**Environment-Friendly Deoxygenation of Non-Edible Ceiba oil to Liquid Hydrocarbon Biofuel: Process Parameters and Optimization Study**


## ABSTRACT

Non-edible Ceiba oil has feasibility as a sustainable biofuel resource in tropical countries that act as alternative to a portion of the fossil fuels used today. Catalytic deoxygenation of the Ceiba oil (high O/C ratio) was conducted to produce hydrocarbon biofuel (high H/C ratio)over NiO-$CaO_5$ /$SiO_2$ -$Al_2O_3$catalyst with aims of high diesel selectivity and catalyst reusability. In the present study, Box-Behnken experimental design was used to evaluate and optimize liquid hydrocarbon yield by considering following reaction factors: catalyst loading (1-9 wt.%), reaction temperature (300 - 380°C) and reaction time (30 -180 min). It was discovered that the optimum yield for hydrocarbon fractionsn-($C_8$ – $C_{20}$ ) was 77% under deoxygenation condition of 5 wt.% catalyst loading, reaction temperature of 340°C within 105 min. Besides, deoxygenation model indicated that interaction effects of catalyst loading-reaction time influence the deoxygenation activity greatly. Based on the product analysis, oxygenated species(e.g. $CO_2$ and CO) were removed mainly via decarboxylation/decarbonylation (deCOx) pathways. The NiO$CaO_5$ /$SiO_2$ -Al2$O_3$ catalyst is stable for five consecutive runs with hydrocarbon fractions within range of 66-75% and n-($C_{15}$+$C_{17}$ ) selectivity of 64-72% as well. The stability profile of NiO-$CaO_5$ /$SiO_2$ -$Al_2O_3$ catalyst indicated that the catalyst able to maintain deoxygenation reactivity throughout five cycles with hydrocarbon yield of 66-75% and n-($C_{15}$+$C_{17}$) selectivity of 64–72 %. However, coke deposition was noticed for the spent catalyst after several times of usage, which due to the high reaction temperature above 300°C.