Modeling and Optimization of Biomass Supply Chain for Energy, Chemicals and Materials Productions

Elkamel, Ali
Chemical Engineering, Univeristy of Waterloo : Professor

https://doi.org/10.15017/1809681

出版情報：Proceedings of International Exchange and Innovation Conference on Engineering & Sciences (IEICES). 2, pp.1-, 2016-10-14. 九州大学大学院総合理工学府
バージョン：
権利関係：

Keynote Speakers

Ali Elkamel
Professor, Chemical Engineering
University of Waterloo, Canada
Email: aelkamel@waterloo.ca

Short Biography

Ali Elkamel is Professor of Chemical Engineering at the University of Waterloo. He holds a BSc in Chemical Engineering and BSc in Mathematics from Colorado School of Mines, MS in Chemical Engineering from the University of Colorado-Boulder, and PhD in Chemical Engineering from Purdue University – West Lafayette, Indiana. His specific research interests are in computer-aided modelling, optimization and simulation with applications to energy production planning, carbon management, sustainable operations and product design. He has supervised over 70 graduate students (of which 30 are PhDs) in these fields and his graduate students all obtain good jobs in the chemical process industry and in academia. He has been funded for several research projects from government and industry. Among his accomplishments are the Outstanding Faculty Award (three times in the last ten years), the Best teacher award, and the IEOM (Industrial engineering and Operations Management) Outstanding Service and Distinguished Educator Award. He has more than 230 journal articles, 120 proceedings, and 30 book chapters, and has been an invited speaker on numerous occasions at academic institutions throughout the world and at national and international conferences. He is also a co-author of four books; two recent books were published by Wiley and entitled Planning of Refinery and Petrochemical Operations and Environmentally Conscious Fossil Energy Production.

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Abstract

In the growing concerns towards global environmental qualities and sustainable feedstocks supplies, scientific and technological efforts were intensified to utilize alternative renewable resources. In this regard, biomass appeared to be one of the potential feedstocks because it is generally carbon neutral and essentially renewable. Furthermore, biomass is virtually found in every part of the world in abundance and could provide socio-economic benefits. However, if it is not managed properly, biomass will be less competitive due to several issues that are associated with its supply chain. Typical biomass supply chain has a series of activities such as growing, harvesting, transporting, aggregating, and conversion which systematic and efficient flows of materials from the fields to the users are highly important. Biomass has competing uses, different kinds and origins which are potentially exploitable, poor geographic distributions for retrieving and

transporting, and variations in physical and chemical properties. It is difficult to make informed decision for any biomass utilization project without having an optimal supply chain. This presentation addresses these issues and presents models for the biomass supply chain for manufacturing energy, chemicals, and materials based on their respective processing routes. The aim is not only to focus on energy production from biomass but also to include chemicals and materials because of several factors such as an emerging cost competitive energy resource such as shale gas, highly volatile energy prices, and customer's preparedness and acceptances. Furthermore, it also could leverage biomass plantations on the producers' sides. The models consider annual profitability of producing products as the performance indicator. Profitability was based on revenues of selling the products and takes costs into consideration as well (e.g. biomass cost, transportation cost, production cost, and emission treatment costs). All processing options are presented in a superstructure of alternatives over which an optimal search was conducted to yield the optimal utilization of biomass for producing materials and energy, while a single ownership was assumed for the whole supply chain's facilities.