

Research Seminar at Queen's University by Dr. Charles Xu (Western University)

Title:

Conversion of Carbohydrates to Renewable H₂ and Green Chemicals

Abstract:

Bioresources are plant-based materials, e.g., wood, microalgae, energy crops and agricultural/forestry biomass/residues, as well as organic wastes from industry, farms and household. Bioresources play a key role in capturing and storing solar energy on the earth. It has been estimated that globally 8500 EJ ($\times 10^{18}$ Joules) of solar energy is captured/stored by nature in bioresources each year, contributing to fixing about 220 billion tonnes of carbon per year (GtC/year), which is about 15 times of world currently total energy consumption (580 EJ). Bioresources have been used by humans to produce bioenergy (fuels, heat or electricity) and bioproducts (bio-based chemicals and materials). It was predicted that globally 50% of chemicals and materials will be produced from renewable bioresources by 2050. As per the IEA's Net Zero Emission (NZE) by 2050 scenario, the conversional bioenergy (e.g., heat and electricity generation from biomass by combustion) is to phase out by 2030, while the share of modern bioenergy, e.g., production of 2nd or 3rd generation biofuels (methanol, F-T biofuel, "drop-in" biofuels and sustainable aviation fuels, renewable natural gas, renewable/green hydrogen, chemicals, etc.) in the total energy supply is expected to increase from 6.6% in 2020 to 13.1% in 2030 and 18.7% in 2050. This research seminar summarizes my past/on-going research in production of renewable/green hydrogen by supercritical water gasification of carbohydrates or other bioresources and production of green chemicals (5-HMF & 2,5-FDCA).

Short Bio



Dr. Charles Xu is full Professor of Chemical/Biochemical Engineering at Western University, Fellow of Chemical Institute of Canada (FCIC) and Fellow of Canadian Academy of Engineering (FCAE). He was the NSERC/FPIInnovations Industrial Research Chair in Forest Biorefinery (2011-2016), acquiring an international reputation in conversion of forestry/agricultural residues or other organic wastes into bioenergy, biofuels and bio-based chemicals/materials, e.g., biocrude production and upgrading, renewable hydrogen production, bio-based polymers and composites production and applications, etc. He has authored/edited 3 books on biorefinery, and published 20+ book chapters and 280+ papers in peer-reviewed journals, having received total citations of over 15,000 with an H-index of 68 to date, and is

recipient of the 2011 Syncrude Canada Innovation Award and the 2019 Award in Design and Industrial Practice from Canadian Society of Chemical Engineering. He is a co-Editor-in-Chief for International Journal of Chemical Reactor Engineering (IJCRE).