E3B The Elements of Bioremediation, Biomanufacturing & Bioenergy Metals in Biology

Durham University · University of Kent · Manchester · Biotechnology and Biological Sciences Research Council

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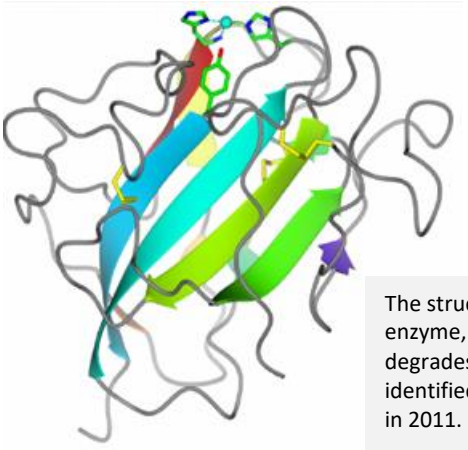
Bioprospecting for new metalloenzymes for the circular economy

We spoke to farmers about existing methods used to control several plant fungal pathogens. Their responses revealed the issues and labour associated with the current use of sulphur, and the need to reduce the amount of sulphur used in disease control. Thus, a specific inhibitor of key fungal virulence factors will be very welcome.

PROJECT AIMS: This project seeks to use a new method to search a vast database (held at CNRS Marseille, France) of the genomes and domain/module structures of organisms that can degrade biomass and polymer waste.
The method searches genomes to find a specific group of enzymes that contain metal ions. These metalloenzymes offer great potential for breaking down biomass and polymer waste, since the metal can deliver particularly powerful chemistry that can attack even the most difficult materials.



The structure of the LPMO enzyme, which oxidatively degrades biomass. LMPO was identified using the new method in 2011.

RESULTS:

- The searches performed at CNRS were highly successful; new sequences were discovered that fulfilled the criteria of the new method.
- These sequences — three new classes metalloproteins — were then expressed in in fungal and bacterial systems at the University of York.
- The expression studies showed that a subset of the enzymes were metal-binding proteins that had activities that make them relevant for use as degradation catalysts for a range of synthetic polymers.

- By associating the presence of the newly discovered metalloenzymes alongside other virulence factors in plant pathogens, and by learning about current control methods, we identified several agricultural diseases that might depend on these new metalloenzymes as virulence factors.

Change in technology readiness level: 1 to 2

OUTCOMES & NEXT STEPS:

- The partners will perform RNAi studies on fungal-infected lettuce leaves to test whether the identified metalloenzymes are virulence factors.
- They have identified a possible specific inhibitor for controlling the activity of the enzymes.
- They are investigating the potential of enzymes encoded by the newly identified sequences the new sequences to degrade plastics; this work forms the basis of a proposal with a major industrial producer of plastics.
- They are exploring intellectual property surrounding the sequences and the activities of the proteins associated with these sequences.