

SINTESIS HIERARKI KARBON AKTIF DARI KAYU MERBAU MANOKWARI UNTUK PENGEMBAN LOGAM Co, Ni, DAN Pd SEBAGAI KATALIS HIDRORENGKAH MINYAK NYAMPLUNG MENJADI FRAKSI BENSIN DAN SOLAR

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ABSTRAK

Telah dilakukan sintesis dan karakterisasi hierarki karbon aktif (HKA) dan hierarki karbon aktif teremban kobalt, nikel, dan paladium sebagai katalis hidrorengkah minyak nyamplung menjadi fraksi bensin dan diesel. Hierarki karbon aktif disintesis melalui aktivasi fisika menggunakan gas CO₂ dan H₂O terhadap kayu merbau yang telah terpirolisis. Keberhasilan struktur pori hierarki dikarakterisasi menggunakan *fourier transform infrared* (FTIR), *surface area analyzer* (SAA) dan *X-ray diffractometer* (XRD). Pengembanan logam dilakukan melalui metode impregnasi basah menggunakan garam prekursor Co(NO₃)₂·6H₂O, Ni(NO₃)₂·6H₂O, dan PdCl₂ secara berturut-turut menghasilkan katalis Co/HKA, Ni/HKA, dan Pd/HKA. Katalis dikarakterisasi dengan *scanning electron microscope* (SEM), SAA, XRD, dan uji keasaman dengan uap amonia. Katalis digunakan untuk hidrorengkah minyak nyamplung pada 475°C selama 2 jam. Produk hidrorengkah dianalisis dengan *Gas Chromatography-Mass Spectroscopy* (GC-MS).

Keberhasilan sintesis hierarki karbon aktif (HKA) ditandai dengan adanya puncak difraksi pada 2θ sebesar 26,46°, luas permukaan yang besar (412,3 m²/g), serta distribusi ukuran pori pada daerah mikro/mesopori (1,356 - 6,160 nm). Hasil penelitian ini menunjukkan bahwa katalis Pd/HKA merupakan katalis dengan performa katalitik terbaik, dimana katalis ini mampu menghasilkan fraksi cair sebesar 27,05% b/b dengan selektivitas terhadap fraksi bensin sebesar 88,43% b/b dan solar sebesar 0,19% b/b. Katalis Pd/HKA memiliki luas permukaan sebesar 524,0 m²/g, nilai keasaman sebesar 20,40 mmol/g, dan kadar logam paladium sebesar 0,430% b/b. Terdapat korelasi linier antara konfigurasi orbital d dengan fraksi cair dan diesel, serta keasaman dengan pembentukan deposit kokas, dengan nilai regresi secara berturut-turut 0,9334; 0,9932; dan 0,9986.

Kata kunci : Hierarki karbon aktif, hidrorengkah, kobalt, nikel, paladium

**SYNTHESIS OF HIERARCHICAL ACTIVATED CARBON FROM
MANOKWARI'S MERBAU WOOD AS SUPPORT MATERIAL OF Co, Ni,
AND Pd METALS FOR HYDROCRACKING OF NYAMPLUNG OIL
INTO GASOLINE AND DIESEL**

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ABSTRACT

Synthesis and characterization of hierarchical activated carbon and impregnated hierarchical activated carbon as hydrocracking catalyst had been done. Hierarchical activated carbon was synthesized through physical activation of pyrolyzed merbau wood with CO₂ and H₂O gasses. The indicator of success synthesizing hierarchical activated carbon is determined through analysis and characterization with fourier transform infrared (FTIR), surface area analyzer (SAA) and X-ray diffractometer (XRD). Metal impregnation was carried out by wet impregnation method using Co(NO₃)₂·6H₂O, Ni(NO₃)₂·6H₂O and PdCl₂ as salt precursor, producing Co/HKA, Ni/HKA and Pd/HKA, respectively. The catalysts were characterized using scanning electron microscope (SEM), SAA, XRD, and acidity test using ammonia vapor. The catalysts were used to hydrocracking of nyamplung oil at 475°C for 2 hours with H₂ gas flow rate of 10 mL/minute. The hydrocracking products were analyzed using Gas Chromatography-Mass Spectroscopy (GC-MS).

Hierarchical structure of activated carbon was achieved and showed with the presence of diffraction peak at 26.46°, pore size distribution in micro/mesopore region (1.356 – 6.160 nm), and high specific surface area (412.3 m²/g). The result also showed that Pd/HKA has the best catalytic performance, where this catalyst has the highest liquid product (27.05%wt) and selectivity towards gasoline (88.43%wt) and diesel (0.19%wt). Pd/HKA catalyst has specific surface area of 524.0 m²/g, acidity of 20.40 mmole/g, and Pd content of 0.430%. It was found that there is a strong correlation between electron configuration in d orbital with liquid and diesel fraction, also between catalyst acidity with coke formation, with the linearity regression of 0.9334; 0.9932; and 0.9986, respectively.

Keywords: Hierarchical activated carbon, hydrocracking, cobalt, nickel, palladium