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U.S. Department of Transportation

SunGrant INITIATIVE South Central Region

Project Title: ***Improving Conversion of Syngas to Biofuels via Direct Monitoring and Control of CO/H_2 in Bioreactors***

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Rationale

Hybrid gasification-syngas fermentation technology for conversion of biomass to biofuels is on the verge of commercialization. Mass transfer is a critical challenge for advancing syngas fermentation because it is associated with low solubility of CO and H_2 in the fermentation medium. We are developing a novel method to increase culture activity, ethanol production, and ethanol to acetic acid selectivity during syngas fermentation. However, the method could not be applied because it was based on indirect CO/H_2 measurements and predictions from our model to provide strategies to control the bioreactor operation. To address these issues, this team will investigate the feasibility of direct monitoring and control of CO/H_2 in the bioreactor. This will allow efficient bioreactor control at conditions that maximize gas conversion and ethanol productivity and yield.

Expected Outcomes

Successful completion of this project will involve the development of the CO/H_2monitoring system for biofuels production in syngas fermentation reactors. This team also plans to identify the operating conditions that maximize gas conversion and ethanol productivity and yield. The Energy Independence and Security Act of 2007 mandates that U.S. transportation fuels contain at least 16 billion gallons of cellulosic biofuels, including ethanol and butanol, by 2022. This shows the potential for a huge market for cellulosic ethanol. At an 80% ethanol theoretical yield from both H_2 and CO, about 109 gallons of ethanol can be produced from one ton of biomass. The theoretical ethanol can be made at an estimated production cost of $1.41 per gallon, even though it is typically sold at prices above $2.00 per gallon.

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