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Industrial Scale Production of Low Cost Enzymes for Cellulosic Ethanol

Background

Because of changing global energy needs and finite petroleum reserves, there is an urgent need to develop technologies for harnessing renewable energy resources. The major biofuel in use today is corn-derived ethanol. In the US, 25-30% of corn production is currently used for ethanol production. However, ethanol yield from corn is lower than from other feedstocks, such as switchgrass, sugar cane, or sorghum. In addition, production of ethanol from corn has a number of disadvantages, including a requirement for substantial amounts of cultivated land and fossil fuel usage. In addition, there is potential for increase in food prices as demand for ethanol increases and food and animal feed crops become replaced by fuel crops. Therefore, renewable non-feed biomass is a more attractive feedstock for bioethanol production.

Cellulosic biomass is a heterogeneous complex of polymers including cellulose, hemicellulose and lignin which are locked in complex carbohydrates called polysaccharides. Separating these complex polymeric structures into fermentable sugars is essential for efficient and economical production of cellulosic ethanol. Two processing options are employed to produce fermentable sugars from cellulosic biomass. One approach utilizes acid hydrolysis to break down complex carbohydrates into simple sugars. An alternative method, enzymatic hydrolysis, uses enzymes to convert cellulosic biomass to fermentable sugars. The final step involves microbial fermentation and yields ethanol. Due to its complex structure, biomass requires different classes of enzymes in large quantities to release fermentable sugars. Traditionally, these enzymes are produced from bacteria or fungi. These methods are expensive and require at least partial enzyme purification. UCF researchers have developed methods for expressing biomass degrading enzymes in plants. These methods offer a number of advantages, including efficient and inexpensive production of enzymes and the ability to produce the enzymes individually, which allows for optimization of enzyme cocktails for particular feedstocks.

Invention

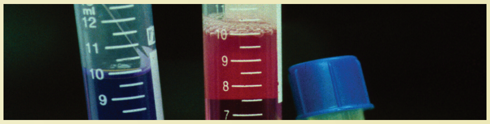
This invention relates to the expression and use of low cost chloroplast-derived enzyme cocktails for biomass degradation.

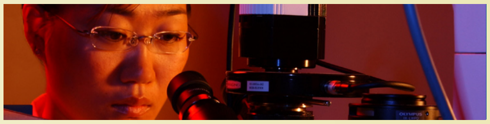
Application

The expression of low cost enzyme cocktails can be used to more efficiently convert biomass into bioethanol as an alternative fuel.

Advantages

- This concept offers an inexpensive technology to produce enzymes for degradation of cellulosic biomass
- Plant-produced cellulose degrading enzymes can be used in crude form, without the need for purification





Lead Inventor

Henry Daniell, Ph.D.

Contact

Attn: Svetlana Shtrom, Ph.D., MBA
University of Central Florida
Office of Research and Commercialization
12201 Research Parkway, Suite 501
Orlando, Fl 32826-3246
Phone: 407.823.5150
Fax: 407.823.3299
sshtrom@mail.ucf.edu
UCF ID # 7557