

SINTESIS HIERARKI KARBON AKTIF DARI KAYU GLUGU DENGAN AKTIVATOR K₂CO₃ SEBAGAI PENGEMBAN KATALIS NIKEL UNTUK HIDRORENGKAH MINYAK NYAMPLUNG MENJADI *BIOFUEL*

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INTISARI

Telah dilakukan sintesis hierarki karbon aktif (HKA) dan hierarki karbon aktif teremban nikel (Ni/HKA) sebagai katalis untuk hidorengkah minyak nyamplung menjadi *biofuel*. HKA disintesis dari kayu glugu melalui proses karbonisasi dilanjutkan aktivasi kimia menggunakan K₂CO₃. Temperatur aktivasi dilakukan pada 600 dan 700 °C, dan rasio berat agen aktivator/karbon sebesar 2,3, dan 4. Karakterisasi HKA dilakukan menggunakan uji bilangan iodin, *X-ray Diffractometer* (XRD), *Transmission Electron Microscope* (TEM), dan *Surface Area Analyzer* (SAA). Pengembanan nikel pada HKA dilakukan melalui impregnasi basah menggunakan garam prekursor Ni(NO₃)₂.6H₂O, dilanjutkan kalsinasi dan reduksi. Ni/HKA dikarakterisasi dengan Spektrofotometer Serapan Atom (SSA), XRD, TEM, SAA, dan uji keasaman dengan uap piridin. Katalis Ni/HKA3-700 digunakan dalam hidorengkah minyak nyamplung dengan memvariasikan rasio katalis:umpan sebesar 1:100, 1:200, dan 1:300 (b/b) serta membandingkan aktivitas dan selektivitas katalis dengan hidorengkah menggunakan HKA dan perengkahan termal. Katalis Ni/HKA digunakan secara berulang sebanyak 3 kali pada proses hidorengkah minyak nyamplung. Seluruh produk hidorengkah dikarakterisasi menggunakan *Gas Chromatography - Mass Spectrometer* (GC-MS).

Hasil karakterisasi menunjukkan bahwa bilangan iodin tertinggi dihasilkan dari rasio berat (K₂CO₃/arang) sebesar 3 dan temperatur aktivasi pada 700 °C (HKA3-700). HKA3-700 memiliki luas permukaan sebesar 96,61 m²/g, total volume pori sebesar 0,0567 cc/g, dan diameter rerata pori sebesar 2,73 nm. Katalis Ni/HKA3-700 memiliki keasaman sebesar 1,076 mmol/g dan luas permukaan sebesar 400,60 m²/g. Hasil hidorengkah menggunakan katalis Ni/HKA3-700 menunjukkan bahwa produk cair tertinggi (74%, b/b) dihasilkan dari rasio katalis:umpan sebesar 1:300 (b/b). Katalis Ni/HKA3-700 menunjukkan selektivitas terhadap fraksi hidrokarbon (66,92%, b/b) yang lebih tinggi dibandingkan dengan katalis HKA3-700 dan perengkahan termal. Pada pemakaian ulang kedua dan ketiga menggunakan katalis Ni/HKA3-700, hasil konversi fraksi hidrokarbon mengalami penurunan secara berturut-turut sebesar 44,26 dan 59,23% (b/b).

Kata kunci: *Biofuel*, hierarki karbon aktif, hidorengkah, nikel

SYNTHESIS OF HIERARCHICAL ACTIVATED CARBON FROM GLUGU WOOD USING K₂CO₃ ACTIVATOR AS SUPPORT MATERIAL OF NICKEL CATALYST FOR HYDROCRACKING OF NYAMPLUNG OIL INTO BIOFUEL

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ABSTRACT

Synthesis of hierarchical activated carbon (HKA) and nickel impregnated hierarchical activated carbon (Ni/HKA) as a catalyst for hydrocracking of nyamplung oil into biofuel had been carried out. The HKA was synthesized from glugu wood through carbonization continued with chemical activation using K₂CO₃. Activation temperature was performed at 600 and 700 °C and the weight ratio of activator agent/carbon used were 2, 3, and 4. Characterization of HKA was done by using an iodine number test, X-ray Diffractometer (XRD), Transmission Electron Microscope (TEM), and Surface Area Analyzer (SAA). Nickel impregnation was done by wet-impregnation using Ni(NO₃)₂·6H₂O as a salt precursor, continued with calcination and reduction. The catalyst was characterized by Atomic Absorption Spectrophotometer (AAS), XRD, TEM, SAA, and acidity test using pyridine vapor. The synthesized catalyst was used for hydrocracking of nyamplung oil with a variation of catalyst to feed ratio and was then compared to hydrocracking by HKA and thermal cracking. Catalyst reusability was done by using the same catalyst for 3 times of hydrocracking nyamplung oil. Products of hydrocracking were characterized by Gas Chromatography - Mass Spectrometer (GC-MS).

The result showed that the highest iodine number was produced by weight ratio (K₂CO₃/carbon) of 3 and activation temperature at 700 °C (HKA3-700). The HKA3-700 had a specific surface area of 96.61 m²/g, a total pore volume of 0.0567 cc/g, and a total pore diameter of 2.73 nm. The Ni/HKA3-700 had an acidity of 1,076 mmol/g and a specific surface area of 400,60 m²/g. The result of catalytic hydrocracking of Ni/HKA3-700 showed that the highest liquid product (74%, w/w) was produced on the catalyst to feed ratio of 1:300 (w/w). Catalyst Ni/HKA3-700 showed the selectivity toward hydrocarbon fraction (66,92%, w/w) more than HKA3-700 and thermal cracking. The second and third reused catalyst Ni/HKA3-700, resulted in a decrease of hydrocarbon fractions, which were 44.26 and 59.23%, respectively.

Keywords: Biofuel, hierarchical activated carbon, hydrocracking, nickel