SAND2019-4626C

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Biomass pretreatment and bioconversion into D-lactate by a genetically modified *Corynebacterium glutamicum*

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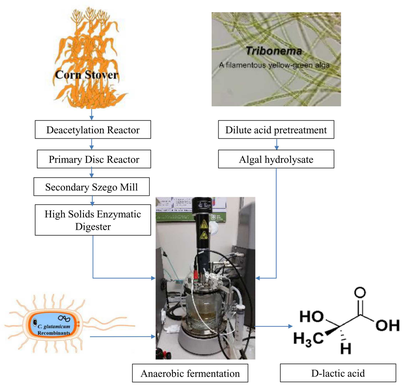
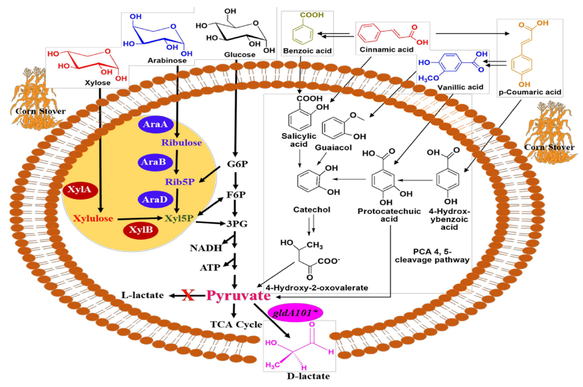
Motivation and Strategy

- The aim of this study is to increase the ability of *C. glutamicum* to utilize all major carbon sources present in from different biomass such as lignocellulosics and algal biomass.
- D-lactate is a precursor for poly-D-lactic acid (PDLA), a bio-based polymer, is a renewable packaging material for fresh fruit containers, drinking cups, lamination films, and other items.
- Recombinant strains of *Corynebacterium glutamicum* were generated after knocking out the L-lactate production pathway and overexpression of ***ldhA*** *-Lactobacillus delbrueckii*, ***gldA101*** *– Bacillus coagulans*, and codon optimized ***gldA101**** and designated AV46, SSL01, and SSL02, respectively, for the production of D-lactate.
- The D-lactate producing strains were grown with glucose and different aromatics such as benzoic acid, cinnamic acid, vanillic acid, and coumaric acid directly.
- Xylose and arabinose uptake pathways were introduced to increase the ability of these strains to utilize xylose and arabinose.

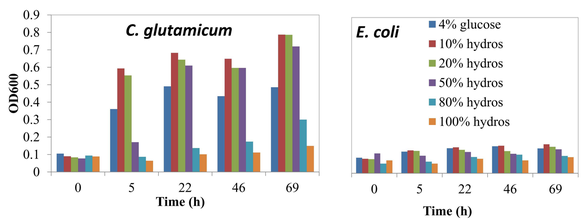
Overall Strategy of this Study



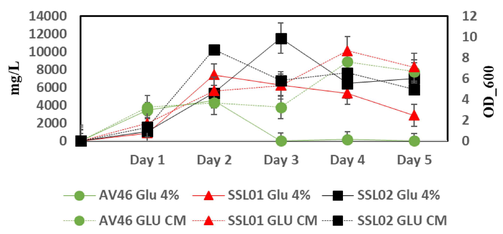
Schematic Depiction of Synthesis of D-lactate in *C. glutamicum* using Biomass-derived Carbon

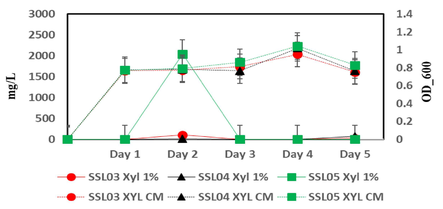


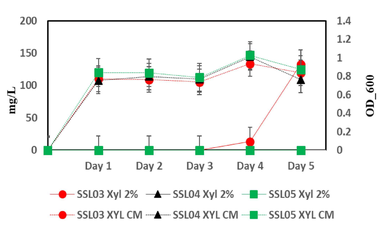
Resistivity of Microbes to Lignocellulosic Hydrolysates

