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Efficient techniques for woody biomass fractionation to enhance enzyme accessibility

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As cellulosic ethanol has achieved economic viability, the development of valuable products aside from biofuels from all main components of woody biomass, including cellulose, hemicellulose, and lignin, has gained traction. However, refining of woody biomass on industrial scales has not been realized because the accompanying lignin, hemicellulose and extractives hinder enzyme and microbial degradation. Hence, the development of new fractionation technologies to separate woody biomass into its core components and for the facilitation of research on the production of specific marketable downstream products are of great importance to ensure a profitable biorefineries on the industrial scale. Here, a novel method has been developed for fractionating cellulose microfibrils from forest residue (tulip tree sawdust) to enhance cellulose digestibility, particularly at minimum enzyme loading. This method involved three main stages: Selective hemicellulose solubilization by subcritical water (subCW) pretreatment, delignification of the subCW-pretreated solids using the Formosolv process, and deformylation/bleaching of the cellulose pulp with alkaline hydrogen peroxide solution. In the subCW pretreatment process, the efficiency of process was assessed by using the severity factor, R0, which describes the combined effect of temperature and time. The chemical composition, physicochemical properties and enzymatic digestibility of the pretreated products can be characterized and strongly correlated with the pretreatment severity. This study clearly showed that the removal of structural barriers to the enzyme attack was the dominant factor affecting enzyme accessibility to the substrate. Additionally, cellulose swelling had the greatest effect on the enzymatic hydrolysis efficiency of delignified pulp obtained by the Formosolv process.

Biography

Aye Aye Myint has completed her PhD in the year 2004 from the Department of Industrial Chemistry (IC), University of Yangon (YU), Myanmar and Post-doctoral studies from School of Chemical and Biological Engineering (CBE), Seoul National University (SNU), Republic of Korea. She has conducted her PhD research work for 3 years and 6 months at the Division of Water Chemistry and Water Technology, Karlsruhe Institute of Technology, Germany. She has served as a Lecturer, IC, YU for about 15 years, and has been working as a Senior Researcher at the CBE, SNU since May 2010 till date. She has published 6 papers in reputed journals.

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