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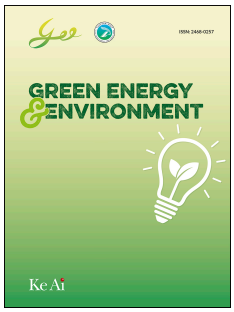

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Aashish Gaurav, Flora T.T. Ng, Garry L. Rempel

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A New Green Process for Biodiesel Production from Waste Oils via Catalytic Distillation using a Solid Acid Catalyst - Modelling, Economic and Environmental Analysis

Aashish Gaurav, Flora T.T. Ng*, Garry L. Rempel

Department of Chemical Engineering, University of Waterloo, Waterloo, Canada, N2L 3G1
*Corresponding author: fttng@uwterloo.ca

ABSTRACT: The challenges in the chemical processing industry today are environmental concerns, energy and capital costs. Catalytic distillation (CD) is a green reactor technology which combines a catalytic reaction and separation via distillation in the same distillation column. Utilization of CD in chemical process development could result in capital and energy savings, and the reduction of greenhouse gases. The efficacy of CD and the economic merits, in terms of energy and equipment savings, brought by CD for the production of biodiesel from waste oil such as yellow grease is quantified. Process flow sheets for industrial routes for an annual production of 10 million gallon ASTM purity biodiesel in a conventional process (reactor followed by distillation) and CD configurations are modeled in Aspen Plus. Material and energy flows, as well as sized unit operation blocks, are used to conduct an economic assessment of each process. Total capital investment, total operating and utility costs are calculated for each process. The waste oil feedstock is yellow grease containing both triglyceride and free fatty acid. Both transesterification and esterification reactions are considered in the process simulations. Results show a significant advantage of CD compared to a conventional biodiesel processes due to the reduction of distillation columns, waste streams and greenhouse gas emissions. The significant savings in capital and energy costs together with the reduction of greenhouse gases demonstrate that process intensification via CD is a feasible and new green process for the biodiesel production from waste oils.

Keywords: Yellow Grease; Catalytic Distillation; Aspen plus Economic Analyzer; Process Intensification