

HIDRORENGKAH α -SELULOSA DENGAN KATALIS Pd/ MORDENIT DAN STUDI KINETIKA PEMBENTUKAN PRODUK CAIR

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INTISARI

Telah dilakukan hidrorengkah α -selulosa dengan katalis Pd/Mordenit dan studi kinetika laju pembentukan produk cair. Katalis Pd/Mordenit dipreparasi dengan metode impregnasi basah menggunakan larutan garam PdCl₂. Katalis dikarakterisasi keasaman dan dianalisis secara kualitatif menggunakan Spektrometer Infra Merah (FTIR), kristalinitas menggunakan Difraksi Sinar-X (XRD), morfologi permukaan *Scanning Electron Microscope-Energy Dispersive Spectroscopy* (SEM-EDS) dan kandungan logam menggunakan *Inductively Coupled Plasma* (ICP). Uji aktivitas katalis mordenit dan Pd/Mordenit untuk hidrorengkah α -selulosa dilakukan pada 400, 450, dan 500 °C dengan perbandingan katalis:umpan (1:10), reaktor *semi-batch*, laju alir gas hidrogen 30 mL/menit selama 4 jam. Perengkahan termal dilakukan pada temperatur optimum 450 °C. Studi kinetika laju pembentukan produk cair dilakukan dengan mengukur pembentukan produk cair pada variasi waktu 30, 60, 90, 120 menit. Produk cair dianalisis dengan GC-MS.

Hasil penelitian menunjukkan kenaikan keasaman total dan kristalinitas katalis meningkat dengan adanya pengembanan logam Pd pada mordenit. Keasaman total mordenit dan Pd/Mordenit berturut-turut 2,56 dan 4,75 mmol/g. Kristalinitas katalis Pd/Mordenit naik 3,76% dibandingkan katalis mordenit. Kandungan logam Pd pada mordenit 0,5%. Tidak terjadi perubahan morfologi permukaan setelah pengembanan logam Pd. Pembentukan produk cair tertinggi hasil perengkahan termal, hidrorengkah dengan katalis mordenit dan Pd/Mordenit berturut-turut 28,89%, 47,11% dan 52,02% pada 450 °C. Studi kinetika laju pembentukan produk cair memenuhi reaksi orde satu. Konstanta laju pembentukan produk cair (k_L) katalis mordenit dan Pd/Mordenit adalah 0,005 menit⁻¹ dan 0,0069 menit⁻¹.

Kata kunci: hidrorengkah, α -selulosa, mordenit, Pd, kinetika

HYDROCRACKING OF α -CELLULOSE USING Pd/ MORDENITE CATALYST AND KINETIC STUDY OF LIQUID PRODUCT FORMATION

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ABSTRACT

Hydrocracking of α -cellulose using Pd/Mordenite catalyst and kinetic study of liquid product formation has been conducted. Mordenite catalyst was prepared by wet impregnation method using PdCl_2 salt precursor. The acidity of catalyst was characterized and analyzed qualitatively using Fourier Transform Infra-red (FTIR), crystallinity of catalyst was analyzed using X-ray diffraction (XRD), surface morphology of catalyst was analyzed using Scanning Electron Microscope-Energy Dispersive Spectroscopy (SEM-EDS) and metal content quantitatively was analyzed using Inductively Coupled Plasma (ICP). The catalyst activity of mordenite and Pd/Mordenite for hydrocracking α -cellulose was performed at 400, 450, and 500 °C by ratio catalyst: feed (1:10), semi-batch reactor, 30 mL/min hydrogen gas flow rate for 4 hours. Thermal cracking was performed at optimum temperature 450 °C. The kinetic study of liquid product formation was carried out by measuring the formation of liquid product at time variations of 30, 60, 90, 120 minutes. The liquid product was analyzed by GC-MS.

The results showed that the total acidity and the crystallinity of the catalyst increased with the presence of Pd metal on mordenite. Total acidity of mordenite and Pd/Mordenite were 2.56 and 4.75 mmol/g respectively. The crystallinity of the Pd/Mordenite catalyst increased by 3.76% compared to the mordenite catalyst. The content of Pd metal on mordenite was 0.5%. No surface morphology changed after Pd metal loaded. The highest formation of liquid product of thermal cracking, hydrocracking with catalyst mordenite and Pd/Mordenite were 28.89%, 47.11% and 52.02%, respectively at 450 °C. The kinetics study of liquid product formation fit with the first order reaction. The rate constant of liquid product formation (k_L) of catalyst mordenite and Pd/Mordenite were 0.005 min^{-1} and 0.0069 min^{-1} .

Keywords: hydrocracking, α -cellulose, mordenite, Pd, kinetic