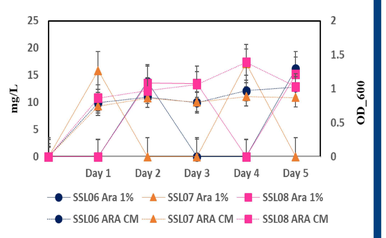


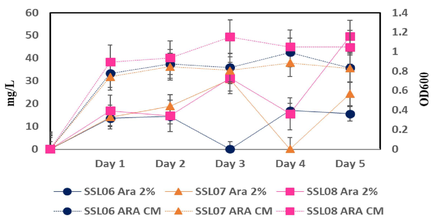
Growth & D-lactate Production in BTM Medium with Different Carbon Sources

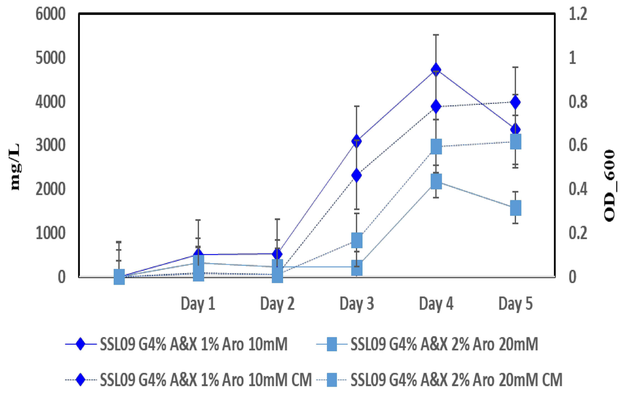












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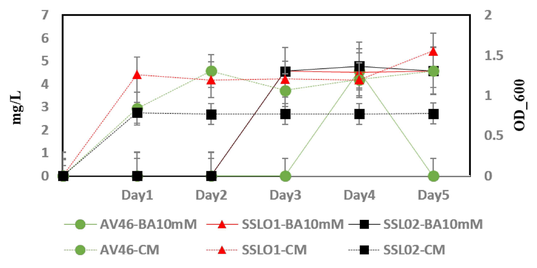
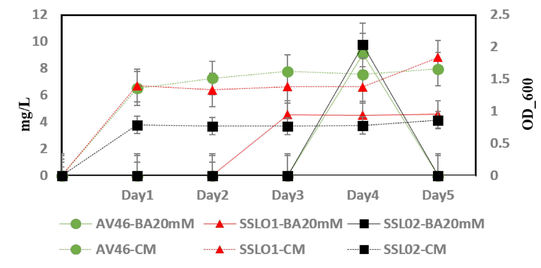
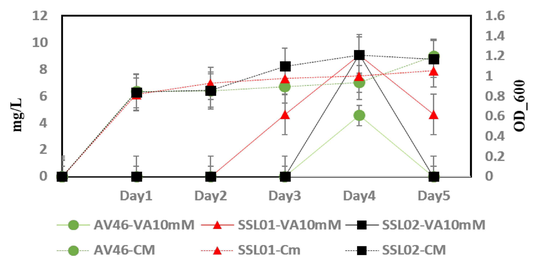
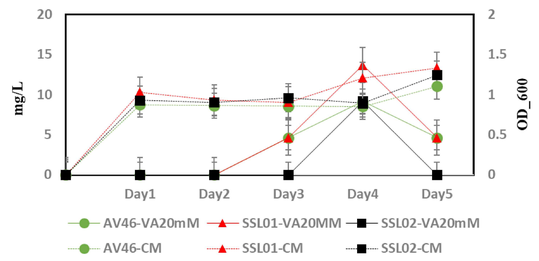
2. Sievert C, Nieves LM, Panyon LA, Loeffler T, Morris C, Cartwright RA, Wang X; Experimental evolution reveals an effective avenue to release catabolite repression via mutationsin XylR. *PANS*, 2017 Jul 11;114(28):7349-7354.

