

FUNDAMENTALS AND BIOTECHNOLOGY RELATED TO MICROBIAL CELLULOSE UTILIZATION

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Cellulolytic microorganisms could be used to process lignocellulosic biomass in one step without added enzymes in a “consolidated bioprocessing” (CBP) configuration. For industrial application, a CBP microbe must effectively utilize one or more components of cellulosic biomass and also produce a product of interest at high titer and yield. Although these properties exist individually among described microorganisms, to date they do not exist together to the extent required. Success in this domain will likely involve convergent fundamental and applied studies.

Results from fundamental studies of microbial cellulose utilization will be presented, including work with the thermophilic anaerobe *Clostridium thermocellum* involving bioenergetics, kinetics, microbial enhancement of enzymatic activity and surface attachment, and mechanisms of ethanol tolerance. Thereafter, recent comparative studies will be presented involving various cellulosic substrates (wood and grass) and conversion systems (simultaneous saccharification and fermentation using fungal cellulase, fermentation by pure cultures including but not limited to *C. thermocellum*, and fermentation by enrichments developed from environmental inocula). Finally, results from the Lynd lab pursuant to engineering *C. thermocellum* for CBP will be described, enabled by the development and increasingly routine application of a genetic system for this organism.