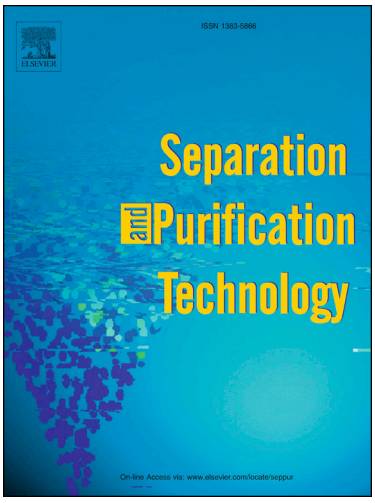


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# Feasibility of Novel Integrated Dividing-Wall Batch Reactive Distillation Processes for the Synthesis of Methyl Decanoate

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## Abstract

The production of methyl decanoate (MeDC) through esterification of decanoic acid (DeC) with methanol by reactive distillation is operationally challenging and energy-intensive due to the complicated behaviour of the reaction system and the difficulty of retaining the reactants together in the reaction region. Methanol being the lightest component in the mixture can separate itself from the reactant DeC as the distillation proceeds which will cause a massive reduction in the conversion of DeC utilizing either a batch or continuous distillation process. Aiming to overcome this type of the potential problem, novel integrated divided-wall batch reactive distillation configuration (i-DWBD) with recycling from the distillate tank is established in this study and is examined in detail.

This study has clearly demonstrated that the integrated divided-wall batch reactive distillation column (i-DWBD) is superior to the traditional conventional batch distillation (CBD) and both the divided-wall (DWBD), and split reflux divided-wall (sr-DWBD) batch reactive distillation configurations in terms of maximum achievable purity of MeDC and higher conversion of DeC into MeDC. In addition, significant batch time and energy savings are possible when the i-DWBD is operated in multi-reflux mode.

Keywords: Dynamic Modelling, Optimization, Energy Usage, Methyl Decanoate, i-DWBD, Esterification

## 1. Introduction

Alternative source of fossil fuels (biodiesel) are increasingly becoming an important role in the modern energy revolution due to several factors such as rapid diminishing of crude oil reserves, rising energy demand, rising environmental concerns of global warming, and rising world oil prices. Biodiesel is a renewable and biodegradable fuel composing of methyl esters, which are derived from vegetable oils and animal fats. Methyl decanoate (MeDC), is one such methyl