573a A Framework for Optimal Utilization of Biomass Inputs in an Integrated Biorefinery

Norman E. Sammons Jr., Harry T. Cullinan, and Mario R. Eden

The forest based industries of the nation possess tremendous unrealized potential for the production of multiple, high-value added products from renewable biomass resources. These products range from bulk and fine chemicals through polymers, fiber composites and pharmaceuticals to energy, liquid fuels and hydrogen. This concept of an integrated biorefinery has the opportunity to provide a strong, self-dependent, sustainable alternative for the production of chemicals and fuels. A fundamental requirement to achieve this vision is the availability of concentrated, low-cost, easily available biomass resources as inputs into the biorefinery. Depending on market prices and trends, the optimum allocation of resources and production capacity may switch between different products, creating a need for systematic, reliable methods capable of incorporating different levels of process detail in the decision making framework. In this work, a mathematical optimization based framework is being developed, which enables the inclusion of profitability measures and other techno-economic metrics along with process insights and performance characteristics obtained from experimental and modeling studies. By utilizing process integration methods, the processing steps can be optimized to ensure efficient use of energy and materials resources. An inherent benefit of the proposed framework is the ability to adapt to new developments within any of the processing steps and thus also incorporate novel innovative production processes in the decision-making framework. In this way, experimental and theoretical efforts can supplement each other in a synergistic manner, by providing direction and data for continued work. This contribution will illustrate the strategy for developing the decision making framework and highlight the applicability of the methods by proof of concept examples and case studies.