

SINTESIS KATALIS LOGAM Ni TEREMBAN PADA PASIR PANTAI PARANGTRITIS (PP) UNTUK HIDRORENGKAH MINYAK KELAPA SAWIT, MALAPARI, DAN NYAMPLUNG MENJADI BIOHIDROKARBON

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INTISARI

Sintesis katalis logam Ni teremban pada pasir pantai Parangtritis (PP) dari desa Parangtritis untuk hidrorengkah minyak kelapa sawit, malapari, dan nyamplung menjadi biohidrokarbon telah berhasil dilakukan. Penelitian ini bertujuan untuk mengetahui karakter, aktivitas dan selektivitas katalis Ni teremban PP pada proses hidrorengkah minyak sawit, malapari dan nyamplung menjadi biohidrokarbon. Preparasi katalis logam Ni pada PP dilakukan dengan metode *blending* menggunakan garam prekursor $\text{NiCl}_2 \cdot 6\text{H}_2\text{O}$ dengan variasi berat logam Ni terhadap PP sebesar 10 dan 20%, sehingga menghasilkan katalis Ni(A)/PP dan Ni(B)/PP. Katalis PP, Ni(A)/PP, Ni(B)/PP dikarakterisasi menggunakan XRD, FTIR, SAA, SEM, TEM, dan uji keasaman secara gravimetri menggunakan adsorpsi basa piridin. Uji aktivitas dan selektivitas katalis dilakukan melalui proses hidrorengkah minyak sawit. Proses hidrorengkah dilakukan menggunakan reaktor sistem *semi-batch* pada temperature 450 °C, laju aliran gas hidrogen 20 mL/menit selama 2 jam, dan rasio berat katalis:umpan 1:200. Katalis dengan aktivitas dan selektivitas tertinggi diuji reusabilitasnya dan digunakan pada proses hidrorengkah minyak nyamplung dan malapari. Produk cair hasil hidrorengkah dianalisis menggunakan GC-MS.

Hasil penelitian menunjukkan katalis Ni(A)/PP memiliki aktivitas dan selektivitas tertinggi dalam proses hidrorengkah minyak sawit menjadi biohidrokarbon dibandingkan dengan katalis PP dan Ni(B)/PP. Katalis Ni(A)/PP memiliki total keasaman, luas permukaan, rerata diameter pori, volume pori, dan ukuran kristal berturut-turut sebesar 0,051 mmol/g; 4,44 m²/g; 3,50 nm; 0,0078 cc/g; 25,86 nm. Hasil produk cair dan total fraksi biohidrokarbon yang diperoleh dari hidrorengkah minyak sawit menggunakan katalis Ni(A)/PP berturut-turut sebesar 68,50 dan 49,87 %b/b. Uji reusabilitas katalis Ni(A)/PP pada proses hidrorengkah minyak sawit setelah penggunaan ke dua dan tiga menghasilkan produk cair dan total fraksi biohidrokarbon yang diperoleh berturut-turut sebesar 60,65; 51,20 %b/b dan 64,20; 41,46 %b/b. Hasil produk cair dan total fraksi biohidrokarbon pada hidrorengkah minyak malapari dan nyamplung berturut-turut sebesar 66,10; 47,83 %b/b dan 64,10; 28,62 %b/b.

Kata kunci: Pasir pantai Parangtritis, nikel, hidrorengkah, minyak sawit.

SYNTHESIS OF Ni METAL CATALYST SUPPORTED ON PARANGTRITIS BEACH SAND (PP) FOR HYDROCRACKING OF PALM, MALAPARI, AND NYAMPLUNG OIL INTO BIOHYDROCARBON

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ABSTRACT

Synthesis of Ni metal catalyst supported on Parangtritis beach sand (PP) from Parangtritis village for hydrocracking of palm, malapari, and nyamplung oil into biohydrocarbon has been successfully carried out. This study aims to determine the properties, activity, and selectivity of Ni-supported PP catalysts in the hydrocracking process of palm, malapari, and nyamplung oil into biohydrocarbons. The catalyst preparation of Ni metal on PP was carried out through the blending method using $\text{NiCl}_2 \cdot 6\text{H}_2\text{O}$ precursor salt with a loading of 10 and 20% Ni metal by weight of PP, resulting in Ni(A)/PP and Ni(B)/PP catalysts. PP, Ni(A)/PP, Ni(B)/PP catalysts were characterized using XRD, FTIR, SAA, SEM, TEM, and acidity test by gravimetric method using pyridine base adsorption. The activity and selectivity test of the catalyst was carried out through the hydrocracking process of palm oil. The hydrocracking process was carried out using a semi-batch reactor system at 450 °C, hydrogen gas flow rate 20 mL/min, and the weight ratio of catalyst:feed 1:200. The catalyst with the highest activity and selectivity was tested for reusability and used in the hydrocracking process of nyamplung and malapari oil. Hydrocracking products were analyzed using GC-MS.

The results showed that the Ni(A)/PP catalyst had the best activity and selectivity in the hydrocracking process of palm oil into biohydrocarbon compared to PP and Ni(B)/PP catalysts. Ni(A)/PP catalyst has a total acidity, surface area, average pore diameter, pore volume, and crystal size of 0.051 mmol/g, 4.44 m²/g, 3.50 nm, 0.0078 cc/g, 25.86 nm, respectively. The liquid product yield and the total biohydrocarbon fraction from hydrocracking palm oil obtained were 68.50 and 49.87 wt%, respectively. The reusability test of the Ni(A)/PP catalyst in the hydrocracking process of palm oil into biohydrocarbon after the second and third run resulted in a liquid product and the total biohydrocarbon fraction obtained was 60.65, 51.20 wt% and 64.20, 41.46 wt%, respectively. The liquid product yield and the total biohydrocarbon fraction from hydrocracking malapari and nyamplung oil obtained were 66.10, 47.83 wt% and 64.10, 28.62 wt%, respectively.

Keywords: Parangtritis beach sand, nickel, hydrocracking, palm oil.