

BIOCHEM show case

A drop-in, renewable alternative to petroleum feedstocks

Problem

Every 40 minutes, the world consumed 100 million gallons of petroleum (± 380 m litres) – the equivalent annual output of a commercial ethanol plant. Existing energy infrastructure is designed for hydrocarbon fuels and renewable replacements need to be compatible for this to be drop-in. The renewable, scalable fuels and chemicals with the greatest potential for rapid and widespread adoption by consumers are those that are both cost-competitive with petroleum and compatible with the existing distribution and consumer infrastructure.

Technical solution

LS9 has developed a platform technology to produce a wide variety of advanced biofuels and renewable chemicals cost-effectively by a simple, efficient, one-step fermentation process. LS9 has engineered established industrial microorganisms to convert fermentable sugars selectively to alkanes, olefins, fatty alcohols, or fatty esters, each in a single-unit operation. The process enables precise genetic control of the molecular composition and performance characteristics of each resulting fuel or chemical product.

LS9's technology leverages the natural efficiency of microbial fatty acid metabolism to biosynthesize long hydrocarbon chains. It combines this with new biochemical pathways engineered into microorganisms to convert the long-chain intermediates into specific finished fuel and chemical products that are secreted by the cells. The products are immiscible with the aqueous fermentation medium and form a light organic phase that is both nontoxic to the whole-cell catalyst and easily recoverable by centrifugation.

LS9 is actively developing the technology for the production of alkanes (diesel, jet fuel, gasoline), alcohols (surfactants), esters (biodiesel, chemical intermediates), olefins

(lubricants, polymers), aldehydes (insulation, resins), and fatty acids (soaps, chemical intermediates).

LS9 is applying this technology platform through a strategic partnership with Procter & Gamble to produce surfactants for consumer chemical products.

Benefits

UltraClean™ diesel meets or exceeds all of the ASTM 6751 specifications for on-road vehicle use. It eliminates the environmental pollutants benzene, sulfur, and the heavy metals found in petroleum-based diesel and will result in a 85% decrease in greenhouse gas (GHG) emissions according to the GREET model for life cycle analysis (LCA). Without subsidy, UltraClean Diesel™ will be competitive in the market with diesel from oil priced at \$45-50 per barrel. LS9 is advancing toward commercial scale with its Renewable Petroleum™ facility, which will come on line in 2010. Initially, this facility will produce UltraClean™ diesel; other products will follow.

- Product performance is enabled through the genetic control of each product's chain length, extent of saturation, and degree of branching
- Does not require any metal catalysts
- Compatible with existing infrastructure
- Diverse product range accessible using the same feedstock

Additional information

LS9 website

<http://www.ls9.com/technology/technology-overview>

EPA 2010 small business award

<http://www.epa.gov/greenchemistry/pubs/pgcc/winners/sba10.html>