





Chemical Product and
Process Modeling

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Process Integration and Feedstock Optimisation of a Two-Step Biodiesel Production Process from *Jatropha Curcas* Using Aspen Plus

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Abstract

Jatropha curcas oil (JCO) has been recognized as a viable non-edible feedstock for biodiesel production with the focus of achieving lesser reliance on fossil fuels. The aim of this work is to integrate and simulate the production of biodiesel from *Jatropha curcas* oil by a two-step process; a hydrolysis step and a trans-esterification step. The challenge is then to optimise the feedstock ratios to obtain the minimal water and methanol consumption to give optimal biodiesel yield. For this purpose, steady-state simulation model of a two-step production process of biodiesel from *Jatropha curcas* oil was prepared using ASPEN Plus V8.8. The response surface methodology (RSM) based on a central composite design (CCD) was used to design optimisation experiments for the research work. From the ANOVA, methanol/oil ratio of the trans-esterification step was found to have a significant effect on the biodiesel yield compared to the water/oil ratio of the hydrolysis step. The linear model developed was shown to be a good predictor of feedstock ratios for biodiesel yield. The surface plot revealed that both feedstock ratios do not show a significant combinatorial effect on each other. Numerical optimisation gave the optimum values of the feedstock ratios as a methanol/oil ratio of 2.667 and a water/oil ratio of 1. The optimisation results also indicated a predicted optimum biodiesel yield of 10.0938 kg/hr.

Keywords: [process integration](#); [biodiesel](#); [simulation](#); [feedstock optimisation](#); [Jatropha curcas oil](#); [ASPEN Plus](#); [central composite design](#)

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