

## **SYNTHESIS OF NiPd-NH<sub>2</sub>/LAPINDO MUD CATALYST FOR THE HYDROTREATMENT OF USED COOKING OIL INTO BIOFUEL**

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### **ABSTRACT**

Synthesis of NiPd-NH<sub>2</sub>/Lapindo Mud catalyst for the hydrotreatment process of used cooking oil into biofuel had been carried out. The aim of this research was to synthesize a catalyst with the highest activity and selectivity in producing liquid fraction consisted of high percentage of hydrocarbon compounds (biofuel).

The Ni, Pd, and NiPd was loaded onto the mud through wet-impregnation method followed by calcination using N<sub>2</sub> gas at 450 °C for 3 h and reduction under the flow of H<sub>2</sub> gas at at 500 °C for 3 h. This step produced LL, Ni/LL, Pd/LL, NiPd/LL catalysts. The addition of amine-functionalized group onto the catalyst was performed by grafting method using 3-Aminopropyl Trimethoxy Silane (3-APTMS) in 20 mL toluene. This step produced NH<sub>2</sub>/LL, Ni-NH<sub>2</sub>/LL, Pd-NH<sub>2</sub>/LL, and NiPd-NH<sub>2</sub>/LL catalysts. The obtained catalysts were then characterized using X-Ray Fluorescence (XRF), X-Ray Diffraction (XRD), Fourier Transform Infrared Spectrometry (FTIR), Surface Area Analyzer (SAA), Scanning Electron Microscopy-Energy Dispersive X-Ray (SEM-EDX), Transmission Electron Microscopy (TEM), and acidity test using gravimetric method. The catalyst was then used in hydrotreatment of used cooking oil in a stainless-steel semi-batch reactor system under H<sub>2</sub> stream for 2 h. The hydrotreatment of catalyst with the best performance was carried out with variation of temperatures (450, 500, and 550 °C) and catalyst/feed weight ratios (1/50, 1/100, and 1/200). The usability of catalyst with the best performance was carried out in second followed by third hydrotreatment run. The composition of liquid product was analyzed by Gas Chromatography-Mass Spectrometry (GC-MS).

The NiPd-NH<sub>2</sub>/LL catalyst with the pore volume and total acidity of 0.03 cc g<sup>-1</sup>, and 0.07 mmol g<sup>-1</sup> was the best performed catalyst that produced the highest liquid fraction of 78.9wt% which consisted of hydrocarbon compounds (biofuel) of 66.1wt% at 550 °C and catalyst/feed weight ratio of 1/100. The firsts, second, and third run of the hydrotreatment using NiPd-NH<sub>2</sub>/LL catalyst produced liquid fraction of 71.5wt% (hydrocarbon compounds of 48.9wt%), 37 wt% (hydrocarbon compounds of 26.4wt%) and 61.7wt% (hydrocarbon compounds of 39.0wt%).

Keyword: lapindo mud, hydrotreatment, biofuel, bimetal catalyst