

University of Waterloo Department of Chemical Engineering

Department of Chemical Engineering Seminar

Wednesday, May 8, 2013

3:30PM – E6-2024

“Lignocellulose Biomass Processing for Biofuels, Biochemicals and Biomaterials”

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Lignocellulose biomass such as wood and agriculture residues is the most abundant renewable material on earth. Traditionally, wood is used for producing lumbers and pulp and paper. This is particularly true in Canada as the forest industry has been one of the largest employers and net exporters in Canada. In recent years, extensive research work has been carried out around the world in the area of bio-refinery in order to utilize the lignocellulose materials for more value-added products such as fuels, chemicals, and nano- or micro-fibres. The use of the renewable material not only benefits the environment but also creates new economies that are more sustainable.

In both the pulp and paper and lignocellulose biorefining process, processing biomass into fibre form or into various wood chemical components is one of the most important steps in terms of overall process costs and final product quality. This presentation discusses our research in both fundamental and applied aspects of the biomass processing. In particular, the mechanisms involved in separating fibres from wood with chemical, biological (enzymatic) and mechanical processes are discussed. Several advanced surface and nanoscale analytical techniques, such as AFM, FE-SEM, XPS, ToF-SIMS, CLSM are developed for biomass research. Fibre morphological changes on a nanoscale in pulping processes and enzymatic cellulose hydrolysis processes are investigated and the impact of changes on fibre quality and biomass digestibility is evaluated. The research results indicate that understanding the fundamental aspect of the lignocellulose materials is essential for developing innovative, cost-effective biomass processing technologies for industrial production, and this is illustrated with commercially applicable technologies we have developed in collaboration with industrial partners.

A brief biography of Dr. Kecheng Li

Dr. Li obtained his PhD in the Department of Chemical Engineering and Applied Chemistry and the at the University of Toronto and he is currently a professor and the Director of Graduate Studies in the Department of Chemical Engineering at the University of New Brunswick.

Dr. Li's research interests include lignocellulose biorefining for renewable fuels, biochemical, biomaterials, and pulp and paper. His current research aims to develop industrial technologies for lignocellulose material processing and developing new analytical techniques for tackling more fundamental aspects of the questions in lignocellulose research. Dr. Li's research has been supported by both government funding such as NSERC -Discovery, -CRD, -SPG, CFI, AIF and NBIF, and by industrial partners including Tembec (QC), Millar Western (AB), Irving Paper (NB), NewPage (NS), Smurfit-Stone Containers (NB), Resolute FP (QC), FPIinnovations, KCL (Finland), Andritz (USA), and Novozymes (USA). Dr. Li has also developed collaborative research with fellow professors in Forestry, ME, Biology at UNB and in other universities and research institutes, i.e., UToronto(ChE), ULakehead(Chem), UWisconsin(Biosystems), UDalhousie(Materials), USDA-FPL(ChE), FPIinnovation(ChE, Physics), UGX-China (BioEng), SCUT-China(BioEng), and KCL Finland(Physics). He is currently the team leader of a NSERC-SPG project in the area of lignocellulose biorefining which involves professors at UToronto and ULakehead and is in collaboration with Irving and Resolute FP. He is also the team leader of a project in the area of bio-mechanical pulping with professors in ME, Biology at UNB and a professor at UToronto, which is co-funded by NSERC CRD, AIF, NewPage, Irving, Andritz, and Novozymes.

Dr. Li has been invited to give seminars at universities and research institutes in Australia, Canada, China, Finland, Korea, and USA. He is currently an editorial board member of the Journal of Bioprocess Engineering & Biorefinery and serves as a reviewer for more than 30 academic journals in North American and Europe in the fields of biorefining, chemical engineering, materials science, applied surface science, biotechnologies, biomaterials, bioenergy, applied chemistry, and pulp and paper.