

Catalytic deoxygenation of triolein to green fuel over mesoporous TiO₂ aided by in situ hydrogen production

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ABSTRACT

The greenhouse gases contributed by combustion of fossil fuel has urged the need for sustainable green fuel production. Deoxygenation is the most reliable process to convert bio-oil into green fuel. In this study, the deoxygenation of triolein was investigated via mesoporous TiO₂ calcined at different temperature in the absence of external H₂. The high conversion of fuel-liked hydrocarbons showed the in situ H₂ produced from the reaction. The mesoporous TiO₂ calcined at 500 °C (M500) demonstrated the highest activity, around 76.9% conversion was achieved with 78.9% selectivity to hydrocarbon. The reaction proceed through second order kinetic with a rate constant of 0.0557 g⁻¹_{triolein}h⁻¹. The major product of the reaction were diesel range saturated and unsaturated hydrocarbon (60%) further the formation of in situ H₂. It is interesting to observe that higher calcination temperature improve crystallinity and remove surface hydroxyls, meanwhile increase the acid density and medium strength acid site. The conversion of triolein increased linearly with the amount of medium strength acid sites. This result suggests that medium-strength acidity of catalyst is a critical factor in determining deoxygenation activities. In addition, the presence of mesopores allow the diffusion of triolein molecules and improve the selectivity. Hence, mesoporous TiO₂ with Lewis acidity is a fascinating catalyst and hydrogen donor in high-value green fuel.

KEYWORDS

Deoxygenation; Decarboxylation; Triolein; TiO₂; Acidity; Hydrocarbon

ACKNOWLEDGEMENTS

The authors gratefully acknowledge the support of Ministry of Higher Education, Malaysia (FP029-2017A), University of Malaya for SATU Joint Research Scheme (ST009-2017), IPPP Postgraduate Research Grant (PG071-2014B) and University of Malaya Fellowship Scheme.