PoCMiB028 BB/L013711/1
1 July – 31 August 2017
Funded by Metals in Biology BBSRC NIBB Proof of Concept grant
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LPMOs: a new face in biomass breakdown?

"The on-going collaboration with Novozymes into the chemistry and activities of biomass-degrading enzymes continues to provide very fruitful research, not only in the discovery of the fundamental chemical processes exhibited by these enzymes but also their potential in biomass processing." Paul Walton, University of York

Paul Walton and Gideon Davies, University of York;
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OUTCOMES: This project examined the structure and reactivity of a new class of *lytic polysaccharide monooxyegenase* (LPMO) enzyme, which were expressed in eukaryotic systems to high yield by Novozymes. The objectives of the work were to establish whether the enzyme required metal ions for maximal activity, and if so, how those metal ions interacted with the enzyme. We also aimed to establish whether the enzyme was active on lignocellulosic substrates with an oxidoreductase type action. A series of metal-binding studies was performed using isothermal calorimetry experiments, from which it was determined that metal binding was weak and non-specific, unlike the canonical class of other LMPOs. Electron paramagnetic resonance studies showed that the enzyme bound copper. Structures of the enzyme showed that the new class of LPMOs forms interactions with lignocellulosic-type substrates near the active site. This is now an area of active investigation.

INITIAL AIMS: The efficient conversion of abundant biomass into liquid biofuel is of vital importance in meeting the world's energy demands. Despite the unrivalled calorific potential of biomass, which is composed mostly of lignocellulose, it has not been possible until recently to convert it through to bioethanol. The reason for this is the chemical recalcitrance of the cellulosic biomass. One promising way to breakdown lignocellulose involves the use of enzymes, especially lytic polysaccharide monooxygenases (LPMOs). LPMOs have overturned our understanding of biomass conversion as they boost significantly the conversion of biomass to ethanol. This project aims to study a new exciting class of metal-containing LPMOs which do not contain the usual active-site amino acids, thereby offering new insight into how biology performs the conversion of biomass and consequently our ability to use biomass as a sustainable fuel source.

- This work is continuing with BBSRC NIBB follow-on funding to examine the reaction of lignin components with the enzyme

Biotechnology and Biological Sciences Research Council