Direct photobiological conversion of solar energy to volatile transport fuels

From 2011-01-01 to 2015-12-31, closed project

Objective

The aim is to integrate photosynthetic solar energy conversion and synthesis of volatile engine-ready transport fuel in a single photobiological process. The focus is placed on the construction of phototrophic model systems for synthesis of the short-chain alkane propane (C3H8). Propane can be used in existing engines without further chemical conversion and can be easily recovered from the production process without destructive harvesting and extraction. However, no commercial biological production process exists and there is no known metabolic pathway for short-chain alkane biosynthesis. The intention is to construct a synthetic pathway for propane biosynthesis. In order to facilitate the construction, alkane biosynthetic pathways are studied in detail and genes encoding key-enzymes are isolated from diverse organisms.

In order to directly capture solar energy to drive fuel biosynthesis, the synthetic pathways are assembled in the photosynthetic model organism Synechocystis sp. PCC 6803. Native host metabolism is thereafter optimized to maximize the delivery of metabolic precursors and reducing energy to the synthetic pathways. In order to facilitate strain construction, cyanobacterial host strains are optimized for metabolic engineering and hydrocarbon fuel biosynthesis. The project has the ultimate aim to generate cyanobacteria strains that synthesize short-chain alkane using only light, CO2 and H2O as substrate. The project has a clear applied target with high potential for socio-economical impact and a high risk / high gain character.

Related information

Report Summaries

Final Report Summary - PHOTOBIOFUEL (Direct photobiological conversion of solar energy to volatile transport fuels)

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