



MICHIGAN OHIO UNIVERSITY TRANSPORTATION CENTER
Alternate energy and system mobility to stimulate economic development.

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PRODUCTION OF FUEL ETHANOL FROM CELLULOSIC PEAT FOR FUTURE TRANSPORTATION SYSTEMS

First Year, Annual Report

May 1, 2007 to December 31, 2007

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PRODUCTION OF FUEL ETHANOL FROM CELLULOSIC PEAT FOR FUTURE TRANSPORTATION SYSTEMS

Abstract

The production of bioethanol from peat is proposed. A search of the available literature yields no prior information on the use of peat as a carbon source for bioethanol. This proposal addresses the production in the most cost-effective manner possible, utilizing special enzymes, and using materials native to Michigan. The bioethanol proposed will either be utilized as fuel or in fuel blends.

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Thus far, the Winter and Benvenuto labs have completed the following in producing ethanol from cellulosic biomass:

Production of peat ethanol:

- This has been accomplished on a small scale in Dr. Winter's lab. Reaction batches are generally 1 liter in volume, or slightly less, and contain 15% - 17% ethanol.
- In Dr. Benvenuto's lab, peat was used as a biomass source along with common yeasts as fermentors. Specifically, baker's yeast and brewer's yeast. The results were negative. Although this was expected, the reactions were run to be sure of the negative result.

Ethanol production from other sources:

- Basic fermentations were performed, using common sugars, plus common yeasts, in Dr. Benvenuto's lab. The aim of these experiments was to determine if the simple chemistry of fermentation can be performed in a teaching lab setting in a secondary or middle school. This is in accordance with the MI-OH UTC education component, which encourages dissemination of results to other educators.

- Refined cellulose fermentation using common yeasts was examined in Dr. Benvenuto's lab. The results were negative, but the use of cellulose represents an important middle step, between the fermentation of simple and complex sugars, and the fermentation of unrefined complex biomass, such as peat. Refined cellulose was provided by Fisher Science Education (formula $(C_6H_{10}O_5)_n$, product number S75083).
- Fermentation trials of common sugars and cellulose using cellulase *trichoderma reesei* (ATCC 26921) were begun. Cellulase purchased from Sigma (product C8546-10KU). Results are pending.

At the current point in this project, both labs have done enough examination of existing background literature to arrive at the conclusion that peat, while a renewable resource, is not renewable on the time scale that would be called for should a sharp rise in the need for biomass feedstocks for ethanol production occur. Because of this, a switch is being made, from the idea of examining a wide variety of yeasts and enzymes combined with peat, to that same variety of yeasts and enzymes in combination with cellulose, guar gum, and other weedy, biomass materials that may be digestible to the yeasts and enzymes.

Note: In light of reported findings, funding for this series of projects was not continued by the MIOH UTC Operating Committee after review November 2007.