian University of Life Sciences, NO)

Curriculum vitae

Hannes Decadt studied at Ghent University and obtained a Master's degree in Bioscience Engineering, specialization Chemistry & Bioprocess Technology, in 2017. Thereafter, he contributed to fundamental research on recombinant *E. coli* strains for precision fermentation at Inbio.be (UGent). In November 2018, he started his PhD research at IMDO under the supervision of Prof. dr. ir. Luc De Vuyst and Prof. dr. Stefan Weckx, in close collaboration with a European cheese company. He is co-author of six scientific papers published in peer-reviewed journals, among which four as first author.

Abstract of the PhD research

Industrial Gouda cheese production still faces several challenges. Different sources of variability within cheesemaking need to be better understood to ensure a more consistent cheese quality. Hereto, the whole fermentation and ripening process of one type of Gouda cheese was studied in detail by quantifying the dynamics of the microbial species and the metabolites. It turned out that the culturable fraction of bacteria varied largely around the selling time point of the cheeses, which hence was a first source of variability. Additionally, three different primary starter culture mixtures were applied in rotation. Although these cultures should behave very similar, they resulted in significantly different concentrations of key metabolites, such as acetoin, responsible for the buttery aroma of Gouda cheese. Moreover, the cultures differed in their abundance of leuconostocs, which also resulted in different levels of competitiveness of the cultures against non-starter lactic acid bacteria (NSLAB), such as *Loigolactobacillus rennini* and *Tetragenococcus halophilus*.

A typical defect that NSLAB species can cause, is the formation of cracks in the cheese body. Several cheeses with cracks were investigated during the present study, and *Loil. rennini* was identified as the sole species responsible for this cheese defect. The underlying pathways were unraveled using shotgun metagenomics combined with meta-metabolomics. This species was abundant in the cheese brine, which proved that the brine effectively acted as an inoculation source for the cheeses. The brine also acted as a dynamic reservoir of microorganisms and consequently requires regular monitoring.

To ensure a reproducible Gouda cheese quality, adjunct starter cultures can be applied in addition to the primary starter culture mixtures. Several NSLAB isolates from the cheeses and brines were collected, and two selected adjunct strains were applied in Gouda cheese productions, namely a strain of *Lacticaseibacillus paracasei* and one of *T. halophilus*, a species (and genus) never applied as cheese adjunct before. Although both adjuncts had some effects, they did not lead to a significantly different cheese flavor. Nevertheless, the potential of *T. halophilus* as cheese adjunct was demonstrated.