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

Víctor González Alonso

to obtain the degree of Doctor of Bioengineering Sciences

Title of the PhD thesis:

Impact of arabinoxylan-enriched wheat flour on sourdough production

Supervisors:
Prof. dr. ir. Luc De Vuyst (VUB)
Prof. dr. ir. Frédéric Leroy (VUB)

The defence will take place on

Thursday, September 18, 2025 at 5 p.m.

VUB Etterbeek campus, Pleinlaan 2, Elsene, Promotiezaal D.2.01

Members of the jury

Prof. dr. ir. Geert Angenon (VUB, chair)
Prof. dr. Bruno Pot (VUB, secretary)
Prof. dr. Ulrich Hennecke (VUB)
Prof. dr. ir. Christophe Courtin (KU Leuven)
Prof. dr. ir. Mia Eeckhout (UGent)
Prof. dr. Anne Willems (UGent)

Curriculum vitae

Víctor González Alonso obtained an interuniversity Master of Science in Food Technology at the Katholieke Universiteit Leuven and the Universiteit Gent in 2018. Afterwards, he worked at the Department of Industrial Engineering (DII) of the Università di Padova. In September 2019, he started his PhD at the Research Group of Industrial Microbiology and Food Biotechnology (IMDO).
He participated in one field experiment in Ecuador to carry out cocoa fermentation processes. He is co-author of nine papers published in peer-reviewed international journals, of which three as first author. He co-supervised two internship students and one laboratory technician. Besides attending one international conference where he gave an oral presentation, he gave thirteen oral presentations and presented one poster at national conferences and research meetings.

Abstract of the PhD research

As a staple food, bread is one of the most consumed food products in the world. Sourdough breadmaking has gained popularity because of its perceived natural and traditional character, along with enhanced flavour, shelf-life, and nutritional benefits. Sourdough is produced through the fermentation of a flour-water mixture by a microbial consortium primarily composed of lactic acid bacteria (LAB) and yeasts. This process can occur spontaneously or through the use of starter cultures.

The present PhD research focused on the impact of arabinoxylan (AX)-enriched wheat flour fermentation for sourdough production. Wheat bakery products contribute significantly to caloric and dietary fibre intake in Europe. AX fibres are of particular interest, since they impact bread quality through their structural properties. AX can be water-extractable (WE-AX), having a neutral or positive effect on dough properties, or water-unextractable (WU-AX), which negatively affects bread quality.

Initially, spontaneously backslopped sourdough processes were tested using triticale flour, followed by wheat flour blends with increased AX content. The fermentation process was analysed using a multiphasic approach combining microbiological culture techniques, DNA-based community profiling, and metabolite target analysis. The results showed diverse microbial communities across sourdoughs, with both homo- and heterofermentative LAB species being present. Smaller-scale fermentations developed stable microbial communities more quickly but with lower diversity. Furthermore, an increase in wheat AX did not result in atypical microbial consortia.

Subsequently, the degradation potential of AX by LAB was studied. *In silico* genome analyses revealed AX-degrading genes in several LAB strains. Four LAB strains were selected and used to produce sourdoughs with high-AX wheat flour. Sequencing confirmed the prevalence of the starter culture strains in the sourdoughs. Fermentation led to smaller WE-AX molecules while maintaining the AX substitution pattern, likely due to acid-activated endogenous xylanases rather than microbial enzymatic activity. This reduction in molecular size may have implications for both digestibility and bread texture. The study also explored metabolic outputs from the LAB. For example, *Limosilactobacillus fermentum* was associated with the production of erythritol. *Lactococcus lactis* was linked to the biosynthesis of buttery flavour compounds, such as diacetyl and acetoin. Finally, (sourdough) bread production with high-AX wheat flour was successfully carried out at pilot scale.