Clean Technology

Fatty Acid-Producing Microbes for Generating Medium- and Long-Chain Hydrocarbons

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The Wisconsin Alumni Research Foundation (WARF) is seeking commercial partners interested in developing a system for using modified bacteria to overproduce fatty acid precursors for medium- to long-chain hydrocarbons that could be used as biofuels or specialty chemicals.

Overview

New, renewable sources of transportation fuel are needed to meet continuing demand. While the main focus has been on biomass-derived gasoline alternatives such as ethanol and other short-chain alcohols, distillates with higher energy density such as diesel and jet fuel are required for the heavy transportation sector.

Biodiesel is a biodegradable, clean-burning combustible fuel made of medium- to long-chain hydrocarbons that can be used in most internal combustion diesel engines. Current methods of making biodiesel involve transesterification of triacylglycerides (mainly vegetable oil). However, this process results in a heterogeneous mixture of fatty acid esters and unwanted side products such as glycerin and methyl and ethyl esters.

The Invention

UW–Madison researchers have developed genetically modified *E. coli* that are capable of overproducing fatty acid precursors for medium- to long-chain hydrocarbons. The modified bacteria were transformed with exogenous nucleic acids to increase the production of acyl-ACP or acyl-CoA, reduce the catabolism of fatty acid products and intermediates, and/or reduce feedback inhibition at specific points in the biosynthetic pathway.

The modified bacteria can be cultured in the presence of sugars to produce fatty acids. The fatty acid products formed during fermentation then can be separated from the fermentation media via a two-phase separation process or other method. The separated products can be used directly or as feedstock for subsequent reactions, including conversion to medium- and long-chain hydrocarbons.

Applications

- Production of medium- and long-chain hydrocarbons for use as biofuels or specialty chemicals

Key Benefits

- Total fatty acid production is increased nearly 10-fold, providing a greater amount of starting material for hydrocarbon production.
- Characteristics of resulting products, including branch points, saturation levels and carbon chain lengths, can be modified for different applications.
- Products may be highly homogeneous and relatively free from unwanted side products.
- System is suitable for continuous processing.
- Modified bacteria are recombinantly stable and growth-competent at 37°C.

- Other organisms such as yeast or additional Gram-positive bacteria may be used.

Stage of Development

The development of this technology was supported by WARF Accelerator. WARF Accelerator selects WARF's most commercially promising technologies and provides expert assistance and funding to enable achievement of commercially significant milestones. WARF believes that these technologies are especially attractive opportunities for licensing.

Additional Information

For More Information About the Inventors

- Brian Pfleger

Publications

- Lennen R.M., Braden D.J., West R.A., Dumesic J.A. and Pfleger B.F. 2010. A Process for Microbial Hydrocarbon Synthesis: Overproduction of Fatty Acids in *Escherichia coli* and Catalytic Conversion to Alkanes. Biotechnol. Bioeng. 106, 193-202.

Tech Fields

- Clean Technology : Biobased & renewable chemicals & fuels

For current licensing status, please contact Jennifer Gottwald at jennifer@warf.org or 608-960-9854