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Towards microbial platforms for lignin valorization: *Pseudomonas putida* cell factories and *Bacillus* synthetic communities

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Stellingen

Behorende bij het proefschrift

Towards microbial platforms for lignin valorization: *Pseudomonas putida* cell factories and *Bacillus* synthetic communities

1. Fully understanding microbial lignin depolymerization pathways would make it possible to efficiently couple depolymerization to biofunneling, reducing by-products and improving carbon efficiency towards target molecules. (Chapter 2)
2. In *Pseudomonas putida*, redox homeostasis can be a primary bottleneck for growth on lignin-derived aromatics, not the absence of aromatics catabolic genes. (Chapter 3)
3. Inspired by nature, in which lignin degradation and utilization are driven by multi-enzyme, multi-species synergy rather than single organisms, synthetic microbial consortia and enzyme cocktails may offer a scalable route towards standardized industrial lignin degradation. (Chapter 4 and Chapter 6)
4. The absence of a straightforward, direct readout for lignin depolymerization remains a central reason why many lignin “degradation” results are difficult to compare across different studies. (Chapter 4 and Chapter 5)
5. A main bottleneck in polymer degradation (such as PET, or lignin) , is that activity on monomeric or dimeric compounds poorly predicts activity on the corresponding polymers, making “enzyme discovery” difficult in practice. (Verschoor JA et al., 2024)
6. Using engineered microbial cell factories to funnel chemically depolymerized lignin oligomer mixtures into single products will potentially bridge chemical and enzymatic lignin processing and enable scalable hybrid valorization routes. (Bugg TDH, 2024)
7. The success of *Pseudomonas putida* as a metabolic-engineering chassis is not only driven by its metabolic versatility and robustness, but also by the availability of advanced targeted genome-engineering tools. (Nikel PI et al., 2019)
8. Lignin valorization is often limited by aromatic toxicity; therefore, engineering host tolerance (e.g., via stress-adaptation modules) can be as enabling as engineering new ligninolytic enzymes. (Kusumawardhani H et al., 2020)
9. During a PhD period, solving one problem often means uncovering a whole new set of problems you didn't know you had.
10. A journey of a thousand miles begins with a single step.

Qing Zhou
Leiden, 12/6/2026