A model-based approach for biomass-to-bioproducts supply chain network planning optimization

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ABSTRACT

Supply chain network operation for biomass conversion and utilization is one of the major areas with influence on biomass-related technological progress and commercialization activities. This paper contributes towards optimizing a biomass-to-bioproducts supply chain planning operation by considering multiple cost factors including biomass resource acquisition cost, production cost, and transportation cost as well as direct sales to meet market demands. A superstructure-based modeling approach provides alternatives of biomass processing routes towards an objective of maximizing annualized profit. The formulated model entails five echelons and is implemented on a practical supply chain operational planning case study that involves a biomass-based manufacturing company in southwestern Ontario, Canada intent on long-term business expansion and product portfolio improvement. The results obtained indicates that an optimal product mix comprising a number of products from different processing stages (including preprocessing) can be expected to be achieved, with profit mainly derived through the sales of biofiller, bioethanol, and byproducts. Importantly, the developed model demonstrates the applicability of such a model-based approach in offering insights on operational optimization to attain economic decision-making on biomass resource utilization and processing route selection.

KEYWORDS

Modeling; Supply chain operation; Network optimization; Planning; Biomass-to-bioproducts; Biomass value chain

ACKNOWLEDGEMENT

The first author thanks Universiti Malaysia Pahang (UMP) for financial support under research grant RDU1703170. This work is also partially supported by the Natural Sciences and Engineering Research Council of Canada (NSERC) and UTP (Universiti Teknologi PETRONAS) Prototype Fund grant no. 015PBA-009.