Biotechnology, Renewable energy, Biofuels.

The University of Georgia Research Foundation, Inc.

Technology Commercialization Opportunity

Hydrogenase Polypeptide for Use in Hydrogen Production Systems and in Multi-enzyme Industrial Processes

UGARF Case: 1348
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Intellectual Property Status: Patent Pending

Introduction

The hydrogen economy offers a compelling future energy vision because hydrogen is abundant, clean, flexible, and secure. Thus, researchers have sought to develop new technologies for production and utilization of molecular hydrogen (H_2) as a potential source of energy to replace fossil fuels. In a biological setting, H_2 conversion is most readily accomplished by complex and oxygen-sensitive hydrogenase enzymes. Oxygen sensitivity is a major drawback for hydrogenase enzymes because oxygen reacts with the enzyme active site to generate a catalytically inactive form of the enzyme. In spite of the large amount of research that has been carried out on hydrogenases, it has not been possible to readily manipulate the enzyme using molecular biology approaches since a recombinant form produced in a suitable host was not available.

Technology Summary

University of Georgia researchers have developed a recombinant form of hydrogenase that evolves hydrogen gas from various substrates (such as starchy materials) even at extreme temperatures, and a method to produce this hydrogenase. In addition to being used directly in hydrogen production processes at various temperatures, this invention also provides the tools to enable the properties of the enzyme to be modified and/or produced in various other organisms. The patent pending technology comprises (among others) several peptide compositions, genetically modified microorganisms capable of expressing rec-hydrogenase, and methods for the production of this enzyme.

Advantages

- Robust, stable (and thermostable) and active even at high temperatures (>80°C)
- Can be used in hydrogen production systems in which carbohydrates are oxidized to generate NADPH, which can then be converted to hydrogen gas by the hydrogenase.
- Uses a common laboratory protein expression host bacterium and all techniques used for cloning and transformations were standard molecular biology techniques.

Potential Applications

- High yield H_2 production from carbohydrates, including in a continuous flow system.
- Production alternative fuels (such as EtOH) as part of an enzymatic system

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