

Inter-integration membrane-reactive distillation for EL synthesis: Equipment development and experimental validating

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March 8, 2021

Abstract

Ethyl levulinate, one of main derivatives of levulinic acid (LA), is of significant potential as platform chemicals for bio-based materials. The esterification of LA was generally carried out in a conventional batch reactor or in a conventional reactive distillation column. However, traditional methods are hard to deal with equilibrium limited reactions and azeotropic issues. Therefore, the reactive-vapor permeation-distillation (R-VP-D) process, which integrated reaction, distillation and membrane dehydration into one single unit, is proposed in this paper and validated in the pilot-scale experiments. A comparative study is made between a pilot-scale RD column with and without vapor permeation membrane module. Owing to the water-selective membrane and the ingenious design of related apparatuses, the R-VP-D process reveal a superiority in LA conversion of 21.9% maximum higher than RD without VP process and removing of product water about 53.6% from VP module, which indicates its promising industrial application in process intensification field.

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