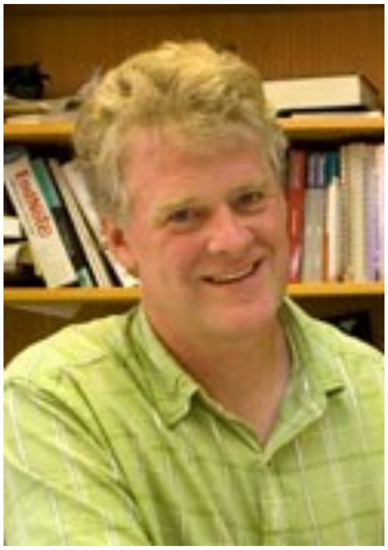
Department of

Chemical and Environmental Engineering

2015—2016 Seminar Series



Tuesday, October 6, 2015

1-2 PM

WCH 205/206

Lee Lynd

Distinguished Professor

Thayer School of Engineering

Dartmouth College

New Paradigms for Low-Cost Processing of Cellulosic Biomass

Recent evidence will be presented suggesting that anaerobic thermophilic bacteria are decisively more effective than commercial fungal cellulases at solubilizing cellulosic biomass under a broad range of conditions. Even the best plant cell wall-solubilizing biocatalysts, however, require some assistance in order for lignocellulose to be processed with high yields in a reasonable amount of time. As an alternative to conventional pretreatment to provide such assistance, we are investigating physical disruption once fermentation is initiated – termed cotreatment. First-of-a-kind data and analysis supporting this concept will be presented including: a) fermentation in the presence of physical disruption at an intensity sufficient to substantially increase lignocellulose solubilization, b) high extents of solubilization comparable to conventional pretreatment, and c) potential for cotreatment with acceptably low energy requirements.

Taking advantage of the outstanding capability of thermophilic anaerobic bacteria to ferment cellulosic biomass without added enzymes requires metabolic engineering tools be developed and applied to these organisms in order to bring product yields and titers to industrially acceptable levels. The feasibility of consolidated bioprocessing (CBP) will be considered, and recent progress will be described involving the cellulose-fermenting *Clostridium thermocellum* and the hemicellulose-utilizing *Thermoanaerobacterium saccharolyticum.* Perspectives will be offered on the general approach of biotechnology based on host organisms with phenotypes that are too hard to move, exemplified by CBP using naturally cellulolytic microbes.

Process analysis will be presented supporting the potential for biomass conversion at radically lower cost, particularly at small scale, by combining cotreatment, thermophilic fermentation, and configurations that minimize the cost of outside battery limit components.

BioSketch: Lee Lynd is the Paul and Joan Queneau Distinguished Professor of Engineering and Adjunct Professor of Biology at Dartmouth College, Focus Area Leader for Biomass Deconstruction and Conversion at the US Department of Energy Bioenergy Science Center, Executive Committee Chairman of the Global Sustainable Bioenergy Project, and Co-Founder and Director of Mascoma and Enchi Corporations. He is a fellow of the National Academy of Sciences, and recipient of the Lemelson-MIT Sustainability Prize for inventions and innovations that enhance economic opportunity and community well-being while protecting and restoring the natural environment, the Charles D. Scott award for distinguished contributions to the field of biotechnology for fuels and chemicals, and two-time recipient of a Charles A. Lindbergh grant in recognition of efforts to promote a balance between environmental preservation and technological advancement.

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