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P.I.5 — Growth and tolerance screening of engineered *Shimwellia blattae* and *Escherichia coli* on agro-industrial residues for isobutanol production

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Poster Presentations #22

P.I.5 — Growth and tolerance screening of engineered *Shimwellia blattae* and *Escherichia coli* on agro-industrial residues for isobutanol production

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Keywords: *Isobutanol production; Agro-industrial residues; Engineered bacteria; Growth and tolerance screening*

Biorefineries are driving interest in transforming agro-industrial residues into valuable products and biofuels. Among these, isobutanol has emerged as a particularly attractive alternative to ethanol due to its higher energy density, lower hygroscopicity, and improved compatibility with existing fuel infrastructure. The sustainable production of biofuels from agro-industrial residues therefore represents a promising strategy to reduce reliance on fossil resources while valorizing waste streams. In this study, the potential of two genetically engineered bacterial strains, *Shimwellia blattae* p424IbPSO and *Escherichia coli* W pIZIbPSO [1, 2], for isobutanol production using agro-industrial residues was evaluated. A preliminary screening was performed to assess microbial growth and tolerance to different waste-derived substrates. The tested feedstocks included cheese whey from the dairy industry, brewer's spent grain (BSG) from the brewing process, and a hot water extract of sugars obtained from grape stems generated in the wine industry. These residues were incorporated at different concentrations into a defined minimal salts medium (M92X), which served as the base culture medium. Growth performance and substrate compatibility were compared against control cultures grown in standard M92X medium. Cultures were conducted in multiwell plates under controlled conditions in a plate reader CLARIOstar (BMG Labtech), with the addition of selective antibiotics (gentamicin and streptomycin) to ensure plasmid maintenance. The screening results demonstrated that both strains were capable of growing on tested residues, although growth profiles and tolerance thresholds varied depending on the substrate type and concentration. Cheese whey and grape stem extracts supported robust growth at moderate concentrations, while higher loadings of brewer's spent grain-derived substrates showed inhibitory effects, likely due to complex matrix components. These findings highlight the adaptability of the engineered strains to heterogeneous, low-cost substrates and provide key insights into optimal substrate concentrations for subsequent fermentation processes. The results will guide future optimization of isobutanol production using agro-industrial waste streams as feedstock.

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References

[1] C. Felpeto-Santero, A. Rojas, M. Tortajada, B. Galán, D. Ramón, and J. L. García, "Engineering alternative isobutanol production platforms," *AMB Express*, vol. 5, no. 1, p. 32, 2015. https://doi.org/10.1186/s13568-015-0119-2

[2] M. G. Acedos, I. De la Torre, V. E. Santos, F. García-Ochoa, J. L. García, and B. Galán, "Modulating redox metabolism to improve isobutanol production in Shimwellia blattae," *Biotechnology for Biofuels*, vol. 14, no. 1, p. 8, 2021. https://doi.org/10.1186/s13068-020-01862-1

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