Optimization of Cellobiase Function in Breakdown of Cellulosic Material Using Co-Enzymes: A Model for Biofuel Enhancement

Sriram, Pranav

Maturi, Jay

Second-generation biofuels, which involve the conversion of waste products such as agricultural and paper waste into ethanol-based sources, present a promising environmentally-friendly alternative to the burning of hydrocarbons. However, currently they are limited by the slow speed at which enzymatic breakdown of cellulose into glucose occurs (the rate-limiting step). Furthermore, these enzymes also account for over 40% of the overall cost of the entire biofuel process. Therefore, finding natural cellobiase sources and optimizing these enzymes would increase the efficiency and decrease the overall cost of ethanol production. This project focused on 6 mass-produced mushrooms for cellobiase activity and 4 broad coenzymes (Vitamins B1, B3, B6, C) to optimize the mushroom-based cellobiase. Shiitake caps and enoki stems were found to have high cellobiase activity after exposure to a p-nitrophenyl glucopyranoside molecule, which acted as a cellobiose substrate. Vitamin B6 and C were able to increase cellobiase in a pure sample and maintain a linear trend in cellobiase function by potentially decreasing end-product inhibition. However, when the optimal mushroom extracts were combined with the optimal coenzymes, there was no significant change in cellobiase activity. Lack of purification of the mushroom source (extracted through Triton X) may have allowed external enzymes to affect the cellobiase enzyme. Future experimentation will include using alternative and more dilute detergents and variations of the Vitamin B6 and B5 coenzyme.

Awards Won:

Third Award of $1,000