Università degli Studi di Napoli Federico II

PhD in Biotechnology - 36th cycle

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Optimization of biochemical saccharification of lignocellulosic biomass

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The biorefinery processes offer diversified solutions for the valorization of lignocellulosic wastes as renewable carbon and energy sources (1). Among these processes, the sugar platform is based on two main steps: i) the hydrolysis of polysaccharides to produce fermentable sugars, and ii) the production of added value products by fermentation by using selected microorganisms. The use of cellulase enzymes for the polysaccharides hydrolysis step is still challenging. The presence of lignin hinders fast and extended conversion of cellulose and hemicellulose into soluble sugars (2). Delignification processes are necessary to achieve specific lignin removal/breaking with low energy duty and minimum formation of fermentation inhibitors. Laccases have been proposed as biocatalyst for specific delignification at mild conditions. In this framework, the overall aim of the research project is to investigate biological pretreatments and hydrolysis based on the use of laccases and cellulases, respectively, using agro-industrial wastes as substrates. The study will address kinetic characterization of the heterogeneous processes - with special focus on enzymes adsorption as a key phenomenon - and operating conditions to combine the use of laccases and cellulases. Expected results will provide quantitative data and tools for modelling, process optimization and bioreactor design.

References

(1) Cherubini, F. Energy Conversion and Management 51:1412–1421 (2010).

(2) Roth and Spiess, 2015. Bioprocess Biosyst Eng 38, 2285–2313 (2015).