KOBE UNIVERSITY J-PEAKS

Kobe University Engineering Biology

6.22.2026
15:00-16:00

Venue
Biomedical Membrane Research and Open Innovation Center
Room Z5

All are welcome

Free of Charge

8th KUEB Premier Seminar

Linking Synthetic Biology to Commercial Opportunities for Sugarcane Biorefineries

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https://www.su.ac.za/en/faculties/engineering/departments/chemical-engineering/prof-johann-gorgens

Access: 68-2; https://www.kobe-u.ac.jp/en/campus-life/maps/rokkodai2/

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Linking Synthetic Biology to Commercial Opportunities for Sugarcane Biorefineries

Abstract

This work presents an integrated framework for prioritising and developing commercially viable sugarcane biorefinery pathways, spanning benchmarking, technology development and pilot-scale validation. More than forty sugar-derived products were evaluated using Aspen Plus® simulations, techno-economic assessment (TEA), and life cycle assessment (LCA), enabling identification of high-potential pathways based on economic and greenhouse gas (GHG) performances. While many biofuels and bioplastics remain cost-challenged, selected food-related and specialty chemicals show strong potential for diversification. Synthetic biology is positioned as a key enabler to realise these opportunities. Modelling of bioprocess performance demonstrated how improvements in yield, productivity, and titre can drive economic viability for target molecules such as 3-hydroxypropionic acid (3-HP) and 2,3-butanediol (2,3-BDO), providing a quantitative basis for prioritising R&D investment. Complementary strain engineering work established a novel oxaloacetate pathway for 3-HP production in Komagataella pastoris, achieving titres up to 50.6 g/L and demonstrating the feasibility of efficient sugar-based bioprocesses in non-conventional yeast hosts.
These capabilities are integrated through a 1000 L containerised demoplant, to demonstrate pilot-scale process performances of advanced microbes under the conditions of industrial operations and feedstock variations in the sugarcane industry, as exemplified by a current project on cellulosic ethanol production. The platform enables translation from modelling and laboratory development to pilot-scale validation across multiple feedstocks and products. Collectively, this end-to-end approach provides a robust pathway to identify priorities for the application of synthetic biology to the development of new microbial bioprocesses, and accelerating the commercialisation of these in diversified sugarcane biorefineries.

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