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Lignocellulose saccharification and direct fermentation to ethanol: An engineered *Saccharomyces cerevisiae* co-displaying active cellulases/domains

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One of the greatest challenges in the 21st century is to meet the growing energy demand world over. The future risks of global warming and shortage of petroleum as well as superior environmental characteristics of ethanol as oxygenate for fuels promote the production and usage of bioethanol. This necessitates for the exploitation of lignocellulosic feed stocks such as agricultural and forest residues for the production of ethanol. Fermentation using temperature tolerant yeasts result in faster fermentation rates, reduce contamination, feasible for simultaneous sacarification and fermentation of cellulosic material. Cellulase surface expressing recombinant *Saccharomyces cerevisiae* are more advantageous over conventional cellulase and ethanol production systems. These yeasts will be doing both efficient cellulase expression and easy conversion of cellulose to ethanol. However, to economize the process it is very necessary to make the yeast to hydrolyze the cellulose and simultaneously ferment to ethanol. In the present study protein engineering was carried out for cellulases (Exo, Endoglucanases and ß-glucosidases) and their surface display in thermotolerant yeast. For Endoglucanase N321H mutated enzyme was active over a broader pH range compared to the wild type. Replacement of four aspartates within the active site centre of endoglucanase with alanine and glutamine results increase in the substrate binding. CBH was designed with and without CBD. Replacement of Alanine of 224 with Histidine and Glutamic acid of 217 with Aspartic acid was found to give more thermostable enzyme. In engineering studies 294 of G replaced with different amino acids for checking the higher activities for substrate recognition. Finally G replaced with aromatic amino acids like F, W, and Y which showed higher activities for substrate recognition than the parent strain. The hydrolytic activities are increased. Enzyme engineering was performed to link the CBD of CBHII to BGL. CBHCBD-BGL exhibited the highest rate of hydrolysis, approximately four fold higher than native enzyme. CBD-CBD-BGL exhibited two fold higher than native enzyme.

Biography

Chandrasekhar Banoth has completed Graduation (2006) and Post-graduation (2008) from Osmania University. He is registered for PhD (2011) on sustainable bioethanol production using lignocellulosic substrates under the guidance of Dr. B. Bhima, Head, Dept. of Microbiology, Osmania University, Hyderabad. He attended 3 national and 2 international conferences and 1 workshop within India. He has 2 publications in his area of work and two publications with his colleagues in the laboratory. He has 2 years experience in Vimta Labs Pvt. Ltd. and 2 years of teaching experience.

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