

Master Thesis Opportunity

Topic: Establishing Reliable Enzyme Quantification Strategies for Cost-Efficient Lignocellulosic Bioconversion Processes

Start Date: September 2025

Deadline: 22nd August 2025

Background

The advancement of second-generation (2G) bioprocesses, which utilize non-food lignocellulosic biomass, is critical for a sustainable bio-based economy. A significant bottleneck in these processes is the high cost of enzymes required for breaking down complex biomass into fermentable sugars. Enzymes remain one of the largest cost factors in the production of lignocellulosic bioethanol.

Currently, the methods for quantifying enzyme activity and loading are not well standardized from lab to industry, and often overlook the breakdown of important non-glucan fractions, e.g., xylan. This can lead to inefficiencies, higher costs, and results that are difficult to reproduce across different studies.

This project aims to address this gap by developing a reliable and integrated enzyme assay protocol. By creating a standardized method to measure the activity of both cellulases and xylanases, and by developing a more representative protein standard, we can enable more precise and cost-effective enzyme utilization, ultimately improving the efficiency and economic viability of 2G bioprocesses.

Aim of the Master Thesis

The objectives of this thesis are:

1. To establish a comprehensive enzyme activity protocol that quantifies both cellulase (FPU) and xylanase (BXU/AXU) activity.
2. To develop and validate a more accurate in-house enzyme protein standard to improve the reliability of total protein quantification assays (BCA/Bradford).
3. To create a clear and reproducible methodology for converting between activity units (FPU/mg protein) and mass-based enzyme loading (mg protein/g substrate), providing a consistent basis for process optimization and comparison.

Requirements

- Solid background in biochemistry, biotechnology, or a related field.
- Good organizational and analytical skills.
- A proactive, detail-oriented, and independent work approach.
- A collaborative team player with a strong desire to learn.

Application Process

Please send your application documents, including a CV and cover letter, to **Eric Kariuki MSc.** (gathirwa.kariuki@tum.de). Feel free to reach out to him with any questions regarding this position.

If you're ready to help develop protocols that bridge the gap between lab-scale experiments and real-world 2G bioprocess applications, we strongly encourage you to apply.

Privacy policy

As part of your application for a position at the Technical University of Munich (TUM), you submit personal data. Please note our privacy policy pursuant to Art. 13 General Data Protection Regulation (GDPR) for the collection and processing of personal data in the context of your application <http://go.tum.de/554159>. By submitting your application, you confirm that you have taken note of TUM's privacy policy. In the case of a written application, we ask you to only submit copies to us, as we are unfortunately unable to return your application documents after the procedure has been completed.