P6.3 - PHYSIOLOGICAL CHARACTERIZATION AND PROMOTER ENGINEERING OF ACETOBACTERIUM WIERINGAE FOR ACETONE PRODUCTION VIA GAS FERMENTATION

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ABSTRACT

The pressing need to mitigate environmental concerns has driven research into sustainable energy and chemical production methods that reduce carbon emissions. Gas fermentation offers a promising avenue for low-carbon fuel and chemical synthesis. *Acetobacterium wieringae*, particularly strain *A. wieringae* JM, has emerged as an attractive host for gas-based biorefineries due to its unique abilities, including growth in diverse gas compositions and pH ranges, and efficient growth on carbon monoxide without co-substrates.

This study focuses on enhancing the potential of *A. wieringae* for acetone production through genetic modification. A transformation protocol was developed, and the acetone production operon from *Clostridium acetobutylicum* was introduced. Novel promoters were explored to widen gene expression possibilities in *A. wieringae*. The stability of the plasmid backbone pMTL83151 carrying replicon pCB102 was assessed. Additionally, the tolerance of *A. wieringae* to gas synthesis derived from biogenic residue gasification was evaluated for potential industrial application.

Gas composition significantly influenced acetone production by *A. wieringae*, with distinct physiological effects observed between strain *A. wieringae* DSM 1911 and *A. wieringae* JM. Four constitutive promoters from *A. wieringae* JM and four from *C. autoethanogenum* were successfully expressed, exhibiting stronger activity than the reference Pthl promoter from *C. acetobutylicum*. Notably, *A. wieringae* JM demonstrated robust growth in synthesis gas from biomass gasification, though with physiological variations.

This study unveils the intricate relationship between gas composition, physiological attributes, and acetone production in *A. wieringae*. The expanded promoter repertoire enhances genetic manipulation potential, propelling the strain's capacity for versatile gene expression. Moreover, the resilience of *A. wieringae* JM to gasification-derived gas synthesis highlights its viability for industrial implementation. These findings contribute to advancing the development of gas-based biorefineries, paving the way for sustainable chemical production with reduced environmental impact.