

Kinetics and design of distillation reactor with ZSM-5@SiC foam catalytic packing for EL synthesis in industrial scale

Qiuyan Ding¹, Hong Li¹, Zihao Chen¹, Yanan Guan², Xingang Li¹, Jinsong Zhang², Yilai Jiao², Jing Zou¹, and Xin Gao³

¹Tianjin University

²Chinese Academy of Sciences

³Tianjin university

March 6, 2021

Abstract

Distillation reactor is one of the important equipment to improve the reaction conversion limited by the chemical equilibrium, however, the design of distillation reactor in industrial scale is still challenging due to the lack of efficient catalytic packing with corresponding kinetics. This work developed the novel catalytic packing consists of the structured ZSM-5@SiC foam catalyst and corrugated sheet, which used in distillation reactor for synthesis of ethyl levulinate (EL). The kinetic of structured ZSM-5@SiC foam catalyst was measured and model regarding the “structure factor” of ZSM-5@SiC catalyst and fluid flow conditions. Furthermore, the design of distillation reactor in industrial scale has been performed based on the developed kinetics, which demonstrated an excellent performance in the designed distillation reactor (EL yield 37.65% with energy consumption 3695 kJ/kg) are achieved. X-ray CT characterization revealed that the ZSM-5 coating thickness has the significantly effects on the kinetics and performances of distillation reactor.

Hosted file

Manuscript.pdf available at <https://authorea.com/users/399966/articles/512363-kinetics-and-design-of-distillation-reactor-with-zsm-5-sic-foam-catalytic-packing-for-el-synthesis-in-industrial-scale>