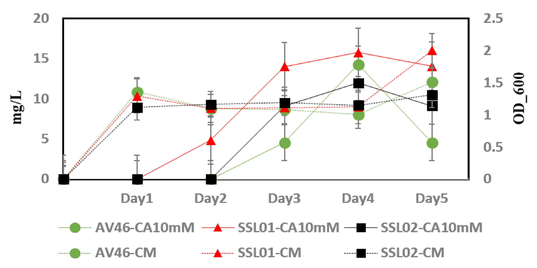
Effect of aromatics on *C. glutamicum* growth and D-lactate production

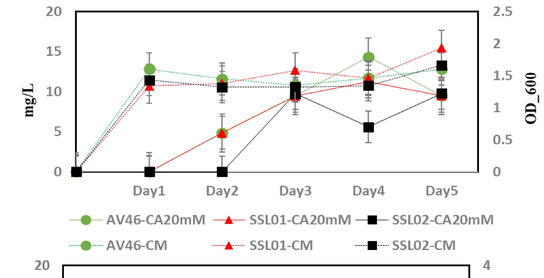


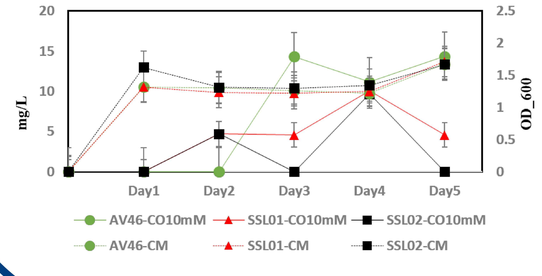


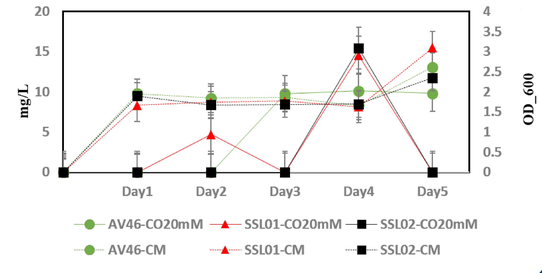




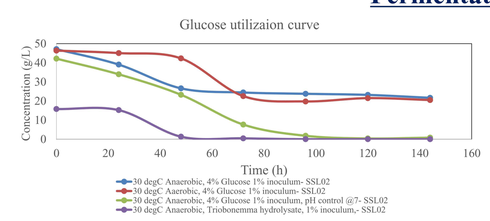


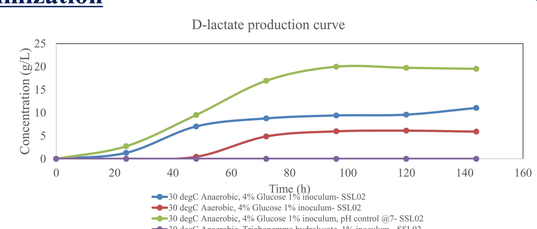


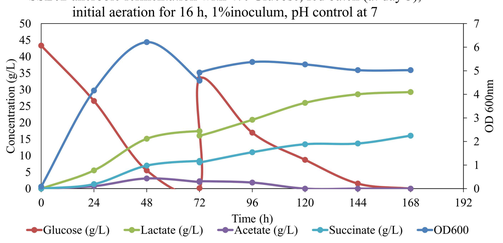


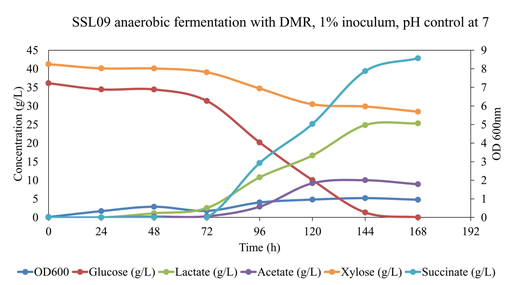


Fermentation optimization









Conclusions & Significance

- Demonstrated the conversion of diverse biomass substrate to D-lactate, a bioplastic precursor of PDLA, in an industrial bacteria *C. glutamicum*.
- Production of D-lactate from hydrolysate in *C. glutamicum* opens the possibility of production of other chemicals.

Ongoing R&D

- Development of recombinant *C. glutamicum* for proteneaous algae biomass
- Co-culture of carbohydrate and protein utilizing strains for algae hydrolysate valorization

Acknowledgements

This research was conducted as part of the Co-Optimization of Fuels & Engines (Co-Optima) project sponsored by the U.S. Department of Energy (DOE) Office of Energy Efficiency and Renewable Energy (EERE), Bioenergy Technologies and Vehicle Technologies Offices. Sandia National Laboratories is a multi-mission laboratory managed and operated by National Technology and Engineering Solutions of Sandia, LLC., a wholly owned subsidiary of Honeywell International, Inc., for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-NA0003525.

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