Advantages of Enzyme Could Lead to Improved Biofuels Production

Cellulase *C. bescii* CelA, a highly active and stable enzyme, exhibits a new cellulose digestion paradigm promoting inter-cellulase synergy.

*C. bescii* CelA, a hydrolytic enzyme with multiple functional domains, may have several advantages over other fungal and bacterial cellulases for use in biofuels production: very high specific activity, stability at elevated temperatures, and a novel digestion mechanism.

A research team from the U.S. Department of Energy's Bio-Energy Science Center, which comprised scientists from the National Renewable Energy Laboratory (NREL) and the University of Georgia, isolated the thermophilic cellulase CelA from *C. bescii*. A comparison was conducted of its cellulolytic activity with that of a binary mixture containing both *T. reesei* Cel7A exoglucanase and *A. cellulolyticus* Cel5A endoglucanase on several substrates. The researchers also compared the cellulose digestion mechanisms of these two enzyme systems using electron microscopy and modeling.

CelA was shown to retain high activity at all temperatures tested, converting 60% of glucan at 85°C compared to 28% glucan conversion for the more common exo/endo cellulase standard mixture, Cel7A/Cel5A, at its optimal temperature of 50°C. This difference in activity translates to a seven-fold increase in activity for CelA at the molecular level.

Transmission electron microscopy studies of cellulose following incubation with CelA suggest that CelA is capable of not only the common surface ablative mechanism driven by general cellulase processivity, but also of excavating extensive cavities into the surface of the substrate. Additionally, during the digestion experiments, CelA achieved 60% conversion of xylan in native switchgrass, showing its potential for industrial processes using mild or no pretreatment.

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