

## **Kinetic and thermodynamic of heterogeneously $K_3PO_4/AC$ -catalysed transesterification via pseudo-first order mechanism and Eyring-Polanyi equation**

### **ABSTRACT**

The use of carbon-based catalysts has drawn so much interest in biodiesel production due to improved reaction performance. However, there was lack of comprehensive studies in term of its kinetic and thermodynamic perspective. Therefore, a methodical study is essential to uncover the influence of the carbon catalyst with respect to reaction rate and yield. This study represents kinetic and thermodynamic of heterogeneously  $K_3PO_4/AC$ -catalysed transesterification. It was done correspondingly via pseudo-first order mechanism and Eyring-Polanyi equation, whereby, under the optimal reaction temperature of 333.15 K, all data have fitted satisfactorily in both models with resulted  $R^2$  of 0.99, respectively. Activation energy ( $E_a$ ) and Gibbs free energy ( $\Delta G$ ) were calculated as  $34.2 \text{ kJ mol}^{-1}$  and  $-33.68 \text{ kJ mol}^{-1}$ , indicating the reaction was exergonic and spontaneous at high temperature.

**Keyword:** Carbon-based catalyst; Pseudo-first order; Eyring-Polanyi equation; Kinetic and thermodynamic; Heterogeneous reaction; Biodiesel