Biomass Program

Engineering Thermotolerant Biocatalysts for Biomass Conversion to Products

Current industrial fermentation organisms are designed to only convert glucose to ethanol and other products. In order to utilize cellulosic biomass which contains 5- and 6-carbon sugars such as xylose and glucose, respectively, biocatalysts must be developed that can efficiently convert 5- and 6-carbon sugars to the desired products.

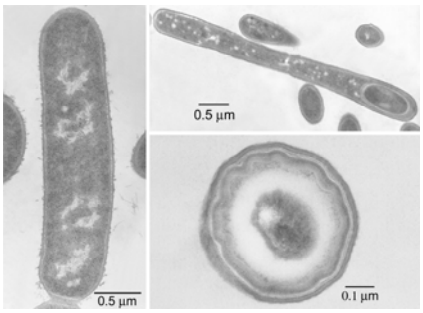
The primary objective of this project is to construct novel, second generation thermotolerant biocatalysts for the conversion of mixed biomass sugars to ethanol that function optimally under environmental conditions that are also optimal for the activity of fungal cellulases (50°C and pH 5.0). This will enable simultaneous saccharification (breakdown of cellulose to glucose by cellulase enzymes) and co-fermentation (conversion of xylose and glucose to ethanol), also referred to as SSCF.

SSCF avoids the issue of product inhibition of cellulase enzymes during saccharification (hydrolysis) that is present in separate hydrolysis and fermentation (SHF) processes. Therefore, lower loadings of cellulase enzymes will be required for SSCF compared to SHF, significantly reducing the cost of cellulose bioconversion processes.

R&D Pathway

The project is divided into three tasks: 1) physiological and genetic characterization of selected second generation biocatalysts for optimum ethanol production; 2) metabolic engineering of selected biocatalysts to incorporate the ethanol production pathway; and 3) metabolic and physiological characterization of the engineered strains.

Researchers will evaluate the performance of the engineered strains and optimize the fermentation conditions for maximum ethanol yield.



Researchers are optimizing a strain of *Bacillus coagulans*, shown here in different stages of its life cycle (vegetative, sporulating, and mature stages).

Bioproducts R&D

Benefits

- **Enable simultaneous saccharification and fermentation processes**
- **Reduce cellulosic ethanol production costs**

Applications

This project will help improve the economics of cellulosic ethanol production and facilitate the commercialization of integrated biorefineries.

Project Participants

University of Florida, Institute of Food and Agricultural Sciences

Project Period

FY 2004 – FY 2007

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