

## Enzyme synergism for the bio-economy: bioproducts and biomedicine

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Enzymes have been widely employed to generate bio-based products (bioproducts) from biomass. In order to degrade complex substrates, however, enzyme consortia have to be used. These enzymes are often combined in bioprocesses without due consideration or any understanding of the complex interactions that exists between these various enzymes. In the modern context, an understanding of enzyme synergism has become a central focus, with the aim of making industrial processes more economically viable by reducing the enzyme loading requirement (through rational and efficient combinations of enzymes) and therefore the cost of these industrial processes (as enzymes are often the most expensive component). Over the course of the past 15 years, our group has studied the phenomenon of enzyme synergism and the underpinning factors that govern or affect this phenomenon. The majority of our past research has concerned itself with the synergistic interactions that exist between the Carbohydrate-Active enZymes (CAZy enzymes/CAZymes) such as cellulases, xylanases, mannanases and other ancillary enzymes – with the ultimate goal of releasing fermentable sugars biofuels more effectively from feedstock biomass for enhanced biofuel production. Our study has now expanded to include the production of other value-added products from biomass for the biorefinery and, ultimately, the bioeconomy. Currently, we are studying the synergism between enzymes that are able to improve the nutrient availability within animal feeds and the release of biomedically important bioproducts from the kelp *Ecklonia maxima*. An additional approach includes the synergistic inhibition of key metabolic enzymes involved in carbohydrate (starch) metabolism for treating metabolic diseases such as diabetes, obesity and cancer - these will be discussed and highlighted.

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