Biofuel-Producing Lactobacillus Strain

INVENTORS • James Steele, Jeffrey Broadbent

The Wisconsin Alumni Research Foundation (WARF) is seeking commercial partners interested in developing a *Lactobacillus casei* bacterium genetically modified to produce more ethanol.

**OVERVIEW**

Microbial transformation of biomass into biofuels remains an important part of the United States' strategy to reduce its dependency on fossil fuels. To produce ethanol from biomass, microbes must be able to efficiently metabolize plant sugars into ethanol under industrial fermentation stresses.

Naturally occurring microorganisms have not evolved to thrive in such industrial processes. Researchers have approached this problem by engineering strains that leverage the genetic strengths of select organisms to supplement the deficiencies in others.

So far, engineered strains have failed to maximize yields under industrial conditions. Continued strain discovery and optimization remains a vibrant research area.

**THE INVENTION**

A UW–Madison researcher and others have modified a *Lactobacillus casei* strain that exhibits the highest ethanol conversion rates yet reported from the genus.

*L. casei* naturally combines many characteristics of an ideal strain when compared to microorganisms typically considered for biofuel production, like *Saccharomyces cerevisiae*, *Zymomonas mobilis*, *Escherichia coli* and *Clostridium sp.*, which all suffer from various deficiencies. A *L. casei* strain exhibiting high conversion rates could represent a novel, more efficient path to market for ethanol production.

The modified bacterium is derived from *L. casei* strain 12A. It is made by (i) inactivating genes that encode a competing lactate enzyme and (ii) introducing genes from another organism (*Zymomonas mobilis*) that encode a pyruvate decarboxylase and an alcohol dehydrogenase II.
APPLICATIONS

• Biofuel (ethanol) production
• Potential adaption to higher margin biochemical products and second generation biofuels such as isobutanol

KEY BENEFITS

• Outperforms all other lactobacilli
• L. casei 12A is an ideal candidate
  ◦ Designated a GRAS (Generally Regarded As Safe) species
  ◦ Amenable to genetic manipulation
  ◦ Has relatively simple fermentative metabolism
  ◦ Highly resistant to environmental stresses, like high concentrations of acids, biofuels and lignotoxins
  ◦ Can utilize lignocellulose mono- and disaccharides
  ◦ Can secrete and display proteins, with potential for use in consolidated bioprocessing

STAGE OF DEVELOPMENT

Starting from glucose, the metabolic end products of the new strain are more than 85 percent ethanol. Ninety percent conversion also appears possible.

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

Related Portfolios
WARF Accelerator Program Technologies
UW–Madison Technologies Developed Through the Great Lakes Bioenergy Research Center

Related Technologies
WARF reference number P100228US02 describes a recombinant yeast strain with improved ethanol tolerance.
WARF reference number P130153US01 describes modified yeast that show improved xylose fermentation and toxin tolerance.

Tech Fields
Clean Technology - Biofuels & renewable fuels

CONTACT INFORMATION

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