Agile Biofoundry CRADA Project - Kiverdi

Title:

Progress towards a new model chemolithoautotrophic host

Project Partners:

Lawrence Berkeley National Laboratory, Oak Ridge National Laboratory, National Renewable Energy Laboratory, Kiverdi

Relevant ABF Capability(ies):

Design: DIVA bioCAD

Build: DIVA DNA Construction

Build: DIVA DNA Sequence Validation

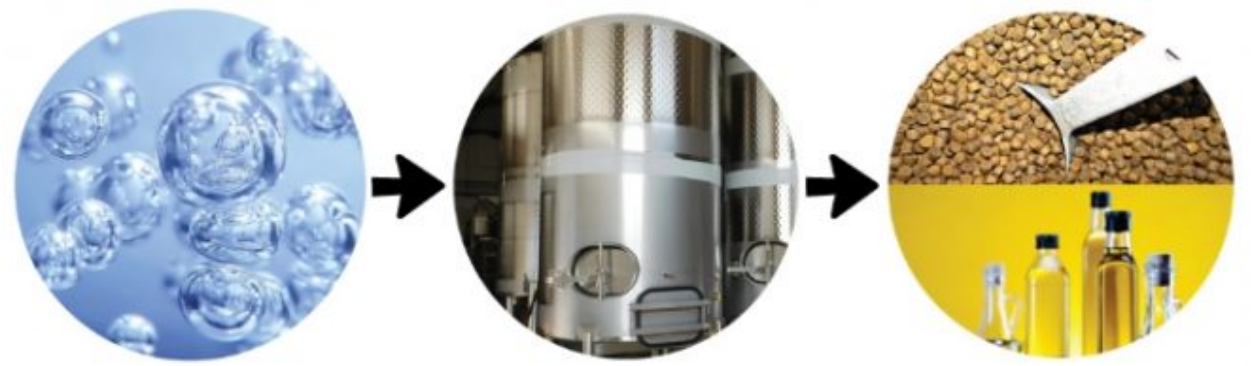
Build: Genetic Transformation and Tool Development

Test: Biocatalyst Optimization

Test: Targeted Proteomics

Description:

Some of the largest scale chemical processes for the production of important commodity chemicals and fuels involve an H2-containing gas mixture as an intermediate [e.g. ammonia, urea, methanol, Fischer-Tropsch (F-T) diesel, and hydrotreatment of crude petroleum to refined fuels]. The successful development of a model H2-oxidizing chemoautotrophic host could expand the range of fuels and chemicals produced from H2 and CO2 intermediates in the chemical, oil, and gas sectors in the near term, as well as from renewable and waste-derived sources of these gases that are expected to greatly expand in coming years.



Among non-photosynthetic bacteria that can utilize H2 and CO2, Cupriavidus necator (C. necator, formerly Ralstonia eutropha), is the best studied. C. necator is an excellent microbial host for the production of a variety of chemicals because it grows extremely quickly to very high cell densities autotrophically on H2 and CO2, is genetically tractable, and has the ability to accumulate polymers, such as polyhydroxybutyrate, at industrial levels. Despite having great potential as a platform bioproduction host, genetic tools are limited, making metabolic engineering of this organism slow and laborious. With the joint efforts from experienced researchers from Lawrence Berkeley National Laboratory (LBNL), National Renewable Energy Laboratory (NREL), Oak Ridge National Laboratory (ORNL), and Kiverdi, Inc., we will develop a suite of next-generation genetic tools to rapidly and efficiently engineer C. necator, enabling the construction of strains capable of producing value-added chemicals and biofuels from CO2 and renewable H2 feedstocks at non-prohibitive costs. As a concrete demonstration of this proposed platform's potential capabilities, we will engineer C. necator to convert H2 and CO2 into a fatty acid derived molecule commonly used as a bioproduct currently sourced from palm kernel oil, the cultivation of which is associated with widespread rainforest destruction.

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Performance period: 10/1/18-9/30/20

Resulting publication(s)/patent(s): None to date.