Interaction of Endoglucanases With Amorphous Cellulose Revealed by Quartz Crystal Microbalance and Neutron Reflectivity

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Project Goals:
Unraveling of interactions between cellulases of different types and insoluble substrates is prerequisite for the design of more effective enzyme systems

Intensive efforts are underway to lower the cost of enzymatic hydrolysis of cellulose to sugars. There are three general types of cellulases: endoglucanses hydrolyze internal bonds and produce chain ends, exoglucanases hydrolyze from the chain ends and release cellobiose, and b-glucosidases convert cellobiose units to glucose. These generic activities are likely to depend upon substrate characteristics. While each component plays an individual role, they work synergistically for highly efficient cellulose degradation. The full nature of that synergism, and its dependence on substrate characteristics, is not fully understood. A fundamental understanding of enzyme synergy would greatly aid the design of enzyme cocktails. In this work we are using quartz crystal microbalance (QCM) and neutron reflectivity (NR) measurements to reveal the actions of endoglucanases on amorphous cellulose. Amorphous cellulose is relevant to biomass pretreated with ionic liquids. QCD and NR are highly complementary and provide unprecedented detail into the effects of endoglucanses on film structure. Results are shown below for an enzyme cocktail from T. viride and from two endos that show qualitatively different behavior.

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