Discovery and development of novel cellulolytic microbes for biofuel production

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ABSTRACT

Microbial biofuel production continues to be largely limited by the recalcitrance of plant biomass to microbial degradation. Here we describe a combinatorial approach involving bioprospecting, fermentation science and genomic exploration revealing promising new opportunities in microbial biotechnology for cellulosic biofuel production. We have isolated a number of promising novel thermophilic cellulolytic clostridia closely related to the model consolidated bioprocessing (CBP) organism C. thermocellum and close relative C. clariflavum from various environments. Given their remarkable cellulolytic capabilities and the identification of unique lignocellulolytic enzymes in these organisms, we have sequenced the genomes of two of these organisms. Analysis of their genomes has provided us with a clearer picture of how these organisms access plant biomass by means of an unconventional cellulosomal system and multifunctional glycosyl hydrolases. In addition, detailed fermentation experiments comparing the breakdown dynamics of 5-carbon polymers and real-life biomass (unpretreated switchgrass) revealed very different approaches to hemicellulose degradation between strains and untapped capabilities in plant biomass solubilization. Future research directions and opportunities will also be discussed.

BIOGRAPHY

Dr. Javier A. Izquierdo is an Assistant Professor in the Department of Biology at Hofstra University. Research in Dr. Izquierdo's lab focuses on exploring the metabolic diversity of microbial processes and the applications we can derive from them. He utilizes cross-disciplinary approaches incorporating microbiological, ecological, evolutionary, molecular and genomic techniques to 1) examine the contributions of microbial communities to environmental processes in terrestrial and aquatic environments and 2) discover novel microbial metabolic capabilities that can be turned into biotechnological applications for industry. Dr. Izquierdo holds a B.Sc. in Biology from Case Western Reserve University and a Ph.D. in Microbiology from the University of Massachusetts Amherst.