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Catalysis, Kinetics and Reaction Engineering

Transesterification of *palm* oil to biodiesel using Brønsted acidic ionic liquid as high-efficient and eco-friendly catalyst

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Abstract: The transesterification of palm oil and methanol catalyzed by Brønsted acidic ionic liquids were investigated. Four eco-friendly Brønsted acidic ionic liquids were prepared and their structures were characterized by NMR, FT-IR and TG-DTG. The results demonstrated that $[CyN_{1,1}PrSO_3H][p\text{-}TSA]$ was more efficient than the other ionic liquids and chosen as catalyst for further research. The influences of various reaction parameters on the conversion of palm oil to biodiesel were performed, and the orthogonal test was investigated to seek the optimum reaction conditions, which were illustrated as follows: methanol to oil mole ratio of 24:1, catalyst dosage of 3.0 wt% of oil, reaction temperature of 120 ^{o}C, reaction time of 150 min, and the biodiesel yield achieved 98.4%. In addition, kinetic study was established for the conversion process, with activation energy and pre-exponential factor of 122.93 kJ·mol^{-1} and 1.83×10^{15}, respectively. Meanwhile, seven times recycling runs of ionic liquid were completed with ignorable loss of its catalyst activity. The refined biodiesel met the biodiesel standard EN 14214.

Keywords: Brønsted acidic ionic liquid; Biodiesel; Palm oil; Transesterification; Kinetic; Optimization