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Renewable fuels and products from biomass: A hybrid thermochemical and biochemical conversion process

Food security, climate change and energy sustainability are three major challenges in the 21st century. Among different renewable energy sources, bioenergy is a renewable primary energy source that touches all three major issues due to its competition with food on land use, low net CO₂ emissions and potentially sustainable if the economic, environmental and societal impacts are properly managed. The research at Bio-renewable Innovation Lab (BRIL) at Guelph focuses on research and development of a novel approach for the production of an array of renewable products such as energy, fuels and products from Canada's particular range of low grade biomass sources. These sources range from woody biomass to agricultural wastes, municipal green bin collections and animal manures. This novel approach integrates thermochemical and biochemical conversion processes through a series of innovative technologies (i.e., hydrothermal pretreatment, supercritical gasification or anaerobic digestion with dry reforming, gas-to-liquid fuel through fermentation). The innovative and synergistic integration of design with processing through the above projects are expected to result in renewable fuels and value-added products. The resulting biocarbon can substitute fossil resources on a cost-performance basis with the added benefit of eco-friendliness. This could mean a tremendous reduction in greenhouse gas emission through the use of bioproduct, reducing our dependency on petroleum. The use of hydrothermal, chemical looping and supercritical gasification, anaerobic digestion, dry reforming of biogas to produce syngas and syngas fermentation techniques in the development and application of biofuels and products would lead to reduced dependency on petroleum and a sustainable economy.

Biography

Animesh Dutta is an Associate Professor and Director of Bio-renewable Innovation Lab and Associate Director of graduate studies with the School of Engineering at the University of Guelph, Canada. He is specialized in advanced energy systems and thermo-fluid science with hands-on experience in reactor design and pilot plant operation, design and performance of various tests in laboratory scale and pilot scale units, thermal design and process development. His current research is focused on thermochemical conversion (gasification, combustion, torrefaction, hydrothermal carbonization and liquefaction) and characterization of agri-residue, biomass and waste (MSW, Bio-solids) for fuel and energy and design and optimization of advanced energy systems. He is committed to developing an innovative research program on energy and other value-added products from biomass and waste materials. In his career, he has published over 75 peer-reviewed journal papers, 3 book chapters and has roughly 85 conference publications and reports.

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