LIGNOCELLULOSE DECONSTRUCTION USING A MOBILE ENZYME SEQUESTRATION PLATFORM (MESP) CONSTRUCTED FROM PROTEINS OF THE ANAEROBIC BACTERIUM *CLOSTRIDIUM THERMOCELLUM* AND THE HYPERTHERMOPHILIC ARCHAEON SULFOLOBUS SHIBATAE WITH A LIGHT SPRINKLE OF NANOTECHNOLOGY

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ABSTRACT

The future of sustainable alternative liquid fuel supplies will undoubtedly include a significant contribution from second-generation bioethanol: cellulosic ethanol. One of the major process bottlenecks preventing cellulosic ethanol from emerging as a principal product in the market is the inability to efficiently deconstruct lignocellulosic biomass at an industrial scale without the use of hazardous chemicals such as sulfuric acid. Deconstruction of lignocellulosic biomass using enzyme-mediated processes would provide a more environmentally-friendly and sustainable approach to breaking down lignocellulosic feedstock. However, enzyme-based catalysis is not as efficient as chemical-based degradation of lignocellulosic materials. Moreover, the cost of enzymes, especially engineered enzymes, drives production costs up and reducing the cost-competitiveness of cellulosic ethanol against fossil-base fuels and even first-generation bioethanol.

New technologies may help to overcome many of the challenges with mass production of cellulosic ethanol. The development of mobile enzyme sequestration platforms (mESP) which Increase the catalytic efficiency and the longevity of enzymes used in while minimizing the need for high-end designer enzymes may prove to be the break-through that the industry requires to propel second-generation bioethanol to the front of the market. In this presentation, the development of a thermophilic and acidotolerant mESP derived from combining protein components from the anaerobic bacterium Clostridium thermocellum and the archaeon Sulfolobus shibate is described along with current and future directions in applying nanotechnology to further enhance this mESP system.