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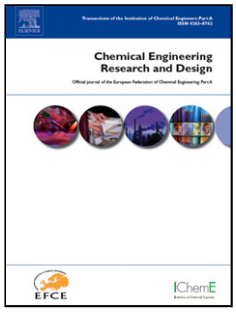

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PROCESS OPTIMIZATION OF A MULTI-PRODUCT BIOREFINERY: THE EFFECT OF BIOMASS SEASONALITY

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ABSTRACT

Biorefineries are integrated process plants producing several chemical products to better exploit all the components of a biomass feedstock. One of the main limitations hindering the development of biorefineries is the uncertainty of a continuous supply of the biomass feedstock during the year and during the whole plant lifetime. As a result, the effect of the change of the biomass type and composition on the plant performance should be accounted for since the initial conceptual design of the multiproduct biorefinery. In this work, process system synthesis and optimization methods have been applied to address the effect of the change of the biomass type and composition in the conceptual design of a multiproduct biorefinery transforming lignocellulosic biomass into levulinic acid, succinic acid and ethanol. The optimal flowsheet was derived from a superstructure embedding several alternative process pathways by optimizing objective functions of economic profitability (net present value, internal rate of return). Results highlight that the composition of the biomass feedstock in terms of cellulose, hemicellulose and lignin has a significant effect on the biomass allocation to the three product production processes and on the relevant optimal flowsheet. Case studies with a combined use of different seasonal biomass types during the year were also studied to provide a methodology to find the optimal biorefinery flowsheet in real scenarios. In the season based scenario studied, product yield distribution and overall productivity of the plant varies during the different periods provided a constant biomass feed rate.

Keywords: lignocellulose, biorefinery, feedstock seasonality, optimization, multi-product.

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