Perengkahan katalitik bio-oil dari hasil pirolisis tempurung kelapa menjadi benzena toluena xilena menggunakan katalis CaO/HZSM-5 = Catalytic cracking of pyrolysis coconut shell oil into benzene toluene xylene with CaO/HZSM-5 catalyst

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Abstrak

Tempurung kelapa merupakan biomassa hasil samping pengolahan buah kelapa yang pemanfaatannya belum optimal karena dianggap sebagai limbah tak bernilai. Dalam proses pengembangannya, limbah tempurung kelapa memiliki peluang yang besar untuk dimanfaatkan sebagai produk dengan nilai ekonomi tinggi seperti BTX (Benzena, Toluena, Xilena) karena memiliki building block berupa senyawa aromatik. Proses pirolisis termal dan perengkahan katalitik biomassa tempurung kelapa telah dilakukan dalam reaktor unggun diam untuk menghasilkan senyawa BTX masing – masing pada suhu 550oC dan 500oC. Katalis CaO/HZSM-5 yang disintesis melalui teknik pencampuran fisik dan impregnasi basah dengan perbandingan 2:1 terhadap umpan bio-oil digunakan pada proses upgrading perengkahan katalitik. Katalis CaO/HZSM-5 dipilih karena penggunaan kedua katalis tersebut secara simultan memberikan efek sinergis dalam menghasilkan senyawa monoaromatik BTX. Penambahan CaO terbukti mampu meningkatkan ukuran pori rata – rata katalis setelah termodifikasi sehingga dapat menurunkan kemungkinan deaktivasi katalis dengan mencegah pembentukan kokas. Karakterisasi BET terhadap katalis menunjukkan bahwa diameter pori katalis CaO/HZSM-5 pencampuran fisik dan impregnasi basah secara berturut – turut sebesar 2,14 nm dan 5,24 nm. Selanjutnya, bio-oil melalui karakterisasi FTIR dimana produk upgrading bio-oil tempurung kelapa didominasi oleh senyawa aromatic, phenol, dan alcohol. Berdasarkan karakterisasi GC-MS, katalis CaO/HZSM-5 hasil pencampuran fisik memberikan kinerja optimal dimana yield BTX tertinggi yang diperoleh sebesar 45,85%. Penelitian ini diharapkan dapat memberikan solusi alternatif dalam mengurangi ketergantungan pada bahan bakar fosil.....Coconut shell is a by-product of processing coconuts whose utilization is not optimal because it is considered as worthless waste. In the development process, coconut shell waste has an excellent opportunity for being utilized as a product with high economic value as BTX (Benzene, Toluene, Xylene) due to its high content of lignin which is the building block in the form of aromatic compounds. Thermal pyrolysis and catalytic cracking of coconut shell biomass have been carried out in a fixed bed reactor to produce BTX compounds at 550oC and 500oC, respectively. CaO/HZSM-5 catalyst was synthesized using physical mixing and wet impregnation technique with a ratio of 2:1 to bio-oil feed in the upgrading process of catalytic cracking. CaO/HZSM-5 catalyst was chosen because the use of the two catalysts simultaneously provides a synergistic effect in producing BTX compounds. The addition of CaO has proven to increase the average pore size of the catalyst after modification and reduce the possibility of catalyst deactivation by preventing coke formation. The BET characterization of the catalyst showed that the pore diameters of the CaO/HZSM-5 catalyst of physical mixing and wet impregnation were 2,14 nm and 5,24 nm, respectively. Furthermore, FTIR characterization showed the upgrading product of coconut shell bio-oil dominated by aromatic compounds, phenols, and alcohols. Based on the GC-MS characterization, the CaO/HZSM-5 catalyst of physical mixing gave an optimal performance where the highest BTX yield was obtained at 45.85%. This research was expected to provide alternative solutions to reduce dependency on

fossil fuels.