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**PRESENTED BY THE WATERLOO INSTITUTE
FOR SUSTAINABLE ENERGY**

Monday, July 9, 2012

1:30 - 2:30 pm

Carl A. Pollock 4333 (CPH)

THERMOCHEMICAL AND CATALYTIC UPGRADING BIOMASS INTO INDUSTRIAL BIOPRODUCTS

Charles Xu, Associate Professor, Western
University

Today's global economy is heavily relying on fossil energy to produce power, fuels, chemicals and materials, while the world fossil resources are depleting fast. Biomass (crops, trees, grasses, crop residues, forestry residues, animal wastes, and municipal solid waste) presents an immense renewable resource that could provide an alternative to fossil resources. The chemical and materials products derived from biomass are called industrial bioproducts. The demand for industrial bioproducts is expected to grow rapidly, with a five-fold increase between today and 2020, and another five-fold increase between 2020 and 2050. The global market potential for bioproducts (green chemicals, alcohols, bio-plastics and resins, platform chemicals, carbon fibre and composites) is expected to approach US\$ 200 billion in 2015. In this presentation, the availability and resources of the agricultural and forestry residues and promising feedstock for industrial bioproducts production, in the US and Canada are discussed. The principal technologies for industrial bioproducts production, including biological (hydrolysis followed by fermentation) and thermochemical processes (gasification for syngas followed by catalytic synthesis, liquefaction for bio-crude oil followed by biooil upgrading) are overviewed. A showcase of several technologies developed in Dr. Xu's lab on thermochemical and catalytic upgrading biomass into industrial bioproducts will also be presented. These include:

- Esterification of Starch for the Production of Biodegradable Materials
- Catalytic Conversion of Glycerol into Ketones, Phenolic Compounds, and Bio-oil
- Production of Bio-phenols and Green Resins/Adhesives from Forestry Residues
- Novel One-step Catalytic Process to Produce 1-Butanol and Fuel Additives from Bio-ethanol



Dr. Chunbao (Charles) Xu received his B.Eng. degree in Metallurgical Engineering from Anhui University of Technology (formerly East China Institute of Metallurgy) in China (1993) and has two PhD degrees: Metallurgical Engineering, the University of Science and Technology Beijing, China (1998) and Chemical Engineering, the University of Western Ontario (UWO), Canada (2004). He was appointed a tenure-track Assistant Professor in Chemical Engineering at Lakehead University (2005) and promoted to Associate Professor with tenure (2008). He was also the Director of Green Energy Laboratory at Lakehead University. In 2011 he became an Associate Professor of Chemical Engineering and NSERC/FPIInnovations Industrial Research Chair in Forest Biorefinery at Western University and is leading the Industrial Bioproducts Laboratory funded by Canada Foundation for Innovation. Dr. Xu is an emerging young researcher building international stature in the field of forest biorefinery - production of bio-energy, bio-fuels, bio-based chemicals and materials from forest biomass and forestry residues. He was awarded the Japan Institute of Energy Outstanding Young Scientists Award (1999) and more recently the prestigious 2011 Syncrude Canada Innovation Award by CSE (presented to a young Canadian chemical engineer under the age of 40 who has made a distinguished contribution to the field of chemical engineering while working in Canada). Dr. Xu has one Chinese patent and two US/Canadian patents in process. He has published four book chapters and more than 120 papers in journals and conferences, including close to 70 peer-reviewed journal papers. He is currently serving as a co-editor-in-chief for the International Journal of Chemical Reactor Engineering (IJCRE), an international peer reviewed journal published by De Gruyter.