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Selective Designer Hydrolysates from Miscanthus Bioenergy Crop for Sustainable Utilization

Background/Objective

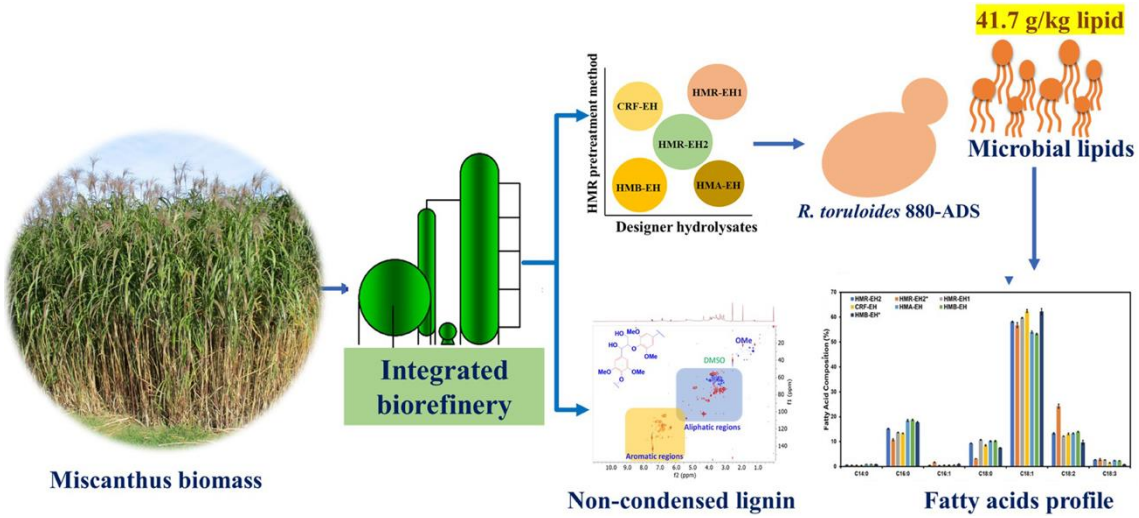
Designer sugar streams were developed from Miscanthus biomass to provide tailored fermentable sugars for microbial lipid production while minimizing inhibitory byproducts and to preserve residual biomass fractions for further valorization.

Approach

Five enzymatic hydrolysates (EH) were generated using alkaline–ethanol fractionation and hydrothermal–mechanical refining pretreatment approaches. Hydrolysates with different sugar compositions and C:N ratios were evaluated as fermentation media with engineered *Rhodotorula toruloides* 880-ADS. The residual solids were also characterized to assess their potential for lignin valorization.

Results

Alkaline–ethanol fractionation generated xylose-rich hydrolysates containing ~105 g/L and ~173 g/L xylose from hemicellulose fractions A (HMA) and B (HMB), respectively. Subsequent fermentation produced lipid yields of 0.05–0.12 g lipid per g sugar. The residue from HMA hydrolysis was enriched in lignin while retaining a relatively non-condensed structure, indicating its potential for downstream valorization.



Designer Miscanthus hydrolysates supported microbial lipid production and retained lignin-rich residues for future valorization.

Significance/Impacts

This work demonstrates that Miscanthus could be fractionated in an integrated-biorefineries approach that could improve biomass utilization and support multiple value streams from one feedstock.

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